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Human ICT Implants: Technical, Legal and Ethical Considerations

Mark N. Gasson
Eleni Kosta
Diana M. Bowman *Editors*

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Series Information

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Foreword

In March 2005, the European Group on Ethics in Science and New Technologies (EGE) to the European Commission, of which I was a member, issued an Opinion on "Ethical aspects of ICT implants in the human body" (EGE 2005). Since then many new, and in many cases exciting, developments in digital technology have taken place. These include, for example, affective computing, ambient intelligence, bioelectronics, cloud computing, neuro-electronics, future internet, artificial intelligence, human-machine symbiosis, quantum computing, robotics, and augmented reality. These advancements have given rise to further ethical and legal debates, especially in Europe (ETICA 2011). Concerns about human dignity, freedom, privacy, and data protection, freedom of research, identity and personality, autonomy and informed consent are no less important than questions of justice (fairness, equality, and solidarity) particularly regarding consumer protection, improvement and protection of health, as well as the application of the principles of proportionality, transparency, and precaution. In their "Ethical Evaluation" (Nagenborg and Capurro 2011, 4.8.2.1) remarked that,

> [I]n contrast to the possible use of ICT implants in AmI [Ambient Intelligence] […] or in bio-electronics, neuro-electronic applications might raise greater ethical concerns, since neuro-electronics aims to provide a direct link between computer technology and the human brain as well as the nervous system in general. Especially the use of pre-conscious brain information-processing has to be seen as being in conflict with the protection of human dignity as highlighted in the "Ethical Analysis". It has to be recognized that (medical applications of) neuro-electronics might also contribute to the welfare of human life and therefore foster human dignity.

This ethical ambivalence should not be understood as though technology were *per se* neutral and all we needed was to distinguish between so-called good or bad uses. From a more basic perspective, it can be stated that no technology is neutral insofar as it *changes* the horizon of options we have had so far. In this sense, thinking about technology means thinking about such changes in ourselves and of our selves. This is highly relevant when dealing with ICT implants in the human body. There is an underlying Cartesian dualism in this reasoning insofar as changes in the human body cannot be separated from the question about *who* we are, which is the ethical perspective. From a (medical-) technical perspective, the human body is an information-processing device similar to other living systems that can be ‘repaired’ or even ‘enhanced’. But, in fact, *my* body concerns primarily *who* I am and not only *what* I am. Who am I? I am not an isolated subject, but a self in interrelations with other selves: Family, friends, colleagues, etc. with whom I share a world. Who I am is a question of the social “interplay” with others in the world (Eldred 2008).

Today, this interplay is cast and decisively shaped by digital technology. Until recently, it has been argued, we were “bodies in technology” (Ihde 2002); now “technics” is becoming “embodied” (Ihde 2010). Both issues concern ourselves—and not just our bodies—in the world. From a whoness-related ethical perspective, ICT implants are not ‘just’ in *the* human body but in *my* human body. My body cannot be isolated from my self or from my being-with-others in the world. Once we are aware of this existential foundation of technology in general and of ICT implants in particular, we are able to ask ethical questions as pertaining not to an anonymous human body but to a singular and irreducible ‘who’ facing her past, present and future life, taking her risks and responsibilities toward herself no less than toward others in a shared world. Some of these questions were raised by the EGE in 2005 and they are today, I think, as relevant as they were a few years ago:

> How far can such implants be a threat to human autonomy, particularly when they are implanted in our brains? How far can such implants have irreversible impacts on the human body and/or on the human psyche and how can reversibility be preserved? […] How far can ICT implants become a threat to privacy? […] What lies behind the idea of an ‘enhanced’ human being? […] How do we relate to persons with ICT implants that are connected online? How far should ICT implants remain invisible to an external observer? […] How far can they be used in order to track human beings and in which cases should this be legally allowed? (EGE 2005, p. 24–25)

The EGE underscored that non-medical surveillance applications of human ICT implants “may only be permitted if the legislator considers that there is an urgent and justified necessity in a democratic society (Article 8 of the Human Rights Convention) and there are no less invasive methods.” (EGE 2005, p. 34) I think that, due to new technological developments, this recommendation is today even more crucial than it was in 2005.

The present volume offers up-to-date, multifaceted contributions on the technical, legal, and ethical debate around human ICT implants by well-known academic experts. This debate should become not only a matter of professional thinking of ethicists, computer scientists, lawyers, the IT industry and policy-makers but, above all, of personal thinking and decision-making in everyday life.

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Preface

This book would be but an idea without the generosity, commitment, and unwavering support of each of the contributing authors. As leaders in their respective fields, it is their insights, experience, and expertise that make this volume timely, thought provoking, and innovative. As the Editors of this book, we would like to express our appreciation to each of the contributors. The initial idea for the creation of this book was born from a report produced in the frame of the FP5 Network of Excellence 'FIDIS' (Future of Identity in the Information Society), and therefore, we would like to thank the partners of the FIDIS NoE. Special thanks go to Dr. Carmela Troncoso, Mr. Hans Hedbom, and Dr. Vassiliki Andronikou.

The Editors would also like to thank their respective universities, without whose support projects such as this one could not be undertaken, as well as their professional colleagues and their families. Each of the Editors brought their own skills to this book but both Eleni Kosta and Mark Gasson would particularly like to thank Diana Bowman for her enthusiasm in turning this project into reality. Finally, the series Editors, especially Franke van der Klaauw, and the staff at T.M.C. Asser Press deserve sincere thanks for their professionalism and their unstinting support.

February 2012

Dr. Mark Gasson
Dr. Eleni Kosta
Dr. Diana Bowman

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Mark N. Gasson was a Senior Research Fellow at the School of Systems Engineering, University of Reading in the UK and now holds the post of Visiting Research Fellow. He obtained his first degree in Cybernetics and Control Engineering in 1998 from the Department of Cybernetics at Reading, and obtained his Ph.D. in 2005 for developing an experimental invasive interface between the nervous system of a human volunteer and a computer system. His interdisciplinary research interests predominantly centre around user-centric applications of emerging technologies, with specific focus on pushing the envelope of Human–Machine interaction. In 2009, he demonstrated the privacy issues of creating detailed behavioral profiles using GPS in mobile phones, and the following year became the first human to be infected by a computer virus using an RFID device implanted in his hand. In 2010 he was the General Chair for the IEEE International Symposium on Technology and Society (ISTAS 2010) in Australia. Mark is passionate about getting young people engaged in and excited about science and aims to generate interest by making the topics accessible and relevant through a variety of activities. He has delivered invited public lectures and workshops internationally and has participated in over 100 events in the last 10 years. In order to communicate in the widest arena possible, he also engages with the national press and other media outlets, including as a guest expert for BBC news.

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Abbreviations

AmI	Ambient intelligence
ATM	Automatic teller machine
BCI	Brain–computer interface
CAS	Court of Arbitration for Sport
DBS	Deep brain stimulation
EEG	Electroencephalogram
EGE	European Group on Ethics
EMGs	Electromyograms
EU	European Union
FDA	Food and drug administration
fMRI	Functional magnetic resonance imaging
HCI	Human–computer interface
ICD	Implanted cardiac defibrillator
ICT	Information and communication technologies
ID	Identification
IMDs	Implantable medical devices
KDD	Knowledge discovery in databases
LBS	Location-based services
LFPs	Local field potentials
MEMS	Micro electro-mechanical systems
NRA	National Rifles Association
OECD	Organisation for Economic Co-operation and Development
PD	Parkinson's disease
PIN	Personal identification number
RF	Radio frequency
RFID	Radio frequency idenification
STN	Sub-thalamic nucleus
TETs	Transparency enhancing tools

UDHR	Universal Declaration on Human Rights
UK	United Kingdom
US/USA	United States of America
VIP	Very important person

Chapter 1
Human ICT Implants: From Invasive to Pervasive

Mark N. Gasson, Eleni Kosta and Diana M. Bowman

Abstract While considered by many to be within the realm of science fiction, for several decades information and communication technology (ICT) has been implanted into the human body. Advanced medical devices such as cochlear implants and deep brain stimulators are commonplace and research into new ways to invasively interface with the human body are opening up new application areas such as retinal implants and sensate prosthetics. It is apparent that as these implantable medical technologies continue to advance their potential for human enhancement, i.e. enabling abilities over and above those which humans normally possess, will become increasingly attractive. In the first instance, this may be giving a person with a deficient sense a device that enables them to function on a vastly superior level. However, it is clear that healthy people will look to implantable technology to augment what we would consider their 'normal' abilities. Technology enthusiasts have already begun to realise the potential of simple

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implantable technologies, with people opting to have passive silicon devices surgically implanted to facilitate identification. It is equally foreseeable that the application of implantable technology, developed initially in a medical context, will be repurposed to augment the abilities of healthy humans. Such developments are beginning to redefine our relationship with technology. The changes are not just technological—they are driving changes in cultural and social paradigms, and further empowering people to seek new experiences and employ new services. It is evident that we need to address the incipient technical, legal, ethical and social issues that the development of human ICT implant devices may bring. This chapter gives an overview of the landscape of issues surrounding human ICT implants, and explains how the following chapters in this book serve to address these key areas in more depth.

Is the human body a suitable place for a microchip? Such questions, and the discussions that they provoke, are no longer hypothetical. Indeed, they have not been for some time now. While considered by many to be within the realm of science fiction, human implants which incorporate information and communications technologies (ICT) have been developed in a medical context for decades and routinely implanted into people.

Medical devices such as cardiac defibrillators and pacemakers used to restore heart rhythm and cochlear implants to restore hearing have become well established and are widely used throughout the world as a way in which to improve an individual's well-being and public health more generally.

These sophisticated devices form intimate links between technology and the body. As of 2009, about 188,000 people worldwide have received cochlear implants, and promising trials have been conducted with retinal and sub-retinal implants for vision. These devices are designed to (partially) repair deaf and blind people's impairments, allowing them to (re)gain 'normal' sensory perception. Indeed the application of implantable technology for medical use is typically 'restorative', i.e. it aims to restore some deficient ability. Recent developments in engineering technologies have meant that the ability to integrate silicon with biology is reaching new levels and medical devices that interact directly with the brain are becoming commonplace. A prominent example is Deep Brain Stimulator (DBS) technology for the treatment of Parkinson's disease.

Keeping in step with developments of other fundamental technologies, these types of devices are becoming increasingly complex and capable, with their peripheral functionality also continuing to grow. Data logging and wireless, real-time communications with external computing devices are now well within their capabilities and are becoming standard features, albeit without due attention to inherent security and privacy implications. In Chap. 4, Tadeusizicz et al. explore the state-of-the-art of invasively implantable technologies and show how cutting edge research is feeding into devices being developed in a medical context. The authors focus their analysis on four technologies—pacemakers and cardiac