Research Master Media, Art and Performance

FEEL WITH ME

From Simulation Theory to Empathetic Encounters in Human-Robot Interaction

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August 2019

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Research Master Thesis

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To my cat, for showing me that other modes of affection are possible

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Abstract

This thesis critically evaluates the use of the concept of *empathy* within the discourses of social robotics and elaborates an alternative framework that could inform new modes of human-robot interaction (HRI). This thesis shows how the definition and implementation of empathy in social robots is largely based on a theory of social cognition, namely Simulation Theory. The author proposes that this vision of empathy is both theoretically insufficient and overtly anthropocentric, as it links empathy with the imitation of human movement, similarities between the human and the robot, and the false distinction between internal and self-contained emotions and external expressive movement. In order to account for a different understanding of empathy in HRI, the author turns to the artistic work of Marco Donnarumma, arguing that his *7 Configurations Cycle* implies a new mode of empathy between humans and robots that is based on a coordination and a co-creation of affective movement rather than an imitation of human motion.

To delve into what the author's reading of Donnarumma's work implies for empathy in HRI, this thesis evaluates Susan Leigh Foster's and Dee Reynolds's research on kinaesthetic empathy and Dan Zahavi's study of phenomenological empathy. This theoretical framework allows the author to conceptualise empathy in terms of a pre-reflexive resonance, a perception, and a coupling. The author then brings these two fields of study into conversation through Maxine Sheets-Johnstone's research on movement dynamics. Along with the author's own contribution to how empathy can be considered a performative process, as well as a performance, this thesis develops a new paradigm for addressing empathy in HRI: *empathetic encounters*. In empathetic encounters, a coordination of movement dynamics takes place that allows two or more entities to be kinetically and affectively attuned to each other. This coordination is performed (in the sense of Erika Fischter-Lichte notion of co-presence) and brings about affective states that are co-created by the entities who are present in the empathetic encounters (in this way being performative, following Judith Butler's ideas on the matter). This paradigm is then brought back to the field of social robotics by a case study analysis of Petra Gemeinboeck and Rob Saunders's robotic project Performative Body Mapping. Looking at their project through the lens of empathetic encounters offers a perspective on how this theoretical framework could inform the design of social robots. Finally, the thesis argues that the notion of empathetic encounters offers a better paradigm for understanding non-human morphologies than that currently offered in social robotics discourses.

Introduction

Human interaction with Artificial Intelligent (AI) technologies is more widespread than ever. As a result, social robotics—the field that focuses on how autonomous robots interact and communicate with other autonomous agents following social behaviours—has attracted a lot of public attention and has led to many projects and experiments dealing with how socially-interactive robots collaborate with humans. In recent years, this exploration of human-robot interaction (HRI) has turned to the issue of emotion, with empathy being a particularly salient trope in most social robotic studies.[1] The reason for this is that within social robotics there is an increasing consensus that an emotional connection between humans and robots, especially an empathetic one, can make collaborations between them more efficient. If the current trends in robotics continue, we can expect a future in which the cooperation with robots will become more and more pervasive. Taking this into account, the field of social robotics is interested in discovering, first, how humans can have a positive attitude towards robots; and second, how humans and robots can collaborate in the completion of a task or the achievement of a goal.[2]

According to studies in social robotics, connections between humans and robots can be more successful if attention is paid to empathy—specifically, to whether or not the robot interacting with people is able to show an empathetic response to the human. A large number of studies have been directed at how this empathetic response can be measured and implemented in robots. However, little research has been done thus far in theorising and critically analysing the concept of empathy at stake in social robotics. As a result, the framework in social robotics for describing and implementing empathy in human-robot relations has several important limitations: it denies difference within empathy; it is anthropocentric; and it does not account properly for the relationality of affects.

A conceptual analysis of how the term ‘empathy’ is being used in social robotics will allow me to explain how such an understanding is based on a theory of social

[1] I chose to employ at this stage the term ‘emotion’ over ‘affect’, which will become the predominant concept when introducing my own contribution, because projects in social robotics try to measure and implement clear-cut emotional states, such as ‘happiness’ or ‘fear’ when dealing with HRI.

[2] These can be extremely varied; nonetheless, it can be said that social robots are mainly being used for care-taking, home tasks or teaching. Therefore, the completion of a task or goal will normally be directed at how collaborative and accepting the human is with regards to the robot’s care or lessons, and how adequate the robotic service given is.

cognition, namely Simulation Theory (ST). In this paradigm, empathy takes place as follows: 1) the target of empathy shows inner mental states through expressive movement; 2) the observer, when confronted with this expressive movement, engages in a simulation and inner mimicry; 3) the observer retroactively projects those states onto the target of empathy, which allows him or her to imaginatively infer what the target feels or thinks. Social robotics's approach to HRI and the design of robots implies a similar understanding of empathy to that of ST, inasmuch as emotions are conceptualised as internal states that are later communicated through expressive movement, and empathy is considered a matter of mimicry of that movement. The main question concerning empathy in social robotics is thus 'How can a robot show and/or feel empathy when interacting with a human?' The answer to this question is usually 'by mimicking humans' movements'; and the question's broader implication is that such an empathetic reaction will create a positive attitude in the human and a better collaboration between them. As I will show, in most social robotics projects the robot acts as the observer of empathy, imitating human expressive movement and therefore (according to ST) showing an empathetic response.

This conceptualisation and implementation of empathy, nonetheless, has significant limitations. Salient among them is the univocal linkage of empathy with imitation and similarity (in order for the robot to successfully mimic the human's movement), as well as the distinction between internal states (individualised and self-contained emotions) and external expressive movement. I will argue that following the paradigm of ST in HRI creates a partial and highly anthropocentric vision of how empathy in social robotics occurs.[3] My aim in this thesis is, firstly, to critically analyse how empathy is being used in social robotics; and secondly, to propose an intervention in the field that could open up new modes of addressing empathy in HRI that overcome the aforementioned limitations of current social robotics discourse. I aim to show how a different understanding of empathy is possible, and how it is already taking place in artistic practices and theoretical discourses, albeit in ways not yet assimilated into current social robotics discourses.

[3] In most social robotic projects that deal with empathy, anthropomorphic robots are used. Because the aim of these robots is to successfully imitate human's movements, the closer to the human physiognomy they are, the more accurate this mimicry will be. This creates certain anthropocentric biases, since the only type of motion that is developed and implemented is that of the human. These biases therefore disregard other types of movements that could be more appropriate to a robotic embodiment. Moreover, it also constrains possible designs to anthropomorphic ones.

In order to look at this other way of conceptualising the empathetic relation between humans and robots, I will turn to the work of Marco Donnarumma. His artistic practice involving human-technology relations hints at a different framework in which humans and robots can empathetically relate by means other than mimicry and simulation. To fully delve into what Donnarumma suggests with his *7 Configurations Cycle*, I shall make use of the concept of kinaesthetic empathy as it has been introduced recently in cultural practices, especially dance, by Susan Leigh Foster and Dee Reynolds. Their theories point at how pre-reflexive movement (being both physical and emotional) is at the heart of empathy. Furthermore, Dan Zahavi's exploration of phenomenological empathy will offer other theoretical complements to those of kinaesthetic empathy, to the effect that empathy is based on a coordination or a coupling of affective and physical states instead of on a mimicry and simulation. Afterwards, I shall bring into conversation these two fields of study through Maxine Sheets-Johnstone's ideas on movement dynamics, as well as with theories of performativity and performance. This will allow me to propose my intervention in the field: the paradigm of *empathetic encounters*. Finally, through this lens, I shall analyse the case study of Performative Body Mapping (PBM): a creative robotics project by Petra Gemeinboeck and Rob Saunders that encompasses dance and the design of social robots.

The main research question and subquestions that direct this thesis will therefore be the following:

Research question: How can we critically make use of the concept of empathy within HRI and, specifically, social robotics?

> **Research subquestion 1)** How has empathy been used within social robotics and what kind of challenges does it pose?
>
> **Research subquestion 2)** How could 'kinaesthetic empathy' and 'phenomenological empathy' be employed in HRI, and what kind of challenges would these concepts pose?
>
> **Research subquestion 3)** How could the above considerations provide us with a new paradigm for an empathetic human-robot relation?

By basing my enquiries on the analysis of case studies and theoretical tools, I will be able to introduce my paradigm of empathetic encounters, with which I provide an alternative perspective on the way empathy is thought within social robotics. On the one

hand, the question posited when thinking about empathy in HRI will not be how a robot can show empathy or how a human can feel empathy for the robot; rather, it will be how a human and a robot can empathetically relate to each other. In other words, within the empathetic encounters paradigm, empathy will not be located in one of the entities (human or robot) but in the process of relating, as something that is co-created in the interaction. On the other hand, when implementing empathy, I will not support the idea that a robot needs to replicate human movement in order to show an empathetic response. Instead, my paradigm will point at the fact that focusing on how the human's and the robot's different movement dynamics can physically and affectively coordinate is a much more fruitful path to analysing empathy. Through the paradigm of empathetic encounters, then, robots and humans will be considered as empathetically attuning themselves through the enfolding of complementary and co-created dynamics within an encounter.

The change from simulation and similarity to coordination of different movement dynamics has a useful advantage: empathy consequently will not be linked to mimicking human movement but to learning how to affectively relate to other, non-human morphologies. Considering that empathy is a matter of coordinating movement dynamics instead of imitating them holds a great importance when discussing difference within the empathetic relation. It ultimately means that two entities that encounter each other do not need to engage in the mimicry of each other's movements and do not need to physically resemble each other. This is essential in HRI and it can inform other forms of design and development of social robots: one that looks for a specifically robotic type of motion, while accounting for difference in our ways of affectively relating to non-humans.

But why is this relevant? I will like to point out how empathy has been understood as a vital feature of interpersonal understanding (Zahavi, 2010), as well as a marker through which racial, gender and other social differences continue to be drawn (Foster, 2010). Historically, scholars, philosophers, and theoreticians of all kinds have argued about the meaning of empathy and, along with it, who was or was not able to partake in it. Thus, uncritically introducing the term 'empathy' within robotics at a time when the technological developments of the field are increasingly questioning our most basic assumptions concerning what it means to be human can be highly dangerous. Universalising and generalising claims of what constitutes a human lead to the reaffirmation of stereotypes, denying the diversity of modes of being and different ways of moving that are present in the world. Affirming that a robot needs move or look 'like

a human' in order to show an empathetic response, then, risks following generalising discourses of what a human being is or should be, without explicitly addressing this issue.

In order to avoid such biases, a conceptual analysis of empathy needs to track in which ways it is being used now, and how other ways of understanding this term can open more inclusive and less anthropocentric paths. With regards to empathy, it is essential to always keep in mind what type of entities are we allowing to enter into this relation, what types of bodies are being considered in this process, and what constitutes the model under which we judge an empathetic encounter as successful. This, of course, exceeds the scope of this study. However, I hope that my paradigm of empathetic encounters can begin to untie the connections that are being made between empathy, similarity, and the creation of bodies, therefore addressing the social and political consequences of such a move.

State-of-the-art in Social Robotics and Contribution of the Research

Social robotics is gaining interest in a number of diverse academic and cultural fields, including philosophy (Seibt, 2016), dance (Laumond and Abe, 2016; Lourens, Van Berkel and Barakova, 2010; Jochum, 2016) or theatre (Knight, 2011; Jochum, 2016; Jochum and Putnam, 2015). HRI in particular has been an area of exploration for scientists, humanities scholars and artists alike due to its dependence on studies about human-nonhuman communication. In recent years, social robotics has paid attention to movement as a means to complement more traditional and costly approaches to HRI, such as anthropomorphic appearance or communication through symbolic language (Van Dijk et al., 2013; De Wit et al., 2018). The exploration of movement as not only functional and pragmatic, but also as a key component in making an agent seem intentional or emotional, is one of the main directions through which social robotics tries to achieve more effective communication and collaboration between humans and robots (Hoffman, 2014; Lourens and Barakova, 2010).

The idea that 'expressive motion' (Hoffman, 2014) can improve HRI—that recognising and responding to emotional and intentional movement is a vital part of connecting autonomous agents—has turned discussions on empathy into a central topic of research in several areas of robotics (Geun Oh and Park, 2014; Xu et al., 2015; Damiano et al., 2014). 'Empathy' is a relatively recent but long contested term that emerged in the field of aesthetics during the nineteenth century (Zahavi, 2009) and later

became an important asset for the philosophical problem of other minds (Zahavi, 2001). Within the field of Theory of Mind (ToM), empathy is generally understood through Simulation Theory, a strand that recent experiments on mirror neurons have significantly contributed to. In this framework, empathy is understood in terms of inner mimicry and perspective-taking (Stueber, 2019). Commonly, especially in the field of psychology, an empathetic relation is understood to rely on an imitation based on similarity and a projection (the latter being strongly connected to an act of the imagination). Furthermore, empathy tends to be divided into two parts: a cognitive one (being able to perceive, analyse and gain knowledge of other minds) and an emotional one (experiencing another person's emotions or feeling emotions due to another person's circumstances) (Stueber, 2019).

In social robotics, two aspects are of great importance for how empathy is understood and implemented in robots. The first is the development of an expressive motion that it is based on human movement—that is, the robot's ability to recognise, imitate and adapt to a human being's physiognomy and social conventions regarding movement (McColl and Nejat, 2014; Michalowski, 2007; Bao and Cuijpers, 2017). The second is a distinction between perceiving, analysing and expressing emotions, and having emotions (Baumgaertner and Weiss, 2014; Tapus and Mataric, 2007; Damiano et al., 2013). Transposing the enquiries into empathy from human-human interaction (HHI) to HRI has two consequences. First, even when the robot is a humanoid that has human motion as a model, its kinematics and behaviour still differ from that of a human, consequently complicating the issue of similarity and analogy in empathy. Second, it is argued that robots lack interiority, therefore making it impossible to fulfil the requirement of feeling emotions in an empathetic interaction, even if they are able to express them on a behavioural level. I argue that these complications in applying empathy through expressive movement to HRI is not due to the unsuitability of the term to the field but to certain paradoxes and assumptions that lie at the core of the concept, namely the idea of emotions being internal states that can be communicated among self-contained individuals through an act of the imagination based on similarity among those agents.

The present thesis begins by analysing the undertheorised usage of the term 'empathy' within social robotics, by means of an exploration of how this concept has been employed in recent projects and experiments. I then turn to dance and cultural studies investigations of the concept of kinaesthetic empathy to see what kind of

possibilities and challenges it might offer to social robotics. This project contributes a critical approach to the concept of kinaesthetic empathy inasmuch as it questions how, and if, it really moves away from the ST paradigm. Scholars from several fronts have engaged in critiques of the recent neuroscientific approach to empathy due to the discovery of mirror neurons. In the field of phenomenology in particular, critiques have been posed regarding the extent to which the simulation paradigm can account for an empathetic relation. However, these lines of argumentation have not directly addressed kinaesthetic empathy and its possible connection to ST. In offering a novel combination of these two strains of thought (kinaesthetic empathy and phenomenological empathy), this thesis proposes a way of dealing with empathetic HRI that challenges anthropocentric discourses, connection of empathy to imitation and the distinction between affective movement and expression.

Theoretical Framework

In order to develop a new paradigm for treating empathy in HRI—a paradigm I will call 'empathetic encounters'—I will use as my main theoretical frameworks the work on kinaesthetic empathy in the field of dance and cultural studies, as well as studies on empathy in phenomenology. Dance studies and its interest in analysing movement and kinaesthetic awareness has provided essential contributions to how empathy can be understood. Moreover, the critique from phenomenology on the accounts on empathy that are based on simulation and mimicry, recently gathered and elaborated on by Dan Zahavi, provide a strong basis for addressing those weak spots in kinaesthetic empathy that still rely on Simulation Theory.

For my research on kinaesthetic empathy I will make use of two recent books that deal with this topic: *Choreographing Empathy: Kinesthesia in Performance* (2011) by Susan Leigh Foster and the edited volume *Kinesthetic Empathy in Creative and Cultural Practices* (2012) by Dee Reynolds and Matthew Pearson. The first of these books presents a useful historical account of the uses of empathy, especially in relation to movement, and is furnished with some contemporary examples of how to approach kinaesthetic empathy in dance and choreography. The second book offers a more varied overview on how kinaesthetic empathy is being used in several cultural and dance practices. These studies will help me trace how this concept is being employed diachronically and

synchronically. As Susan Leigh-Foster and Dee Reynolds are the main theoreticians in this field of enquiry, I will also make use of articles written by them on the matter, in order to further understand their conceptualisation of empathy in dance.

These works critique the idea, as developed in social cognitive accounts of empathy, that emotions are expressed in movement. Instead, they argue that movement in itself can be both physical and emotional. Thus, according to the theorists of kinaesthetic empathy, empathy consists in a connection between two entities, a resonance that is based on kinaesthetic awareness of one own's body and of body memory. Movement within kinaesthetic empathy is considered to be pre-reflexive and both physical and emotional. In this sense, and contrary to theories of social cognition, empathy within kinaesthetic empathy discourses is not related to grasping an emotion expressed in movement and being moved by it (feeling the emotion yourself). Instead, the theorists claim, empathy is a pre-reflexive, kinaesthetic resonance in the observer's body that comes from the movement that is perceived in the target of empathy. However, discourses on kinaesthetic empathy still rely on an observer who needs to engage in the inner mimicry of another agent's movements through the kinaesthetic awareness of their own body and body memory. Thus, even if this concept is based on a pre-reflexive and emotional movement, it is still based on ideas of imitation.

These shortcomings of kinaesthetic empathy will be complemented by Dan Zahavi's work on phenomenological empathy, in particular his book *Self and Other: Exploring Subjectivity, Empathy and, Shame* (2014). Along with several articles published before this book, Zahavi traces the concept of empathy in the works of Edmund Husserl, Edith Stein, Max Scheler, Maurice Merleau-Ponty, and Alfred Schutz. His account of how this term has been used in the phenomenological tradition, as well as his critical approach to social cognition and recent debates on mirror neurons, provides my research not only with a historical understanding of phenomenological empathy but also with an up-to-date account of how this line of thought positions itself against current conceptions of empathy. Furthermore, far from merely recollecting the phenomenological take on the matter, Zahavi elaborates a critical account of empathy and interpersonal understanding more generally. Several ideas in Zahavi's account of empathy will be essential to my own analysis, especially the ones pertaining to how perceiving others as minded sentient creatures is a direct, unmediated experience that does not require simulation and projection; how empathy is an other-oriented experience, moving away

from ideas of similarity and self-other conflation; and how encountering another calls for a dynamic enfolding of complementary actions and not of mimicry.

As I will discuss in more detail later, theorists working within kinaesthetic and phenomenological empathy have their differences and contradictions. However, both strands have something essential in common: they analyse how the target evokes empathy in the observer, rather than how the observer simulates and subsequently projects their states on the target of empathy. This could create a different entry point in the issue of empathy between humans and robots than that of social robotics: it could focus on how the robot evokes empathy in the observer instead of how the robot shows empathy (by mimicking human movement). In order to understand better how this empathetic evocation takes place, I will make use of the works of Maxine Sheets-Johnstone, who will prove an excellent liaison between kinaesthetic and phenomenological empathy.

Sheets-Johnstone is a philosopher, dancer, choreographer and scholar who paid attention throughout her working life to both phenomenological research and kinaesthetic awareness. Especially relevant for my argument will be her idea of how movement dynamics can physically and affectively attune two agents. Sheets-Johnstone's study of movement dynamics, as well as my own enquiries on how empathy is performative and a performance, will allow me to propose a new paradigm for empathy in HRI: empathetic encounters. Through this contribution, I will also explain how empathy should be considered a process instead of an individual experience that either humans or robots have. Once the empathetic encounters paradigm has been introduced, I will turn to talk about empathy in terms of *affect* rather than emotion. Due to the pre-reflexive and processual character of my account of empathy, the term 'affect' seems to be more suitable than predetermined and clear-cut emotions when describing empathetic connections. Nonetheless, in the chapters in which I analyse social robotics and kinaesthetic empathy in dance, I will be faithful to the terminology that these theorists use, which associates empathy with 'emotions' and 'feelings'.

When applying the paradigm of empathetic encounters to HRI, it is possible to change the perspective on empathy from an understanding of emotional movement as being simulated in individual entities, to affective movement as being co-created in the process of relation between two or more entities. The line of enquiry that opened kinaesthetic empathy and phenomenology can be complemented with a performative view of empathy in which a co-creation of affective movement dynamics in a process of

relation occurs in the here and now. This change of paradigm moves away from the strand of Simulation Theory in social robotics by focusing on the coordination of movement dynamics instead of on the mimicry of human motion. Moreover, by considering empathy as happening in the process of relating and through a performative lens, the questions of whether or not a robot can feel empathy for the human or how the human can feel empathy towards the robot will change: through the paradigm of empathetic encounters, robots and humans can be considered as empathetically attuning themselves via the co-creation of complementary dynamics.

Methodology

The methodology of this research combines three methods. The first is a conceptual analysis: how the concept of empathy is being employed in social robotics, and how it has been treated in dance and phenomenology. The second is an analysis of Marco Donnarumma's artwork *7 Configurations Cycle,* which I use as a theoretical object[4] that will allow me to open a new path within the framework of empathy in robotics. The third is a case study analysis of the Performative Body Mapping project that explores how these new ideas of empathy can be reinforced or challenged.

The structure of the thesis in terms of methodology is as follows. Firstly, a conceptual analysis of the usage of the term 'empathy' within social robotics allows me to map the field through this particular point of view. Then, the work of Marco Donnarumma will be used to offer a new perspective on how empathy could be thought of in the frame of human-technology interaction, hinting at a possible new

[4] I use this term following Mieke Bal's considerations on the matter. For Bal, a theoretical object is characterised by its ability to "motivate, entice, and even compel thought" (12). Introducing theoretical objects in one's research would then mean to accept that objects cannot just be described by theory; on the contrary, they produce theory by raising questions, by triggering people's thoughts. Even if in my case study analysis of Performative Body Mapping I do not merely 'apply' theory to an object but let the object speak back on its own terms to the theory, I believe there is a distinction between the manner in which I approach Gemeinboeck and Saunders's project, and the way in which I address Donnarumma's practice. Hence the differentiation in two methods. While Gemeinboeck and Saunders explicitly qualify their research as dealing with empathy in HRI, Donnarumma does not. His main concern is neither empathy nor affect among humans and robots, but the larger artistic exploration of hybrid corporealities and modes of becoming with technology. Performative Body Mapping, therefore, can be considered an instance of how empathy in HRI could be developed otherwise (contrary to traditional social robotic strands) and is consequently considered a case study of the present thesis. Donnarumma, on the other hand, is regarded as a theoretical object inasmuch as his practice offers a way of thinking. His artistic work opens the space for the emergence of a theory that is useful for my own research.

conceptualisation of empathy in human-robot relations. In order to properly delve into this proposition, a conceptual analysis of how empathy has been treated in the fields of dance and phenomenology will prove useful. With the path that Donnarumma opened, and the theoretical framework that kinaesthetic empathy and phenomenological empathy provide, I will be able to offer my own contribution: the paradigm of empathetic encounters. Finally, a case study analysis of the project Performative Body Mapping of Petra Gemeinboeck and Rob Saunders will be explored through the lens of this new paradigm. With their practical approach to the development of social robots and their creative ways of dealing with human-robot interactions, the concept of empathetic encounters will be enriched and complicated, showing the possibilities but also the challenges that come when bringing this theory back to the realm of robotics.

For the conceptual analysis of empathy within robotics, I will rely on descriptions of projects in the field of social robotics, as well as reviews of the state-of-the-art of this area of study. For the conceptual analysis of empathy within dance and phenomenology I will base my enquiries on theoretical papers that apply the term 'kinaesthetic empathy' to diverse cultural practices, and on the work of Dan Zahavi, as his more recent texts select and summarise the works of several phenomenologists on the matter. For the analyses of the works of Donnarumma, Gemeinboeck and Saunders I will make use of theoretical papers by the makers, interviews, and recordings of the pieces and projects. The first two materials will allow me to engage with their own view on their creative processes, as well as their theoretical analyses of the issues at hand, their inspirations, and their frames of references. The last material, recordings of the specific pieces, will offer a valuable insight into how the performances took place, permitting a close reading of their visual, auditive and performative aspects.

Outline of the Thesis

This thesis will be divided into four chapters:

Chapter one will map the field of social robotics regarding empathy. It comprises a conceptual analysis of how the term 'empathy' is being used, showing its connection to ST. The main problematics and limitations of this approach will be explained at the end of the chapter: its connection to imitation and similarity, as well as the notion of internal emotions that are communicated through expressive movement.

Chapter two will be dedicated to an analysis of Marco Donnarumma's *7 Configurations Cycle*, used as a theoretical object to think with. This will provide me with the tools to initiate a novel way of treating empathy in robotics. His practice shows how, instead of being linked to mimicry, empathy is better understood through coordination and the co-creation of affective movement in a particular 'configuration'. This notion of configuration will point at how the affective connection is an ongoing and co-constitutive becoming where a modification of the body schemas of the entities interacting takes place. His practice will also hint at how this coordination is established in a common ground of oscillatory patterns and through pre-reflexive means: what he calls *automaticity*.

Chapter three will be used to describe the theories that allow me to delve into the concepts implicit in Donnarumma's work. Through the exploration of kinaesthetic empathy via the works of Susan Leigh-Foster and Dee Reynolds, as well as phenomenological empathy in Dan Zahavi, I will start to delineate the paradigm that I want to propose (empathetic encounters). The main contributions of these two fields of research will be how empathy can be considered as a pre-reflexive resonance of affective movement instead of a conscious simulation and an imaginative projection; how empathy is a matter of perception and not expression; and how coordination and not mimicry is a better framework for analysing how empathy emerges in an encounter.

Chapter four will create a dialogue between kinaesthetic and phenomenological empathy by means of Maxine Sheets-Johnstone's research on dance and movement and my own contribution. Through this I will fully elaborate my proposal: the empathetic encounters paradigm, where ideas of empathy as performative, as a performance, and as processual will be key. Finally, this chapter will turn back to a project in social robotics: Performative Body Mapping. This final move aims to bring my theory back to the field of designing social robots in order to see what the possibilities and challenges of my theoretical framework are. By analysing their way of creating a social robot, as well as the different workshops in which people interact with it, it will be possible to look at their manner of describing and implementing empathy. Their approach to affective and empathetic relations between humans and non-humans will offer a practical perspective on the development and design of social robots. Even if they claim that their project is based on the idea of kinaesthetic empathy, I show how their methods and reflections on

the matter move beyond that concept and approximate my paradigm of empathetic encounters.

The **Conclusions** will offer a summary of my main hypothesis and claims, as well as further explanation of the methods and relevance of this thesis. It will also include a comparison of my two main case studies (Marco Donnarumma's *7 Configurations Cycle* and Performative Body Mapping) and their connection to the empathetic encounters paradigm. Finally, this thesis will point out possible further lines of research in the field of empathy in social robotics based on my theoretical framework.

CHAPTER 1. Empathy in Socially-Interactive Robots

This chapter analyses the use of the concept of empathy in social robotic discourses, pinpointing what what kind of theoretical underpinnings it has. By analysing a number of experiments, reviews and theoretical papers, I will outline both the conceptual understanding and the practical implementation of empathetic methods in the development of social robots. After a concise summary of how empathy has been treated within the Theory of Mind debate in philosophical and psychological discussions, I will return to robotics and claim that usage of empathy that field corresponds to the one elaborated in Simulation Theory (ST). Finally, I will address how empathy in ST has certain limitations that become more visible once we move from human-human interaction (HHI) to HRI.

In this chapter I examine how movement, especially gestures and facial expressions, have gained great importance within the empathy debate in social robotics. These movements are understood as expressive tools by means of which the robot can express empathy towards the human. I go on to show how such an understanding of movement is linked with the conception of empathy within ST. In ST, expressive movement is considered to show the inner mental states of the target of empathy. When seeing this, ST proposes, the observer engages in a simulation and inner mimicry of those states, retroactively projecting them onto the target. This is what, according to ST, allows the observer of empathy to be able to imaginatively infer the inner mental states of the target and empathise with them. Social robotics's approach to HRI and the design of robots implies a similar understanding of empathy to that of ST. The most common way of creating robots that show empathy in social robotics is designing them to mimic human behaviour. Finally, I argue that the understanding of empathy in ST has essential flaws, especially when used in robotics. I claim that a more appropriate conception of empathy, both in HHI and HRI, relies neither on imitation nor on a false distinction between internal emotions and external expressive movement.

The Importance of Movement and Connections to Empathy

Many of the advances currently underway in the field of social robotics deal with the interaction between humans and robots, usually in the form of a cooperative relationship aimed at enhancing the human's performance or at providing a service to the human.

Social robots are being used as teachers (L2Tor), as caretakers (Growmeup), and as companions in diverse modes of therapy: from people suffering with dementia (Tessa robot), to autistic children (Kaspars), to people that experience depression and anxiety (Haptic Creature) (Sefidgar et al. 2016; Robins and Dautenhahn, 2014; Rintjema et al. 2018; Loghmani et al. 2018; Barakova and Lourens, 2010). Therefore, the development of those machines is directed towards their efficiency in the service given and their capacity of making the humans interacting with them comfortable.

For a socially interactive robot to fulfil its role correctly, it needs to be able to recognise, learn, and express social cues that human beings employ in their daily interactions. Consequently, communicating in complex dialogues, perceiving and showing emotions, employing gestural cues, or exhibiting specific characteristics are all tasks to which roboticists are currently applying themselves in the development of those robots (Fong et al. 2003). Specifically, in the design of those robotic companions, much emphasis has been on facilitating 'a useful transaction provided to a human by a benign machine' (Granjon, 2016: 74-75).

It is thus clear that in the era of socially-interactive robots, both the acceptance of the robots by their human counterparts and the effective cooperation between humans and robots are key aspects to take into account. In order to achieve such a goal, many strategies have revolved around giving the robot an anthropomorphic appearance. Anthropomorphic design has gone hand in hand with anthropomorphism—that is, the ability of humans to attribute human characteristics to non-human beings or objects based on their behaviour (Fink, 2012).[5] In this sense, when focusing on human-like robots, designers deal not only with appearance, but also with issues surrounding communication and behaviour.

Changing the perspective from anthropomorphic shapes alone to anthropomorphism through behaviour has led some roboticists to address the design of social robots in a different way. Some have decided to focus on movement and behaviour, while at the same time working with simpler, non-anthropomorphic shapes. Focusing on

[5] This tendency of humans to anthropomorphise non-humans has been already pointed out by several scholars. One of them is the psychological experiment conducted by Fritz Heider and Marianne Simmel in 1944 on apparent behaviour. In such experiment, people ascribed human characteristics to mere geometrical shapes based on their perceived behaviour in a short animation film, which people read through a human narrative, based on their learned social cues.

developing human-like behaviour instead of a human-like appearance has a double advantage: it levels the expectations that people might have when interacting with anthropomorphic robots; and it is also less costly (Van Dijk et al., 2013; De Wit et al., 2018). The main area of research in socially-interactive robots that deal with human-like behaviour focuses on the implementation of gestures, especially facial expressions. A great number of studies have analysed how a person performs better a task—especially children in learning environments—when the robot establishes eye contact and gazing cues or smiles at the human. These same experiments have measured how the attitude of the human towards the robot that 'shows' empathy is more positive than when the robot remains neutral (de Wit et al. 2018; Van Dijk et al. 2013).

However, the movements performed by these social robots are mostly facial expressions, not bodily movements; and they are usually treated as a complement to other features that are given more attention, mainly verbal human language. Furthermore, these movements are usually added at a later stage in the design and are only developed in a functional manner in order to comply with the pre-determined tasks that the robot needs to fulfil. Some researchers in the field of robotics, especially those who work at the intersection with more artistic fields, are indicating the problems of this strategy. Petra Gemeinboeck and Rob Saunders (2015), for instance, encourage roboticists to focus on movement qualities in the whole body and not only on expressive facial features in order to generate affective responses. Another designer, Guy Hoffman, highlights the importance of developing expressive movement from the beginning of the design, instead of in the last stages, which will lead to more appropriate shapes that might be simpler in appearance but more complex in movement (Hoffman and Ju, 2014).

The contemporary trends that roboticists like Hoffman exemplify not only look at implementing functional and pragmatic movement in social robotics, but also search for a development of movement that would aid in making the robot seem to be an intentional agent. For example, Lourens, Barakova and Van Berkel state that it is essential to move beyond functional movement—such as the type of movement that needs to be performed in order to take hold of an object—and to also take into account 'intentional, reward, and emotional features' that will make the robot act and be perceived to be autonomous (2010: 1256). It is important to mention in this respect that only a few researchers are focusing on the whole of the robotic body, instead of just facial expressions, in order to display emotions—and those who do so implement it through dance (McColl, 2014: 262).

Lourens, Van Berkel and Barakova have created a framework for expressing and interpreting emotional movement based on recorded material analysed through Laban Movement Analysis (LMA). Similarly, Heather Knight (2014; 2016) makes use of the Laban Effort system in order to give the robot the ability to enact motion in an expressive manner. They are not the only ones: other groups interested in robotics are making the most not only of notation systems, such as the Laban method, but also of the corporeal expertise of dancers in order to develop robotic movement (Masuda, 2010; Masuda and Itoh, 2009).

The conviction that expressive motion is a fundamental part of HHI and therefore could greatly inform developments in HRI has spread across social robotics. It is precisely this emphasis in recognising and responding to emotions expressed through movement that has brought the term 'empathy' into the equation. A striking number of studies in socially interactive robots are using empathy not only as one concept through which to analyse the cooperation between humans and robots, but also as the main feature to develop in this context. Empathy is usually summoned as a tactic by means of which humans and robots can achieve a better connection (Leite 2012; Hegel et al. 2006); can perform a task more efficiently and in a cooperative manner; or can induce trust and a positive attitude towards the robot (Junchao, 2015).

In the experiments where this level of cooperativity and acceptability is measured, empathy and movement are always linked in a very specific manner that, as I will argue, leaves out other essential features of this connection. In these accounts it is through the display of gestures, but mainly facial expressions, that emotions are understood to be conveyed and intentions inferred. Hoffman and Ju affirm that 'movement can be used to classify and recognise, but also to assign internal states and intentions. This capability is usually referred as theory of the mind' (Hoffman and Ju, 2014: 89). The movements of the robot are thus considered as a channel through which, either by a rational deliberation or by an automatic emotional connection, humans can understand the robot's simulated motives, emotions, and intentions. Movement in these cases becomes a means to an end: the end of identifying and connecting with a perceived 'robotic mind'. However, this mind is considered to only *simulate,* and not experience, the emotions and intentions that a human counterpart would experience. In this sense we can interpret Yunqing Bao and Raymond H. Cuijpers's affirmation: 'It is crucial to focus on how people naturally adopt

an 'intentional stance' and interpret the behaviour of the robot *as if it possesses goals, intentions, and beliefs*' (2017: 691) [emphasis added].

The goal of these experiments is to create the adequate circumstances under which human and robot can empathetically relate, and also to analyse to what extent this is taking place effectively. Therefore, when dealing with empathy, social robotics tries to make the robot *show empathy for* the human, as well as make the human rate how well this happens and how it makes them feel. In the experiments where robots are said to *show* empathy, we can observe how they are made to do it in two ways: either by perspective-taking (expressing emotions after analysing a situation) or by mood contagion (expressing emotion by mimicking humans' motions). In the first case, the robot would analyse a situation, judge an appropriate response according to its parameters, and select a mode of expression through movement and gestures; in the second case, the robot would mimic human emotions expressed in movements. Here we can observe the distinction that it is usually made between cognitive empathy and emotional empathy, described by Charrier et al. as it follows:

> Emotional empathy can be defined as the ability to experience and understand another entity's affective experience by sharing the same feelings […], it also includes mimicking behaviours. Cognitive empathy refers to the ability to represent and understand the internal mental states of someone and to be intellectually able of perspective taking […] (Charrier et al. 2018: 1)

Robots that show empathy through perspective-taking have the goal of assessing what they would do in a certain situation according to their programmed parameters and judging accordingly. Interestingly for the purposes of this thesis, they show this capacity for perspective-taking in emotions expressed through verbal and bodily expressions (albeit mainly facial expressions) (Charrier et al. 2018; Leite et al. 2012). In Leite et. al (2012), for example, this is implemented in a chess game where two human players are observed, judged, and encouraged by a bystander robot. This robot offers what the authors deem as empathetic responses to one of the players and neutral responses to the other, by positioning himself in the role of the player it emphasises with and responding emotionally through facial and verbal expressions to its chess moves. The robot in cases like this one is considered to display empathy because it is able to infer its companion's emotional state (linked to its point of view) and respond accordingly.

However, most experiments focus on mood contagion—automatic responses that create a congruent mood between two entities—rather than on rational perspective-taking. This transference is always analysed through visuality: it takes place through the observation of the person's or robot's emotional expression, which is considered as a vehicle of internal motives. In these types of experiments empathy is understood to work in the following way: the observation of an emotional expression can help in understanding the target's behaviour (Junchao et al. 2015: 1217) and make the observer experience that same emotion by mimicking the behaviour (Laurel and Robinson, 2008). In its application to robotics, however, the robot cannot 'feel' that emotion when mimicking the human's motion; they are only able to 'show' empathy on a behavioural level. For instance, Frank Hegel et al. treat empathy as the mirroring of humans' emotions expressed in verbal speech and facial expressions by a humanoid robot. In this case, even if auditory cues are also introduced, their consideration of empathy mainly relies on the visually-recognised human movements that are mirrored by the robot in order for the robot to share and convey emotion—empathy takes the form of motor mimicry. They use the torso of an anthropomorphic robot for mirroring what they label 'happiness', 'fear' and 'neutral' emotions in the target's facial expressions and report on the results of humans interacting with it. As they state, 'a robot who is capable of mirroring the emotional expressions of a user may be interpreted as showing empathy' (Hegel et al. 2006: 56). Another instance explored by Riek Laurel and Peter Robinson (2008) is that of a robot head in the shape of a primate that mimics human's facial expressions in real time in order to make them feel that the machine is empathising with them. According to this study, if the empathetic connection is effective, users are more likely to rate it positively.

Lourens, Van Berkel and Barakova (2010) also show an underlying comprehension of empathy similar to that of ST. They write that 'motor imitation is fundamental for an infant's emerging ability to detect the correspondence between self and others. The early opportunity for an infant to detect similarities with others leads to later understanding of other's intentional behaviour and the development of theory of mind' (2010: 1256-57). As mentioned above, in their experiments expressive movement is analysed through LMA, which, as they state, 'is a formal "language" for movement description and emphasizes how internal states, feelings and intentions govern the patterning of movement throughout the whole body' (2010: 1257). The distinction

between internal feelings and the external expressions of them is also present in Lim and Okuno's experiment (2015): with the goal of enhancing the cooperation between humans and robots, they try to implement empathy by means of a robot mirroring human expressions.

Through an extensive review of robotic projects that deal with emotion, Luisa Damiano et al. (2014) conclude that most of those experiments distinguish between internal and external emotions. The development of 'external or social emotions' is the label that Damiano et al. use to categorise those projects that focus on the construction of anthropomorphic robots that facilitate empathy, while those who attend to 'internal or individual emotions' look for the construction of endogenous processes of regulation that imitate human emotional mechanisms. In the first case, the emphasis is on the expressive aspect of emotions by the robot by means of proxemics, movement, gestures, bodily and facial expressions. This is considered to be a simulation or a faking of emotions that the robot does not 'really' have. The second case is an attempt to create artificial emotions and robotic empathy. The latter is, however, more of a speculative projection on the future of such experiments, rather than an actually-existing approach; at present roboticists mostly focus on creating so-called 'external emotions' to build an empathetic relation with humans.

The projects that deal with these 'external emotions' treat movement as a means to convey emotions and facilitate empathy, be it through cognitive means (perspective-taking) or through emotional contagion (motor mimicry). At the core of this idea is the conceptualisation of empathy as encompassing internal and individual states that only later are communicated through expression. In this paradigm, expressive movement would involve 'simply transmitting information about their supposedly pre-defined and individual emotional states' (Damiano et al., 2014: 8). But when moving the discussion to HRI, a fundamental problem arises: since robots do not possess a human mind as it is understood in these theories, they do not have the necessary interiority to 'really have' those emotions. Being only focused on its expression, the emotion conveyed and the empathy shown can only be a simulation, a faked expression of the 'real thing'.

In sum, whether they are based on perspective-taking or emotional contagion, all of the experiments in social robotics devoted to empathy share a basic understanding of the relationship between emotion and movement: emotions are thought to be internal and individual states only accessible to humans and simulated by robots; and, in a subsequent

and contingent stage, these internal states are communicated through movement (mainly facial gestures). It is in this later phase that, more or less rationally, the entities can display empathy by observing, analysing, and sharing those emotions through movement or by mimicking the target's expressive movement. Furthermore, in the strands focused on emotional empathy (the most common ones in this field), there is a clearer connection between empathy and simulation or mimicry: it is through the imitation of another's movement that empathy is enacted.

A Brief History of Empathy: From Lipps to Simulation Theory

The term 'empathy' is relatively recent: only being introduced in the nineteenth century, it has been a contested term that has circulated in numerous fields of study. Having originally emerged in the field of aesthetics, the concept of empathy was quickly associated with the long-standing philosophical problem of other minds. Difficult to delineate, empathy has blurred its boundaries throughout the last centuries with neighbouring concepts, such as emotional contagion or sympathy, which led some theorists to abandon the term in search of greater conceptual specificity. In the second half of the twentieth century empathy was mainly left to psychologists who treated it as a process that ought to be analysed by the empirical sciences (Stueber, 2019). It was, however, through the discovery of mirror neurons and the subsequent revivification of Simulation Theory that empathy was reintroduced into philosophical and neuroscientific discourses (Stueber, 2006: 4).

The term 'empathy' was first coined in 1872 by philosopher Robert Vischer, who named it *Einfühlung*. It was later on, in 1909, that Edward Titchener translated it into English. Its usage proliferated in philosophical aesthetics; from the second half of the eighteenth century, many thinkers in that field had been occupied with similar ideas, such as the human capability of 'feeling into' works of art, as well as nature. Before that time, however, another term was used with similar connotations: sympathy. In the seventeenth century, Sir Kenelm Dibby's theory of the powder of sympathy analysed sympathy as a cosmic magnetism where people would be subjected to multiple attractions or repulsions of atoms. This connection was an effect of direct contagion. In the eighteenth century—especially in the work of the aesthetician Jean-Baptiste DuBos—sympathy came to be understood as a theory of connectivity that relied instead on an act of imagination between

isolated individuals. One way or another, sympathy as a precursor of empathy pointed at 'agreement, harmony, consonance, and accord' (Foster, 2010: 130).

Empathy came to be thoroughly analysed in the field of aesthetics by the philosopher Theodor Lipps, who until today remains the principal reference in the field. His understanding of the term was directed not only at the explanation of an aesthetic experience, but also at a broader interest in recognising others as minded creatures. Lipps conceived of empathy as a psychological process of resonance that took place in the perceptual encounter with objects. This resonance would trigger inner experiences similar to the ones that a person has when moving his or her own body. However, as the attention is perceptually focused on the object, those inner resonances that are internally experienced in the human body are projected onto the perceived object and understood as a quality of the object (Stueber, 2006: 7). If the experiences are positive, I perceive the object as beautiful; if they are negative, my perception would be aesthetically unpleasant as well. In this case, an analogy between an object of art and the human body is drawn. Similarly, Lipps employed the term empathy for the connection established between two human agents that consider each other as minded creatures. In this context, Lipps understood empathy as an unconscious process of inner mimicry whereby the mind of the observer mirrors the other's mind based on their corporeal expressions (Montag and Heinz, 2008).

At the beginning of the 20th century, Lipps's introduction of empathy into the debate of intersubjectivity was seen as appealing because it posed an alternative to the analogy argument for the problem of other minds. The philosophical problem of other minds deals with how we conclude that other agents are minded creatures like ourselves—that is, creatures capable of thinking and feeling in a similar way to us. Traditionally, the justification to this commonsensical belief was found in the argument from analogy, developed by the nineteenth-century empiricist John Stuart Mill. He stated that we attribute mental states to other people based on their perceived behaviour and the analogy that we can extract from our own behaviour. Therefore, if a behaviour X corresponds in me to a mental state Y, if I see X in another person, it must correspond to Y as well.

Lipps rightfully points out with regards to the analogy argument that it falls short of dealing with the problem of other minds as it remains within a Cartesian framework where the other minds are fundamentally inaccessible to us (Stueber, 2019). Lipps's theory of empathy tried to move away from the analogy argument. His proposal offered

an understanding of empathy as a process of simulation and projection that, according to him, would be able to account for other minds. In this sense, Lipps could be considered as the precursor of Simulation Theory. This problem of other minds is closely related to the so-called Theory of Mind (ToM); that is, the 'ability to attribute mental states to oneself and others' (Baron-Cohen, 1991: 234). Based on the idea that only our mind is accessible to ourselves, the 'problem of other minds' dilemma wonders how it is possible for us to ascribe mental states and emotions to other people if their minds are fundamentally inaccessible to us. In order to explain how ToM takes place, two main theories were developed in the philosophical tradition: Theory-Theory (TT) and Simulation Theory (ST).

TT, initially developed in the 1980s, proposes that our ability to infer mental states from others rests on our capability of perceiving their available behaviour, as well as on the existence of certain theoretical principles. These principles are in close connection to what it has been deemed 'folk psychology': 'the abilities and the repertoire of mental concepts such as beliefs, desires, and emotions that ordinary people without any specific psychological training possess and use for understanding other people as minded creatures' (Stueber, 2006: 2). TT also claims that the way people acquired knowledge of other people's mental states was inherently similar to the way people access other type of knowledge, such as an understanding of physics. Through links between environmental inputs, inner states, and behaviour outputs, people could determine causal links that would help them in creating a general theory that could be applied to other people, as well as to oneself (Shanton and Goldman, 2010; Stueber, 2006).

In contrast, ST understands our inference of others' mental states not as mainly determined by theory but by ego-centric methods in which oneself is used as a model to understand other people's minds. This process requires first a simulation, and afterwards a projection (Stueber, 2006). According to ST, our way of accessing others' minds is by means of a prediction, along with an inner imitation of their mental state. First proposed by Gordon and Heal and further elaborated by Harris and Goldman, ST maintains that people use imagination, mental pretence or perspective-taking to understand other people's mental states (Shanton and Goldman, 2010). Therefore, the process that someone would experience in ST would be the following:

> A mentalizer simulates another person by first creating pretend states (e.g. pretend desires and beliefs) in her own mind that correspond to those of the target. She

then inputs these pretend states into a suitable cognitive mechanism, which operates on the inputs and generates a new output (e.g. a decision). This new state is taken 'off line' and attributed to the target (Shanton and Goldman, 2010).

As can be seen from these descriptions, both ST and TT treat mental states as internal, individual and only accessible to oneself in an unmediated fashion, which can only be perceived and communicated through the mediation of the body. The fact that this perception of emotions is mediated by physical behaviour and not directly accessible is what calls for other methods, such as simulation or inference from 'folk psychology'.

New strands in philosophy and psychology are creating mixtures of both TT and ST, with an overall tendency towards the latter. Among those, Alvin Goldman stands out. Rejecting classical approaches to cognitive studies that do not pay attention to the body, Goldman endorses a situated and embodied cognition approach. However, he insists that this does not mean rejecting mental representations. Rather, his proposal 'makes a central appeal to a certain class of representations, namely "bodily representations"' (Goldman, 2013: 11). In this sense, his proposal does account for conscious imagination, inference and representation, despite its being centred around simulation.

Goldman usually refers to empathy as mind-reading, making a distinction between the human ability to understand behaviour in terms of mental states and simple behaviour reading, which would be assigned to non-human animals. In this respect, one of the previously-mentioned pervasive conceptualisations of empathy also holds for Goldman's theory: the belief that the body expresses something internal to it that needs to be 'read' like a text, thereby disclosing something that it is not experientially available. Furthermore, even if he claims to be developing his theory in the framework of embodied cognition, it is relevant to note how he refers to the empathic process as '*mind*-reading': this, as well as his constant allusions to the importance of understanding '*mental* states', might make us wonder to what extent is the body present in his research. The mind-reading that Goldman proclaims might take place in unconscious mimicry or imaginative inference, but both will always deal with an imitation of an entity that shares a similarity with the empathiser.

Goldman links empathy to both imitation and deliberative inference in his distinction between two forms of empathy: low-level and high-level. For him, even if empathy can happen in an automatic and unconscious manner (the mirroring process that

takes place in low-level mind-reading), reconstructive empathy, with its correspondent act of imagination and consciousness, is the one that seems to possess the greatest importance. A similar distinction is at play in another influential simulationist[6] who also adds considerations from TT: Karsten R. Stueber (2006). He divides empathy into 'basic' and 're-enactive' forms: the former designates an unconscious mechanism of inner imitation that underlies our ability to understand others as minded creatures; the latter describes a process that involves cognition and the ability to imitate the emotions, beliefs, or intentions of others.

In psychological debates, this separation of different types of empathy is conceptualised as the aforementioned division between cognitive and emotional empathy (Davis, 1980; 1983). The first area of study defines empathy primarily as a cognitive phenomenon, whereas the second deals with issues surrounding emotional contagion processes that occur in a less reflexive sphere. As we have seen, Goldman's and Stueber's analyses involve mixtures between cognitive and emotional empathy, implying that empathy is understood as a simulation that encompasses some theoretical inference. Nonetheless, the focus remains invariably on the similarity that is called for in an empathic connection between two individuals, and in the mimicry that takes place in order to establish that connection. This idea finds further support in neuroscientific research on mirror neurons. As Goldman (2013) points out, the discovery of mirror neurons highlights how imitation takes place not behaviourally, but through an internal resonance that activates neurons. This has been taken by simulation theorists as a sign that a 'primitive version' of imitation underlies human empathy, or in his words, human mind-reading. In contrast, high-level mind-reading or re-enactive empathy encompass imagination and conscious inference. According to simulation theorists, then, the discovery of mirror neurons would not be equivalent to ST but would account only for a primitive part of it.

Mirror neurons were discovered in 1998 in experiments using primates. Neuroscientists observed that there were certain types of neurons that 'discharge when the monkey *observes* an action made by another individual and when it *executes* the same or a similar action' (Gallese, 2005: 108) [emphasis in the original]. Further experiments showed how these neurons were also present in humans, although this part of the research is ongoing and therefore uncertain, especially with regard to how they function and what

[6] I use this term as employed by Dan Zahavi in his works, referring to those theorists that explain empathy through ST.

kind of stimuli they react to. According to Vittorio Gallese, a main proponent of this theory, the discovery of mirror neurons in humans shows how processes of inner imitation happen in a reflex-like manner in intersubjective encounters. Mirror neurons have been taken to prove not only the existence of empathy but also a particular understanding of empathy: the one that had imitation and similarity at its core, that is, ST. As Gallese points out: 'Anytime we meet someone, we do not just perceive that someone to be, broadly speaking, similar to us. We are implicitly aware of this similarity because we literally embody it' (2005: 104).

As mentioned at the beginning of this section, the theory of empathy advanced by Lipps can be considered a precursor of ST, inasmuch as he claimed that the empathetic process relied on an inner mimicry that used the body of the empathiser as a model. That is why mirror neurons have been considered as a scientific proof, not only of a basic version of ST but also of Lipps's hypothesis. However, in Lipps's conception of empathy there is a strong emphasis on the past experience of the empathiser, since, according to him, an expression in an external agent or object can only provoke an affective state if the perceiver had already experienced that state in the past. Therefore, the possibility of perceiving something new and emergent in the other is impeded by the vital role that the first-person perspective holds in this account (Zahavi, 2014). Traditional simulationists, and later mirror neuron scientists like Gallese, do go further in this respect, as for them the simulation between two agents happens through an unmediated resonance that does not need to rely on past experiences. This involuntary mimicry, at least in a low level, is considered to activate neural pathways that lead the empathiser to experience the same emotion as the target of empathy.

However, Gallese indicates an additional factor of particular interest for the present study. When explaining how empathy relies on similarity, he specifies that this similarity is not just *visual*, as this would imply that we are only capable of recognising things that share the same form, shape, and standards as us. Rather, the similarity due to which mirror neurons fire is based on a commonality of *action*. Therefore, we recognise things as similar to us in terms of their behaviour, in terms of how they share motor schemas with us, and not only in terms of their visual appearance. These automatic responses that are linked to motor schemas create a link with more kinaesthetic understandings of this process. Consequently, the discovery of mirror neurons not only favours Lipps's conception of empathy; it also opens up a path for both a kinaesthetic

understanding of empathy, as well as a conception of it that deals with intercorporeality. However, several important differences between the system proposed by mirror neurons with both kinaesthetic and phenomenological empathy will be pointed out in subsequent sections.

Application to Robotics: Problematics

As Damiano et al. (2014) rightfully mention in their review of social robotics, experiments regarding empathy nowadays implicitly or explicitly mark a division between internal emotions and external expressions of them—that is, between emotions and the corresponding movement that communicates them; or, to put it more simply, between 'having emotions' and 'enacting emotions'. It is commonly understood in social robotic experiments that robots are able to express and recognise emotions but do not have them, as they cannot really 'feel' them. In Baumgaerter and Weiss (2014), for example, there is a strict division between emotions and behaviour, which leads to the conclusion that 'having emotions' is unnecessary for an ethics of HRI, as the key thing for a robot is to show appropriate behaviour. Furthermore, in this study they claim that emotions can lead to irrational biases; therefore, since robots do not really have emotions, they are the more ethical choice when providing services to humans. Apart from the fact that the clear differentiation between emotions and expressions of emotions is problematic, another sensitive matter arises: the belief that as robots 'do not really have emotions', they will not be biased when interacting with a human. This attitude clearly does not take into account that establishing the parameters under which embodied AI behaves is carried out by humans and for human standards, which makes it almost impossible, and certainly naïve, to claim that robots can provide an unbiased service.

Another instance of this division between 'having emotions' and 'enacting emotions' can be found in Tapus and Mataric (2007). The authors clearly define empathy as perspective-taking, as well as an internal state that 'can sometimes be recognized through imitative bodily movements' (2007: 1). In this case, it is important to note how expressing the emotion through movement is not only a secondary step but also an optional one, and thus not an integral part of the empathetic process. Moreover, as evident in the above citation, the expression of the emotion and its recognition are considered to take place only through imitation. This idea of empathy being associated with perspective-taking and imitation can also be observed in Ana Pavia's discussion of its

relation to social robots: 'In order to have empathy we need to identify ourselves with the others in some way. Identification is what makes us adopt the emotions, situation and behavior of the others we are empathizing with' (2011: 66).

As demonstrated throughout this chapter, in the usage of the concept of empathy within social robotics two aspects seem to be key. The first is its connection to movement. Social robots make use of the research on human movement regarding kinaesthetics, proxemics, facial expressions, and gestural or bodily motion in order to create an embodied AI that would be able to both imitate and recognise that movement (McColl and Nejat, 2014; Michalowski, 2007; Bao and Cuijpers, 2017). However, in the robotics projects analysed in this chapter, movement is considered to be a mere channel through which emotions and intentions are expressed. The second is a distinction between 'enacting emotions' and 'having emotions' (Baumgaertner and Weiss, 2014; Tapus and Mataric, 2007; Damiano et al., 2013), with the consequent claim that robots can only simulate empathy but not really experience it themselves.

In social robotics projects, then, there is a specific understanding of empathy that applies to both HHI and HRI. Through an analysis of their projects it is possible to recognise the assumptions that the majority of social roboticists share when talking about empathy in HHI and its transposition to HRI. This common and unaddressed understanding of empathy and how it should be implemented in social robotics has several limitations. Even when a robot is designed in an anthropomorphic shape, its kinematics will still differ from those of humans. Also, differences in behaviour are still perceivable, even when the robot tries to mimic a human motion. Therefore, the supposedly necessary similarity that needs to be established between two agents, be it in appearance or in action, might not be sufficient. Furthermore, robots are said to lack the ability to 'really' think or feel as humans do. According to social roboticists, this implies that robots will never be able to experience empathy; they will only be able to simulate it on a behavioural level.

I have been arguing that these limitations do not come from the inability of robots to 'really' experience empathy, nor to the unsuitability of the term to inform the design of social robots or to improve HRI. My claim is that *such limitations are already at the core of their understanding of empathy*: an understanding similar to that of ST. Simulationists maintain a division between cognitive and emotional empathy (low-level or basic empathy and high-level or re-enactive empathy), which we also see in robotics when they focus on either emotional contagion or perspective-taking. In ST there is also

an emphasis on mimicry and projection with the necessary prerequisite of similarity between the agents that establish the empathetic connection. In the same way, experiments in social robotics regarding empathy deal with a robot mimicking human movement in order for the robot to show empathy. Finally, it is understood that the mind of others is experientially inaccessible and, consequently, mental states are treated as individual, internal, and only available to oneself. Moreover, mental states in ST are considered to be expressed by bodily behaviour, therefore creating a very strong distinction between external and internal—a division also clearly established within social robotics.

As empathy has become such an essential topic of research in HRI, it is vital to critically engage with what type of conceptualisation is being used in social robotics and what the implications are of such an approach. In the following chapters I will propose a different understanding of empathy: one that it is not based on a difference between internal emotions and external expressive movement, an emphasis on similarity with and among humans, and an empathy that is based on imitation; but one in which movement evokes or elicits an empathetic connection, instead of just communicating a supposedly pre-determined mental state. I will also argue that the enacting of emotions in movement during the empathetic process not only fulfils a communicative role; rather, it involves a performative aspect of the emotion in itself: *enacting an emotion creates that emotion*. Similarly, emotions are always relational. In this way, relationality also plays an essential part in the creation and evolution of emotions in empathetic connections.

In order to develop a new paradigm for human-robot empathetic connections that could open other paths for treating this topic within social robotics, I turn to the work of artist Marco Donnarumma. His work on human-technology relations will function as a stepping stone through which I will be able to address a different entry point to empathy within robotics. After an analysis of his artistic work and his theoretical reflections on the matter, I will show how what Donnarumma suggests is in line with different theoretical understandings of empathy as developed by kinaesthetic empathy and several strands of phenomenology. By basing my enquiries on these two fields of thought, I will emphasise the performative aspects on empathy and propose a new paradigm for this connection in social robotics. In so doing, I aim to show that a different understanding of empathy to that currently as play in social robotics is possible, and that this new conceptualisation could inform other approaches to HRI, as well as the design of social robots.

CHAPTER 2. Offering a New Perspective: Marco Donnarumma

In this chapter, I shall start with an overview of the work of Marco Donnarumma and his *7 Configurations Cycle*: an on-going project that includes performances and installations with human dancers, robotic hardware, machine learning software and microorganisms. My aim in this part of the thesis is to use his practice as a theoretical object that suggests the possibility of a new form of human-robot empathetic relationship. Even though his artistic work not only deals with robotic art but is rather part of the bigger sphere of human-technology relations, Donnarumma and his artistic usage of computational systems and robotic prostheses will prove useful in offering a different way of thinking about empathy in HRI. In his research, as well as in artist statements about his work, Donnarumma never mentions the word 'empathy', but 'affect'. Nonetheless, I propose that looking at his practice through the lens of empathy offers a different entry point to the subject matter of this study.

Marco Donnarumma's work, especially his performances *Corpus Nil* and *Eingeweide* (within the *7 Configurations Cycle*), proposes a radical thinking about the possible physical and affective attunement between humans and machines. Seen through the perspective of empathy, these explorations suggest a counter-proposal to ST. Donnarumma's work with computational systems and robotic prostheses hints at how empathy in HRI can be understood as a process in which a coupling of movement dynamics takes place, rather than a mimicry of human motion. This coordination or coupling in his work is based on a vibrational oscillatory rhythm shared by the neural network patterns of the prostheses and by the human body. Such a coupling occurs when thresholds are crossed through automaticity (a form of pre-reflexive attunement that requires entrainment), which allows for potential movements to be actualised, consequently reconfiguring the body schemata of both humans and robots. The artist considers the physical and affective attunement between human and machine that happens in his performances as a form of configuration: a co-constitutive and ongoing organisation of human body, robotic hardware, and software in an unstable and changing engagements.

After describing the *7 Configurations Cycle*, I move on to analyse how the notions of vibrational rhythm and configuration play a part in Donnarumma's practice by means of a case study analysis of *Corpus Nil*. This will give us an understanding of how empathy

can be a process in which the attunement of movement dynamics plays a vital part. Once these notions have been developed, I will proceed to an analysis of *Eingeweide*, along with the concept of automaticity, in order to explain how a pre-reflexive coupling, and not a mimicry, can be considered as a more suitable framework for understanding empathy.

Professional Trajectory: *7 Configurations Cycle*

Marco Donnarumma is a performer and scholar who, since the early 2000s, has been developing work in the intersection of live arts, music, computation, biological science and robotics. He holds a PhD in performing arts from Goldsmiths College, and is currently a fellow of University of the Arts Berlin, in collaboration with the Neurorobotics Research Lab. His performances and installations have toured over 60 countries in many well-known festivals, such as the Venice Biennale and the Transmediale Festival for Art and Digital Culture. Following the work on body and prosthesis by artists like Stelarc, Donnarumma focuses on the intersection between technology and the human body, trying to offer a non-anthropocentric view on the matter that can deal with 'a constructive mutual influence' (Donnarumma, 2016: 67). His concern with how scientific research and technological development can be used for transhumanist[7] and normalising[8] practices makes Donnarumma critically engage with the human-technology relationship, drawing mainly from disability, posthumanist[9] and gender studies. As he expresses in his official webpage, he is interested in showing the connection between 'humans, technology and living-others as a harsh, poetic and humbling form of intimacy'.

[7] Transhumanism, as Cary Wolfe eloquently puts it, "derives directly from ideals of human perfectibility, rationality, and agency inherited from Renaissance humanism and the Enlightment" (2009: xiii). Having its root in rational humanism, it constitutes a movement dedicated to the enhancement of human intellectual, physical and emotional capabilities, with the elimination of certain conditions, such as diseases or, in a more general way, suffering. Transhumanism can be understood then as an intensification of humanism inasmuch as the 'essence' of the 'human' is achieved by transcending materiality and embodiment.

[8] For Donnarumma, technological advances, especially those that are in close connection with the human body, may risk following ideas of disembodiment and/or perfectibility. An example of this agenda could be the assumption that prostheses should be used either as enhancements of the human body or as 'correctors' of a functionally diverse body, which the intention of transforming diverse corporealities into 'normal' ones.

[9] Posthumanism, contrary to transhumanism, does not try to overcome the human, as this would fall into narratives of historical change and progress. However, it does question what a human is and how it has been and is conceptualised in other discourses. In particular, it argues that a concept of the human that is based on fantasies of disembodiment and independency does not hold anymore. It also seeks to de-centre the human, making alliances with post-anthropocentric discourses.

This is especially recognisable in his *7 Configurations Cycle,* a group of performances and installations made in collaboration with artists and roboticists. The cycle deals with the integration of new technologies into the body and the implications of this process. The *7 Configurations Cycle* has toured with shows and exhibitions in nineteen countries. Each work exposes a type of embodiment described by the artist as a 'configuration': a type of co-constitutive organisation of human bodies, robotic hardware, machine learning software and microorganisms that affect each other. So far, five pieces compose the cycle: *Amygdala, Corpus Nil, Eingeweide, Alia: Zu Tài* and *Calyx.*

These works offer intense theatrical experiences that reflect on non-human agency and its potential to reframe the conception of the 'human'. By means of a close connection between movement and sound, Donnarumma creates pieces in which human and technological bodies influence each other and co-constitute the hybrid corporealities that are shown on stage. My claim is that this affective connection between human and technological agents relies on a different conception to the one explored within social robotics. This is because the machines that are employed in Donnarumma's work, in order to affectively attune themselves to the human, do not make use of the mimicry of human motion; rather, they employ their neural networks and sensorimotor systems to co-create (along with the dancers) the movements that are performed on stage.

In most of the works of the *7 Configurations Cycle*—and especially in *Corpus Nil* and *Eingeweide*—Donnarumma makes use of two techniques: improvised choreographies with AI prostheses and biophysical music. Each prosthesis uses neural networks and learning algorithms that allow them to interact, perceive and respond to their human dancing counterparts. These prostheses, usually covering a part of a dancer's body or hindering their usual movements, act autonomously, driven by their oscillatory neural patterns (see figures 1 and 2). The machines are not pre-programmed but rather work by trial and error, therefore changing and adapting their motion in each performance by means of their connection with the environment and the human bodies on stage.

With regards to biophysical music, it is important to first survey Donnarumma's early works on the field of computation. Interested in the way sound influences the performer's and the audience's perception, Donnarumma delved into the field of biophysical media; that is, the audio and visual material that emerges from biological and physical mechanisms of the human body (Donnarumma, 2012c). With this type of exploration, Donnarumma developed the 'Xth Sense': a biophysical system for

interactive music performance comprising wearable sensors and an ad hoc computational engine. The 'Xth Sense' is able to capture the sounds of muscle contractions and feed them to a software system, in which mathematical and learning models are employed to analyse sound and later on transform it into changing musical activity (Donnarumma, 2012a).

The 'Xth Sense' is the main technological device that is used in *Corpus Nil*, whereas in *Eingeweide* this technique will be expanded and complemented through the use of the AI prosthesis Amygdala, with which Donnarumma performs an improvised choreography. While the focus of our study is in the empathetic connections established through robotics and humans, as most explicitly explored in *Eingeweide,* in order to theoretically and technically understand how Donnarumma came to that stage it will be necessary to first analyse *Corpus Nil*. Therefore, the next section will be dedicated not only to this performance, but also to how biophysical sensing, and its consequent understanding of vibrational rhythm, contributes to a comprehension of the human-robot empathetic attunement that takes place in *Eingeweide*. His work will consequently serve as a thinking-in-practice that opens a different path to empathetic connection to the one explored in the previous chapter. His work on human-technology interaction, I argue, gives a hint of how coordination can provide a more suitable framework than mimicry to account for empathy in human-robot relations.

Configuring Bodies: vibration as a mode of empathic connection in *Corpus Nil*

Corpus Nil is a solo performance created by Donnarumma in 2006, in which, on a black background and showing only his back and neck, Donnarumma's body seems to morph continuously. Conceptually, this performance takes a stance on how we perceive a human body and what kind of assumptions come with that perception. Negating the body, as the title suggests, implies erasing the things that are known about a human and a machinic body and creating a new idea of it. This other body revolves around a possible co-creation and co-operation between autonomous entities: a hybrid corporeality. My claim is that this new creation is based on a type of affective attunement between human and machine that can be understood through a paradigm of empathy, albeit one markedly different from that emerging in social robotics discourses.

When the performance starts, in total darkness and with a high-pitched electronic sound in the background, the audience is unable to perceive anything on stage apart from that stable sonic presence. Slowly, we start seeing a figure—or rather, parts of flesh that are being slightly illuminated at the centre of the stage. With that discovery, the music starts changing in a composite way, adding layers to the previous sonic background: at times the high-pitched sound is transformed, at other times replaced, creating a minimal electronic composition that changes in intensity and rhythm. With time we perceive a body more clearly, but we are still not able to distinguish which part of it is being shown, or how. It could be legs, or arms, or back, or chest, but certainly no face is shown. It is possible to note how certain sudden changes of movement influence the music that is being played, which makes you sense some kind of connection between these two entities. But at other times they are not connected, and the light and sound seem to make decisions on their own. The body starts moving more strongly, resembling a fly, or some kind of insect, or an organ pulsating, or a bone. It seems to be mutating into different entities. The lights now start flickering frantically, and the body responds with differences in tension, in rhythm. Thanks to these lights, we are able to perceive more clearly how that body is covered in tattoos that depict spines, or veins, or the branches of a tree.

The performer may be upside down, on his back. Or is it up? Where's the head? The body moves as if it were hung from the ceiling: is it trying to free itself? He seems to fly or breathe through the shoulders when the music comes to a halt, and the body stays there, in tension, contracting itself. Slowly moving its parts again when the lights fade out, the body becomes recognisable as a carnal silhouette. The intensity of the music increases, and with it we are able to experience the muscles and tendons of that part of the body, but we lose sight of a broader view. More noise starts coming from the musical palette: a blurry, fuzzy feeling. That piece of body stretches, or tries to advance, sensing the environment, like a blind person checking their surroundings. The muscles constantly move, as if there was life inside of them. But suddenly they stop, the music slows down and the movements turn soft and calm, as if rocking themselves. Now we cannot tell which part of the body is moving, where the limbs come from, or where they go. Something feels out of place; the movements do not make sense as gestures, they do not belong to a whole but to a shapeless motion that dances with the light and the music.

Frantically, the body responses to a rhythm that is going faster. But the lights go off. And the music stops. We hear some clapping.[10]

At a technical level, this performance is enabled by sensors installed on Donnarumma's body and a software system that computes the sensors' data through algorithms. By wearing two different biosensors on his upper arms and by connecting it to a computer off stage, his muscle movements can be perceived and translated into sound and light by an AI algorithm created by Dr. Baptiste Caramiaux. The algorithm receives data from the sound produced by the muscle movements of the performer and resynthesises them in real time, using a bank of oscillators and other sound modulators. The software learns by analysing tension levels, release times, and torsion force from the muscles. Even if the performer can slightly influence the system by, for example, making an abrupt movement, it is nonetheless inherently not controllable by the human. Consequently, the software used in *Corpus Nil* makes autonomous choices about the overall audio mix and the specific musical options. Thanks to the sound and light input that the computer gives to the performer, the human body can respond and be modified accordingly. The system that it is created in *Corpus Nil*, therefore, works more like a co-affecting feedback loop where the emergent result is a co-creation of human and machine. As Donnarumma explains:

> The system is not programmed to execute specific actions, but rather to exhibit an emergent behaviour which relates—but is not driven by—the performer's movement. Its behaviour changes throughout the performance as well as across different iterations of the same piece in response to aspects of the performer's muscular activity (2017: 8)

In *Corpus Nil*, both the computational system and the performer need to learn how to coordinate with the other body on stage. While for the human performer this requires a certain level of training that would allow him to respond to the technological cues, for the system this learning has to do with a reading of the human's biosignals and their transformation in emergent patterns. This feedback, nonetheless, does not stand for a self-regulating system, but rather for a 'mutual and unstable engagement' (2017: 8). This instability comes from the fact that the entanglement is set on an improvised performance

[10] For a better grasp of the performance, consult its recording from the show in London, 2016, in the frame of the exhibition "The Game Europe Plays – Body Tech" at the University of Greenwich: https://vimeo.com/205899193

setting, where both entities are co-affected by each other and their environment, evolving on their own and in a different manner in each interaction. In Donnarumma's words:

> What is important, though, is that the loop cannot be controlled; I cannot predict what exactly the machine will do, and the machine cannot predict how exactly I'll move. It is a largely unpredictable feedback where myself and the machine listen to each other, trying to maximize the moment, right here and right now. (quoted in Graf, 2004: n.p)

The connective material between these two entities, human and technological is the body's muscular activity, which allows performer and computational system to enter into a dialogue. But as Donnarumma highlights, this connection not only happens on a physiological level, but also on a phenomenological one, 'through thresholds of sound and vibration that affect potential movements, latent psychic states and possible programmatic changes' (2017: 9). This idea of potentiality, and possible actualisations of movement, relates to Donnarumma's understanding of individuation and configuration, which will be a vital base for describing how two bodies can coordinate in an empathetic manner.

Following the work of Simondon, Donnarumma explores how individuation is a process where a human being acquires certain physical, psychological and behavioural characteristics. In this way, an agent would actualise certain potentialities through others, the affordances of the environment and as a result of their situated experience. In a similar line, Donnarumma also points out how these potentials are actualised when thresholds are crossed. These thresholds, Donnarumma notes, are usually exceeded through discipline and habit; therefore an entrainment is necessary in order to actualise certain potentialities of a particular individuation.[11] This entrainment does not refer only to physical activity, as it also includes learning to be affected (Donnarumma, 2016: 80). By learning to be affected, as Donnarumma puts it: 'one also learns how to affect others differently. Relationality becomes key' (2016: 9). When thresholds are crossed both entities enter into a sort of entanglement in which both are mutually affected, learning in the process how to actualise certain potentials.

[11] For Donnarumma, 'entrainment' refers to a state where corporeal and psychological thresholds are crossed through a series of specific acts—that is, through certain training.

For Donnarumma, nonetheless, it is essential to notice how human individuation is never separated from technical individuation, as technical instruments constantly affect the body's materiality and psyche. This leads him to assert that 'the latent abilities and qualities of a human body […] are developed only when they exceed a given threshold through technical objects' (2016: 75). For Donnarumma, the potential capabilities of human bodies are actualised in collaboration with technical devices, and never in isolation from them. Furthermore, this collaboration does not take place between two individual, separate and self-contained entities, but through a co-constitution between entities in formation. Human and technical individuation are considered in Donnarumma's academic and artistic work as situated and relational processes, inasmuch as they relate to each other in mutual co-creation. The process of being an embodied human-technical individual, then, is conceptualised as a constant becoming, a 'partial and relative resolution, continually operating through the latent potentials held by the performer' (2016: 72).

'Through the process of becoming the performer re-structures herself' (2016: 72), Donnarumma asserts. And it is precisely this re-structuring that it is at the core of his concept of *configuration*. As he further elaborates, configuration designates an affective interaction through the material and immaterial conditions of human bodies and technology. Donnarumma considers the embodiment of the technological body as emergent in the interplay of these mutually-affected entities: that of the human and of the technological devices (mainly his AI biosensor 'the Xth Sense' and his AI prostheses). The emergent corporeality engages in a re-structuring of previous functions, parts, perceptions, or affects.

This re-structuring of parts is particularly evident in the way in which the technological body is presented to the audience in *Corpus Nil*. Being covered in black paint except for the back and the neck, Donnarumma appears solo on stage against a black background (see figure 3). This only part of his body visible to the audience, and it is covered in multiple tattoos that show inside organs or structures, such as spines or veins (see figure 4). However, the way in which it is presented disrupts the perception of a traditional human body. Donnarumma exposes his body in a strange fashion, by kneeling on the floor and bending his back until his head touches the floor. This unusual position, along with the obfuscation of the rest of his body, allows the spectators to perceive something different: a re-configuration of his body through movement and through the

interaction with technological devices. This type of display works in favour of what he tries to achieve: the presentation of a hybrid body that is able to explore atypical ways of being in the world, through a re-structuring of its parts. In this way, in a changing manner, his neck at times resembles a back; and his back, an arm; and his arms, legs, in a progression of morphing effects that continuously modifies this co-created corporeality (see figures 5 and 6).

Analysing this configuration within the field of music, Donnarumma asserts that in the process of becoming, performer and instrument create a hybrid body. This, however, does not mean that both fuse into one entity; on the contrary, 'it can be observed and experienced as a whole, while each part—human and technical—retains its particular features and capacities to affect' (2016: 9). Therefore, the hybrid form of corporeality that is constantly in the making in these configurations neither erases human subjectivity nor denies technological agency—it expands both domains into other forms of affect. In this sense, Donnarumma points out,

> [t]he capacity to affect and be affected does not reside only in the human, but also in the computational system, for it contributes to the performance in ways which are not fully determined but rather emerge from the dynamic interactions between the human and the technical (2016: 10).

In *Corpus Nil*, this co-affection takes place through the 'Xth Sense' or through the translation of the muscular activity of the dancer. Using the 'Xth Sense', the vibrations of his movements are captured and adapted to a palette of sound and light directed by an AI software. However, this machine works autonomously; and even if the biological signals of the human body influence the programme, they do not determine it or control it, as the software can make its own choices regarding the output. In turn, this auditive and visual composition influences Donnarumma's movements, at times enhancing but at other times disrupting their perception and motor skills.

Donnarumma asserts that while in neuroscience biological motion is an emergent and fruitful field, in music it has only been studied as a means to control virtual instruments. According to the artist, this overlooks the expressive capabilities of biological sounds produced by the human body and the affective potential of such sounds in the performer's perceptual experience (Donnarumma, 2012a). In *Corpus Nil*, the movements of the performers are coupled with sound through the usage of small

microphones that capture and amplify the vibration of muscles. These bodily sounds, known as mecanomyograms, are subcutaneous oscillations produced by muscle fibres and blood vessels which create very low-frequency vibrations. The resulting sounds are analysed via algorithms and later on transmitted through speakers to the rest of the theatrical setting.

The idea of focusing on the human's subcutaneous oscillations will be key, as afterwards, in its usage of AI prosthesis, this same oscillatory mechanism will be implemented in their algorithms. The rhythmic behaviour of oscillatory activity, as Ermentrout and Chow point out, is ubiquitous in human neural systems and plays a vital role in motor activity such as breathing, eating, and sensory and cognitive functioning (2002: 629). This oscillatory activity has been explored in neural networks among humans and has proved to be inspiring for roboticists who aim to implement coupled oscillators to control locomotion in robots (Still and Tilden, 1998). As Hein et al. point out, in most cases central pattern generators (CGPs) are used, which are 'able to produce periodic signals in a self-contained way, i.e. without having any rhythmic input into themselves' (2007: 2). However, hybrid controllers are currently being developed where these CGPs are used to create a basic rhythm through networks of oscillators—but they can also be modified by sensory information (Still and Tilden, 1998). In Donnarumma's AI prostheses, as we will see in the next section, he employs hybrid controllers, where the sensory information is computed by the robot itself in real time.

The 'Xth sense' is thus triggered by the data coming from the vibrations of the human body (understood as an oscillating rhythm), which creates the possibility of coupling. Through these affective interactions, human and technological bodies do not only influence each other but rearrange their respective parts, 'forming an unfinished technological body' (2016: 12). In this sense, the embodiment of this hybrid body is understood as a configuration: an ecology of relations, a negotiation. The relationship between human and technological bodies, nonetheless, does not always carry positive connotations. As Donnarumma highlights, these negotiations can bring up as many disruptions as generative potentials. Configurations, therefore, can either generate or hinder modes of becoming, which implies that the idea of error and failure is integral to this process. This is more clearly observed in the way Donnarumma deals with the notion of prosthesis, which will be analysed in the next section.

The configurations of humans and machines in Donnarumma's work thus deal with a potential and co-constitutive becoming that can offer new modes of lived experience by extending, hindering, or reconfiguring the previous abilities and perceptions of the performer. This hybrid becoming in his work is understood specifically as a 'vibrational rhythm' (2016: 76). I propose that this co-created becoming through vibrational rhythms can be understood as a new form of empathetic connection between humans and machines. It is important for this purpose to understand how this vibration must not be considered as belonging to the human counterpart or as a controllable aspect of the performance. On the contrary, vibration is something that emerges from the hybrid collaboration between humans and machines. Because of his interest in grasping the movement that the inner human body produces and its potential for musical creation, Donnarumma establishes *vibration* as a focal point of connection among entities. In the first place, this vibrational rhythm links movement and kinaesthetic experience with music through devices such as the 'Xth Sense'. In the second place, it couples humans and machines, as it is through this muscular vibration that both hardware and software are able to receive information and transform it, giving it back to the performer's body in the shape of a musical composition. Finally, it joins audiences and performers. Regarding this last part, Donnarumma asserts:

> When my inner body vibrations become tangible sound breaching into the outer world, they invade the audience members' bodies through their ears, skin and muscle sensory receptors. The tension of my inner body resonates in their muscles, establishing a nexus between player and audience. The listeners' bodies, my own body and the performance space resonate synchronously. The flesh vibrational force becomes a vector of affect (2012c: 4)

Along similar lines, Donnarumma explains in an interview that he tries to create pieces which can be considered as 'experiences' for the performers and the audience, in a way that both can access the work in a visceral way.[12] For this the idea of a vibrational rhythm is essential, not only because it materially affects the body, in a pre-reflexive way, through the vibrational patterns that are sensed and are used to deliver information to the computational system, but also because they relate to a common dynamic between humans and machines in terms of movement. You do not need to know what is happening

[12] Information retrieved from a Q&A session during one of his talks, at the Robot Marathon in Dusseldorf, 2019.

on stage to experience this coupling, Donnarumma has expressed.[13] The empathetic connection experienced by both performer and audience in this setting, as the author points out and as his methods show, does not rely on mimicry of any kind, but on a coupling or attunement between the vibrational rhythm of bodies and computational systems.

This vibrational rhythm as a mode of empathetic connection has other important consequences. The encounter in this vibrational rhythm, which I propose to understand as an empathetic connection, also relies on a contextualised performance, in a specific here and now that is modified every time it is performed. In this sense, the author asserts: 'repetition and rhythm, the pulsating vibrations, sounds and light patterns created by the AI software affect directly the way I—and the audience—perceive and perform my body on stage' (quoted in Graf, 2004: n.p.). Thus, the emergent hybrid body, as constituted by the interaction with the computational system and also by the shared vibrational rhythm between humans (performance and audience) and mechanical bodies, is also a *situated* creation, only able to emerge from the interaction in the particular performance that takes place.

Coordination and Actualising Potentialities in *Eingeweide*

When you enter the stage, everything is black. You slowly start to hear a rhythm, resembling a heartbeat: deep, but growing louder. It progressively starts sounding more mechanical, like a repeated blow. It goes faster and louder, more and more metallic each time. Now another sound enters the ground, in a form of an interruption of the initial beat, like a noise, accompanied by a blue light, signalling a point in space. But you cannot really see what is there. The interruption now is part of the new beat, creating a compound repetitive tone. The reiteration makes you feel like you are entering a state of trance. The rhythm becomes more intense and you start seeing, in the middle of the black room, a figure moving on the floor—a figure of which you are able to distinguish limbs but not a clear body. Slowly you start realising that what you are witnessing is two human bodies on the floor. At first, they are both showing their backs, with their heads down, and they move as if they were one entity with multiple and amorphic limbs. You can see cables on

[13] Information retrieved from a Q&A session during one of his talks, at the Robot Marathon in Dusseldorf, 2019.

their bodies, but it is difficult to distinguish to whom they belong or where they start and end.

They push each other until the music comes to sudden change of rhythm, causing them to separate. Once away from the other, they try to get accustomed to their new embodiment on the floor and in relation to their cables. They move, slowly crawling, while the blue light turns on again and starts pulsating in the background. Sounds becomes wavier, as if you were hearing it from underwater. Their foetal positions make you think of a womb. They start approximating their prostheses/organs, which move independently on opposite sides of the stage. After an initial and slow contact, they are finally able to adhere themselves to the prostheses, to adjust to them. We see how one of the performers stands up and moves with the prosthesis in unusual ways, hunched, probably overtaken by the weight and movement of the prosthesis, which is on his face. The other dancer stays on the floor, elevating her back and legs higher and higher, moving with her head facing the ground, in contact with a cloth that traces the path she crosses. Crawling, changing positions, and standing up do not seem easy. They are taken back and are re-adjusted by the physicality and motion of their prostheses.

The non-human devices cover the faces of both performers. They both flutter, oscillating from one side to another, creating waves of movement with their bodies, sometimes stumbling, sometimes graceful. The motion that emerges from their entanglement is at times violent, and in other cases caring. Eventually they reunite: four bodies in coordination, in the middle of the stage. The way in which they relate now is different from what we saw at the beginning: the incorporation of the objects changed the manner in which their initial corporealities moved. This time they seem to be one on top of the other: more limbs, technological and human, are entering the picture. The tension in their bodies increases. The music stops; their bodies, or that compound body, releases and drops to the floor. This is the end of the performance.

At a narrative level, this creation works as a prequel to *Corpus Nil*, inasmuch as it ‘conjure[s] up what happened to that unfamiliar creature in *Corpus Nil* before it was born’ (Donnarumma, 2018). However, technically speaking, *Eingeweide* extends the former performance, as it uses the same software for the composition of sound and light while employing an expanded musical palette. Furthermore, it introduces an improvised choreography with a robot: Amygdala, the AI embodied prosthesis that previously was used to perform a ritual in an homonymous installation. Before continuing with the

explanation of how this prosthesis works and the manner in which the performer empathetically coordinates with it in *Eingeweide*, I will go back and specify how the concept of prosthesis is used elsewhere in Donnarumma's oeuvre.

In Donnarumma's work prostheses have to be understood not as an extension of the human body but as an incorporation. In a different way to how prostheses are made and marketed for the general public, Donnarumma creates autonomous AI prostheses whose behaviour is influenced by, but beyond the control of, the human. Therefore, by creating an intimate connection with the prosthesis, the resulting movement of the technological body will be something that has been co-created by these two bodies-in-the-making. The prostheses that he employs in his performances, nonetheless, tend to limit one or several human capabilities: for example, in *Eingeweide*, it covers the performer's face and restricts his/her movements. However, it is because of this failure in carrying out a particular human ability that the performer needs to explore, through the machine, how to embody him- or herself differently and in relation to the other bodies on stage. As the artist puts it in his official webpage, 'truly autonomous machines out of human control; organs living outside of the body—Could this help us understand that the power of the human body lies in its ability to be different and to take on unexpected forms and identities?'.

The exploration of these new forms is enacted in *Eingeweide* by two human dancers: Margherita Pevere, the artist himself, one AI prosthesis (Amygdala) and a cloth made out of bacteria. However, due to the scope of this thesis, Donnarumma's entanglement with Amygdala will be the focus of the section. The prosthesis used in *Eingeweide* had already exposed in one of the installations that compose the *7 Configurations Cycle*: Amygdala, an AI in the form of a human-like limb, was hung inside of an industrial grade computer cabinet and performed a repetitive task inspired by the animistic ritual of skin-cutting (see figure 7, 8 and 9). The animistic ritual of purification is still practiced in Papua New Guinea, Africa and East Asia: it involves cutting one own's skin in order to let 'corrupted' blood out, altering one's physiognomy. Amygdala's goal is to constantly cut an artificial skin created for that purpose, until the moment in which it becomes too hard to manipulate and is substituted by a different skin (see figure 10). This robot, as well as the rest of the AI machines that comprise the *Cycle*, are all results of an original template that is adapted depending on the demands of each artwork (see figure 11). The prostheses of the *Cycle* are first hand sculpted, then modelled

in 3D software, 3D printed, assembled and refined by hand. Finally, some of the prosthesis (including Amygdala) are covered by a bacterial biofilm designed by Margherita Pevere (see figure 12).

Created by Donnarumma in collaboration with the Neurorobotics Research Laboratory in Berlin, the prosthesis of *Eingeweide* reacts and senses the movements of the human performers and their environment through haptic sensors and neural networks. Driven by adaptative neural networks that compute equations in real time, it does not follow a pre-programmed script. Rather, it is moved by an emergent motion spontaneously created from the activity of the neural networks, in a way similar to a sensorimotor system. Its way of learning, therefore, is via trial and error. Due to the fact that these networks receive constantly updated information about the robot's body and its environment, Amygdala is able to adapt to physical changes or constraints surrounding it. These neural networks follow a similar technique to those employed in *Corpus Nil* and base their functioning on oscillations. This AI prosthesis works independently from its wearer and its starting point comes from algorithmically-created oscillations that, subsequently and in combination with its sensing system, can be expanded and adapted to its environment. Therefore, Amygdala constitutes a different prosthesis to that of the 'Xth Sense' used in *Corpus Nil*, in which the data of the system came from the human body and its muscular vibrations.

The neural networks used in Amygdala are biomimetic, inspired by the oscillations of the human brain and body and by animal coordination. Manfred Hild, director of the Neurorobotics Research Laboratory with which Marco Donnarumma creates his prostheses, specialises, among other things, in creating dynamics of recurrent neural networks, as well as sensorimotor systems, in robots. These dynamics are made in analogy to biological nervous systems, and they work in a decentralised manner, which means that all the robotic parts of a particular robot can be removed and mounted again, maintaining their separate functionality at all times. This is essential for the way in which they work in the lab, as separate limbs can be tested simultaneously by different parts of the team, and because they want to achieve a robotic creation in which its 'limbs are multi-crosslinked and work together cooperatively'. This decentralisation is what allows Donnarumma to employ 'out of the body organs' and to explore how their separate and autonomous movements can coordinate with the human body on stage. The 'organs' in

Eingeweide are both the AI prosthesis Amygdala and the cloth made out of bacteria (see figure 13).

The neural networks of Amygdala are adaptative to its surroundings, and thanks to its sensing system, it can react to external stimuli, such as touch, pressure or torsion. As Amygdala is installed in close connection with Donnarumma's body, especially on his face, this contact is what permits these two bodies to coordinate their movements. The learning, of course, is a process, as the neural networks get new knowledge about its partners and environment each time, constantly modifying its behaviour. This interaction, physically and affectively performed in each specific show, is what constitutes the type of coordination that I would like to analyse in terms of empathy and that takes place specifically through what Donnarumma terms 'automaticity'.

The idea of automaticity as a form of physical and affective attunement is how Donnarumma describes performing with his AI prosthesis, but it was also addressed in his previous work as a way of connecting performer and instrument. He explains how it is a form of entrainment with a particular body technology in which the human experiences a feeling of 'becoming unconscious'. In his own words, 'corporeal self-discipline, trained psyche and systematic experimentation engage with one another to bring the body and the instrument into a mode of unconsciousness which yields creative potential' (2017: 5). Automatism, as defined by Donnarumma, is a transitional process, in which consciousness drops off and a certain threshold is surpassed that allows humans to establish contact with technology in a form of hybrid entanglement. As he asserts, 'letting consciousness fade and allowing attunement to replace control, radical experimentation with technological bodies can materialise' (2017: 15).

In such threshold conditions, however, the body and the technology with which it is entangled do not fuse into one entity, as 'body technology can be perceived as extra personal, something which is other than the subject and yet an integral part of it' (2017: 4). In this automaticity, then, body and prosthesis remain distinct entities, but are attuned in a form of pre-reflexive coordination that creates the emergent movement and, at the same time, reconfigures their original bodies. In this reconfiguration, a change of the body schema takes place, which Donnarumma addresses through the well-known example of Merleau-Ponty and the blind stick. In the same way that for a blind person, a blind stick is not a mere object but an extension of touch, a complement to his or her proprioceptive sense, the robotic prostheses in Donnarumma's creations, when attuned through this

automaticity, modify the body schema of the performer. Donnarumma explains his notion of automaticity through the practical example of the incorporation of a certain body technology: an instrument during jazz improvisation. As the author points out, when certain thresholds are crossed, like that of physical pain, the body automatically and non-consciously modifies its posture in order to play a similar pattern without experiencing that pain. This type of automaticity, created in a threshold condition, can offer creative and new ways of expression, but it also essentially modifies the body of the performer and the way in which the instrument is being played.

As with an instrument, robotic prostheses offer specific material possibilities and constraints; but unlike traditional instruments, the AI prosthesis used in *Eingeweide* also has the ability to sense, to react, and to generate autonomous movement. These qualities of Amygdala, as well as its positioning on the face of the performer, create limitations that force Donnarumma to adapt physically and affectively to that machine. The constraints enabled by Amygdala, with its own shape, kinesis and, in general, with its way of being in the world, if incorporated by the performer, allow for the crossing of thresholds which can lead to novel ways of moving. This co-created way of motion is also a reconfiguration of the body, the senses, the perceptions of the person, and consequently a modification of his or her body schema. In Donnarumma's words:

> The affective forces I experience are learned by the hybrid body not as a mere bodily mechanism, but as a specific motor programme, a body schema that yields a given expressive and affective value. However, this way of learning is neither fully conscious, nor completely stable. As discussed earlier, this is a willing and unconscious form of incorporation (2017: 13)

In automaticity, the idea of 'inhabiting' a technological body is essential. The relationship between performer and prosthesis is not one of domination or extension, but rather a pre-reflexive way of gaining corporeal knowledge of non-human embodiments, in a manner that creates a hybrid corporeality. This resulting re-configuration of both bodies in *Eingeweide* is therefore achieved by the kinaesthetic experience of inhabiting and incorporating Amygdala, as well as by the affective attunement that both human and machinic bodies need to do.

I want to propose that in the configurations that take place in *Eingeweide*, a form of empathy that is radically different from that employed in social robotics emerges. This

human-machine empathy is driven by a pre-reflexive resonance, manifested in the automaticity in which Donnarumma engages with Amygdala when surpassing thresholds of consciousness and physical training. The encounter, different each time and marked by the specificities of the performance, creates a mode of physical and affective attunement whereby human and machinic bodies need to engage in a coordination, in a coupling, rather than in a mimicry of each other's movements.

Automaticity, being a processual state, constitutes the specificity through which empathy can take place in *Eingeweide*. This process allows for the creation of a hybrid becoming in which 'movement as a vector of affect' is co-created by this entanglement of human-machinic corporealities. In the empathetic connection taking place between Donnarumma and Amygdala, thresholds of consciousness are crossed through automaticity so that both bodies can physically and affectively attune to each other, consequently modifying and reconfiguring their body schemata. Similarly, with regards to the audience's reception of the piece, Donnarumma mentions that the public does not need to know what is happening on stage to experience this coupling as well.[14] This pre-reflexive connection between bodies, then, also takes place between the human-machinic performers and the spectators, who experience a coupling with the movement on stage, especially through what Donnarumma calls 'vibrational rhythm'. This vibrational rhythm allows for a cooperation between entities in an empathetic manner.

Back to Robotics: What Does Marco Donnarumma Offer?

To look at a configuration, Marco Donnarumma explains, does not mean to analyse how different parts relate to each other, but rather to grasp how affect and expression emerge from this entanglement (2016: 111). Similarly, this has been my aim when introducing Donnarumma into the debate around empathy in HRI: to explore how the configurations that he creates can be understood as a new manner of empathetic connection that is different from ST. With his practice, we can begin to find a different entry point to the issue of empathy: one that focuses on the process of relating empathetically through coordinating dynamics. This will allow for an understanding of empathy that, rather than being based on stable, individual, and predetermined emotions, constitutes a becoming in

[14] Information retrieved from a Q&A session during one of his talks, at the Robot Marathon in Dusseldorf, 2019

which affective states are co-created in the coordination of the movement dynamics of both entities.

Marco Donnarumma emphasises this processual characteristic in his notion of configuration, which stands for a constant re-configuration of the self when actualising potentials. Crucially, these actualisations happen in a situated and contextualised encounter, where there is a co-creation of machinic and human ways of being physically and affectively attuned. This hints at empathy being a performance (a co-presence happening in the here and now) and performative, inasmuch as the affective states are created in the moment of their sharing[15]. Furthermore, Donnarumma's work implies an attunement, or a coordination of dynamics, rather than a mimicry of human movement. This coupling is established through a commonality of dynamics: in his specific case, through an oscillatory pattern that is shared by the human body and the software that drives the prosthesis. But the coupling also relies on the crossing of thresholds via entrainment. In the examples explored, this crossing takes place in automaticity, which expands the body schemata of the entities involved in a pre-reflexive manner.

In this relationship, both human and machinic bodies contribute to the co-creation of movement dynamics—to their attunement, but also to the modification of their embodiment. As Donnarumma asserts, 'human-machine embodiments are forms of co-dependence rather than pairing of two different things. I argue that human and technological actors can unite into an ecology of physiological, experiential, psychological and technical components; a form of hybrid corporeality' (2017: 2). This ephemeral bodily experience modifies the way in which the corporealities on stage are perceived, re-structuring their parts and their function, but also essentially affecting the way in which these entities perceive their surroundings and their own body schemas. Donnarumma's body on stage is affected and influenced by a musical rhythm that changes his motion and his perception of the theatrical space: firstly by a computational system that modifies and synthesises his muscular movements; and secondly through his close connection with Amygdala. His interaction with the prosthesis prevents him from seeing but also restricts his movements: he experiences a re-configuration of his physical

[15] The notions of performance and performativity, which are important theoretical tools to the development of my paradigm of empathetic encounters, will be described and contextualised in chapter three. At this stage, and even if it risks some degree of generalisation, I consider it best to only hint at their possible use concerning empathy and the work of Marco Donnarumma.

capabilities, of his bodily affordances, and needs to work with the machinic body in order to coordinate with it.

Finally, HRI in Donnarumma's work can be analysed as a different form of empathy, not only in his engagement with robotic prosthesis and computational systems on stage, but also with regards to the connection between the performers and the audience perceiving the show. Based on his notion of vibrational rhythm, this oscillatory movement dynamics explored by Donnarumma constitutes the tissue through which human and machinic entities can be connected, both on and off stage. As he explains, the audience can directly experience this coupling as in immediate bodily resonance through vibrational rhythm. Moreover, the spectators also contribute to the co-creation of affective states in this empathetic encounter by being a part of a situated performance and by being able, through their presence, to alter, diminish, or enhance the automaticity needed for the dancer and the machinic body to effectively coordinate.

CHAPTER 3. Empathy in Dance and Phenomenology

This chapter will be dedicated to developing the theoretical tools that will allow me to further delve into what Marco Donnarumma's work proposes concerning debates around empathy in HRI. By analysing kinaesthetic empathy and phenomenology, I begin to work towards a new understanding of empathy within HRI. The reflections on empathy in both fields of study furnish relevant ideas that are in line with Donnarumma's artistic suggestions. When brought into dialogue with the latter, the understandings of empathy in these two areas of study will allow me to further explore a new mode of addressing empathy in HRI.

Kinaesthetic empathy, mainly theorised by Susan Leigh-Foster and Dee Reynolds, will be useful for probing how movement plays a vital role in the empathetic process, rather than being a mere expressive tool of an inner emotional life. I will show how their take on the matter can be used to dismantle the dichotomy upheld in social robotics discourses between internal emotions and external expressive movement. Phenomenology follows a similar path of inquiry when thinking about empathy in terms of perception rather than expression. Consequently, these two fields focus their research on how the target evokes empathy in the observer, instead of how the observer projects onto the target of empathy, as is the case with ST. However, phenomenology offers something else as well. It provides a strong critique to a part of kinaesthetic empathy that still depends on ST: its association with mimicry and simulation. Alternatively, phenomenological empathy, as theorised primarily by Dan Zahavi, considers empathy to be an issue of coordination or coupling.

I begin this chapter by analysing kinaesthetic empathy as explored in the works of Susan Leigh-Foster and Dee Reynolds. Through an analysis of their books *Choreographing Empathy: Kinesthesia in Performance* and *Kinesthetic Empathy in Creative and Cultural Practices*, as well as of several articles on this subject, I point out the strong and weak points of their theories. Dan Zahavi's work on the phenomenological approach to empathy will be key in complementing but also critiquing certain aspects of kinaesthetic empathy. Finally, the last section will offer a recapitulation of the main features of both theoretical fields. That section will also call attention to what their theories offer to HRI, particularly to the empathy debate as elaborated in social robotics.

Kinaesthetic Empathy: Susan Leigh Foster and Dee Reynolds

Kinaesthesia, generally understood as the sensation of the movement and position of one's own body, has been recently introduced into the empathy debate. Research on how the kinaesthetic sense not only produces an empathetic connection between two agents but also constitutes a vital part of empathy has been a line of enquiry for several scholars, of whom Susan Leigh Foster and Dee Reynolds are among the most prominent. The concept of kinaesthetic empathy has been explored more extensively in Foster's book *Choregraphing Empathy: Kinesthesia in Performance*. Reynolds, writing both alone and in collaboration with Matthew Reason, has published several articles on the matter, as well as the edited volume *Kinesthetic Empathy in Creative and Cultural Practices*.

Foster is a choreographer, dancer and scholar who has published several monographs regarding the history of dance, gender politics, choreographic and improvisational practices, and recently the study of kinaesthetic empathy in dance. Reynolds has been conducting research on dance audiences and has been collaborating with choreographers since 2008. She was the project leader of 'Watching dance: Kinesthetic empathy' from 2008 until 2011. She is also a co-founder of the Manchester Dance Consortium. Both authors start their enquiries about empathy by analysing the relationship that is established between the dancing and the viewing body, in response to the question 'how and why do you respond to the motions of another body?' (Foster, 2008: 46). According to them, 'audience experiences of dance can therefore be conceptualized in terms of responses to movement, most prominently in terms of what has been described as "kinesthetic empathy"' (Reynolds and Reason, 2010: 49).

As outlined in chapter 1, the concept of empathy has changed substantially over time. However, its contemporary understanding is underpinned by the field of psychology, which closely connects it with a cognitive and/or emotional experience, but not with a physical one. As Foster asserts, 'the fact that the experience of empathy needs to be qualified with the adjective "kinesthetic" belies the pervasive assumption that emotional and physical experiences are separate' (Foster, 2010: 10). In this sense, even if Foster and Reynolds initially focus their interests on the relationship between the viewing and the dancing body (in other words, on how audiences experience empathy towards the dancer), their enquiries broaden up to a wider field that reconsiders how empathy has been conceptualised and the role of movement sensation within it.

As shown by Foster's monograph and by Reynolds's edited book, kinaesthetic empathy in dance and cultural practices is a fruitful multidisciplinary field of research that brings together audience research techniques, cultural and political critique, aesthetic enquiries and neuroscientific research. Studies on kinaesthetic empathy have been done in film and theatre studies, but also on artistic psychotherapy—especially with autistic children—and in experiments regarding motor systems and skills. Shared concerns in all these fields range from the affective responses that this kinaesthetic empathy establishes between agents, its ethical implications, and its functioning and applications (Reynolds and Reason, 2012). Even if its usage might vary depending on the study and its focus, some generalisations of what kinaesthetic empathy offers to the debate can be drawn, especially when we look at Foster's and Reynolds' respective works.

As Reynolds and Reason (2010) point out, the term 'kinaesthesia' comes from the Greek *kinein*, meaning movement, and *aesthesis*, translated as 'sensation'. It was coined in 1880 due to research done in nerve sensors in the muscles and joints, and it was mainly implemented in physiological studies on the sense of one's own motion. These recently discovered sensors gave an awareness of the body's position and movement. Foster (2008) in this respect highlights how un the 20th century, however, neurological investigations brought the term 'proprioception' to the fore, which after C. S. Sherrington's conceptualisation of it substituted the term kinaesthesia for some time. Foster then explains how proprioception was then defined as a system of spiral-level neural arcs that adjusted the body's relation to the gravitational pull. Kinaesthesia gained widespread use again around 1966 through the work of James J. Gibson, who defined it as a perceptual system that encompasses information about joint position, muscular exertion, and orientation in space and with respect to gravity. As Reynolds and Reason (2010) make evident then, in contemporary uses kinaesthesia also includes proprioception, as well as stimuli that comes from outside, or exteroception.

As it has been already mentioned, empathy was introduced around the end of the nineteenth century by Theodor Lipps. In Lipps's theory, a strong physical responsiveness between people and objects was to be found, since empathy involved a movement in one's own body that came to inhabit the object of perception. Foster highlights how rather than replicating a picture of the other in one's mind, Lipps's conception of empathy implies 'taking on its structure, rhythm, and momentum' (Foster, 2010: 154), in which 'the entire dynamism of the other was replicated within the observer's self' (Foster, 2010: 154).

Lipps, according to Foster, first introduced kinaesthesia into the empathetic response, inasmuch as the perceiver internalised the movement of the observed object or subject and reproduced it.

This interplay of kinaesthetically perceiving and reproducing, which in philosophical and psychological debates was ignored in favour in the problem of other minds, was taken up by dance scholars and developed into a theory of kinaesthetic empathy. As Reynolds and Reason (2010) summarise, in 1930 John Martin continues reflecting on this type of kinaesthetic simulation through the terms 'muscular sympathy', 'metakinesis', or 'contagion'. Foster (2008) also points out how Martin argued that when viewing the dancing body, the spectator feels equivalent kinaesthetic sensations: a contagious process that he called 'inner mimicry'. Martin, according to Foster, understood the sense organs that report movement and postural change to be strongly connected to the nervous system, where emotions were generated. Because this physical sensation was inevitably linked to emotions, the audience would be able to also grasp the choreographer's desires and intentions when experiencing this inner mimicry. It is important to note that Martin was writing at a moment when contemporary dance had broken off with narrative sense and with a structure through which it can be analysed. His theory became widely accepted as it provided an explanation as to how this type of dance was apprehensible. Martin's theories, Foster (2008) emphasises, relied on an individuated experience, rather than a collective one, and it deemed empathy as the sharing of certain universal kinaesthetic feelings. It was the individual spectator who, through the particular properties of their musculature, could connect with feelings that would be recognised and shared by the whole of humanity. As Foster points out, 'kinesthesia as entwined with the emotions presumes that all humans share this same connection and that they are all equally moved by the same depictions of humans predicament or struggle' (2008: 52).

For Martin, the reproduction and simulation of that emotional movement through kinaesthetic empathy did not imply a traditional imitation but a process that yielded the experience in itself onto one's own body. The experienced movement would create a conflation between selves, a muscular connection that preceded language and that was associated with an unconscious process (Foster, 2010). This idea was continued in the scientific field by Vittorio Gallese in his discussion on the aforementioned mirror neurons. According to him, and thanks to the experiments with this type of neurons, a mode of resonance that precedes action and self-other distinction takes place. The mirror

neuron mechanism does not offer the possibility of distinguishing between agent and observer, rendering instead an intersubjective space through their connected kinaesthetic simulated actions and sensations (Gallese, 2005). This space is considered by Gallese as *'"we" centric*' (2005: 111) [emphasis in the original].

Reynolds herself relies on mirror neurons research in her own project 'Watching dance', as they employ techniques from neurophysiological research, especially Transcranial Magnetic Stimulation (TMS) and Functional Magnetic Resonance Imaging (fMRI) tests, to address questions of kinaesthetic empathy. However, as Maxine Sheets-Johnstone (2012) points out, one of the main problems of relying on this type of neuroscientific research is that the keen interest in pinpointing the exact brain areas that get activated during the mirroring process has resulted in a displacement of the core of kinaesthetic connection in empathy, namely movement. As she explains, mirror neuron research has emphasised the use of TMS and fMRI scans in order to locate the brain areas that function during the mirroring process, as this is their main concern. Nonetheless, when researching into mirror neurons, scientists have also made use of neuromuscular studies, which hardly gets acknowledged in their reports. The use of neuromuscular studies also brings to the fore the question of how mirror neurons come to be. Sheets-Johnstone points out that we are not born with this neuronal mirroring capacity; she goes on to explain that, if we take this into account, then mirror neurons must have a grounding in corporeal-kinetic and tactile-kinesthetic experience (Sheets-Johnstone, 2012: 387). Furthermore, we might ask to what extent kinaesthetic empathy derives from the mirror neuron system or if it triggers that system. According to Sheets-Johnstone, there is thus a commonality of corporeal experience that precedes this mirror resonance, that allows this resonance, and that constitutes the basis for all future kinaesthetic connections among entities.

Following Gallese, Reynolds associates empathy with simulation and projection, as well as with a process that renders self and other indistinguishable. Concerning the first point, she considers empathy as 'embodied simulation or substitution' (Reynolds and Reason, 2010: 53). Specifically, she defines kinaesthetic empathy as encompassing 'experiences of embodied and imaginative connection between the self and the other, particularly in moments of inner mimicry or imagined substitution' (Reynolds and Reason, 2010: 71). She also specifies at one point that emotion is not present in the movement but rather 'projected onto the movement by the spectators' (Reynolds and

Reason, 2010: 67). In this sense, the theoretical advances of kinaesthetic empathy seem, in her work, to fall back on a previous conception where emotion and movement are dissociated. Moreover, this idea of projection does not take into account the performativity and co-constitution of this emotional movement between agents in the empathetic process (this was pointed out in the previous section regarding robotics and will be described in length in chapter three).

Concerning the indistinguishability of self-other, Reynolds argues for a move from 'emotions' to 'affect' in the conception of empathy. Affect, as defined by her, consists in an activation, a rise in the level of energy, that excites the body before this process reaches consciousness. Kinaesthetic empathy takes place through the viewer's internalising of the dancer's visible movement. This connection, according to Reynolds, is better understood in terms of affect rather than emotion. This implies that empathy, instead of being an interpersonal understanding where self and other are discrete entities, should be associated with a 'fluid relationality, where belonging together precedes separation' (Reynolds, 2012: 127). By making this move, Reynolds is allying herself with the definition of empathy employed in mirror neuron research and embodied simulation, where there is a previous shared plane in which subjectivities are not distinguishable. This idea keeps empathy in the realm of similarity, which could risk denying difference in the long run. In addition (as will be further explained later in this section with regards to Foster), issues surrounding universal claims in empathy can also arise. However, in her practices she does account for cultural and social influences in the process of empathy. Instances of this are her audience research studies on reactions to the performance *5 SOLDIERS*, and to a ballet and a Bharatanatyam dance show. Reynolds and Reason acknowledge that the empathetic responses to those artistic products are conditioned by cultural and social experiences: for example, 'lack of familiarity caused distance and an inability to connect with or even see the movements being performed' (Reynolds and Reason, 2010: 57). In this sense, kinaesthetic empathy in response to movement performed on stage would be determined not just by the movement itself but also by the audience's individual and cultural particularities and interpretative strategies.

In subsequent articles, Reynolds seems to change her previous point of view and decides to reserve the term 'empathy' for interpersonal understanding produced through emotional identification in mirroring and perspective-taking. Consequently, she distinguishes between 'kinesthetic affect' and 'empathy' (Reynolds, 2013: 212), with the

former meaning a connection in an 'embodied manner which is not dependent on emotion and cognition' (Reynolds, 2013: 213). She is careful to highlight, nonetheless, that in lived experience both processes are not clearly distinguishable, 'as affect may implicitly inform and amplify empathy by intensifying internalised simulation of another's behavior and contributing to our sense that we are empathetically "entering into" the world of another' (Reynolds, 2013: 213). Following this understanding, she categorises the audience's responses to *5 SOLDIERS* as either empathetic reactions—including perspective-taking and interpersonal understanding—and affective responses, where, instead of a mirroring, a 'translating' into their own experience is supposed to take place (2013: 221).

This change of paradigm, however, also leads to certain problems. Reynolds clearly associates empathy with embodied simulation, projection, and mirroring, while also distinguishing between emotional and cognitive empathy (as do contemporary strands of psychology and philosophy of mind). Furthermore, affect, as she herself admits, is not distinctly separated from empathy. If Reynolds follows the axioms of mirror neuron research, in which empathy is conceptualised as pre-reflexive and as an unconscious resonance between two entities, we might wonder how would it be possible to link empathy with emotional identification and clearly separate it from affect. Empathy and its emotional and physical characteristics, as defined by neuroscience, happens at a stage where cognitive reflection and categorisation has not yet taken place, making this emotional response closer to the definition of affect than of emotional identification. Thus, whether she associates or differentiates empathy from affect, there seems to be a mismatch in her research: in the first case, between her definition of empathy and her practice in audience research; and in the second case, between her definition of empathy and her positioning in relation to mirror neuron research.

For her part, Foster has offered a strong critique of the tendency to associate empathy with similarity and with a blended space of shared subjectivity, arguing that predilections for universality lurk beneath the claims of most theorists of empathy and sympathy. Paradoxically, this universality only accounted for the experience of a certain type of subject or corporeality. For example, Chavalier Louis de Jaucourt and Adam Smith explained the process of empathy and sympathy by the way in which an audience would connect with a rope dancer, and by how they would feel, in their own bodies, similar kinaesthetic experiences to those of the acrobat. However, the image of this rope

dancer however and even if it was not acknowledged by those theorists, was invariably that of a masterful, rigid, skilful, male, and white body. As Foster critiques (2010), their definitions of empathy and sympathy were consequently extremely paradoxical: these emotions seemed to occur instantaneously and for everyone, as a universal human capacity, but they also resulted from an exercise of judgement and interpretative skills that could only be developed by people of generous spirit. This, according to Foster (2010), served to justify colonialism and the dehumanisation of the colonised people who did not have the same predisposition of spirit and therefore were not able to experience these emotions to the same degree.

Likewise, according to Foster, John Martin conceptualised kinaesthetic empathy as a general capacity that served to convey the same meaning of dance to everyone, as a vehicle of a pan-human emotional realm (Foster, 2010: 159). This definition allowed him to justify how any dancer could represent everything, such as Martha Graham's impersonation of Native Americans or of black people by Modernist dancers. In close analogy to Smith and Jaucourt, this attitude also led him to fall into exclusionary practices by implicitly showing that it was only the white, middle-class body that was able to feel into others. It is important to note 'how power circulates through and between bodies as they make claims to feel what others are feeling' (2010: 175). Experiences of empathy, as well as their conceptualisation, are marked by social and cultural imperatives, and by processes of exclusion, where some bodies are privileged over others, and where some subjects are universalised to the detriment of others. This is what constitutes what she calls 'choreographing empathy', that is, cultivating 'a specific physicality whose kinesthetic experience guides our perception of and connection to what another person is feeling' (2010: 2). In this sense, when analysing empathy it is important to both account for differences and also to acknowledge what types of experience, corporeality, and power relations we are enacting or privileging in our usage of the concept.

As we have seen, Foster is not only critical of claims to universality in empathy, but also of the idea that this concept needs to be linked with similarity: of experiences, of bodies, of sensations. Although she does not complement this critique with a theoretical counterproposal in her research, in the performances that she offers as examples in *Choreographing Empathy*, as well as in her own practice, she does hint at a different way of treating kinaesthetic empathy in dance. In her analysis of the performance *Woman and Water* by the Alutiiq choreographer and dancer Tanya Lukin-Linklater, she focuses on

how empathy can be a process of attunement rather than a universal capacity. According to Foster, Lukin-Linklater practices a type of kinaesthetic empathy that consists in showing how her body learns to tune itself with others and with the landscape. She engages in a slow process where she connects with grass, water, sand, quilts and basins, and later on starts introducing the audience. She carefully summons them, embracing them, asking them to form a close connection to her personal and, in a way, distant ritual. Therefore, Foster considers the kinaesthetic empathetic connection created between dancer and public not in terms of analogy, similarity, or blending of experience, but as a process that needs attentive participation, time, and effort in attuning diverse experiences in the commonality of a 'we' that respects difference.

As she explains, she is interested in how 'multiple subjects could experience empathy collectively, creating a distinction between "I" and "you," while also bringing into existence a "we"' (2010: 164). This 'we' is radically different from that invokes in mirror neuron research, and even from the one that Reynolds seems to advocate in her studies of affective empathy, as the community which is formed maintains the differences of the parties involved. The 'we' that Foster advocates will be more connected to what I develop in the next section concerning the phenomenological conception of empathy.

Foster, like Reynolds, still links kinaesthetic empathy to embodied simulation; however, she starts to move away from its formulation in ST and mirror neuron research by indicating how difference in similarity is enacted. In this sense, she specifies how everyone has their own idiosyncratic ways of moving, and how these differences are stored in memory. Therefore, when perceiving and simulating another's movement, each experience will be different and 'specific to our history of moving' (2010: 168). This is more clearly shown in her own practice, particularly in a lecture-performance that she delivered at Live Arts Studio in Philadelphia called 'Kinesthetic Empathies and the Politics of Compassion' (2011).[16] In this event, she explores the question of how the viewing body can claim to corporally apprehend what the bodies on stage are doing through her carefully selected words and her corporeal means. Especially relevant is what happens at the end of the danced performance-lecture: Foster brings people from the audience to the stage and asks them to start a mirroring exercise among them. Meanwhile she delivers the rest of her lecture, where she reflects on copying and the role of learning

[16] The full lecture-performance can be seen at http://danceworkbook.pcah.us/susan-foster/kinesthetic-empathies.html

how to dance within this copying practice. Her words are complemented with an improvised demonstration where the audience is able to see how mirroring always has difference at its core. Even if the participants try to carefully replicate the movements of their partners, absolute and exact duplication is never possible, and the way in which each person simulates what the other is showing is always determined by their own history of movement: whether they are professional dancers or not, whether they are younger, older, shorter, taller, more or less agile, and so on. Apprehending someone else's movement, she seems to imply, and being moved by it—be it literally or internally—requires recognising not only the other's movement but our own incorporation and translation of it.

To summarise: Kinaesthetic empathy, in contrast to theories of empathy prevalent in psychology and philosophy of mind, offers the idea that movement can be both—indeed simultaneously—physical and emotional. It highlights how the empathetic connection has a strong kinaesthetic component at its core, instead of treating it mainly as a cognitive issue. As mentioned in the previous section, this division between internal emotions and external expression through movement was not only prevalent in theories of empathy and their usage in social robotics but was also a main drawback for scholars considering the possibility of empathetic robots. This distinction is now called into question as, with kinaesthetic empathy, *the movement in itself, be it in action or in internal simulation, can be already emotional*. Moreover, the empathic connection between two agents, according to kinaesthetic empathy, is based on an immediate bodily connection, rather than on a cognitive process of imaginative projection. In this sense, kinaesthetic empathy turns from the issue of how the viewer projects emotions onto the target to an analysis of how the target's movement evokes something in the viewer—a kinaesthetic sensation in the viewer's body that brings about emotions. Nonetheless, this connection continues to be conceptualised in terms of mirroring and mimicking, largely due to the importance of mirror neuron research (especially in Reynolds's work).

To a greater or lesser degree, theories of kinaesthetic empathy as analysed by Foster and Reynolds also point to the social constructedness of the empathetic process in their attempts to remain critical of theories of universality. In this sense, a call for difference instead of similarity is being made. However, this point is either in contraposition to the theoretical definition of empathy that is in use, as in the case of Reynolds, or only hinted at in examples and not fully theorised, as in the case of Foster.

Finally, and especially in Reynolds's work, kinaesthetic empathy remains strongly associated with a process of simulation and projection that relies on similarity and a visual relationship between the empathiser and the object of empathy. And while Foster is interested in the differences inherent in the process of mirroring, she still identifies empathy with simulation and does not look for modes of addressing it that depart from the imitation paradigm.

Phenomenological Empathy: Dan Zahavi

Dan Zahavi is a Danish philosopher, whose main areas of research are in the field of phenomenology, philosophy of mind, intersubjectivity, social cognition, and intentionality. His ongoing recent work reflects on shared emotions, we-intentionality, and second-person engagement, which lead him to develop ideas on empathy and its relevance for social cognition. Drawing from theories of empathy as treated in the field of phenomenology, Zahavi traces a different entry to the topic, offering other perspectives to the ones proposed by Theory of Mind (ToM).

As mentioned in the first section, issues of social cognition and interpersonal understanding have been most thoroughly treated within the field of ToM, with Theory-Theory (TT) and ST being its main strands of thought. To briefly recapitulate what these two positions advocate for: while TT claims that our comprehension of others relies ono a detached intellectual process, ST believes that to understand others we make use of our own mind as a model. These two strands claim to have improved upon the previous manner of solving the problem of other minds based on analogy. In that formulation, one's own mind is understood to be directly accessible to oneself and expressed to others through the mediation of bodily behaviour. Therefore, in order to understand other people's minds, the argument from analogy considered it necessary to observe the expressive movement that is given and infer the inner mental state of the person by analogy to correspondences between one's own expressive movement and inner states. Even if TT and ST proposed their modes of intersubjective understanding as opposed to the argument from analogy, Zahavi claims that they might not be so far away from each other after all. His case is that the argument from analogy, as well as TT and ST, all rely on the idea that expressive phenomena are only mediators of the living life of another, which is essentially inaccessible to the observer. That is why, either by analogy, theory, or simulation, it is supposedly necessary to go back to the observer's own experience

(which is, contrary to the experience of the life of another, accessible to him/her) to comprehend others.

Whether implicitly or explicitly, ST has become the basis of contemporary theories of empathy, including those followed in social robotics. The traditional accounts of ST hold to the beliefs explained above, with the following axioms. Firstly, in this understanding of empathy, movement is considered as a mere tool, as a medium that, in its expressive capacity, carries information about inner mental states and emotions. Hence, the common classification of empathy within classical theories of simulation as 'mind-reading', indicating that 'we come to identify mental states on the basis of bodily behaviour in a manner analogous to the way in which we grasp meaning on the basis of written inscriptions' (Apperly, 2011: 4, cf. in Zahavi, 2014: 99). Secondly, ST assumes that the life of others is experientially inaccessible to us, in opposition to our own mind, which is given to us in a direct and unmediated fashion. Zahavi shows how in diverse accounts of empathy by phenomenologists these two assumptions have been challenged: firstly, because empathy is a perception rather than an effect of inference from expressive movement; and secondly, because our acquaintance with ourselves is never a purely mental experience, and it does not occur in isolation from others and the environment. Therefore, the premise that only our mind (as separated from our body and in opposition to other minds) is given to us in direct, isolated and unmediated manner is not accurate (Zahavi, 2001: 152).

Furthermore, ST claims that 'we can use our mind as a model, use it to "mirror" or "mimic" the minds of others. That is, our ability to predict and explain the actions of others is frequently taken to depend crucially on our ability to project ourselves imaginatively into their situation' (Zahavi, 2008: 514). In ST this capacity to mirror others is based on a similarity between both agents and on a subsequent sharing of the state that has been mimicked. This last point has led some theorists of ST to conflate empathy with emotional contagion, and argue that an essential part of the empathetic process entails the sharing of similar emotions. Thus, ST heavily builds on both similarity and a conflation of self-other in order to account for empathy. Zahavi critiques imitation as a base for empathy, since we are able to perceive and comprehend behaviours as linked to emotional states even if we are not able to mimic them, such as a dog moving its tail. Moreover, he claims, the conflation of self-other can be a characteristic of emotional contagion but not

of empathy. The latter, as it will be explained later, is directed at the other, and is based on preserving a distinction between the self and another.

The position of empathy in the mirror neurons debate requires further exploration, as some of its formulations seem to diverge from traditional accounts of ST. One of the most interesting neurobiological findings in mirror neuron research is that our capacity to understand others as intentional agents may draw on prelinguistic and more corporeal means, ultimately based on a 'machinery of motor control' (Zahavi, 2014: 154). Instead of abstract thinking, imaginative projection, or theoretical rules, intersubjective understanding is linked to our motor systems (a claim similar to those forwarded in theories of kinaesthetic empathy). As Zahavi points out when assessing the discoveries of mirror neurons:

> In order to understand the action, the presence of visual information is insufficient. Rather the motor schema of the observer has to be involved. That is, the observer must rely on his or her own internal motor knowledge (provided by mirror neurons) in order to translate the observed movement (2014: 154-155).

This would imply that instead of understanding social cognition as a matter of inference or the 'reading' of expressive movement, mirror neurons could point at something closer to a perceptive, experiential process in which an 'immediate, automatic, and almost reflex-like' (Gallese, 2005: 101) connection among agents takes place. As Sheets-Johnstone has suggested, this connection would be based on experiences of kinetic/tactile-kinaesthetic abilities 'accrued in the course of my developmental and educational history' (2010: 112). Or, as Gallese puts it, this process relies on similarity, albeit not one based on visual resemblance but on a commonality of action (2005: 113). In this sense, the mirror neuron system would work in such a way that there would be '"vocabularies" of motor actions at the core of the cortical motor system […] [so that] when an appropriate stimulus is presented, the relevant schema is activated' (Gazzaniga, 2009: 550).

However, from this initial claim, Gallese goes on to explore a broader implication of mirror neurons. According to the neurobiologist, all types of personal relations, including action understanding but also the recognition of emotions and sensations, are based on this mirror neuron system; therefore they can be accounted for in terms of automatic and unconscious embodied simulation processes. By placing processes of

simulation and inner mimicry at the centre of the discussion, Gallese redirected the mirror neuron research to the strand of ST in which empathy is characterised as a mode of mimicry and projection. A clear proof of this is the early paper that Gallese wrote together with Alvin Goldman, where mirror neurons were described as the underlying base for mind-reading. As they point out:

> Humans' mind-reading abilities rely on the capacity to adopt a simulation routine. This capacity might have evolved from an action execution/observation matching system whose neural correlate is represented by a class of neurons recently discovered in the macaque monkey premotor cortex: mirror neurons (1998: 493).

In later works, Gallese keeps on referring to the mirror neuron system as the proof of empathy being 'mind reading' (2005). Therefore, even if his findings could advocate for an idea of empathy closer to a more bodily and unconscious process of perception, rather than traditional accounts of ST that relied on a process of imaginatively projecting yourself onto the other, by aligning himself with Goldman he ends up joining the strand of ST as well. The interesting advances brought up by Gallese's research seem to be stranded when associated with ST, in a conception of mirror neurons as a primitive base for more advanced modes of empathy where cognition and perspective-taking are involved.

However, Zahavi questions whether the process of mirroring in neurons could be considered as a form of empathic simulation. According to him, even if the same neural path is activated when I execute an action and when I see that same action, that does not necessarily mean that for me to recognise and ascribe a motive to another person, I first need to undergo a process of inner mimesis. As Zahavi puts it: 'the fact that the same area of the brain is involved in both processes does not mean that there is simulation involved' (2015: 519). Furthermore, even if this process takes place not only with motor actions but also with emotions, the same logic applies. In this case, Zahavi concedes that a bodily and subconscious process of a type of emotional sharing might happen; however, he asserts, 'why speak of the involved subpersonal processes in terms of simulation, and not rather of, say, resonance mechanisms?' (2015: 520). The mirror neuron mechanism could account for emotional contagion, but not empathy; and it would lack enough foundation to align this resonance mechanism to a process of simulation and projection.

Gallese, then, seems to be in a middle ground between a conception of empathy as shown in traditional accounts of ST and a more phenomenological understanding of it, where motor schemas, and a commonality of action are at play. Nonetheless, Zahavi argues, Gallese's claims for empathy within the mirror neuron paradigm do not fully align with the phenomenological proposal. One reason for this is that phenomenologists such as Edmund Husserl and Edith Stein, who advocate for a coupling as a form of empathy (in a similar manner to the resonance system of mirror neurons), are careful to point out that this does not imply any type of projection onto the other of my own experience, and that self and other always remain separated entities in the process. Furthermore, phenomenologists are more keen to emphasise the value of complementarity and not mirroring when dealing with empathetic processes (this especially the case for Merleau-Ponty, one of the theorists that Gallese uses in his exploration of mirror neurons as an empathetic method).

Thus, Zahavi has attempted to offer a counterproposal to that of ST, which, as we have seen, is the prevalent mode of understanding empathy even within mirror neuron research. As Zahavi points out, the different theories of empathy claimed by various phenomenologists differ; however, certain similarities or common goals can be drawn. Salient among these is the idea of moving away from a conception of empathy as linked to similarity and projection of one's own states into another's body, and towards understanding it as a perception.

Phenomenologists rejected the idea of empathy being an analogical or inferential process, arguing instead that the empathic connection was a unique form of intentionality within intersubjective relations. Empathy, as this particular perception, would make us experience the desires, beliefs and feelings of others in a direct manner. Several critiques have been made towards phenomenological empathy in this regard, to the effect that empathy cannot be a direct experiential understanding as it is always influenced by contextual factors. In this regard, Zahavi claims that the opposition in this case should not be established between contextual and direct, but within direct and indirect experience. For instance, an indirect experience of another person's emotional life would be when the other's psychological state is not my primary intentional object—it is not experienced as a presence, but rather I am inferring it from another perceived object (Zahavi, 2014).

It is also important to mention that, as Stein points out, the experience of empathy is like perception inasmuch as it is a direct and non-inferential process; but it is also unlike

perception in that it is not offered to us in its fullest presence, as 'that presence is only available to the subject of experience' (Zahavi, 2010: 294). In this sense, the fact that phenomenologists consider empathy to be a direct experience does not entail that it can be equated with a first-person experience, as the other cannot possibly experience himself or herself in the same way as the target of empathy does. The second-person access to the emotional life of the other does differ from a first-person experience, but this difference is precisely constitutive of the empathetic experience, because it is the reason we can claim that we are able to experience *other* minds at all. As Zahavi highlights:

> It is possible to experience minds in more than one way. When I experience the facial expressions or meaningful actions of another, I am *experiencing* foreign subjectivity, and not merely imagining it, simulating it or theorizing about it (2010: 295) [emphasis in the original].

This empathetic perception or experience of other minds is possible because, as Zahavi argues (here following the ideas of Scheler), 'affective and emotional states are not simply qualities of subjective experience, rather they are given *in* expressive phenomena' (2010: 292) [emphasis in the original]. Following this line of argument, emotions are understood as being offered to us in a direct manner through the perception of movement instead of being internal states that need to be inferred or simulated thanks to the information provided by expressive movement (Zahavi, 2014: 183). Zahavi explains how Stein followed this line of thought, claiming that 'an unexpressed emotion is an incomplete emotion'; for her, the expression was not just a medium but an externalisation of the emotion, making of the two a natural unity (2014: 183). As the theorists of kinaesthetic empathy argue, movement can be emotional in and of itself; but with the advances offered by phenomenological empathy, it is also possible to say that our perception of that emotional movement creates a non-inferential access to the emotional life of others. This wrecks the distinction upheld in traditional strands of ST between internal states and external expressive movement, because 'bodily behaviour is meaningful, it is intentional, and as such it is neither internal nor external, but rather beyond this artificial distinction' (Zahavi, 2001: 153).

What it is perceived in these empathic moments, however, is not just a body or a mind, but a psychophysical unity. For Zahavi and the phenomenologists that came before him, one of the main issues of the ToM debate regarding empathy is the fact that this process is treating the mind as 'something exclusively inner, something cut off from the

body and the surrounding world' (Zahavi, 2008: 520). Our experience of others, however, entails the perception of an embodied mind, a unified whole where both mental states and bodily states are apprehended and cannot be clearly separated from each other. However, Zahavi is careful to specify that this experience of the embodied mind of the other 'rather than eliminating the difference between self-experience and other-experience, takes the asymmetry to be a necessary and persisting existential fact' (2014: 151). Empathy constitutes then a type of other-directionality, where the life of the other is experienced as being first-personally lived by that other.

Although several phenomenologists point at this idea of other-directionality as essential to empathy, Zahavi mainly draws on Schutz to analyse this trait. For this philosopher, empathy is a case of 'thou-orientation' (*Dueinstellung*) where the other is bodily co-present and immediately given as a psychophysical unity: 'it is not the standard first-person acquaintance, but rather a distinct other-acquaintance […] the specificity of the access is due to the fact that it is basic and intuitive; that is, the empathized experience is given directly as existing here and now' (Zahavi, 2014: 151). When both the agents involved in the empathic process are directed towards each other, this thou-orientation turns into a we-relationship. Opposed to the shared blended space defended by Gallese and simulationists (where self-other indistinguishability would not only precede self-other distinction but also enable empathy), phenomenological empathy emphasises the importance of difference and separate self-other experience in this we-experience.

Zahavi's description of this phenomenological 'we' also implies certain ideas about empathy as an encounter, as a performance and a performative process. These 'empathetic encounters', as I would like to call them, rely firstly on a bodily co-presence and a consequent co-constitution, which I will analyse in more in depth in the next section. This is clearly expressed in the following quote, where Zahavi summarises Schutz's views on the matter

> In the face-to-face encounter, there is, according to Schutz, a concrete we-relationship, a shared motivational context in which our respective streams of consciousness are interlocked, immediately affecting each other, and in such situations there is a form of other-understanding that isn't exclusively based on theory, imagination or past experiences (2014: 143).

In this encounter both entities are being mutually affected, creating in the flow of the process the emotions being perceived. This co-constitution, however, rather than being described as a mirroring or a sharing, it is understood by phenomenologists in terms of *coordination*. Zahavi describes this particular feature of empathy by focusing on the parts of Merleau-Ponty's work in which he describes self and other as collaborators in reciprocity during an intersubjective encounter. In this way, the phenomenological approach to social cognition suggests that empathy, 'rather than simply occasioning a mere replication or simulation of those actions, elicits a dynamic response that takes those actions as affordances for further complementary actions' (2014: 160-161). Merleau-Ponty's ideas about empathy are, according to Zahavi, better understood when we relate them 'to dancing [rather] than to mirroring' (2014: 161).

Possibilities and Challenges

The discussions of kinaesthetic empathy in the work of Foster and Reynolds hold that movement, far from being an expressive tool of an inner emotional life, can be both emotional and physical at the same time, thereby questioning the distinction between internal emotion and external expression. Moreover, kinaesthetic empathy pointed at how the manner of grasping this emotional movement happens through a pre-reflexive, immediate bodily connection, not through an act of imagination or a conscious reflection, as previous theories such as ST would have it.

This immediate bodily connection correlates with Zahavi's proposition that empathy is a direct and non-inferential mode of perception. Through this perception, he argues, it is possible to access to the emotional life of the other via a second-person perspective. In this way, and in relation to the concerns of kinaesthetic empathy theorists about placing difference in empathy, the experiences of the empathiser and the target of empathy would remain distinct, even if connected. Nonetheless, this connection is conceptualised differently in both traditions. Whereas kinaesthetic empathy continues to rely on a notion of simulation and mimicry to account for the empathetic bond, phenomenology opts for a different type of linkage, closer to the notions of coordination or coupling.

These two fields offer a new understanding of empathy that could be useful in social robotics. Firstly, the strand of thought that current theorists of kinaesthetic empathy

have delineated suggests the possibility of a different understanding of movement within HRI: instead of being an expressive tool of an inner mental state, as most social robotics projects would have it, movement is a key part of the empathetic process. Secondly, phenomenology's take on the matter makes it possible to position empathy as a perception, rather than an issue of expression. Finally, these two fields analyse how the target evokes empathy in the observer, rather than how the observer simulates and later on projects their states on the target of empathy. By applying these theories, we could reach a very different position with regards to empathy in robots: instead of focusing on how a robot *shows* empathy (mainly by mimicking human's movement), we could analyse how the robot *evokes* empathy in the observer.

Furthermore, kinaesthetic empathy and phenomenological empathy offer another take on the limitations that ST posed in HRI. As mentioned in chapter 1, two main challenges emerge when transposing simulationist theories of empathy from HHI to HRI. Firstly, the issue of dissimilarity between different kinds of embodiment complicates the empathetic process of mimicry and simulation. Secondly, as emotions are considered internal states expressed through movement, robots are only capable of imitating but not 'feeling' those empathetic emotions due to their lack of interiority. Regarding the former point, phenomenology was useful inasmuch as it shows how the empathetic connection does not rely on a physical similarity but rather on a commonality of action. This connection is based on a coordination and not a mimicry and a simulation. Furthermore, dance scholars, could begin to dismantle this dichotomy between internal states and external expressive behaviour by considering movement as emotional and not merely as a tool in expressing an internal emotion. Similarly, by considering empathy in a pre-reflexive, bodily manner, kinaesthetic empathy theorists claimed that this emotional movement had an immediate and physical effect on the empathiser, leaving aside a more cognitive and conscious inference process within empathy.

However, Foster's, Reynolds's and Zahavi's respective understandings of empathy and its connection to emotions or affect are not always similar, even if they may be read as complementary. Whereas Foster and Zahavi tend to associate empathy with emotions and feelings, without getting into specifications of what these terms might mean, Reynolds distinguishes between an emotional and an affective realm. However, as mentioned above, her association of empathy with one or the other field is not consistent (although in her latest writings she seems to define empathy more clearly as emotional

identification in a process of mirroring and perspective-taking). By contrast, Zahavi understands this perspective-taking as occurring in a process of perception where we access but do not fuse with the motives, beliefs, and emotions of the other. In this sense, both Reynolds and Zahavi consider empathy in the broader realm of intersubjective understanding, in which we are able to recognise and ascribe motives and feelings to another person. This understanding, however, happens through pre-reflexive bodily means which, later on, can or cannot be cognised.

In this thesis I follow this understanding of empathy as a pre-reflexive bodily resonance among entities, although I associate it with affect rather than emotions. As I understand empathy to take place in a pre-reflexive realm where clear distinctions have not yet been made or rationalised, I consider affect a much more suitable term for it.[17] Furthermore (as will be emphasised in the next section), empathy is a process: a situated and constantly changing becoming where certain affective states are actualised. Due to this processual trait, an empathetic connection is not properly characterised by well-defined and clear-cut emotions. Nonetheless, the fact that affect takes place in a pre-reflexive realm and is associated with intensities and processual forces rather than rationalised emotions does not mean that it is completely outside of the representational realm. As Eugenie Brinkema (2014) explains, structure and form, instead of being opposites to the workings of affect, are the modes in which the particularities of affects (in the plural and not in a generalised singular) take place. When considering affect in empathy, then, I look at its specific modes of working in the case studies selected, through particular configurations that involve formal, content-related, and contextual characteristics.

To conclude this chapter, it will be useful to reflect on how Donnarumma opened the empathetic processes that kinaesthetic empathy and phenomenology could

[17] Affect has become an essential term in contemporary approaches in the humanities, especially since humanities studies have turned away from representation and dedicated their interest to materiality and embodiment. Affect theory covers an extensive ground which I cannot fully review in this thesis. It is usually understood, nonetheless, that two strands in affect studies prevail: one philosophical, started by Baruch Spinoza, followed by Gilles Deleuze and more recently by Brian Massumi, and one psychological, with Sylvan Tomkins and Eve Kosofsky Sedgwick as their main representatives. In the philosophical realm—the one that I align myself with here—affect has been conceptualised as a force or intensity, an increase or decrease in the body's vital force, that remains in a state of potentiality. For further reading about this strand of Affect Theory, one could refer to Spinoza's *Ethica, Ordine Geometrico Demonstrata* (1677), Deleuze and Guattari's *A Thousand Plateaus: Capitalism and Schizophrenia (*1980) or Massumi's *Parables for the Virtual: Movement, Affect, Sensation* (2002).

subsequently be used to analyse. As shown in the case studies of *Eingeweide* and *Corpus Nil*, Donnarumma understands the relationship between humans and technology in terms of an attunement rather than a mimicry. This attunement could take place not because of a similarity in distinct corporealities but because of a commonality in movement between those entities: in the case of his works, a commonality based on an oscillatory rhythm. The connection established through oscillations between humans and computational systems and prostheses was done by a process of automaticity—that is, by pre-reflexive means. Kinaesthetic empathy and phenomenology, therefore, were able to conceptually develop what could be hinted at through his practice: the idea of empathy being a pre-reflexive bodily connection where a coupling takes place in movement. However, both the reliance of kinaesthetic empathy in simulation, as well as some unexplored features of the empathetic connection in both kinaesthetic empathy and phenomenology, require further investigation. In the next chapter I expand on the notions of configuration, automaticity and oscillation present in Donnarumma's work to argue that empathy can be understand as a performance, as performative, and as based on a commonality of potential dynamics, not just of movement.

CHAPTER 4. Empathetic Encounters

This chapter is dedicated to developing a new paradigm for human-robot empathetic interactions, which I term 'empathetic encounters'. I begin by drawing connections between my two main theoretical sources: kinaesthetic empathy and phenomenology. The work of Maxine Sheets-Johnstone is be crucial in doing so. Her research interests in both phenomenology and kinaesthesia aids me in better complementing these two fields with regards to empathy. Her notion of coordinating movement dynamics is particularly useful for establishing the empathetic encounters paradigm.

Following this, I indicate some aspects that have been hinted at in my theoretical sources but that have not been sufficiently addressed thus far. Firstly, I explain how empathy should be considered as a process instead of an experience that either humans or robots have. In my reading of Marco Donnarumma's work in the previous chapter—particularly his notion of configuration is the becoming it implies—I already gestured towards the possibility of conceiving empathy in terms of a process and an encounter. The understanding of empathy as a process leads me to conceptualising it as a performance and as performative. Furthermore, I discuss empathy's relation to actualising potential movements and the notion of body schema.

After a section in which these characteristics of the empathetic encounters paradigm are related to the discussion of social robotics, I analyse the project Performative Body Mapping. Petra Gemeinboeck and Rob Saunders's approach to robotics will provide an account of how new modes of empathy could be developed in HRI. Looking at their practice through the lens of the empathetic encounters paradigm offers a perspective of how this theory could be implemented in the design of social robots. This case study will speak back to my theory from a practice-based perspective, entering a dialogue with my theoretical enquiries in order to think in a material way about empathy in HRI.

Dialogues Between Kinaesthetic Empathy and Phenomenology

In the preceding chapter I sketched a theory of empathy opened by Donnarumma and that with the conceptual aid of both the field dance studies and phenomenology started to depart from the conception of empathy within the Theory of Mind debate. Susan Leigh Foster's and Dee Reynolds's work offered critical approaches to the history of empathy by showing its problematic assumptions, as well as possible counter options. In addition,

Dan Zahavi's writings complemented the propositions of kinaesthetic empathy with a consideration of empathy as based on a coupling rather than a simulation, as well as with an emphasis on the distinction between self and other in the empathetic connection. However, Zahavi leaves aside the importance that kinaesthetic empathy placed on movement. In order to reconcile these two aspects, as well as expanding on the notion of coordination as an alternative to imitation, the work of Maxine Sheets-Johnstone will prove useful.

Sheets-Johnstone, a philosopher who was previously a dancer, choreographer, dance scholar, and teacher, heavily draws on phenomenology for her philosophical research. Furthermore, her keen interest in emphasising movement and kinaesthetic experience throughout her work creates a useful link between kinaesthetic empathy and phenomenological empathy for my own study. In order to understand how both fields are connected in her theory, we first need to comprehend her notion of movement dynamics. For her, 'we are not simply bodies, morphological forms having such and such parts, but dynamically moving and dynamically attentive creatures' (2010: 112). In this sense, kinaesthetic experience is for her not a matter of sensation as much as a matter of dynamics: when we move, what we kinaesthetically feel is the dynamics of our movement. Similarly, the empathetic connections that are created also rely on this dynamism.

Sheets-Johnstone discusses this last point through the work of Edmund Husserl in the *Fifth Cartesian Meditation*. According to her, Husserl does not explicitly discuss empathy but gives cues as to how we could understand this process. She divides those cues into three parts: the sphere of ownness, similarity, and harmoniousness. All of the characteristics that Husserl considers as determinant to the sphere of ownness—that is, the most reduced sense of self—are rooted in kinetic/tactile-kinaesthetic experiences. These kinaesthetic capacities, as Husserl points out, are 'accrued in the course of my developmental and educational history' (2010: 112). Similarity, as underpinning the pairing or coupling with others, is not based on formal appearance but in kinetic dynamics. In this way, we are able to relate to others inasmuch as we share a commonality of movement dynamics where animate beings can recognise each other as 'dynamically similar to the ways in which I move' (2010: 112). And harmoniousness, as a form of enabling an empathetic connection, refers to a 'qualitative kinetic concordance' (2010:

113) between entities that share this commonality of movement dynamics. As pointed out in the first cue, this is influenced by our educational and developmental history.

As a way of exemplifying how this phenomenological coupling might work through movement dynamics in a more practical manner, Sheets-Johnstone makes use of the work of infant psychiatrist Daniel Stern. In his studies about affect attunement, Stern exposed how the dynamics of movement are kinaesthetically apparent, congruent with affective dynamics, and recognisable. Quoting Stern, Sheets-Johnstone gives the following example of this attunement:

> A nine-month-old girl becomes very excited about a toy and reaches for it. As she grabs it, she lets out an exuberant "aaah!" and looks at her mother. Her mother looks back, scrunches up her shoulders, and performs a terrific shimmy with her upper body, like a go-go dancer. The shimmy lasts only about as long as her daughter's "aaaah!" but is equally excited, joyful, and intense (Stern quoted in Sheets-Johnstone, 2010: 177)

This example is particularly relevant when understanding empathetic connections, and especially the new paradigm that I have been sketching, for several reasons. Firstly, it is vital to note that a coordination of movement dynamics takes place, as well as the fact that this coordination is linked to affective states. As she expresses, 'infant and mother are thus cognitively as well as affectively and kinetically attuned' (2010: 117). Secondly, this example shows how kinaesthetic empathy is established between these two entities not by means of an imitation but an attunement, a coupling that coordinates dynamics in an immediate manner. In Sheets-Johnstone's words: 'it is not a question of imitation but of dynamics; dynamics created by infant and mother together through some mode of bodily movement' (2010: 117). Finally, it also points at how, through their interaction, they 'create synergies of meaningful movement' (2010: 117). This means that rather than recognising previously-defined affective states in the other before coordinating with them, those states are co-created during the attunement. In this regard Sheets-Johnstone asserts that 'emotions are not "states" of being but dynamic phenomena that are experienced in the flesh' (2010: 124).

Similar assertions are to be found in Marco Donnarumma's artistic practice: my analyses showed how movement dynamics played a great part in affectively coordinating human and machinic bodies. In Donnarumma's case, these dynamics are oscillatory rhythms shared by the human dancers on stage and by the prostheses whose neural

network patterns are structured in an oscillatory manner. Through this oscillation Donnarumma seeks to physically and affectively couple distinct bodies. Even if different, these human and machinic bodies nonetheless deeply influence each other. By placing the prosthesis on parts of the performers where they purposely hinder certain movements, Donnarumma looks for a re-configuration of the human body by means of a co-creation of affective movement dynamics, leading to the emergence of a hybrid corporeality. Sheets-Johnstone's work thus offers a vital understanding of how not just gestures or movement, but *movement dynamics* lie at the core of the empathetic relations. It is these movement dynamics that allow humans and robots to effectively coordinate in empathetic encounters, like those shown in Donnarumma's work.

Before continuing with this topic, it is worth noting that Sheets-Johnstone, Zahavi, Foster, and Reynolds all treat the topic of empathy only in HHI. Their considerations do not go beyond an anthropocentric understanding of intersubjective communication. This is not necessarily a shortcoming when evaluating their theoretical contributions. However, it is vital to note that when transposing the debate from HHI to HRI—and this is the main purpose of this chapter—the rules of the game change. Throughout this study, I have tried not to conflate human and robotic perspectives, as these two entities possess physical, psychological, and phenomenological qualities whose differences should not be disregarded. The robot capacity to perceive and be affected greatly differs from that of the human, and my attempt at enlarging the concept of empathy does not imply that human and robotic experiences should be considered under the same parameters.

This notwithstanding, the complications that arise from transposing contemporary theories of empathy, like that of ST, is not due to the inadequacy of this term for HRI. On the contrary, as I have been arguing in this study, these problematics are due to the underlying assumptions of this concept, especially with regards to its association with imitation. Moreover, the question of empathy is usually located in one of the two ends of the empathetic connection (mostly on the one of the empathisers); however, I want to propose that empathy is better understood if located in the process instead. As I argue later in this chapter, the concepts of performance and performativity offer an effective means for doing so.

In his reconstruction of the phenomenological empathy discourse, Zahavi hints at the idea of complementarity, and not mirroring, to account for the empathetic connection. Empathy thus becomes a matter of being coupled, not of mimicking. Similarly, Sheets-

Johnstone considers the recognition of movement dynamics and their potential for a concordance among kinaesthetic patterns as vital for us being 'affectively and kinetically attuned' (2010: 177). Both authors, in their analysis of the empathetic connection, mention or hint at a possible co-creation in this coupling but do not really delve into it. I consider this, on the contrary, to be an essential aspect of how we can understand empathy in a different way, an aspect that could modify the way in which we use this concept within social robotics.

To take this line of thinking further: When considering empathy within two entities, human or robotic, the discussion tends to revolve around one of them being able, or not able, to experience or perceive empathy. Within the field of robotics, specifically, studies are focused on whether or not robots can *feel empathy for* humans. The discussions I have been trying to trace here in kinaesthetic empathy and phenomenology, however, already point at something different. With their considerations of an immediate bodily connection and of a coordination of empathetic responses depending on each other's actions, both strands implicitly start to locate empathy in the process of creating an empathetic connection. Instead of being an experience that takes place in one of the entities involved in the relation, empathy is constructed *in the process of relating*.

The processual character of empathy was one of the main points of my analysis of Marco Donnarumma's artistic work. As noted there, Donnarumma's theoretical and practical thinking give a special importance to the concept of becoming, inasmuch as for him individuation consists on a process where human and technology mutually and constantly recreate each other. This was especially evident in his concept of configuration, which stands for a particular re-organisation of physical and affective parts of a technological body. The configurations formed in *Eingeweide* and *Corpus Nil* can be grasped in their here-and-now, in their situated and contextual performance. However, they are part of a bigger becoming where an ever-changing enfolding of dynamics takes place. My proposal was to read this processual character of Donnarumma's configurations as a form of empathy, as a way of opening up a new conception of the empathetic relation. As discussed above, this indicates how empathy is not located in one or the other end of the encounter but in a process that is co-constituted by both human and robotic entities. Furthermore, it also calls attention to the fact that, by being part of this relation, the entities involved experience a re-configuration of their initial properties,

consequently altering their own materiality and capabilities within the empathetic encounter.

The idea of empathy being constructed processually also implies that empathy is performative, as well as a type of performance. It is for this reason that I have called this paradigm 'empathetic encounters'. Associating empathy with an encounter is not an entirely new idea. This link has occasionally been made in both kinaesthetic and phenomenological empathy. Reynolds, for example, tries to analyse empathy in her first works as an affective encounter rather than as emotional identification (2013: 112). She also supports her argument with the work of Jill Bennett, who defines empathy as 'a form of encounter predicated on an openness to a mode of existence or experience beyond what is known by the self' (2005: 9). In the realm of phenomenology, Edith Stein suggests that empathy might be a form of understanding of someone's emotional life that is characterised as an encounter 'with the subject created in the encounter' (Parviainen, 2003: 155). Finally, Zahavi too builds on the notion of a face-to-face encounter in order to describe empathy as a perception, explicitly stating that this process might be understood 'as a thematic encounter with a concrete other' (2001: 154).

The idea of empathy as a performance arises in particular to phenomenology, in which empathy typically emerges from a face-to-face encounter. This was already noted by Foster who, at the beginning of *Choreographing Empathy*, writes that 'theories of sympathy/empathy also analyse the empathetic encounter as if it were a performance, staging the moment of connection by describing the positions, movements, and feelings of all those involved' (2010: 13). Empathetic encounters, in these areas of research, are mainly thematised as a performance event where two entities are co-present. Relatedly, Erika Fischer-Lichte was the first theatre scholar who defined the concept of co-presence as a main characteristic of theatre and performance. As she asserts in *The Transformative Power of Performance*, '[t]he bodily co-presence of actors and spectators enables and constitutes performance. For a performance to occur, actors and spectators must assemble to interact in a specific place for a certain period of time' (2008: 32).

However, I would like to expand the notion of co-presence, as scholars like Pedro Manuel (2014) have done, to include modes of mediated or simulated presence as also

forming part of the performance setting.[18] Especially relevant for settings like that of HRI, where the typical positions of human performers and audiences are subverted, this expanded notion of co-presence allows us to understand a performance event as something that happens in the *here and now* without the need to consider 'real' human bodies as sharing the same time and space. Taking into account this reformulation of co-presence, empathy can be linked to a performance event, of which two distinct but co-affecting positions (those of the performer and of the audience) are fundamental parts.

Considering empathy as a performance also points to the fact that it is a contextualised process, that it is situated in a specific socio-cultural and economic framework. As happens in the here and now, with specific performers and audiences, its particularities depend on the moment it is performed, as well as on the background of both participants. This implies that an empathetic encounter cannot be considered in an abstract, detached sense. On the contrary, it should be accounted for as a co-constitution of affective states that have a grounding in the conditions of the world, as well as in the socio-cultural biases and expectations that accompany each entity that takes part of the empathetic process. (This was explored also with Donnarumma's notion of configuration: the empathetic relation between humans and robots relies on a potential sphere, but it is actualised in situated, contextual performances that possess their own particularities and need to be grasp in the specificities of their here and now.) Empathetic encounters, then, can only be analysed in their actualisation of a specific mode of potential movement dynamics, even if it is important to keep in mind that this actualisation belongs to a bigger plane of an ever-changing and co-created becoming.

This co-constitution leads us to consider empathetic encounters not only as a performance, where two positions are staged and are sharing a here and now, but also as performative. The notion of performativity, first introduced in the linguistic realm by John

[18] Pedro Manuel analyses theatrical and performative practices in which this feedback loop of actors and audiences sharing the same space and time is cut off. In these situations, when the audience-actor pack is called into question, a modification of the concept of co-presence occurs. As he explains, the question nowadays is how to understand the 'real' and 'immediate' presence of the body on stage in the time of image manipulation, digital encounters and reproducibility. Manuel's research explores the cases in which this physical co-presence is extended in three ways: either the audience members create the dramaturgical action without actors; the audiences are spatially or temporally separated; or the performance is presented to a non-human public.

Langshaw Austin (1962)[19] and later reformulated by Judith Butler (1990),[20] is understood in this study as a set of acts which, through repetition and the process of being performed, create the reality that they seem to represent. As Butler poses it, something being performative implies that 'it has no ontological status apart from the various acts which constitute its reality' (1990: 173). In the context of empathy, it would imply that the affective states being shared are, also and at the same time, brought about in a performative way during the process of sharing. From this it follows that affects in empathetic encounters are not individualised inner states but co-created in an act of coordination between different entities during the performance of the empathetic act.

Such a performative view of empathetic encounters also emphasises a point mentioned above: the fact that empathy should be located not at one end of the relation but in the process of relating. Empathetic encounters are processes or becomings where a coordination take place, where certain affects and not others are co-created along the way and in that specific time and space.[21] This also introduces the idea of virtuality or potentiality within the empathetic relation. [22] The virtual is understood here as that which is fulfilled in its actualisation but that, nonetheless, exists, as real, in a frame of potentiality. In close connection to this idea, Zahavi remarks that empathy 'elicits a dynamic response that takes those actions as affordances for further complementary actions' (Zahavi, 2014: 160-161). The idea of affordances, first theorised by James J.

[19] In his well-known book *How to Do Things with Words,* Austin defines the performative utterance of performance sentence as that which indicates the performing of an action, such as 'I declare you husband and wife'. In these cases, the utterances are not just 'saying something' (1962: 7) but '*doing* something—namely, marrying, rather than reporting something, namely *that* we are marrying' (1962: 7. Emphasis in the original.).

[20] Butler expanded the notion of the performative in her book *Gender Trouble*, in order to account for an explanation of how gender is constructed and reinforced. For her, performativity in this sense shows that the supposedly fixed 'essence' of gender is no more than a social creation supported by corporeal acts and discursive means, consistently repeated in a form of ritual.

[21] The concept of becoming is well-known in philosophy, most notably in modern and contemporary strands of thought like that of Gilles Deleuze and Felix Guattari, as well as in new materialism. In this thesis it refers to a processual and never complete mode of being in the world, different from essentialist and static doctrines that would consider the individual as a self-contained and invariant being.

[22] Gilles Deleuze is the philosopher that delved into the concept of the virtual most extensively, basing his enquiries on Henri Bergson's considerations of the 'possible' and the 'real'. Substituting the concept of the possible in favour of the virtual, Deleuze explains how the virtual is not 'realised' in the real but 'actualised' on it, being the virtual plane already fully real (Deleuze, 1991). The virtual then is not the condition of possibility of rational experience (of a personal and individuated empirical frame) but the condition of genesis of real experience. In other words, the virtual is a differential field that is actualised through processes (Smith, 2018).

Gibson, allows the possibility of understanding empathetic encounters as offering potentialities that may or may not be actualised through the interaction between different entities, as well as with the environment.[23]

As Maaike Bleeker (2017) highlights when dealing with an ecological approach to design, thinking with Gibson's affordances in the field of robotics would furnish

> an approach that does not start from an autonomous entity that then has to prove its capability for survival in an encounter with an environment, but from the potential of the environment and how the creature-to-be-designed can tap into this potential—that is, actualise it (Bleeker, 2017: 8).

Understanding movement as a vital mode of connection between humans and machines, Bleeker goes on to explain how our capacity to relate to robots does not rely on a similarity of movement but rather on our ability to 'make sense of them in terms of potential actions' (2017: 14). To return to the idea of coordinating movement dynamics in empathetic encounters: robots and humans do not need to share the same morphologies, nor do they need to rely on a similarity of shape or action. Instead, these two entities, when entering into the process of co-creating an empathetic state, would rely on a potentiality of movement that is or is not actualised in the encounter.

In Marco Donnarumma's work this actualisation of potential movement takes place through the crossing of thresholds. As he explains, through habit and entrainment it is possible to go beyond certain thresholds of movement and explore a new configuration of the body. This is precisely what the artist explores via automaticity in the pieces analysed above, *Eingeweide* and *Corpus Nil*. As described above, automaticity consists is a mode in which the performer's consciousness is surpassed and a new type of pre-reflexive attunement can take place with the machinic entities. In his connection with computational systems and prostheses, as well as in his connection to the environment in *Corpus Nil* and *Eingeweide*, certain physical limitations are established. In the first performance, Donnarumma stays on the floor, supporting his whole body on his neck, while attaching himself to sensors that will give him feedback in the form of sound. In

[23] Gibson introduced the concept of 'affordance' in his book *The Senses Considered as Perceptual Systems* (1966) in order to describe the ways in which the environment has potentials for certain actions and perceptions and not for others. In this sense, what living beings can or cannot do in determinate environments depend not only on their capabilities and sensorimotor systems, but also on what those spaces 'afford'.

the second performance, a prosthesis is attached to his face, limiting his view and movements. In these threshold conditions, boundaries of pain, discomfort and physical restrictions are crossed, which, along with the trance-like state that Donnarumma reports to have experienced during the performances, allows for automaticity to come in and consciousness to drop off. In these moments, when control of the incorporated objects is no longer an option, a reconfiguration of the body of the performer takes place, modifying his body schema and therefore allowing for new potential movements to be actualised (in this case in collaboration with the machinic body).

The idea of potentiality of movement can better be understood through the notion of body schema. This concept has been a fruitful manner of understanding how the human body functions and how it couples itself with other human and non-human entities in a non-reflexive way. Here I follow Shaun Gallagher's (1986, 2005) understanding of body schema as a non-conscious performance of the body, as opposed to a body image, which would be an inconstant intentional object. As Gallagher explains, the body is not usually an object for consciousness, unless there is a voluntary reflection about it, brought up by experiences of pain, pleasure, fatigue or the like. In these cases, the body is perceived as 'mine', as an object for self-consciousness, and hence creates a body image which contains perceptual, cognitive, and emotional aspects. The body schema, on the other hand, 'is an active, operative performance of the body, rather than a copy, image, global model, or conception of the existing parts of the body. The schema is the body as it actively integrates its positions and responses in the environment' (1986: 548).

One example Gallagher uses to show how the conception of body schema is deeply related to the performance of the body in response to an environment is eyestrain. Whenever this action happens, the attention of the person that strains his or her eyes is directed towards the environment (is it too sunny? Is this text boring?) but not to the eyes in themselves (Gallagher, 1986: 549). Similarly, and depending on the environment in which the actions need to be performed, the body schema can also be extended. For example, when a carpenter's hammer becomes part of the operations of the carpenter's hands, this tool is integrated into the person's non-conscious body schema (Gallagher, 1986: 548). Returning to the idea of a potentiality of movement: the body schema of human and non-human entities when experiencing an empathetic encounter can be extended, when actualised, in the coordination of their movement dynamics. This is especially relevant inasmuch as it opens up a path for new movements, and new

connections in movement, that are not based on the mimicry of human motion, but rather engage in a co-creation of human and non-human potential dynamics.

A New Paradigm for Human-Robot Interaction

As I have been explaining in the previous section, looking at empathy through the concept of empathetic encounters offers a different understanding that the one proposed by ST. This is particularly relevant because a number of problems arise when applying the notion of empathy to social robotics via ST paradigms, not only in the sense of the possibility or lack of possibility of robots to 'feel' empathy, as opposed to enacting or simulating it, but also inasmuch as it is grounded on the mimicry of human motion.

The paradigm of empathetic encounters, as I have theorised it so far, therefore shifts the emphasis to the fact that this act is an encounter and a process. This encounter, first of all, is understood as a performance event that takes is staged here and now, and where more than one entity is present. It is, furthermore, a process: a becoming, something that occurs in relating, and not an inner state that afterwards is communicated. In this encounter, a coordination of movement dynamics takes place, which allows two or more entities to be kinetically and affectively attuned. This coordination is performed and, in the affective realm, brings about affective states that are co-created by the entities that are present in the empathetic encounter. Therefore, the empathetic encounter can be considered as performative, inasmuch as it creates the affection that is shared, but also because it takes place through repetitions that are socially, culturally, and physically determined.

Talking about performativity and its socially-encoded nature, Butler (1993) remarks that in the performative sphere there is always an excess between the command and the appropriated effect (1993: 122). This 'slippage' (Butler, 1993: 122) leaves grounds for disobedience, for an alternative path to that of social prescription and endless repetitions of the same. The fact that empathetic encounters are conceptualised as performative also leads in this direction: in the repetition of this co-created act, there are possibilities for excesses and slippages outside of our culturally- and socially-embedded dynamics. Considered through the lens of body schemas and virtuality, this makes space for the possibility that through the interaction with other agents in empathetic encounters,

we can actualise new potentialities of movement that coordinate with but beyond the human.

In an empathetic relation between humans and robots through movement this is of a vital importance if we want to consider new paths when kinaesthetically and affectively relating to alien morphologies. In this sense, as I propose here, a more appropriate way of addressing empathy in HRI is not, as it has been the case in social robotics, through imitation and mimicry of human motion. Instead, it is better to consider this co-created experience as taking place in the coordination of movement dynamics of these entities. This, however, does not imply that humans and robots both experience this relation in the same manner: the perceptual, sensory world of both entities are different, and we should not conflate them. By understanding empathy as a process, attention is also brought to the performativity of this act. This allows for another aspect to arise in relation to HRI: in the performativity of empathetic encounters, new potentialities of movement dynamics can be actualised that move beyond human motion. In this way, it would be possible to account for a less anthropocentric empathetic relation that only considers the human (and a certain type of human[24]) as the model for movement mimicry and simulation. In this paradigm, therefore, the movements that compound the empathetic process do not serve as mere expressive tools for communicating the inner mental life of humans, nor do they work as means for the robot to simulate and imitate those states. Instead, those movements are considered to be a co-creation that could open potentialities for other actualisations of movement dynamics, for a reconfiguration of bodies, where the performativity of both the affective states being shared and the bodies being coordinated is accounted for.

Making this conceptual shift with regards to empathy in HRI achieves two things. Firstly, it is possible to offer a new way of looking at how empathy takes place not only with and towards robots, but also in HHI. By bringing into debate both kinaesthetic empathy and phenomenology, I have shown how, in empathetic processes, a coordination

[24] As Foster (2008) has pointed out, theories of empathy and sympathy, while having universalist claims, were paradoxically associated with a very concrete image: that of a white, male and abled body capable of experiencing those connections. As it occurs in many other realms of thought, the centre tends to be untheorized, falsely being associated with the 'genera', the 'normal', and the 'obvious'. Having 'the human' in its most general sense as a model to imitate risks forgetting about difference and silently allying with the commonly-accepted notion of what a normal human being is; that is, the idea of a normative human being that Foster tried to call out.

of movement dynamics takes place that allows us to be attuned in a co-creation of physical and affective states, rather than a mimicry of expressive motion that communicates internal mental conditions. Secondly, this paradigm, with its connection to the notions of virtuality and body schema, can point at new directions that might be less anthropocentric when dealing with empathy in HRI. The paradigm of empathetic encounters does not rely on the mimicry of human movement in order for the robot to express empathy, as the projects based on ST would do. This implies that other possibilities for developing empathetic encounters between humans and robots are open, and that those possibilities would take into account that the coordination of affective movement dynamics is co-created among those entities, instead of being based on human motion as its sole model.

This could offer a very different entry point to the issue of empathy than that of current explorations in socially interactive robots. As we saw in the first chapter and as Damiano et al. (2014) summarise, social robotic strands tend to be divided into two categories: those that, in a more speculative manner, attempt to create 'artificial emotions' and those that, mainly drawing from proxemics and movement studies, find 'expression' to be a key feature in the communication of emotions between humans and robots. This last strand is the one I analysed in the first chapter, pointing out how their conception of empathy heavily relied on ST and a strict divide between internal emotions and external expressive movement. However, as Damiano et al. (2013) highlight, the first strand also bases their experiments in a dichotomy between internal and external, instead of addressing the relational quality of emotions. This is what they propose in their reviews of the state-of-the-art of social robotics: to consider affective expression not as a means to transmit information about pre-determined states but as a way of mutually defining and determining them. As they write:

> The revised role which we propose for the expression of emotions demands that we develop a *relational* conception of emotions, and transform the conceptual oppositions central to the classical theory of emotions—*external* and *internal*, *social* and *private*, *inter*- and *intra*-individual—into in-dissociable complementarities (Damiano et al., 2013: 8)

In this way the priority becomes 'providing these machines with a bodily system of affective coordination appropriate to their users' (Damiano et al., 2013: 276). Their evaluation of social robotics in the field of affect resonates with the project of the present study. By turning from current discussions on empathy in social robotics to the paradigm

that I have proposed of empathetic encounters, we are able to account for 'emotions as relational', as Damiano et al. put it, but also for their performativity and their co-constitution in the empathetic process. In order to understand how empathy in HRI can move from an imitation paradigm to a conception based on the coordination of affective movement dynamics, it is important to both rely on a conceptual analysis and to explore how this coordination could be achieved. In the next section, I would like to turn to a practical project, Performative Body Mapping, which will provide a more specific and material account of how empathy can move away from ST in robotics.

Empathetic Encounters in Robotics: Performative Body Mapping

Petra Gemeinboeck and Rob Saunders consider themselves as part of the area of creative robotics: a field in experimental art that looks at HRI from a cultural perspective, and that develops artistic practices to deal with the issues that arise from that interaction. Their practice could be considered as a middle ground between robotic art and social robotics, as their methods are artistic and performative, but their work is directed towards developing and designing socially interactive robots. In recent years robotic art has proven a fruitful field for exploring robotics in general, and HRI in particular, as unlike social robotics it does not focus on physical anthropomorphic appearance or language skills. Rather, robotic art, as produced by artists like Mari Velonaki, Stelarc, Bill Vorn or Simon Penny,[25] looks for other paths of connection, such as dysfunctionality or prosthetic entanglements.[26] The advances brought up by robotic art in this respect are mainly connected to movement, exploring the kinaesthetic capabilities of non-anthropomorphic machines, and their relation to human others and their environment. Contrary to the strands in social robotics that introduce dance or dance studies within the design of anthropomorphic robots, the intersection of dance and robotics can also work towards non-anthropomorphic shapes. The belief of these artists is that focusing on how

[25] Velonaki and Penny both work with the affective responses that non-anthropomorphic robots can elicit. Velonaki's performance *Fish-Bird* uses with two moving wheelchairs that drop love messages as they move around the space. In Penny's *Petit Mal* a wheeled robot explores its surroundings and reacts to people.

[26] Vorn's *La Cour de Miracles* and *Hysterical Machines* explore machinic life-like dysfunctional behaviour that can elicit affect from the spectators. In these installations, robotic figures can be found begging, convulsing or shaking in response to the public's presence. Stelarc, on the other hand, as a long tradition of prosthetic art in which his body is closely connected and dependent on robotic objects that usually move independently, like in *Re-Wired/Re-Mixed*, creating a feeling of fragmentation and uncontrollability in relation to technology.

movement evolves in machines and in HRI, rather than using human motion as a complement to an anthropomorphic shape, might be a more fruitful path.

Gemeinboeck and Saunders's project Performative Body Mapping (PBM) focuses on the exploration of non-humanlike morphologies for robots and their capacities to move in meaningful ways for humans. According to them, a connection between robots and humans should be established on the basis of movement rather than appearance, as the latter requires more expensive means of design and could lead to disappointment, inasmuch as the human partner would expect a type of intelligence that would match the human appearance. Movement has proved in robotic art its importance and its significance in establishing a meaningful connection among humans and robots. As they state, movement 'is key to human recognition of a robot's responsive and social qualities' (2014b).

PBM bases its ideas on the concepts of embodied cognition and enactive perception, whose main representative is Alva Noë (2004). Noë's conceptualises perception it as something we *do* (a way of acting) and not something that happens to us or in us, as previous theories of perception such as representationalism have claimed.[27] The world then becomes available to us as a result of our physical movement and interaction with our environment: 'our ability to perceive not only depends on, but is constituted by, our possession of this sort of sensorimotor knowledge' (2004: 2). His work, furthermore, points at how perception is not a process solely located in the brain that constructs an internal representation of the world but rather a skilful activity of the whole animal. According to him, because an animal is active, embodied and environmentally situated, it is not required to create a representation in detail of the world before acting on it. Following from this, a robot's embodiment consequently carries with it a particular way of perceiving and acting that significantly differs from that of the human. The aim of PBM is to understand how this 'alien' embodiment moves and expresses itself, while at the same time 'imbuing it with a sensitivity for the shapes, rhythms and textures of human movements and gestures' (2014b).

Their exploration of movement in order to develop socially interactive robots, therefore, greatly differs from the one that usually takes place in social robotics, as

[27] Representationalism is the philosophical belief that the human mind perceives only mental images (representations) of material objects.

summarised in chapter 1. Instead of using movement as a complement to an anthropomorphic shape, or as a means to add communicative nuances, PBM looks at movement as a way of finding non-anthropomorphic shapes and connections to alien morphologies. By acknowledging that the robot has its own mode of being in the world, rather than using it to mirror humans, Gemeinboeck and Saunders are able to approach the issue of movement in robotics from a less anthropocentric position. Nonetheless, as they themselves assert, their project also tries to make social robots aware of human shapes and rhythms, which creates a complicated but productive tension in the development of their workshops.

Social robotics practices tried to solve the difficulty of making a robot with its own physiognomy and kinematics sensitive to human motion by making the robot more similar to the human, as well as by making it mimic human motion. PBM uses a different mode of addressing this difficulty by using movement experts from the beginning of their project. Even if in some social robotics experiments, dance methods, and movement experts were used in order to implement human motion into the robot, Gemeinboeck and Saunders's approach distances itself from traditional social robotics in two aspects. Firstly, they implement this movement knowledge from the beginning, working alongside dancers and choreographers even to create the shape of the robot. Movement, then, becomes essential to the body of the robot, instead of being implemented at a later stage in the project. Secondly, PBM relies on the expertise of a specific type of dance training which will be useful, according to them, in searching for non-anthropocentric forms of motion.

The dancers used for this project belong to De Quincey Company, a group of professional dancers trained in BodyWeather technique. This type of dancing, close to Butoh,[28] uses images to work with the body, trying to move in nonhabitual ways and taking the human body to unknown places. An example of this usage of imagination to explore unconventional motion would be the following: in one of the workshops of PBM, the choreographer Tess De Quincey gave one of the dancers interacting with a robotic costume the cue of expressing a question mark.[29] Instead of visually representing the

[28] Butoh is a type of Japanese dance created by Kazuo Ohno. It involves slow, imaginative movements that try to look for a new corporeality after the atomic bombings of Hiroshima and Nagasaki and the emotional and psychological consequences that the event had for Japanese people.

[29] As will be explained in detail later, PBM works with what they call 'costumes' in the first stages of the project: an object that stands for the future robot body and with which the dancer can interact.

symbol, the dancer enacted what a question mark stands for, or what it does. By trying to find a movement that would perform a questioning sensation, the dancer started with 'a hesitating twist that accelerated upwards with a slight inclination, before it came to a sudden halt' (Gemeinboeck and Saunders, 2017: 5). In this way, the BodyWeather technique offers the dancers the possibility of investigating novel manners of experiencing their bodies and modifying their movements, which, according to Gemeinboeck and Saunders, is beneficial when connecting with an unfamiliar object and when searching for the movement that it is particular of that shape.

Moreover, the BodyWeather practice always positions and experiences the body in relation to space, other bodies, and its surroundings. Therefore, it advocates for an ecological and performative approach to movement instead of an individualistic or representational one. As Gemeinboeck and Saunders specify, 'their bodily thinking also evokes the ecological approach of distributed cognition, however not, as it is often understood in robotics, in the form of a collective of networked, separate agents, but rather as an entanglement; a thinking *with* the world' (2019: n.p) [emphasis in the original]. Hence, the moving body creates knowledge by making new and changing connections with a world that, precisely through these new configurations, consequently changes. For this, the performers following a BodyWeather technique reject habitual paths, engaging with things beyond what they are supposed to be. This relational approach helps them in actively exploring a co-constitution of movement through their experiences, the cues that are given, their imaginative resources, and the limitations or constraints given by the object with what they are moving.

The BodyWeather technique thus allows the dancers to explore movement outside their learned human biases and to relate to alien morphologies. Furthermore, by focusing not on specific movements or gestures that clearly relate to the choreographic cues but on movement qualities, this technique also offers an interesting perspective on robotics. As mentioned above, one of the goals of PBM is to imbue the robot with a sensitivity for human rhythms and dynamics. As the artists state, including dancers in the design of the robot's movement from the beginning of the project follows and extends the 'Theatrical Robot Methodology', where an actor or mime is disguised as a robot and behaves following a script (2014b). For them, linking the development of a robot's movement to dance is essential, as that artistic field is concerned with movement quality, which involves 'its dynamic, affective and expressive characteristics, and always involves

intentionality "articulated in and through" the movements' (2006). However, intentionality in this case refers only to the directionality and intensity of the movement. In order to explore these movement qualities, PBM 'harnesses dancers' movements expertise to shape a robot and its ways of learning to move and interact with the world' (2017: 2).

The artists chose this methodology because, according to them, dance is able to provide us with knowledge about the empathetic potential of our kinaesthetic experiences (2017: 8). Thus, they focus on developing the machine's kinetic abilities in the hope that this will increase its affective and empathetic potential. As opposed to social robotics' concern with empathy, where most projects tried to focus on how a robot could show or express empathy, PBM deals with how the robot *evokes* empathy. As will be explained in the next subsection, their workshops try to discover whether the movement dynamics of the dancers are captured and reproduced by the robot, and whether those dynamics, with their corresponding affective qualities, are then perceived by an audience in a similar manner. The artists describe this as an instance of kinaesthetic empathy, a phrase that indicates a conflation of physical and affective qualities in movement (as explained in my analysis of kinaesthetic empathy above).

The importance of movement dynamics and its connection to empathy will be explained in the next subsection, as well as their reasons for using demonstration learning as one of their methods. However, my main interest lies in how PBM opens a line of thought that goes beyond what existing theories of kinaesthetic empathy offer. In this sense, I propose, using the lens of empathetic encounters will be more fruitful, as it will give a hint of how performativity and coordination plays a role in the empathetic relation. Finally, Donnarumma's notion of configuration will also be essential in comprehending how human and robot empathetically relate, especially in the first stages of their project.

Stages and Prototypes

There are four stages that compose the PBM project: bodying, grounding, imitation and improvisation. In the first two steps two things take place: first, the design of a sculptural costume that will be inhabited by the dancers; and second, a version of that sculpture with sensorimotor systems, wide-angle cameras and distant sensors that allow for the robot to move autonomously, prevent collisions, and recognise faces. The next two stages, imitation and improvisation, correspond respectively to the dual mode of learning that

PBM employs in the development of social robots: imitation/demonstration learning and an algorithmic model for curiosity.

The bodying stage consists in the creation of a costume that will be inhabited by dancers, who, in turn, will explore the possibilities of movement with this form (see figure 14). Once the form has fully been established in the bodying phase thanks to the dancer's kinaesthetic feedback, a prototype is created with a sensorimotor system (self-sensing and distance sensors) and an 'active motor babbling' that allows for a mapping between the motor and the sensor data coming from the robot. This prototype will then be worn by the dancer who explores his/her surroundings. In order for the performer to be able to sense what the robot perceives with these newly installed sensors, a soundscape or a vibrational landscape will be created in a form of translation that will connect the dancer and the robot experiences.

Once the performer builds an acquaintance with this prototype, he/she will start enacting motions that are captured. The motion capture, nonetheless, is installed on the prototype itself, not on the human body; therefore, the human figure is not directly recorded even if it activates the robot's motion. In the third phase (imitation), these movements will be shown to the robot. In this stage the robot learns through imitation learning and thanks to the videos recorded previously. This demonstration learning is especially useful at the beginning in order to test if the robot can replicate correctly. As Gemeinboeck points out, it is important to note that in their project imitation is not their goal and only presents one intermediary component in the process. [30] Furthermore, what is recorded and shown to the robot is the result of an entanglement, not human motion, and it does not consist on specific gestures but rather on their rhythms and intensities—that is, on their movement qualities.

In the next phase, improvisation, the robot learns to improvise movements based on variations of the taught movement qualities. This stage is achieved thanks to a model for curiosity. This machine learning method has been implemented by Gemeinboeck and Saunders in previous robotic art works, in particular in *Accomplice*, in which the authors explain how 'the robots are programmed to be curious and, as such, are intrinsically motivated to explore, experiment and discover through interaction with their environment' (2014a). This installation consisted of a series of robots located on a gallery

[30] Information retrieved from a conversation with Petra Gemeinboeck

wall and programmed to punch and destroy it in a playful and exploratory manner. For that purpose, the robots were imbued with capabilities for perceiving and creating a map where expected outcomes could be predicted. In this way the robots could proactively intervene in the wall and determine 'what is different enough to be interesting' (Gemeinboeck and Saunders, 2014a). The machine learning techniques used in *Accomplice* thus combine unsupervised and reinforcement learning techniques: a self-organising map to determine similarities and differences between images, and Q-learning to permit the robot to access strategies for moving around the wall. The goal of the system is to perceive 'interesting images' (that is, different from the previous ones) and to generate a reward through action (see figure 15). The algorithmic model for curiosity employed in *Accomplice* and used again in PBM, therefore, creates an intrinsic motivation to learn that directs the robot's movement. Furthermore, thanks to this model, the robot is able to create a map of its own embodiment through self-exploration. The introduction of this model allows the robot to improvise due to its own intrinsic motivation and based on the constraints and biases that it learned during the previous phase.

From one of the objects that was used in the dance workshops, Gemeinboeck and Saunders created a first prototype (cube performer 1) that has been shown in the exhibition Re/Pair, as part of The Big Anxiety Festival in Sydney (see figures 16 and 17). This robot has two components. The first is a kiwi drive that consists of an omnidirectional wheeled based on three degrees of freedom (x, y, yaw), which allows the robot to turn on the spot and move across the room without having to turn itself. The second component is a Stewart platform with six degrees of freedom relative to the base (x, y, z, yaw, pitch, roll) that permits the robot to shift, tilt and rotate (Gemeinboeck and Saunders, 2018) (see figure 18). This mechanical structure can afterwards be covered with any type of shell, which in the case of the Festival was a white cover that made it look like a gallery plinth. At this stage the robot is not fully developed and it does not cover all of the functions that the designers had initially planned, as it is not able to respond to the audience and only performs a series of movement phrases that it has learned during the movement workshops.

As Gemeinboeck and Saunders express, their intention when staging the robot in the exhibition was to explore 'the robot's affective qualities and if the audience would attribute agential capacities to this early prototype, and whether this would, in their eyes, render the robot more humanlike' (Gemeinboeck and Saunders, 2018). Through a

questionnaire given to 48 people that interacted with the robot, whose ages ranged from 21 to 55 years old, they were able to tackle the affective capacity of the robot, its perceived intelligence and agency, as well as its level of intelligibility and anthropomorphism according to the public (see figure 19). Whereas the ratings for anthropomorphism were significantly low, the ones for perceived intelligence and agency were moderately high, with the rating for affective capacity being the highest. Furthermore, 36% of the public considered movement an essential part of their attraction to the robot. However, as they rightfully point out, the experience of the audience with cube performer 1 varies depending on socio-cultural factors, making difficult to universalise results that are contingent on people's personal and cultural backgrounds (Gemeinboeck and Saunders, 2018).

In another workshop with expert participants, they tried to measure more specifically if the movement qualities enacted by the dancers in the costume would approximate the participants' perception. This, for them, would count as kinaesthetic empathy: they propose that 'the dancers' "distinctive spatio-temporal-energic dynamics" are transcribed into the costumes' (external) kinetic dynamics that in the audiences' "kinetically-sensitive eyes" register as kinesthetic empathy' (2019). In the workshop, they gathered performers and experts in designed and showed them cube performer 1 performing a 3-minute movement sequence in three different qualities: light and airy quality; boisterous, chunky quality; and playful and not predictable. According to the survey, most people associated similar characteristics to the movement qualities that the dancers were trying to enact in the costume.

Bodying the Robot

As the last section showed, Gemeinboeck and Saunders's approach in PBM tries to explore whether or not movement qualities are important for a human-nonhuman empathetic relationship. This returns us to the importance of movement dynamics in empathetic connection, as analysed above with reference to the work of Sheets-Johnstone, as well as how this connection is established through pre-reflexive bodily means. Gemeinboeck and Saunders's interest in seeing how the audience can experience a similar quality to the one imbued in the robot by the dancers and enacted by the prototype clearly relates to issues developed in kinaesthetic empathy. But in what follows I would like to further analyse how their experimentation with empathy brings something else to the

table; something that, I propose, can be better interpreted through the 'empathetic encounters' paradigm.

In order to do that, I would like to come back to the first phase of the project and analyse it in depth, as I believe that this stage is of vital importance in understanding what PBM brings to the paradigm of empathetic encounters in robotics. During the first phase, or 'bodying', dance workshops are held where the performers from De Quincey Company embody a prototype of what the robot body could be. This prototype, however, it is not determined from the start and changes its shape depending on the kinaesthetic interaction with the dancer. At the beginning of this process the team selects a series of objects that will later be in contact with the performers. These objects are selected based on two criteria: being as simple as possible, and not having any recognisable back/front or limbs. In this way, Gemeinboeck and Saunders argue, the dancers can focus on the kinaesthetic sensations produced by the interaction instead of being distracted by the appearance of the object. Furthermore, for them it is important to check whether the prototype arising from that object would be able to move autonomously and would be able to imitate movements. The most interesting objects that they found from a series of workshops were a spiral tube, a cardboard box, and a broken tetrahedron. From the cardboard box the prototype called cube performer 1 was created.

In the artists' words, the main aim of PBM is to create 'machinic forms of embodiment that don't rely on mimicking familiar bodies' (2017: 1). Thus, they try to implement a method where movement and form co-create each other in a continuous interplay, in contrast to the typical social robotics approach of implementing movement after the physical robot has been created. That is why, 'rather than understanding the robot as a mechanical artefact, which requires to be implanted with social qualities, this approach enacts the robot as a sociomaterial phenomenon by placing movement at the centre of the encounter' (2017: 2). Movement, therefore, is not considered only as a particularity of each type of embodiment but as the force that creates a body. In their own words: 'It is the movement from which the robot's body, with all its affective, intelligible qualities, emerges' (2017: 1).

The PBM project thus introduces two novel factors into the empathy debate. Firstly, movement is treated not only as a form of empathetic connection but also as a force in the becoming body of an entity. As they write: 'We believe that movement and its connection-making, relational potential is key to be becoming-body (bodying) of a

robot and its capacity to relate to other bodies and the world' (2017: 1). This means that when dealing with the affective potential of movement and its role in creating an empathetic connection between humans a robot, its capacity for determining the materiality of the robot and the human counterpart needs to be addressed. In this sense, as Gemeinboeck rightfully puts, the design of a robot morphology and movement, requires us to conceptualise it in terms of 'intra-actions', a term coined by new materialist philosopher Karen Barad (Gemeinboeck, 2019).[31] Gemeinboeck considers that her relational approach towards robotics opens up—or exposes—the intra-active field that is HRI by 'exploring what gets activated and emerges "through and as part of their entangled intra-relating"' (2019). The object that the dancers embody in this bodying phase, therefore, is not a fixed materiality; on the contrary, it provides a starting point for an intra-active and ongoing process of becoming-body that emerges from the interplay between the object, the environment, and the dancer. Gemeinboeck reference to Barad's theory of intra-actions is particularly pertinent for this topic, as it places movement at the centre of the performativity of matter, being the force in creating this machine-becoming body.

Secondly, by treating movement under this light, a new line of research can be explored—one that looks for non-human-like movements and machinic-specific forms and motions. This is possible through the object that it is embodied by the dancers and that strands as a costume that maps two different—and in-the-making—bodies. The costume is a full-size, non-mechanical prototype of the robot design in process, the form of which will be modified according to the dance workshops. Through the intra-action between the dancer, the affordances of the costume and space, and the cues from the choreographer, a movement emerges that consequently influences the future form of the prototype. However, as they emphasise, it is not just the costume that gets modified, as the dancer's movement are also co-shaped by the material forces of this object. This is

[31] Karen Barad's (2007) theory of intra-actions, part of her agential realist ontology, seeks to consider configurations and relations instead of things and words. On the one hand, there are specific exclusionary practices which are embodied as material configurations of the world in causal relationships; on the other hand, there are material phenomena which are constituted by relations and not independent things. This means that the primary epistemological unit is not an independent object (which is an atomistic conception of reality) but phenomena. Barad, in a drive to critique theories of representationalism which treat, on the one hand, matter as passive and language as agential and, on the other hand, relate to them as whole entities that interact, proposes instead to move towards a posthuman understanding of performativity. Therefore, Barad builds on Butler's analysis of how discursive practices shape not only the subject but also the matter of bodies.

particularly obvious in a costume with a transparent wall, where it is possible to observe how the body of the performer needs to reconfigure itself in order not only to fit into the costume but also in order to achieve a certain motion (see figure 20). For example, in order to make the box tilt, the performer inside does not tilt herself but looks in a different configuration how her body can create that tilting in the exterior. The relationship between the movement of the dancer and the resulting motion, therefore, is not one of mimicry but of a coordination.

This costume, in principle a motionless object, turns into a body (and specifically a becoming-body of the future robot) when the dancer starts moving with it. In this sense, the costume permits two things: it allows the dancer to experience and collaborate with this alien morphology, seeking new movements that would not have been possible to explore without the prosthesis; and it works as an 'embodied interface' that maps the embodiments and movement capacities of both human and robot (Gemeinboeck and Saunders, 2018). The costume, then, is a sort of middle ground that, on the one hand, offers freedom to look for new morphologies and non-humanlike movements, and on the other hand, helps create a connection between human and robotic movements and shapes.

This mapping also sets the ground for phase of 'imitation', as the robot needs to learn from movements of the dancer in the costume. The robot imitates 'the recorded movements from the dancer, disguised to mirror the robot's embodiment' (2017: 2). For Gemeinboeck and Saunders, this morphological mapping between the human and the robot body through the costume addresses the phase of 'imitation', with a new perspective that would be able to solve the correspondence problem. The correspondence problem is understood within robotics as the difficulty that arises, within imitation learning, when mapping or translating between the two different embodiments of a human and a robot—as explained above, after the dancer embodies the costume and her movement are recorded (Gemeinboeck and Saunders, 2017). In this way, when the prototype of the robot learns from that recording it imitates not a human morphology but something that resembles almost exactly its own embodiment. Their project proposes an interesting approach to this mapping, as 'the robot learns to imitate a human disguised and performing as that particular robot; thus, the human teacher "meets the robot half way"' (2014b). In this sense, the mapping between morphologies differs from a traditional mapping method, as the agent providing the data from which the robot learns is not a human being, but a hybrid human-robot created through intra-actions in movement.

Where to Locate Empathy?

As mentioned above, Gemeinboeck and Saunders work with the concept of kinaesthetic empathy for describing what kind of bodily and affective connections can take place between humans and non-humans. My claim in this section is that even if they base their reflections on this concept, their project opens up different ways of thinking about empathy that go beyond kinaesthetic empathy and get closer to my explanation of empathetic encounters. In order to understand this, it is important to track first what definition of kinaesthetic empathy is at play in Gemeinboeck and Saunders's project. Even if a full conceptualisation of it is not given in PBM, several scattered comments on this term are present in their writings. Firstly, their definition of kinaesthetic empathy seems to be strongly linked to embodiment, but also to a sense of connectivity with other corporealities and the environment. As they assert, 'this bodily thinking with external forces and other bodies is, we believe, a powerful example of kinesthetic empathy' (2017: 8). In this context kinaesthetic empathy is associated with a sense of coupling with other material and embodied entities. Furthermore, it is defined as a 'moving body's capacity to resonate with an observer' (2018), aligning their definition to the one explored in dance studies where empathy was considered to move away from a cognitive realm to a pre-reflexive, kinaesthetic resonance. In this sense, they emphasise that empathy is not a matter of projecting our feelings into a robot but a force that 'the moving robot body, despite it being radically different to our body, can actively transfer to us—make us feel' (2016).

Secondly, kinaesthetic empathy is understood in PBM as both the dancers and the audience's 'embodied affective responses as they encounter and engage with the robot's perceived kinesthetic intentionality, before emotions or thoughts are formed' (2018). This kinaesthetic intentionality is based on motion dynamics that were imbued in the robot through the dancers' kinaesthetic intentionality in the workshops of the first phases. The empathetic response, therefore, is analysed in PBM in both the dancers (when engaging in the creation of movement with the costume) and in the audience (when interacting with the robotic prototype). These two empathetic responses, even if they both rely on embodied affective responses, differ inasmuch as the audience does not have access to the same tactile and kinaesthetic experience as those of the dancers when inhabiting the costume. The audience, consequently, engages in a more visual connection with the robot, where the kinaesthetic empathetic response is based on watching moving robots.

According to Gemeinboeck and Saunders, the aim of their project is not specific and does not go beyond exploring 'how far we can push the relationship between abstract, simple morphologies and their potential to elicit empathic and affective responses' (2017: 3). However, when analysing their concept of kinaesthetic empathy and the way in which it is implemented in PBM, one needs to ask: who is experiencing this response? Is it just aimed at the human? Is empathy then, in this robotic context, just a one-way process? PBM connects with the enquiries that I explored in the empathetic encounters paradigm. However, this connection, when considering HRI, seems to be possible only on the part of the human. In this sense, it is the dancers, when moving with the costume, and later on the audience, when interacting with the prototype, that experience kinaesthetic empathy and are moved by the robot. These two entities—the human and the robot bodies—even if entangled in the bodying phase where movement and the emergent body were co-created, seem to be later on separate entities where only one of them can experience an empathetic response.

Gemeinboeck and Saunders put the value of affective movement at the core of their human-robot empathetic connection. Moreover, their emphasis on the empathetic connection as a feeling that the robot moving body evokes is of interest here, as it focuses on how empathy is a matter of perception as well as a pre-reflexive bodily resonance. However, by locating kinaesthetic empathy only in the human responses to the robot's movement, they do not solve the issue of considering the robot a mere simulator or elicitor of empathetic reactions. PBM, nonetheless, not only refers to affective movement as being a key aspect of the empathetic connection, but also introduces the concept of the performativity of matter and of intra-acting in relation to movement. In this way, movement is treated as a configuring force in an ongoing process of embodiment between humans and robots. The role of the costume, as already mentioned, is of great importance as a mapping source between two becoming-bodies, but also as a potential body-in-itself. This performative understanding of the human-robot relationship, however, seems to be restricted to the project's initial phases, and is not fully theorised when engaging with empathy. As I proposed in the empathetic encounters paradigm, however, the performativity of affective states in empathetic relations is an important issue to address.

Trying to check whether people perceive the same qualities that the dancers imbued in the robot is indeed an interesting and important task: it shows the extent to which the dynamics of movement (and not just gestures) are relevant to our connection

to alien morphologies and to our affective relations with them. Nonetheless, I do not consider that this should be analysed through the lens of empathy, as this would imply that empathy is still being linked to notions of mimicry and a resonance that is based on a similarity between the qualities of movement perceived and the qualities that were enacted by the robot. Instead of following that path, I claim that the empathetic relation is better understood as a process of attunement: the coordination of movement dynamics. This conceptualisation of empathy is better grasped within PBM in the usage the BodyWeather technique, as well as in the dancers' relation to the costume when creating the body of the robot.

As already mentioned, one of their definitions of kinaesthetic empathy, as well as their usage of the BodyWeather technique during the project, opens a path for a different understanding of empathy. One of the ways of describing kinaesthetic empathy in PBM is that of thinking with external forces, or a sensitivity and connectivity with bodies and the environment. Similarly, the dancers engage in an artistic practice where movement is understood as a form of distributed cognition, an ecological approach that considers dance as a way of re-configuring, adapting and enacting changes in the environment and in their bodies. These ideas, also explored in the concept of intra-actions during the bodying phase, could create a new space to reconsider the role of performativity and co-constitution within empathy, allowing for a consideration of the empathetic process more in terms of coupling or coordination rather than imitation.

A process that can be understood through the 'empathetic encounters' paradigm is most clearly developed in the 'bodying' stage. When engaged in this phase, the performers need to adapt and re-adjust their bodies in order to fit the physical constraints of the robot-body-to-be. Moreover, their bodies are positioned inside the costume in a manner in which control over this object cannot be fully attained. The relationship between dancer and costume resembles an inhabiting more than an extension of the human body. These conditions make the performers reconfigure their body, inasmuch as the physical limitations and the way in which they are positioned offer them different ways of moving than the ones usually enacted by a human dancer. Similarly, when the choreographer gives them a cue for a movement that needs to be seen in a certain manner from the exterior, the motion that they perform with their bodies tends to be quite dissimilar to the one that the costume finally shows. The connection between these two motions—the human's and the future robot body's—is not one of similarly or mimicry

but one of a coordination or attunement by means of which a co-created movement emerges. Furthermore, because they are interested in performing 'movement qualities' (as they call them), this coordination takes place at the level of dynamics, not of gestures.

As explained above, Gemeinboeck and Saunders understand these co-created and emergent movement dynamics to be performative: active forces in creating the embodiment of the robot-becoming body. This also points to the fact that the individuation that finally takes place when creating the prototype comes from an evolving intra-action between the human and the machinic. The becoming of these movement dynamics, nonetheless, *does not end once this robot body is created*. On the contrary, the empathetic relationship that takes place between dancer and robot, and later on between robot and audience, is an ongoing process of coordinating affective movement dynamics that makes empathy in itself performative, and not just the materiality of the body. As mentioned in the preceding chapter, this implies understanding that empathy should be located in the process of relating, and not on one end of the empathetic relation.

In order to create an empathetic connection in an encounter between humans and robots, it is essential that both entities have a common framework of action, and that the human has the possibility of engaging in non-anthropocentric movement dynamics. The workshops that Gemeinboeck and Saunders create are pertinent in this respect. However, it is much more productive to think about empathy as the process of relating between humans and robots with these movement dynamics once they have a mutual framework, rather than considering it as the process of recognising those similar movement qualities. By making use of a human-machinic entanglement in the bodying phase, as well as by trying to create a motion that it is particular to the robot while being sensitive to human dynamics, PBM creates a very useful mutual framework of action for empathy. However, in the next phases it is important to see how this empathetic relation can emerge between humans and robots as based on a coordination of movement dynamics. These dynamics would allow both bodies to attune themselves and co-create affective states in a pre-reflexive manner.

Conclusion

This thesis has proposed that the current framework used in social robotics to describe and implement empathy has fundamental limitations, underlying assumptions, and biases at its core. The way in which empathy in social robotics is linked to ST has several downsides. Firstly, the assumption of the false distinction between internal affective states and the external expression of them. Secondly, the association of empathy with a process of imitation. Thirdly, the belief that in order to create empathetic robots a mimicry of human movement is needed, which creates a highly anthropocentric approach to empathy in HRI. This becomes problematic inasmuch as it does not address difference within empathy, does not provide sufficient ground for developing non-anthropocentric and non-anthropomorphic robots, and offers an inadequate account of the role of affect and movement in the empathetic process.

By means of robotic art, dance studies, and phenomenology, I provided an alternative conceptualisation of empathy that could, on the one hand, address those complications and, on the other hand, open the possibility for a less anthropocentric human-robot empathetic connection that allows for difference to emerge in empathy. My theoretical contribution to this debate—the paradigm of *empathetic encounters*—therefore does not understand empathy as the imitation of human motion in order to express supposedly internal affective states. Rather, it conceptualises empathy as a process involving a co-creation of affective movement dynamics which allows for a coordination and a coupling between two entities.

This study's project of addressing the problems that currently exist in social robotics discourse while providing a new paradigm for surpassing them was made by creating a multi-layered account of empathy in robotics that involved several interdisciplinary vectors. The first is from practice to theory and from theory to practice. After mapping the field of social robotics and its account and implantation of empathy, Marco Donnarumma's work served as an object to theorise about a new form of addressing human-robot empathetic relationships. From this analysis, I then turned to theories of empathy in dance studies and phenomenology. This was later used to develop my theoretical paradigm of empathetic encounters, which was taken back to practice through Petra Gemeinboeck and Rob Saunders' robotic project Performative Body Mapping (PBM).

The second vector is from robotics to art and from art to robotics. I started this thesis by analysing how empathy was being used in social robotics. Afterwards, by means

of Marco Donnarumma's *7 Configurations Cycle*, I considered how empathy could be looked at when human-robotic entanglements were explored via an artistic practice. Finally, my analysis of Donnarumma's artistic work was taken back to the field of social robotics through the more practical approach of Gemeinboeck and Saunders' research. However, their project, is not merely a robotic experiment, as their methods are mostly aligned with dance and performance. As they assert, they belong to the 'creative robotics' field of work. However, due to their interest in approaching the design of social robots, as well as their practical and material perspective on doing that, I have treated them as a way of bringing the discussion back to the field of robotics.

This mode of constructing my argument has aided me in offering an interdisciplinary account of how empathy could be conceptualised otherwise. My analysis of the area of social robotics in the first chapter led me to claim that the discourses on empathy in this field of study are based on Simulation Theory (ST). In this paradigm empathy is understood to be the simulation and subsequent projection of the inner mental state of the target of empathy, who shows those states through expressive movement to the observer. When employed in robotics, ST leads to the creation of anthropomorphic robots that successfully mimic the motions of the human counterpart in order to display empathy and, consequently, to be perceived more positively by the human. This usage of empathy, I claim, links it to imitation, similarity, and a false distinction between internal states and external expressive movement.

The other line of understanding empathy explored in this thesis was opened by the work of Marco Donnarumma and later analysed through theories of kinaesthetic and phenomenological empathy. This conceptualisation proposes that empathy is better understood as a matter of perception, and not expression, and as a pre-reflexive bodily resonance instead of a conscious simulation and an imaginative projection. Such consideration, as PBM shows, brings a difference into focus when empathy is applied to robotics: instead of paying attention to how the robot displays empathy, this new strand analyses how the robot evokes empathy in the human observer. By means of workshops and careful observations, Gemeinboeck and Saunders offer vital discoveries in this respect: the empathetic connection established between humans and robots, firstly, was based on movement and not appearance; and secondly, it relied not just on gestures but on movement dynamics (or 'movement qualities'). These movement dynamics are able to convey affective states from the bodying stage, where the dancers interacted with the costumes, to the moment where the audience encountered the robot.

However, this new way of looking at empathy also indicated something else: how empathy was more closely related to coordination than to mimicry. In this respect, Donnarumma's work explores how this coordination or coupling can take place between humans and AI prostheses. To do so he implemented neural networks based on oscillations in his prosthetic robots. The data of those neural patterns is algorithmically generated, so even if it is influenced by the interaction with the environment and the human dancers due to its sensorimotor system, it does not originally come from the human. This implies a slightly different initial stage than that of PBM, due to their usage of human dancers to start a motion in the costume. Therefore, in Gemeinboeck and Saunders's project the initial motion comes from the choreographer giving verbal cues and from the human executing the movement. Donnarumma, then, tries to explore how these two different dynamics, that of the human and the machine, when encountered in a common ground of oscillatory patterns, can affectively coordinate. In his examples, this coordination takes place through automaticity, a mode of pre-reflexive entrainment that allows both entities to co-create affective movement.

Donnarumma's notion of configuration also hints at how empathy could be understood as a processual state. For the artist, a configuration is a co-constitutive and on-going organisation of human body, robotic hardware and software in an unstable and changing engagement. Therefore, even if this co-affective entanglement of human and machinic bodies can only be experienced in a situated and contextualised moment (that is, in the performance of its making), it belongs to an ongoing becoming where both human and robotic entities co-determine themselves. When analysed through the lens of empathy, this would mean that in the encounter between humans and robots, empathy is located in the process of relating, and that the affective states that emerge in that configuration are co-created in the moment in which they are shared. Curiously, in Donnarumma's configurations, the empathetic encounters that take place between human and machinic bodies also imply a re-structuring of their original corporealities.

With regards to PBM, it would be interesting to apply this notion of configuration when dealing with the bodying stage of their project. This idea of configuration is especially relevant for PBM when the dancer moves inside the costume, engaging in a motion that happens to be different from the movement that is perceived from outside. That is, in order to convey a certain affective state with movement dynamics, the dancers need to coordinate their motion with that of the costume, rather than engage in a practice of imitation. This leads to several considerations: firstly, that both human and robot deal

with a re-structuring, a reconfiguration of their initial embodiments in the empathetic encounter; secondly, that this co-creation is related not only the emergent motion but to their possibilities for perceiving and acting in the world. In this sense, both human and robot modify their body schemas, immersing themselves in a coupling, but also opening a path for less anthropocentric modes of affectively relating to alien morphologies. Gemeinboeck and Saunders addressed this in their reflections of the performativity of movement, and how the co-created motion influenced their respective embodiments. However, I claim, through the path explored with Donnarumma and the empathetic encounters paradigm, not only their embodiments can be considered as performative but also the affective states shared during this empathetic relation.

When seen in his light, empathy is best considered a situated and contextualised encounter between human and robot, where a coordination of dynamics takes place in a co-creation of affective movement that is made in the process of relating. This points at the performativity of empathy, as well as its possibilities of being considered a performance. Implementing this concept of empathy in PBM could allow for an analysis of how this coordination takes place in further stages of their project, such as the interaction between the audience and the robot. Moreover, this way of conceptualising empathy also offers a different approach to projects that deal with social robots, as it puts the emphasis not on mimicry or a similarity of appearance, but on coordination in a commonality of movement dynamics.

This commonality, nonetheless, is based on a virtuality of movement, which allows for different potentialities to be actualised in this human-robot empathetic encounter. This opens the possibility for less anthropocentric motion to take place, as well as a connection to alien morphologies. Both in Donnarumma's and Gemeinboeck and Saunders's work, such a possibility was created through limitations. The prostheses in Donnarumma's practice and the 'costumes' in PBM created physical constraints in the dancers interactions with them, forcing those performers to adapt and readjust their human bodies to inhabit a different corporeality. In both cases, the ability of the dancers to reconfigure themselves in this close kinaesthetic connection with the machinic body allowed for coordination and movement to emerge from this entanglement.

However, one might ask, why is this important? Why this interest in offering a new paradigm, in exploring practices that could give human-robotic empathetic relations a different meaning? As Susan Leigh Foster already showed, empathy has been used as a tool for enacting power dynamics, where certain individuals could claim that only a type

of people were able to experience empathy, and that this empathy happened through a resonance or a mimicry of a very specific type of corporeality. Such exclusionary practices could be brought back to robotics when employing this term, as the model for mimicry in social robotics is the human body, and the robots that display this empathy are mostly anthropomorphic. Claiming that a robot moves or looks like a 'human' nonetheless risks forgetting about differences within humans and their multiple ways of being in the world. Certainly, robots that mimic 'human' motion do not imitate the movement of a person in a wheelchair, or a person with arthrogryposis. The general conception of what a human being is tends to lead to the reaffirmation of stereotypes, creating at the end a universalised mode of moving and existing. The new path explored in the work of Donnarumma and Gemeinboeck and Saunders, when analysed through the lens of the empathetic encounters paradigm, offers a new perspective on this. At the same time, it focuses on how to affectively relate to non-human-like morphologies. In this sense, by searching for particular robotic motions that are not based on human movement, as well as by their interest in coordinating that alien dynamic to our own, it opens a new framework for considering empathy.

Furthermore, I have been arguing that understanding empathy as processual and performative makes it possible to propose an alternative framework that questions the belief that empathy is experienced by self-contained humans with internal and pre-defined emotions that are only subsequently communicated. The path explored in this thesis is based on the fact that humans are and have always been entangled with the environment and with other non-human entities. Not only movement but their corresponding affective states are influenced by this connection to non-human others: they are co-created by that interaction. Thus, exploring new ways of coordinating ourselves with non-human others in empathetic relations has the potentiality of enlarging our modes of being in the world and of feeling with the world. Thus, thinking about empathy turns out to be more than just that: it is a thinking about our engagement with the world, about our affective connection to others, and about what this relation could mean. In this thesis, I have tried to sketch a different path of action with regards to empathy. Now I encourage you to continue this road: to think with me, to feel with me.

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Appendix

Figure 1: Donnarumma in *Alia: Zu Tái* with a prosthesis installed on his chest

Source: https://7c.marcodonnarumma.com/

Figure 2: Donnarumma in *Eingeweide* with the prosthesis Amygdala on his face

Source: https://marcodonnarumma.com/

Figure 3: Marco Donnarumma covered in black paint on a black background, showing only his back and neck for *Corpus Nil*

Source: https://marcodonnarumma.com/

Figure 4: Marco Donnarumma in *Corpus Nil*, with tattoos displaying internal parts of the body

Source: https://marcodonnarumma.com/

Figure 5: *Corpus Nil*

Source: https://marcodonnarumma.com/

Figure 6: *Corpus Nil*

Source: https://marcodonnarumma.com/

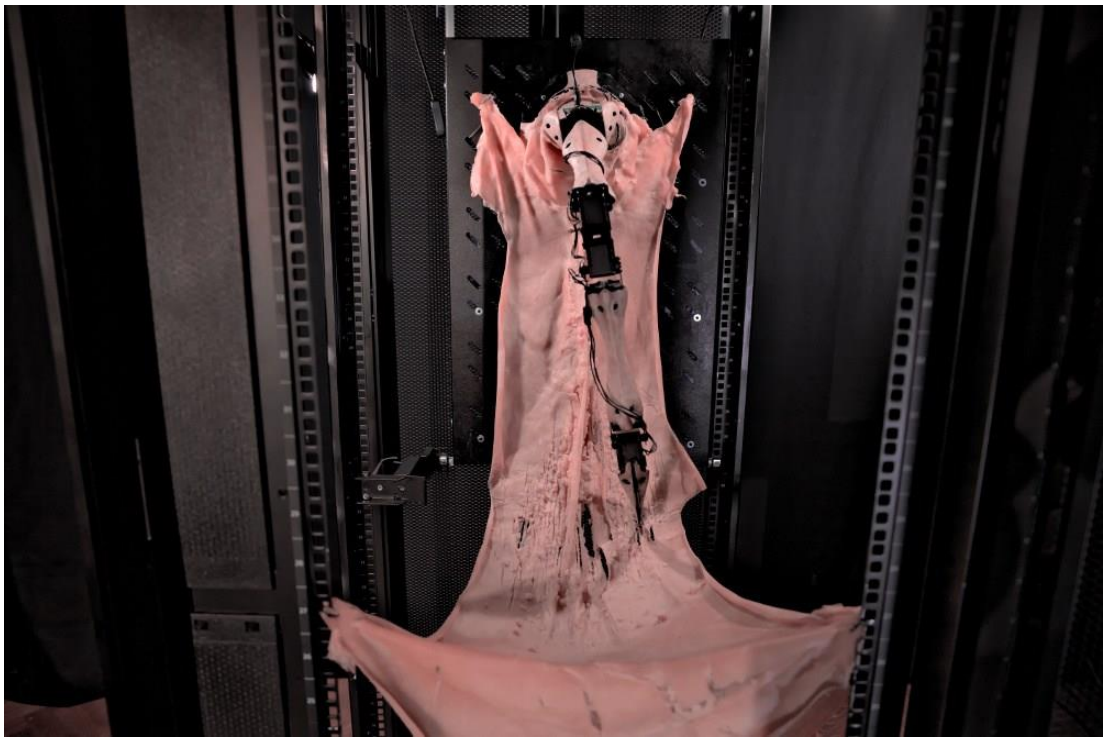

Figure 7: Amygdala inside of an industrial cabinet, cutting artificial skin

Source: https://7c.marcodonnarumma.com/

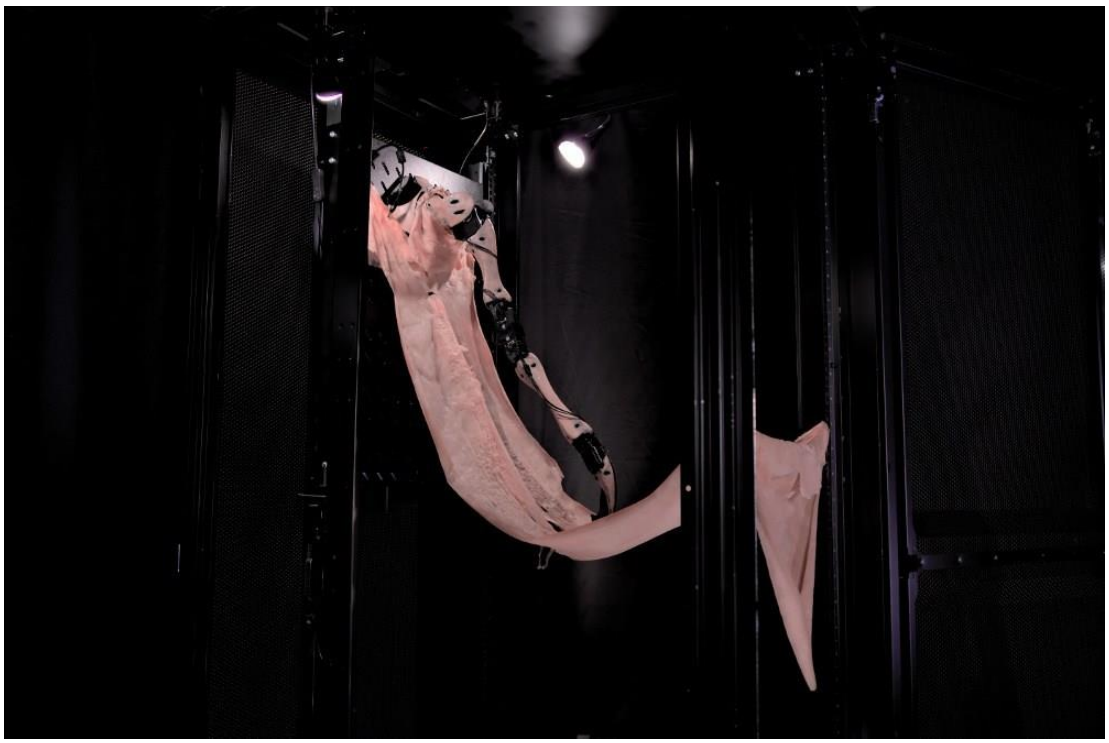

Figure 8: Amygdala's movement – inspired on a ritual of skin-cutting

Source: https://7c.marcodonnarumma.com/

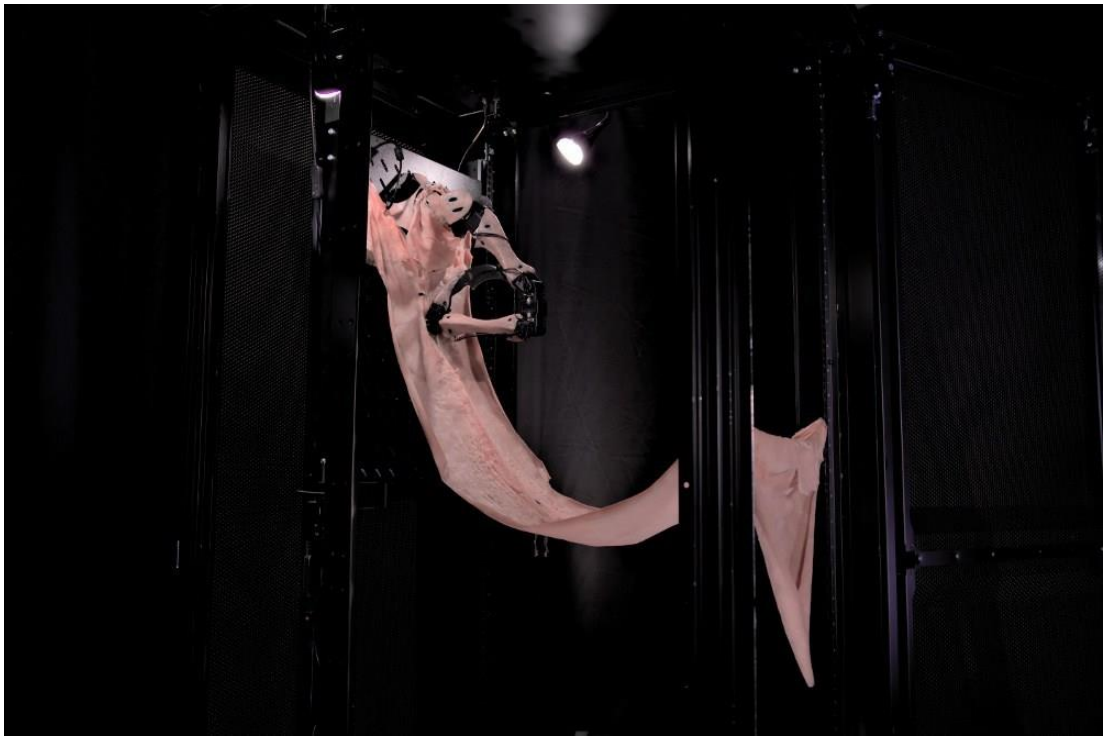

Figure 9: Amygdala's movement – inspired on a ritual of skin-cutting

Source: https://7c.marcodonnarumma.com/

Figure 4: previous skin manipulated by Amygdala. When it becomes too hard to cut, it is transported to a different installation called *Calyx*

Source: https://7c.marcodonnarumma.com/

Figure 11: original hand-sculpted template of the prostheses

Source: https://7c.marcodonnarumma.com/

Figure 12: Amygdala, called sometimes Rei in *Eingeweide*, modified and covered by bacterial biofilm

Source: https://7c.marcodonnarumma.com

Figure 13: Marco Donnarumma and Margherita Pevere in *Eingeweide*

Source: https://7c.marcodonnarumma.com/

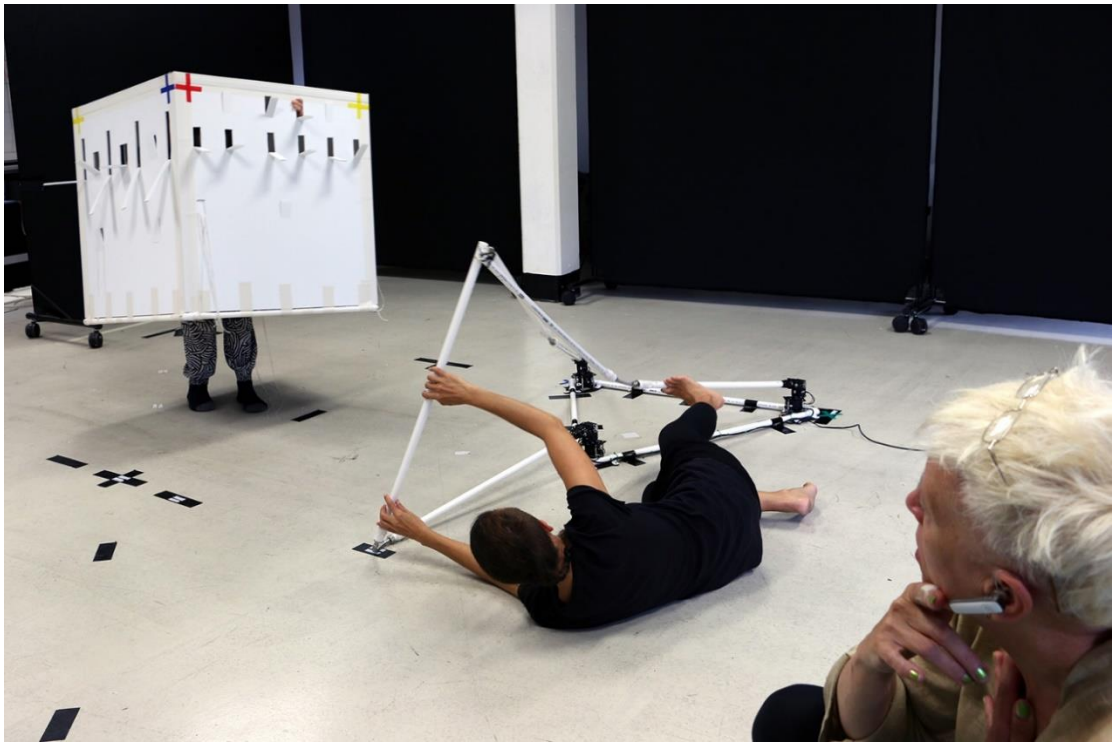

Figure 14: two dancers engaging with the robotic costumes of a cube and a tetrahedron, observed and guided by the choreographer Tess de Quincey

Source: http://www.impossiblegeographies.net/mml/

Figure 15: close-up of the installation *Accomplice*

Source: http://www.impossiblegeographies.net/mml/

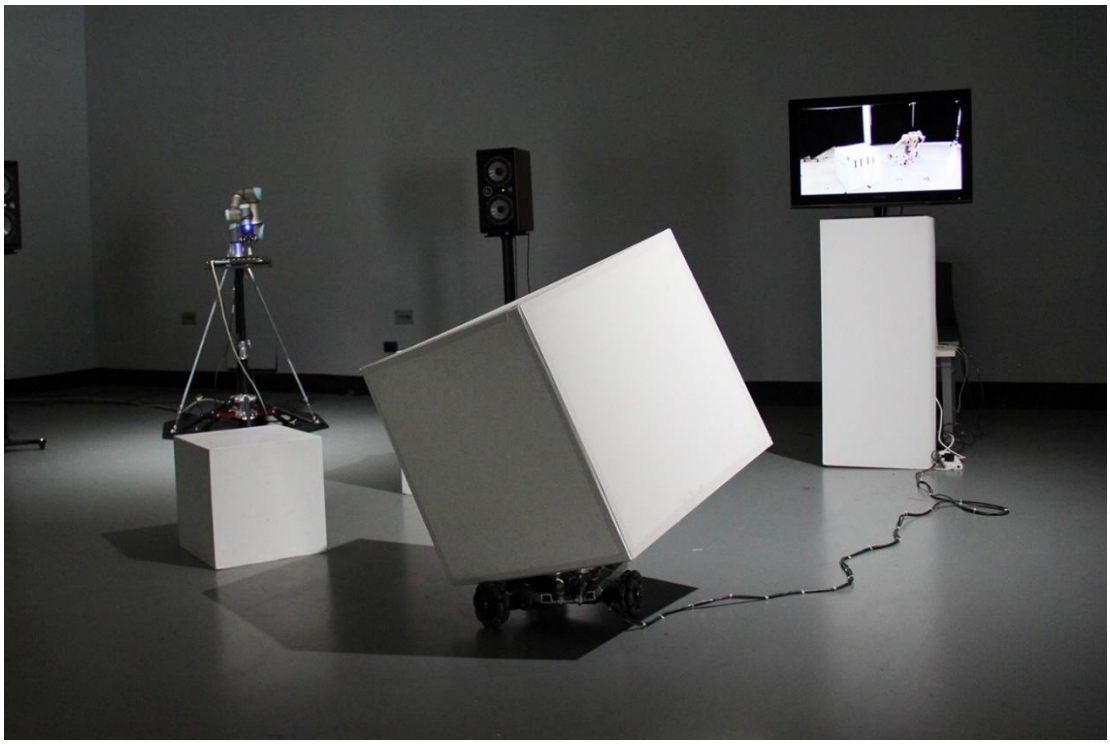

Figure 16: Cube performer 1 in The Big Anxiety Festival, Sydney

Source: http://www.impossiblegeographies.net/mml/

Figure 17: Cube performer 1 in “Performing Robots Conference”, Utrecht

Source: picture taken by me at the Performing Robots Conference

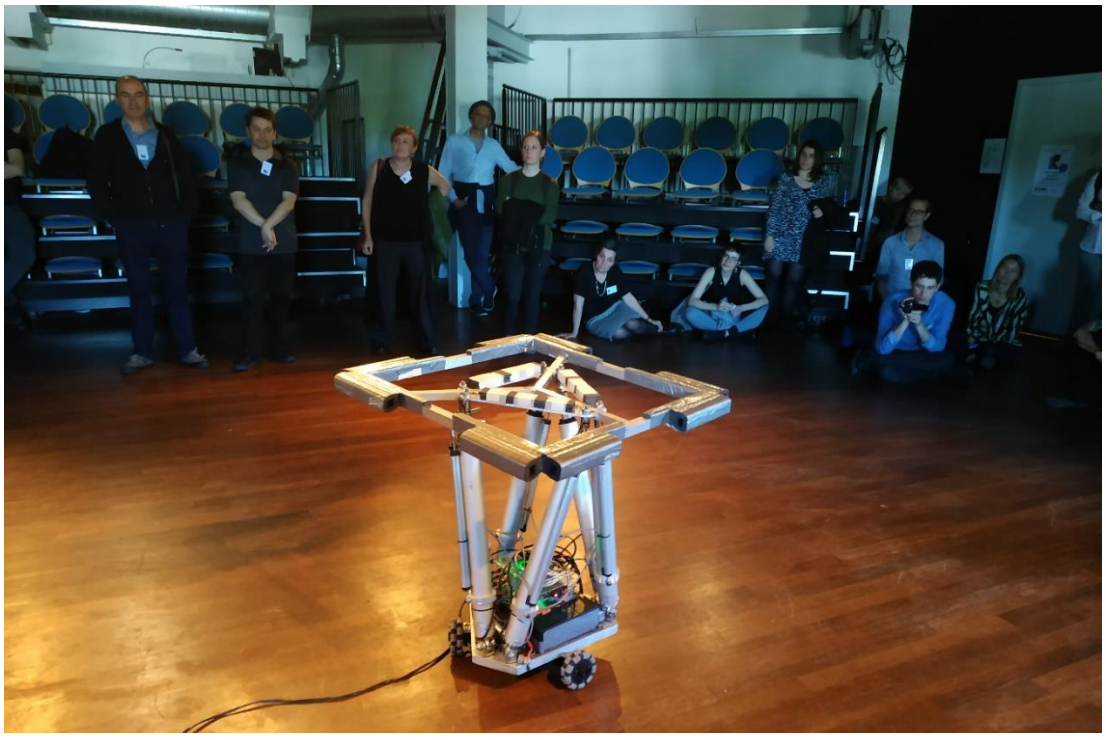

Figure 18: inside of Cube performer 1

Source: picture taken by me at the Performing Robots Conference

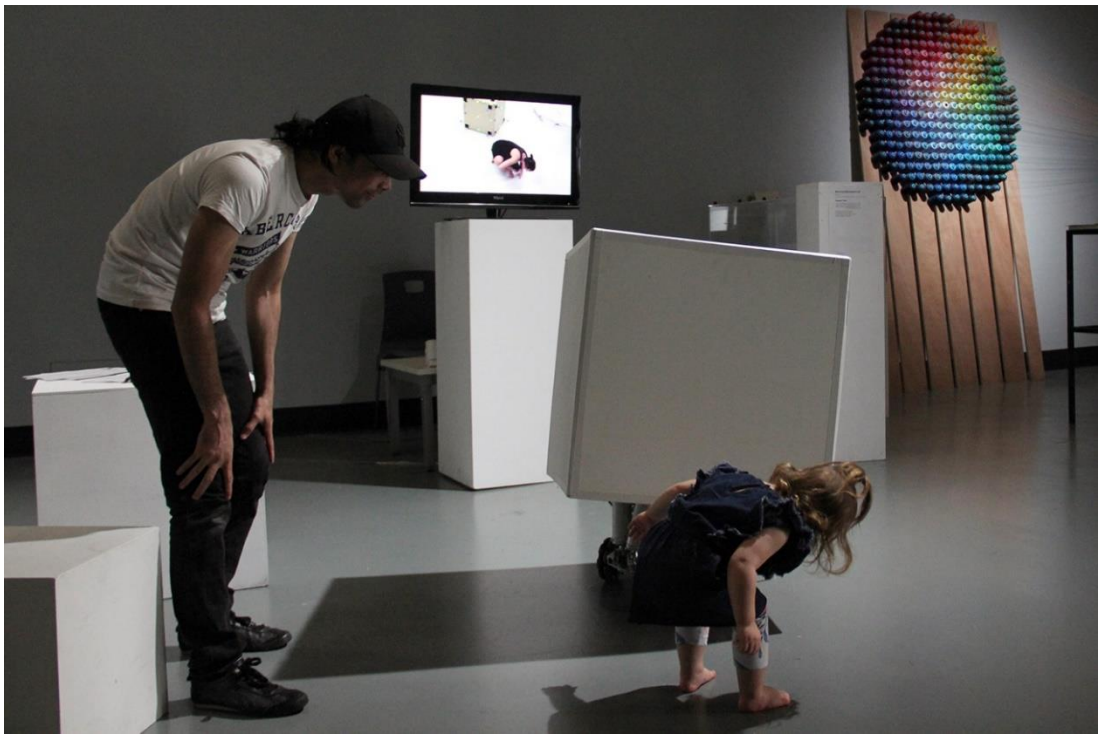

Figure 19: Girl and man interacting with Cube performer 1 with a screen in the back showing one of the workshops with De Quincey Company

Source: http://www.impossiblegeographies.net/mml/

Figure 20: Cube with transparent sides, inhabited by one of the dancers

Source: 'Exploring Social Co-Presence' (2019)