

Preface

The De Vinci Innovation Center (DVIC) is a community of makers that develops technologies within philosophical and critical frameworks to shape our societies' futures. The objective is to implement real-world solutions as well as design projects to enhance public engagement, improve education, and overall provide scientific knowledge. Our researchers contribute actively to top-level international research in multiple fields, including artificial intelligence, human-computer interactions, education, and ecology. We believe that these objectives require a transdisciplinary approach, that bridges the gap between sciences, techniques, sociology, and philosophy. This is performed by collaborating with other scientists and industrial and startup sharing our values, to form strong research partnerships...

The Artificial Lives group, led by Dr. Clement Duhart, aims to develop the next generation of machines and Human-Machine Interfaces. The group members strongly believe that through the combination of Design and Engineering, human-centered technologies can blend into our environments to become invisible, vastly improving daily lives. To achieve this vision, the members contribute to human-computer interactions, cognitive enhancement through new forms of extended intelligence, learning platforms, and cobotic. Our bio-inspired, multidisciplinary approach couples AI and virtual reality with intelligent materials, robotics and the Internet of Things.

For the past two years, De Vinci Innovation Center (DVIC) students following the Creative Technologies curriculum had the opportunity to develop their vision on technology, innovation, and society. This proceeding is a composition of six master's theses, ranging from Machine Learning, Human-Computer-Interaction to Robotics. The authors strongly believe that developing alternative futures requires new types of engineering that take into consideration both the people's needs and the environment. These documents have been written to reflect this vision and refined over several months with an iterative reviewing supervised by the Principal Investigators.

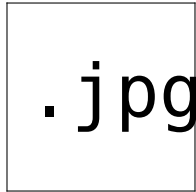
The Authors, the Principal Investigators and the whole DVIC community is proud of releasing this first proceeding. We dedicate this first edition to Pascal Brouaye and Nelly Rouyres, without whom nothing would have been possible.



List of Theses

HAPTICS IN THE SERVICE OF DIY PROSTHESES

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TRISTAN JOURNAL - has always been interested in medical engineering and innovation. He was interested in improving the human body and in prostheses.

HAPTICS IN THE SERVICE OF DIY PROSTHESES

TRISTAN JOURNAL

Today, technology plays an increasingly important role at the heart of global issues; technological accessibility has become imperative for improving the quality of life for everyone, including individuals with specific needs. This thesis embarks on a thorough exploration of the intersection between haptic technology, prosthetics, and technological accessibility.

The DIY (Do It Yourself) kit is at the heart of this research, offering an innovative approach to empower users to design and customize their prosthetics. By harnessing the capabilities of haptic technology, this kit aims to enhance user experiences by providing precise and intuitive sensory feedback.

Throughout this thesis, we will address several critical dimensions, including prosthetic design, selecting suitable materials, and integrating haptic components to enhance sensory perception. Additionally, we will explore the possibilities bio-materials offer to create bio-patches integrated into prosthetics, thereby opening new horizons in rehabilitation.

This research advocates for a straightforward approach by emphasizing the convergence of technology and accessibility. Furthermore, it paves the way for democratizing medical innovation by enabling users to take charge of their rehabilitation.

Beyond the technical results, this thesis contributes to a reflection on how technology can serve inclusion and improve quality of life, strengthening our understanding of the relationship between humans and machines in the context of modern prosthetics.

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Introduction

1

Bla Bla Bla

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This thesis contributes to the understanding and development of haptics for medical innovation, specifically in the field of prosthetics, intended for both experienced and novice users through a DIY kit.

Understanding the role of technology and its accessibility is crucial in today's society and that of tomorrow. It is a significant step in realizing all new projects and must be considered by researchers and businesses. In this first chapter, an analysis and questioning of technological accessibility at various scales are carried out. Starting with technological innovation as a whole, then medical innovation, and finally prosthetics. This thesis provides a comprehensive reflection and encourages the approach to making technology more accessible while linking it to the thesis project.

The second chapter focuses on the field of haptics and takes a first step toward it by exploring various components and their possible uses. It explores different functions and provides simple codes for various uses. Through multiple prototyping and various tests, it offers solutions for implementing different components used for haptics that can be placed on a prosthesis.

The final chapter explores the development of a user-friendly and accessible prosthesis for everyone. This is achieved through selecting materials, a design method, and the design itself. The chapter addresses how to design to cater to a wider audience, how to implement different components into the prosthesis, and how to ensure longevity through clever design and material choices. The second section of this chapter deals with the creation of bio-patches made from accessible and user-friendly bio-materials. Prototyping and material and user tests are included in this thesis.

This thesis may be limited to individuals already present

in these various fields. However, there are numerous possibilities for improvement with the constant evolution of medical innovation and the emerging field of haptics. This first step can be pushed further by creating increasingly advanced kits with new components, code improvement and optimization, and prosthetics designed for such devices.

This thesis is a first step toward haptics and medical innovation in prosthetics by offering a simple DIY kit accessible to everyone. It combines programming, understanding of haptics, 3D design, and bio-materials. Furthermore, this work presents methodological contributions to the integration of haptics into the field of prosthetics. It is accompanied by prototyping with methods to combine innovation, efficiency, and accessibility.

Acknowledgements

It's with deep gratitude that I pick up the pen today to express my sincere thanks to all those who have contributed to the realization of this Master's Engineering thesis. This work represents the culmination of several years of effort and learning, and I am honored to share this moment with you.

Firstly, I would like to thank Dr. Marc TEYSSIER and Dr. Clément DUHART for their invaluable guidance, constant support, and insightful advice. Your expertise and passion for research have been a source of inspiration.

My thanks also go to the entire faculty of the DVIC, including the PI and doctoral students. Your high-quality teaching and willingness to share knowledge have enriched my academic and professional journey.

I want to express my gratitude to my colleagues from DVIC for their teamwork, exchanges, and mutual support. Our discussions and debates have shaped my understanding of the topics covered in this thesis, and I

am honored to have shared this experience with all of you.

Finally, I would like to thank Violette ANICET-MERVEILLEUX for her help with the bio-patches and bio-materials for this project. And I would like to express my gratitude to all those who have contributed, directly or indirectly, to completing this research work. Your advice, feedback, and contributions have been invaluable in accomplishing this thesis.

Finally, I would like to express my deep appreciation to my friends and family for their continuous support and positivity during the years of my studies.

