

Brain Digitalization: Understanding Public Attitudes and Regulatory Implications for Brain Implants

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2 Abstract

This study delves into the topic of brain implant technologies, examining how the public perceives them and the ethical concerns that arise regarding their therapeutic, enhancement, and altering applications. A survey was conducted to gather data from business informatics students at Corvinus University of Budapest. The purpose of the survey was to assess their levels of support and find any noteworthy ethical and privacy concerns. Interestingly, the survey revealed a gender disparity in attitudes towards technologies, with women exhibiting greater techno-scepticism compared to men. Furthermore, among techno-optimists—those generally favourable towards controversial technologies—there was a notable division in their support: they were more accepting of implants for therapeutic uses but showed reservations about enhancement and alteration applications. The findings demonstrate robust support for therapeutic applications, such as the treatment of paralysis and memory impairment, whereas the use of enhancement and alteration purposes met with significant skepticism. Respondents notably emphasise privacy concerns, particularly around the misuse of data and access by third parties. The study confirms the premise that therapeutic uses are more widely accepted than enhancement and alteration among respondents and highlights the presence of privacy issues that are universally seen across all usages. The statement implies that there is a requirement for strict regulatory frameworks to tackle ethical difficulties and privacy challenges. This could promote wider acceptance and responsible integration of brain implants into society. These findings may prove useful for legislators, technology developers, and the academic community as they deal with the complexities of neurotechnological breakthroughs. However, it is important to note that these findings are based on a specific demography and a non-representative sample even for this specific demography.

3 Introduction

The incorporation of technology into human cognitive processes is a very thought-provoking area of study in contemporary research. This TDK thesis investigates the developing field of brain chip technologies, with a specific emphasis on the public's attitudes and the ethical aspects related to the different uses of implant technology: therapeutic, enhancement, and alteration. With the advancement of neurotechnology, brain chips can now act as interfaces between the human mind and computers. This opens up revolutionary possibilities, such as enhancing memory and controlling things with only thoughts. Companies such as Neuralink have promoted this idea, offering potential skills that could fundamentally change the way humans and machines interact.

Shifting from the world of speculative science fiction to practical, upcoming applications, brain chip technologies, also known as brain-computer interfaces (BCIs), not only serve as an arena for advances in science but also spark important ethical, societal, and legal discussions. The level of public involvement and approval of these technologies varies greatly, depending on various factors such as the perceived advantages and disadvantages of the technology as well as confidence in its creators. The wide range of acceptance highlights the importance of understanding public attitudes, as they will greatly influence the adoption of the technology and the extent of its regulatory surveillance.

This study is relevant due to the rapid progress in the creation of brain implants, which is evident through significant advancements and public experiments conducted by businesses such as Neuralink. However, there is a significant delay in the general public's knowledge and understanding of these technologies, resulting in a lack of acceptability and support. This gap presents a substantial risk, similar to the disputes and negative reactions observed with new technologies as a result of insufficient public involvement.

This research aims to analyse the intricate details of public attitudes towards brain chip technology at three different application levels: therapy, enhancement, and alteration. Every level has unique advantages and ethical dilemmas, which are likely to provoke diverse responses from the general population. This study aims to provide a comprehensive understanding of the factors that either help or hinder the acceptance of brain chip technologies through a thorough examination of these responses.

In order to accomplish this, a survey methodology has been employed, collecting data from students at Corvinus University of Budapest who were selected for their knowledge and understanding of both the technological and ethical dimensions of

brain implants. Examining this data will clarify the many viewpoints held by a technologically aware demographic, offering a vital understanding of the future outlook of public opinion on this important matter.

The results of this study are expected to play an important part in the continuing debates around the ethical, social, and technological aspects of brain implants. To effectively manage the complexity involved with potentially disruptive technologies, stakeholders such as lawmakers, developers, and the academic community can improve their understanding of public views and the underlying reasons behind them.

4 Literature Review

In the era of advancing neurotechnology, the emergence of brain chips as a potential interface between the human mind and technology has become an interesting topic. Giving potential memory improvements or even the ability to control a computer with an individual’s mind (Neuralink n.d., Abdelnaby et al. 2022). In this case, Neuralink, which is being done by a team under Elon Musk, promises the latter. Exploration of Neuralink has opened a fascinating window into the possibilities of brain-chip technology. However, a comprehensive understanding requires a deeper investigation into the specifics of Neuralink.

4.1 Neuralink, Brain Implants and Brain-Computer Interfaces

In recent years, technology has not only advanced but also become intertwined with our daily routine, making our life easier in certain ways. From the presence of smartphones, acting as portable computers, to the rise of wearable technology like smartwatches, which seamlessly integrate into our lifestyles, technology has become closer to our human body. The advent of virtual reality (VR) has further blurred the lines between digital and physical worlds, offering immersive experiences. Looking ahead, emerging technologies like brain implants are the next step of even deeper integration, potentially allowing direct communication between our brains and digital devices. As technology continues to evolve and innovate, it becomes increasingly inseparable from our daily existence, shaping the way we live, work, and interact with the world around us.

Neuralink represents a significant advancement in brain implants, yet it’s important to explore other aspects of this rapidly evolving field, particularly considering the increasing competition. Competitors such as Synchron, Precision and Stanford University have also made significant findings and methods for enhancing human brain functions (Precision n.d., Synchron n.d., Goldman 2023). While the market for brain implants is expanding rapidly, public awareness of this technology remains limited. According to a study conducted by Abdelnaby (2022) and his team, 326 adults from more than five countries in the Middle East and North Africa during the period from May 2021 to July 2021, only 54.6% of participants had heard of this new technology, with a mere 6.1% recognising its significance (Abdelnaby et al. 2022). Given these findings, there is a pressing need to raise awareness about brain implants before they become more widely accessible to the general public. Lessons should be learned from previous oversights, such as those seen with AI, where discus-

sions surrounding regulation and ethics were insufficient before it was widespread. To understand the practical implications of brain implants, it's important to distinguish between invasive and non-invasive types.

Invasive brain implants involve the insertion of devices directly into the body, hence the name, typically through surgical procedures. On the other hand, non-invasive devices are positioned outside the body, often contacting the skin or scalp (Rousi & Renko 2020). Following these definitions Neuralink and the device of Precision are classified as invasive while EEG devices are non-invasive. Whenever a device is considered invasive, people will be more reluctant to the use of non-invasive devices (Abdelnaby et al. 2022, Rousi & Renko 2020). People are scared of the possible side effects and are also scared of possible health issues which may arise from an invasive device. Non-invasive devices have seen more of an acceptance in some articles, however, one research done by Rousi & Renko (2020), mentioned that people "dehumanized" users of brain implants even if said implants were non-invasive (Rousi & Renko 2020). According to these articles, it is already expected to see a low acceptance rate towards Neuralink, regarding the method of implanting it into the human body. Neuralink also needs to make sure the device poses no risk towards the health of the patient who desires to use it. At present, the first person has already undergone Neuralink implantation, and thus far, the patient remains healthy, with Elon Musk suggesting promising results. However, concerns arise among researchers regarding their lack of transparency and information access (Sriram & Ghosh 2024, Drew 2024). The situation is indeed worrisome, and the lack of transparency could further exacerbate public concerns. Additionally, ongoing investigations into the deaths of monkeys used in the experiment add to the problem. According to anonymous statements, Neuralink used healthy young animals for the experiment, some of which met a gruesome death. Researchers report that the monkeys involved in the experiment were also visibly distressed, raising concerns about the ethical treatment of animals (Mehrotra & Cameron 2023). As of the present moment, investigations into these incidents are still ongoing, with the assumption that the revelations will likely influence public perception, particularly among academics.

However, amidst the troubling news surrounding Neuralink, there have been beneficial devices. A research group utilized brain implants to assist individuals who suffered brain injuries. Remarkably, the device led to a significant improvement of 32% in the patient's condition. They were able to concentrate, read, remember, drive properly, and get through the day without napping. Some patients even refused to take off the implants by the end of the experiment (Knapton 2023).

In addition, members of the public have utilized EEG devices in combination with machine learning techniques. These individuals have demonstrated innovative

applications of such technology, showcasing its potential beyond traditional medical settings. A noteworthy example is seen in the Twitch community, where a streamer known as Perrikaryal has garnered attention for her use of EEG devices in gaming. Using machine learning algorithms, her brain signals are used to play video games, enabling her to execute various commands solely through her thoughts. She can attack and even dodge attacks with her mind. While the device certainly has its drawbacks, such as difficulty in control, the Twitch streamer has already achieved remarkable feats. For instance, she successfully conquered a challenging stage in the video game Elden Ring, renowned for its difficulty even by conventional standards (Andersen 2023). Another individual self admittedly is using BCI tracking with VR. By using a pre-existing biosensor data analysing library, this person utilizes the BCI (Brain Computer Interface) tracking to control their avatar’s ear movement in the video game VRChat using their thoughts (Rantis 2024). This shows how some members of the public have been actively engaging with existing technologies long before the prominence of brain implants. By pushing the boundaries of what is possible in the realm of human-machine interaction.

Considering all this information, the latest breakthrough involves Japanese researchers implementing Mental Images. Using a device to extract pictures directly from the human brain, this development opens the door to visualising dreams soon (KYODO 2023). Recent developments represent the strides toward the digitalization of the human brain, a process advancing rapidly. However, amidst this fast progress, research lags, underscoring the urgency of addressing potential issues from these technologies. Now more than ever, it is imperative to engage in discussions surrounding the ethical, social, and practical implications.

As the development of more advanced brain implants is on the way, it is important to start considering regulatory measures that will support the future generation tasked with implementing and managing these technologies. By laying the groundwork for regulations now, we can address potential challenges and ensure that ethical and safety standards are upheld. An obstacle of great importance in this process is the challenge that experts encounter when attempting to communicate complicated scientific and technical information to the general population (Sakura & Mizushima 2010). Some articles have begun to explore the concerns that the public has, serving as a valuable starting point for discussion. By addressing these issues head-on, we can gain insights into the public’s apprehensions and work towards solutions that promote responsible innovation.

4.2 Attitudes towards Brain Implants and Privacy Concerns

In a study by Pelegrin-Borondo et al. (2017), utilising the Cognitive-Affective-Normative (CAN) model, it was found that the public’s interest in brain implants was not solely based on ease of use or utility. Only 6.20% and 5.20% of the participants expressed interest in brain implants for these reasons alone (Pelegrin-Borondo et al. 2017). In terms of the affective factor of the model, the study also examined the positive and negative emotions of the participants, as well as anxiety. It was found that positive emotions had a more significant influence on individuals’ willingness to use brain implants, whereas negative emotions and anxiety played a comparatively smaller role (Pelegrin-Borondo et al. 2017). However, another research study presented contradicting results, revealing that a majority of people expressed anxiety regarding the use of brain implants (Orito et al. 2020). One important distinction between the two groups of participants may account for the differences in their levels of anxiety. More precisely, the individuals who experienced anxiety were utilising brain implants to control a robotic arm. They directly interacted with the mentioned technology. Lastly, the normative factor includes subjective and social norms. The article mentioned that 25.19% of the intention to use brain implants could be explained by these normative factors (Pelegrin-Borondo et al. 2017).

In a study by Kerschner & Ehlers (2016), researchers aimed to explore the spectrum of attitudes towards technology among their peers. The findings revealed four distinct attitude types: Enthusiasm, Determinism, Romanticism, and Scepticism (Kerschner & Ehlers 2016). These categories offer a detailed understanding of the different ways in which technology is perceived and interacted with by both academics and the general public. Priest’s (2006) research investigates the public’s views around gene technologies in Canada and the United States, identifying several groups of opinion like as ”true believers” and ”ethical populists” that represent different levels of acceptance and scepticism towards technological progress (Priest 2006). By combining these observations, it becomes clear that Kerschner and Ehlers concentrate on broader attitudes towards technology, whereas Priest examines particular societal reactions to gene technologies. This highlights the complex landscape of public opinion influenced by cultural, ethical, and practical factors, underscoring the significance of recognising these viewpoints when formulating and executing technology policies.

Building upon the existing knowledge of various public opinions on technology, it is important to further explore the specific concerns that the public has regarding the wider adoption of cognitive enhancement technologies (CETs). These concerns are mostly concentrated in important domains like safety, privacy, and health, all of which have substantial effects on society’s acceptance and regulatory strategies

(Rousi & Renko 2020). Cognitive Enhancement Technologies (CETs), such as Brain-Machine Interfaces (BMIs), are at the forefront of enhancing human abilities. BMIs, or brain-machine interfaces, are devices that enable direct connection between the brain and external devices, efficiently connecting human cognitive functions with computer-based systems (Orito et al. 2020). As demonstrated by the neuroethics discourse in Japan, the convergence of BMIs and CETs shows the revolutionary potential of these technologies while also underscoring the necessity of carefully weighing their implications on individual privacy, health safety, and the larger social fabric (Frewer et al. 1998, Sakura & Mizushima 2010). Neuroethical considerations have been included in national neuroscience projects in Japan, demonstrating a significant focus on public communication and interdisciplinary collaboration. This involves addressing societal issues regarding BMIs by utilising frameworks such as neuroethics research units within notable projects like the Strategic Research Programme of Brain Sciences (Sakura & Mizushima 2010). These efforts seek to close the gap between expert knowledge and public perception, emphasising the importance of society’s acceptance in the implementation of neurotechnologies (Sakura & Mizushima 2010).

According to a study in the UK, public worries regarding health primarily centre around the potential unforeseen and lasting impacts of technologies (Frewer et al. 1998). Health experts and members of the public alike are taking a cautious approach because of concerns that new technologies may interfere with natural biological processes, potentially cause dependency, or worsen natural abilities (Rousi & Renko 2020). Moreover, the invasive characteristics of implantable brain-machine interfaces (BMIs) give rise to health-related fears. These gadgets can change neural functioning, which could increase concerns about possible physiological and psychological dependence or diseases (Orito et al. 2020).

Privacy concerns arise due to the ability of technology to collect and analyse extensive amounts of personal data. The concern regarding the potential misuse of this data, or the excessive invasion of privacy through surveillance, points out profound concerns about the decline of personal liberties and self-governance in the era of digital technology (Frewer et al. 1998, Rousi & Renko 2020). Furthermore, due to the ability of brain-machine interfaces (BMIs) to gather and transmit neurological data, there is significant concern regarding the confidentiality of sensitive information. Study participants indicate discomfort regarding the utilisation of their brain signals for reasons beyond their initial intention, such as in marketing or even more ominous applications like mind control or the prediction and manipulation of behaviour (Orito et al. 2020). The Cambridge Analytica incident illustrates these concerns by demonstrating how psychographically customised advertisements, created using unlawfully obtained Facebook data, can be employed to manipulate political choices to

a vast extent (Hinds et al. 2020). Although the issue became public, the public did not withdraw from digital platforms. Instead, they demonstrated 'privacy fatigue' - a feeling of resignation in response to the constant and widespread occurrence of data breaches. This tiredness gets worse by a lack of awareness of the complex dynamics of online privacy. Many individuals are unaware that their activities on social media platforms, such as liking and sharing posts, can expose personal data through algorithmic examination. This data is later utilised to deliver highly accurate adverts tailored to their preferences (Hinds et al. 2020). This form of data collection poses a challenge to traditional ideas of privacy and emphasises the importance of strict and clear controls on data to safeguard people in a world that is becoming more interconnected. Alongside these privacy problems, there is an equally pressing need to address risks associated with technology, specifically cognitive enhancement technologies (CETs) (Frewer et al. 1998).

The concern of safety issues associated with technology is important, due to the potential for technological breakdowns that may result in disastrous consequences (Frewer et al. 1998). This is particularly relevant to cognitive enhancement technologies (CETs), as the dependability of these devices carries the possibility of malfunction or failure, which could result in severe consequences. The scepticism arises from doubts regarding the durability of the technology and the effectiveness of current regulatory systems in adequately addressing these concerns (Rousi & Renko 2020). In addition, there are widespread concerns regarding malfunctions that have the potential to cause accidents or misuse, particularly when these devices are employed for controlling external machinery or important systems. The presence of questions regarding responsibility and the distribution of responsibility in cases of accidents caused by device malfunctions highlights the necessity for well-defined regulatory frameworks (Orito et al. 2020).

4.3 Other "Controversial" Technologies

In today's vibrant and fast-changing technology environment, numerous novel developments have surfaced, offering the potential to transform various elements of everyday life and the wider socio-economic structure. Nevertheless, the introduction of such technologies frequently triggers heated discussions and concerns, covering issues such as their environmental consequences and moral implications.

The array of technologies that have sparked public discourse includes Nuclear technology, ICT, Mobile phones, agricultural chemicals (pesticides and insecticides), Genetic modification (GM), Genomics, Cloning, Hydrogen technology, RFID, Nanotechnology, and Genetic Engineering in food production. Each of these technologies

presents potential advantages but also carries risks that might hinder its acceptance and incorporation into society. Insufficient or inaccurate information might result in misconceptions and increased anxieties, which can be addressed by providing transparent and truthful communication regarding the risks and advantages connected with emerging technologies (Gupta et al. 2012).

Technologies that are seen to have minimal risk and significant benefits, such as solar electricity, tend to be viewed favourably by the public (Devine-Wright 2007). Nevertheless, technologies linked to considerable dangers such as GMOs and pesticides, frequently encounter notable resistance despite their potential advantages, mostly due to concerns regarding their ongoing impact on health and the environment (Frewer et al. 1998, Olofsson et al. 2006). Another technology with similar characteristics is nuclear power, which is highly contentious due to its potential to inflict substantial damage to human health and the environment. The huge potential for nuclear accidents to cause catastrophic consequences renders this technology a focal point of public controversy (Gupta et al. 2012).

A study revealed that individuals who prioritise the important worth of nature (ecocentric) exhibit a higher degree of scepticism towards gene technology, but those who prioritise the practical use of nature for humans (anthropocentric) display a greater level of acceptance. Curiously, the survey also uncovered that women often exhibited greater concern over gene technology in comparison to men. These findings indicate that gender and environmental perspectives have a significant role in shaping public opinion towards complicated technology (Siegrist 1998). Furthermore, another study conducted by the same author revealed again that, on average, men exhibited greater degrees of acceptability towards gene technology in comparison to women. It is noteworthy that the study also discovered that trust does not completely account for the difference in perception between genders. Although women exhibit lower levels of trust, they nevertheless acknowledge certain advantages in gene technology, suggesting the presence of additional influencing factors (Siegrist 2000).

Ethical considerations are of utmost importance, particularly in technologies that involve the alteration of biological processes such as genetic modification and cloning. The ethical discussions surrounding these technologies frequently revolve around worries about "playing God" and the moral consequences of modifying natural living forms for human ends (Gupta et al. 2012). Technological integration into daily life might disturb existing social and cultural norms, resulting in societal resistance. For instance, the widespread usage of mobile phones and ICT has brought up concerns over the gradual loss of privacy and the alteration of interpersonal communication dynamics (Frewer et al. 1998).

Data collecting technologies, such as RFID and various ICT applications, pro-

vide substantial privacy risks, which give rise to concerns about monitoring and the protection of personal data. The adoption of these technologies can be considerably limited by public concerns about privacy (Gupta et al. 2012). Additionally, the rise of nanotechnology raises comparable concerns. A recent study conducted in Taiwan revealed the public’s concern about the advancement of ”minuscule surveillance devices” enabled by nanotechnology. These compact devices have the potential to be considerably more widespread and challenging to identify than current methods, potentially resulting in continuous and inconspicuous surveillance (Chen et al. 2013, Lee et al. 2005). It also raises questions about the confidence in government institutions. The acceptability of new technologies relies heavily on the public’s trust in the organisations responsible for their development and regulation. Distrust, due to previous failures, perceived lack of openness, or conflicts of interest, can result in scepticism and refusal to accept novel technology, such as genetically modified (GM) foods and stem cell research (Frewer et al. 1998). Olofsson, Öhman, and Rashid (2006) found that trust in experts and official bodies is associated with more positive attitudes, while trust in NGOs is linked to increased risk perception and scepticism (Olofsson et al. 2006). This implies that if the public has doubts or cynicism about genetically modified (GM) foods, they may also have similar concerns about new technologies like as brain implants. This is particularly true if the public believes that there is a lack of openness or involvement from non-governmental organisations (NGOs) in the development and regulation of these technologies. This is consistent with a recent study that investigates the level of acceptance towards gene technology. The level of confidence that individuals place in organisations and researchers using gene technology significantly shapes their perception of the advantages and drawbacks associated with this technology (Siegrist 2000).

Public opinions towards controversial technology are influenced by a complex relationship of ethical, cultural, informational, and sociological elements. To improve public acceptance and successfully integrate new technologies into society, it is important to address these issues by using well-informed policies, transparent communication, and ethical governance. To strike a balance between innovation and public welfare, governments have to understand and address the socio-psychological factors that influence the acceptability of technology.

4.4 Integration of Brain Implants and Cyborg Ethics

The impending advances in neurotechnology present noteworthy opportunities and complex ethical challenges due to the integration of brain implants. These gadgets, which possess the ability to enhance cognitive talents beyond typical human capabili-

ties, raise significant problems regarding privacy, autonomy, and consent. Regulatory frameworks are urgently required to properly tackle the ethical concerns that arise from new technologies and to guarantee their responsible development and utilisation. To mitigate potential instances of misuse, these regulations must prioritise safety protocols, cognitive freedom, and ethical use of data (Ireni-Saban & Sherman 2022, Rousi & Renko 2020).

The difference between the therapeutic and enhancement objectives of brain implants introduces complexity to their acceptability and regulation (Jotterand 2008). To achieve advancements that go beyond ordinary cognitive powers, it is necessary to implement extra rights and security measures, which may lead to the creation of a separate category of rights known as 'cyborg' rights. These rights would expressly address the unique abilities and potential needs of individuals with enhanced powers, ensuring their inclusion in legal systems that currently only consider human capabilities (Ireni-Saban & Sherman 2022).

The level of acceptability of brain implants in society varies across different cultures, and this has significant implications for unity and inequalities. Societal acceptability is significantly shaped by ethical, religious, and philosophical convictions, leading to inequalities between people who possess the ability to acquire upgrades and those who do not (Makridakis 2017). These gaps can create a unique form of socio-economic stratification, either reinforcing existing inequalities or leading to the emergence of new ones (Rousi & Renko 2020).

The introduction of artificial intelligence into human biology through brain implants poses distinct challenges to our understanding of autonomy and identity. The integration can blur the distinctions between humans and machines, which may present a difficulty to our traditional concepts of personal agency and self-identity. The future implications of these enhancements are still unknown, needing thorough and ongoing research as well as ethical review (Ireni-Saban & Sherman 2022).

The use of invasive technology exhibits significant variations across different nations and civilizations. The study "Assessing the acceptance of technological implants (the cyborg): Evidences and Challenges" highlights that while some segments of the population are open to embracing these enhancements, the general acceptance in society is yet to accept this new technology. The adoption of these technologies is primarily motivated by the perceived usefulness and emotional responses they induce, with positive emotions playing a vital role in their acceptance (Pelegri-Borondo et al. 2017).

From an economic perspective, the widespread adoption of these technologies has the potential to drastically alter the financial dynamics of healthcare, impacting various factors including the expenses related to medical treatments and the insurance

frameworks used (Rousi & Renko 2020). Emphasising accessibility and equity is important. Insufficient regulation of improvements could worsen inequities in productivity and quality of life, benefiting the privileged few while neglecting the others (Jotterand 2008).

In the end, these technologies make us reevaluate the central concerns about the nature of humanity and the evolution of our species. They prompt us to think about the desirability and ethical acceptability of surpassing our biological boundaries, potentially leading to a new understanding of the concept of humanity in a technologically improved future (Ireni-Saban & Sherman 2022, Jotterand 2008).

5 Research Questions, Hypotheses

The emergence of brain chip technologies offers major opportunities and difficulties in the field of neurotechnology. This study aims to clarify public opinions regarding various degrees of implant technology, including therapy, enhancement, and alteration. It will achieve this by asking specific questions that analyse the impact of demographic, psychological, and contextual factors. The primary research questions include:

- Q1: What are the gender-based differences in support for various levels of brain chip technology?
- Hypothesis 1 (H1): Gender gaps will influence the level of acceptance for brain chip technologies, resulting in observable preferences for the three levels of technology—therapy, enhancement, and alteration. The hypothesis is based on research conducted by Siegrist (1998, 2000), which discovered significant gender differences in the acceptability of gene technologies. This research suggests that a similar pattern may also be present when it comes to the acceptance of brain implants.
- Q2: In what ways do techno-attitudes vary with the different levels of use regarding brain implants?
- Hypothesis 2 (H2): Public acceptance of brain implants will vary greatly according to their intended use, whether it is for therapy, enhancement, or alteration. It is expected that the public will be more receptive to brain implants used for therapeutic purposes. This hypothesis is based on the premise that prioritising medical recovery is generally regarded more positively because of the perceived intention of use in comparison to enhancement or alteration.
- Q3: What role do psychological factors play in shaping attitudes towards brain chip technologies?
- Hypothesis 3 (H3): Psychological factors such as techno-optimism and techno-scepticism, will be important in influencing favourable attitudes towards brain chip technology. Individuals that display scepticism characteristics are expected to be less likely to embrace these advanced technologies.

The goal of the empirical study is to gain a thorough understanding of the elements that may impact the public acceptability of brain chip technology. These

hypotheses will serve as a guide for the investigation. The results are expected to provide practical and useful information for policymakers, technology developers, and researchers involved in the ethical and social aspects of breakthroughs in neurotechnology.

6 Methodology

6.1 Sampling

This study utilised a survey methodology, employing Microsoft Forms for data gathering. The survey focused on Business Informatics students at Corvinus University of Budapest, specifically selected for their anticipated knowledge and understanding of both technological and ethical aspects related to brain implants. The survey consisted of 16 carefully designed questions aimed at assessing students' viewpoints and attitudes towards brain implants in various scenarios.

The choice to employ a survey methodology was driven by the necessity for a thorough and numerical grasp of student opinions in a relatively cost-effective and effective manner. Surveys are highly beneficial for this specific demographic because they provide the opportunity for anonymous participation, which may promote honesty in comments regarding sensitive subjects like brain implants. (Lee & Lee 2012)

Surveys have the benefit of collecting broad information, but they also have drawbacks, such as the possibility of biases in self-reporting and the non-random selection of participants, which may not accurately reflect the broader public opinion. (Tarr 2013) Moreover, the utilisation of a single institution for sampling could restrict the applicability of the results.

116 students participated, which resulted in an interesting dataset for study. The sampling approach employed was non-random, specifically targeting students already enrolled in technology-related courses who are assumed to possess an understanding of the subject matter. This selective sample was important in guaranteeing that respondents have the necessary expertise to offer well-informed viewpoints on the complex subjects addressed in the survey.

Upon analysing the social demographic data of the survey participants, some major trends become apparent. The majority of respondents, making up 63% of the sample, identified as male, while 36% identified as female. The age distribution showed a not-so-surprising bias towards young adults, as 86% of individuals fell within the 20–23 age range. The participants demonstrated a nearly equal division between techno-optimism and techno-scepticism, with 53% favouring the former and 47% favouring the latter. From a geographical perspective, the majority of participants, specifically 90%, lived in urban areas. In contrast, a small proportion of 10% resided in rural communities. Notably, most individuals exhibited a decreased tendency towards religiosity, as shown by the average score of 3.1 on a religious scale that ranged from 1 to 10.

6.2 Analysis

The analysis aimed to dissect the attitudes of the surveyed students towards brain implants, focusing on three distinct levels of application:

- Therapy: Applications related to medical treatment and health improvement. (Jotterand 2008)
- Enhancement: Uses aimed at augmenting human capabilities beyond their natural state. (Jotterand 2008)
- Alteration: Modifications that change human functions in non-traditional ways. (Jotterand 2008)

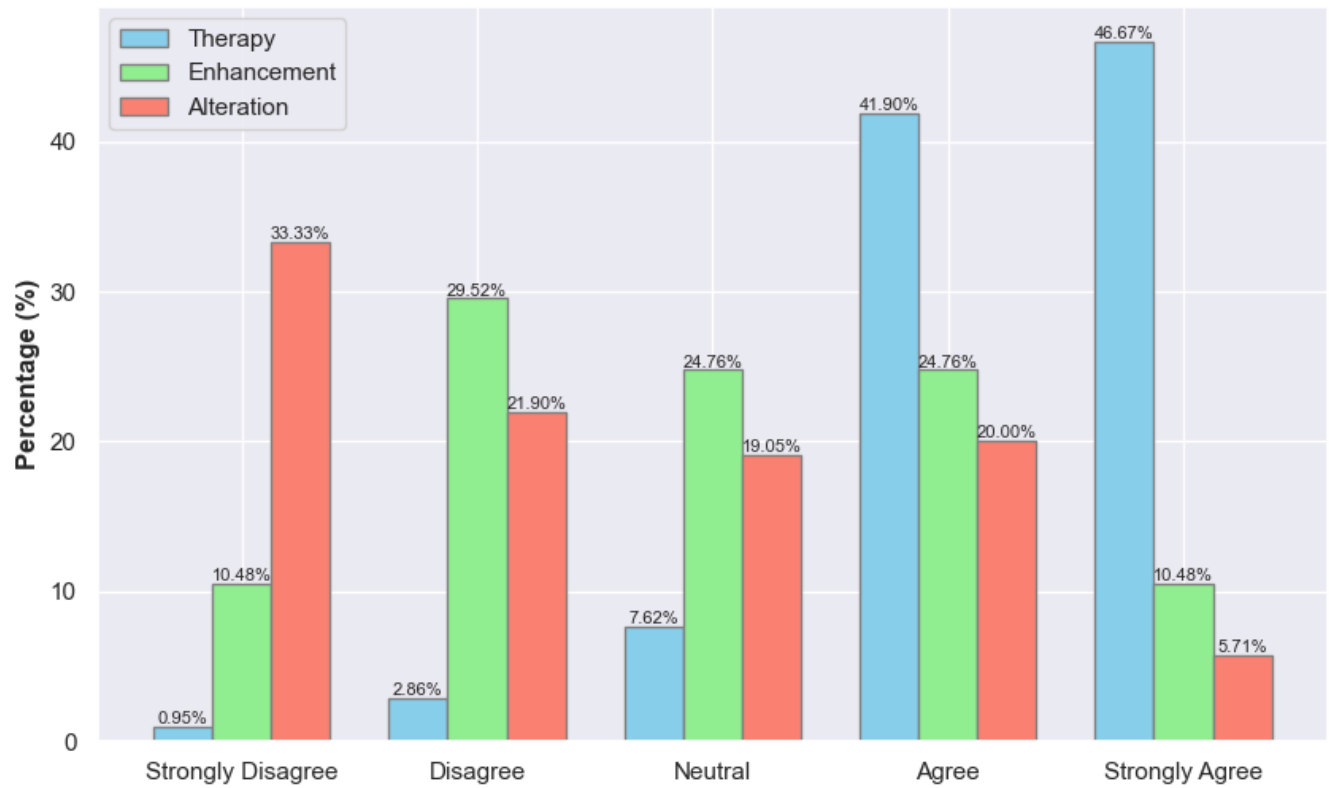
The purpose of selecting these levels was to provide a thorough exploration of the sociological, practical, and ethical concerns of brain implants. The data was analysed using quantitative methodologies to identify patterns and correlations in attitudes among various demographic and psychographic categories. This method enabled a detailed understanding of the variables that impact the acceptability and opposition towards brain implant technology.

In addition, the survey also addressed important subjects such as privacy concerns and trust in the creators of brain implant technology. These components are important for understanding the broader context of students' perspectives, highlighting potential barriers to acceptance, and identifying areas that need further debate and research.

The foundation for a comprehensive examination of students' perspectives on brain implants is established by this methodology, which blends a targeted survey with a multi-layered analytical approach. The results obtained from this study are expected to provide an interesting contribution to the ongoing discourse on the ethical, social, and technological aspects of brain implant applications.

7 Findings

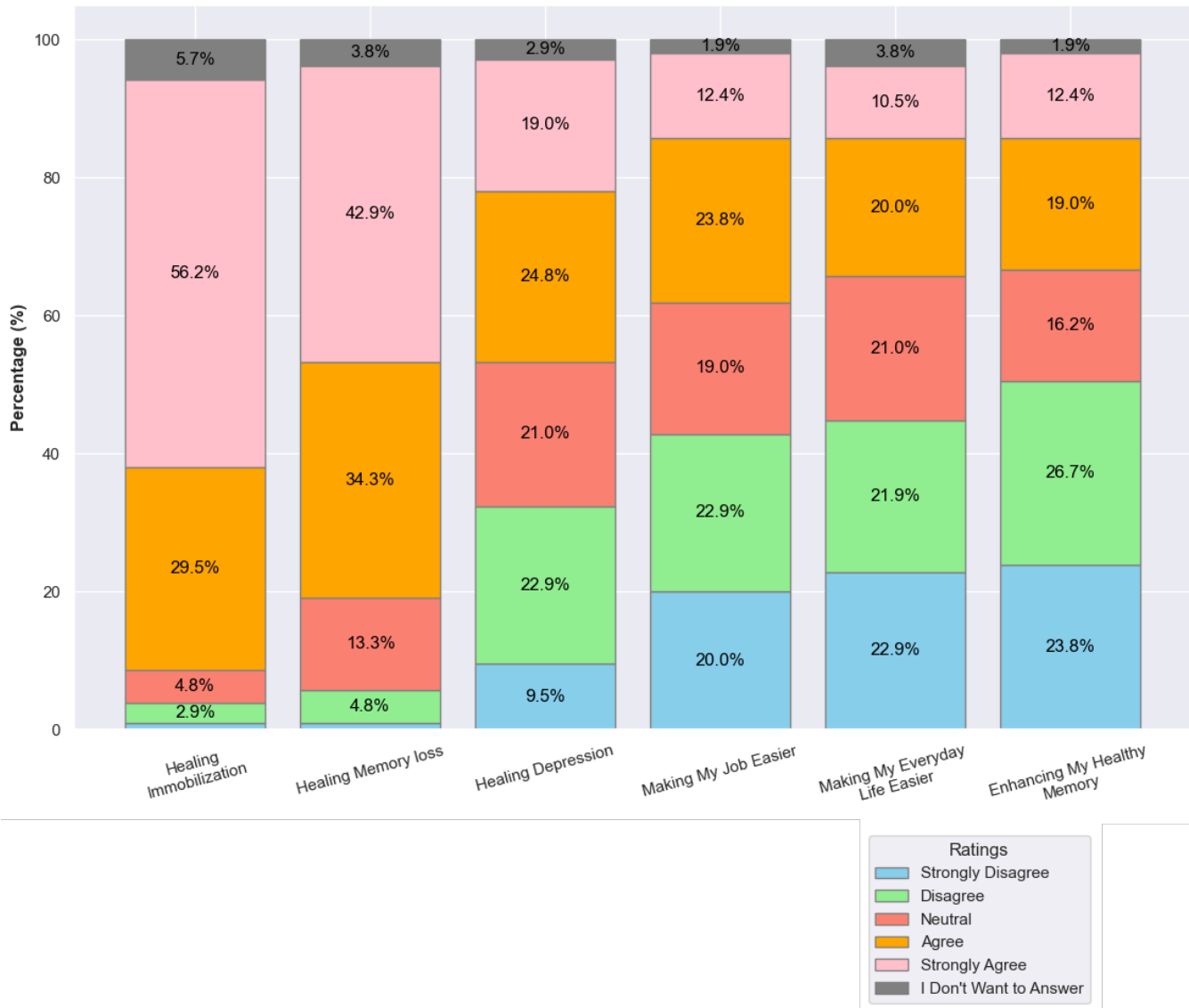
Figure 1: Distribution of Responses for the Level of Use of Brain Implants: Therapy, Enhancement, and Alteration (%)



Note: $N = 105$

The analysis focuses on the support levels for three categories, namely therapy, enhancement, and alteration, as depicted in the bar chart (Figure 1). The research indicates that nearly half of the respondents express strong support for therapy, highlighting a substantial endorsement of therapeutic applications. Enhancement and alteration earn relatively low levels of agreement, with around 20% and roughly 25% of respondents agreeing, respectively. It is notable that there is a relatively high level of strong disagreement regarding alteration and considerable hesitation about enhancement.

Figure 2: Stacked Distribution of Responses Regarding the Use of Non-Invasive Brain Implants on Themselves in Certain Situations (%)

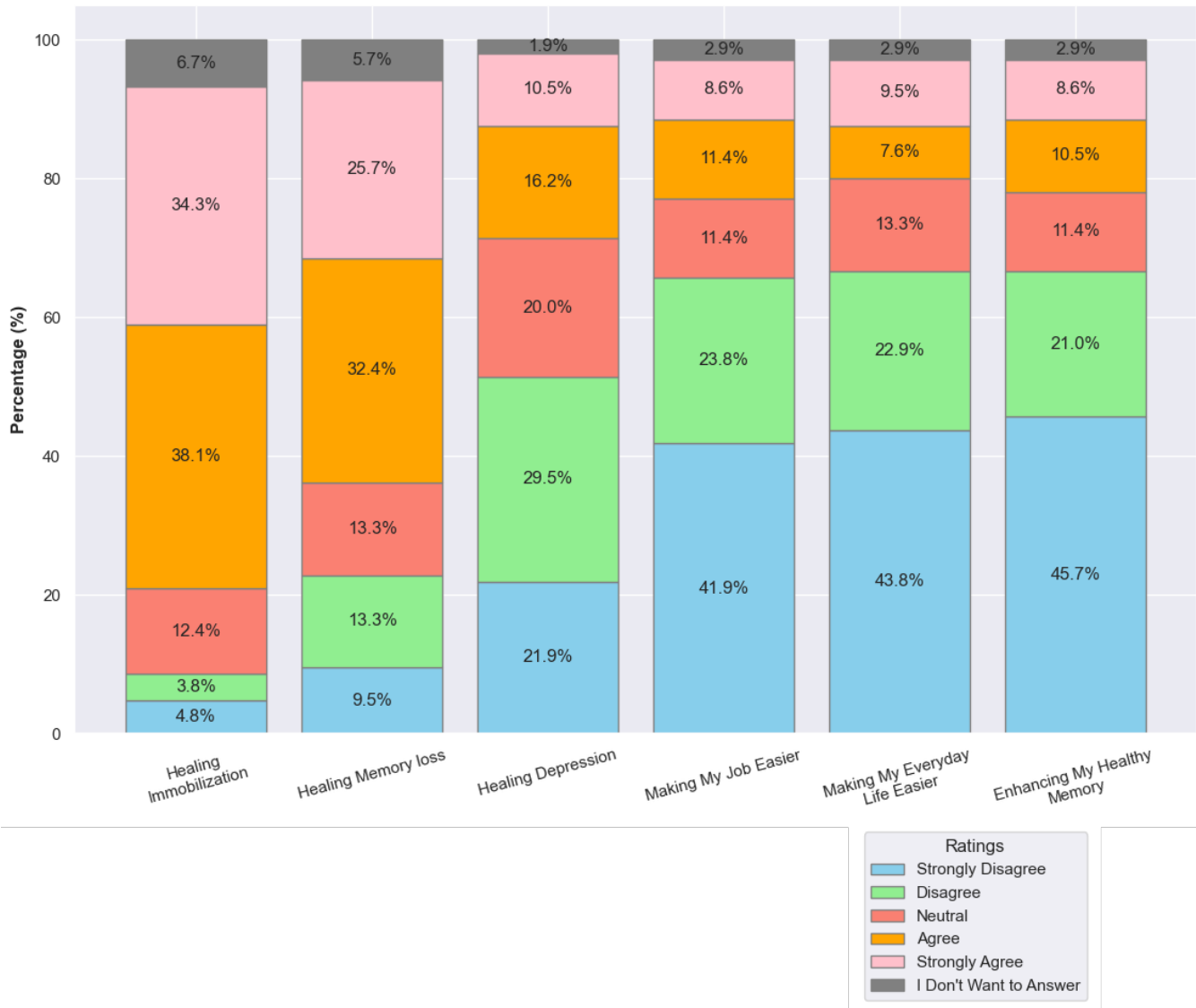


Note: N = 105

Upon investigating non-invasive brain implants, notably in Figure 2, the phrases regarding enhancements attract little support, as around 30% of respondents agree with them, while nearly more than half of respondents disagree. Showing a reluctance to use brain implants for enhancement. However, there was significant support for

other areas such as "healing immobilisation" and "healing memory loss," with more than half of the respondents supporting treatments except for depression. These findings suggest that respondents are absolutely supportive of brain implants in healthcare, while they are non-supportive of enhancements in the case of non-invasive brain implants.

Figure 3: Stacked Distribution of Responses Regarding the Use of Invasive Brain Implants on Themselves in Certain Situations (%)

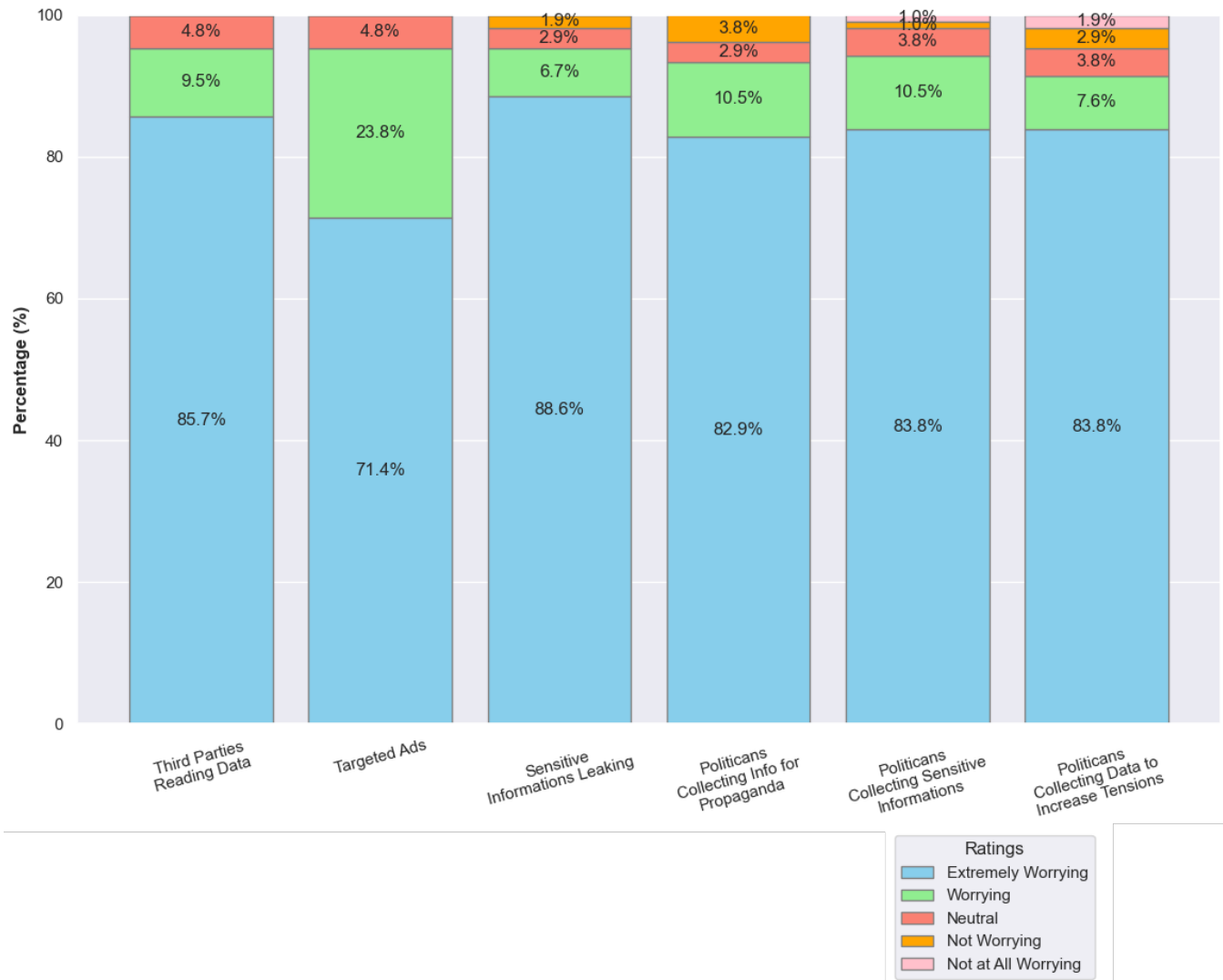


Note: N = 105

The data depicted in Figure 3 has a comparable layout to Figure 2, but specifically relates to invasive brain implants. Attitudes seem to be more divided. The concept of "healing immobilisation" is highly supported alongside "healing memory loss," as almost half of the participants strongly agree with it. This indicates

a significant endorsement of the use of invasive implants in therapeutic situations among respondents. In contrast, the level of support for all enhancement situations decreases significantly more when compared to non-invasive implants, indicating possible concerns about the invasive nature of the technology.

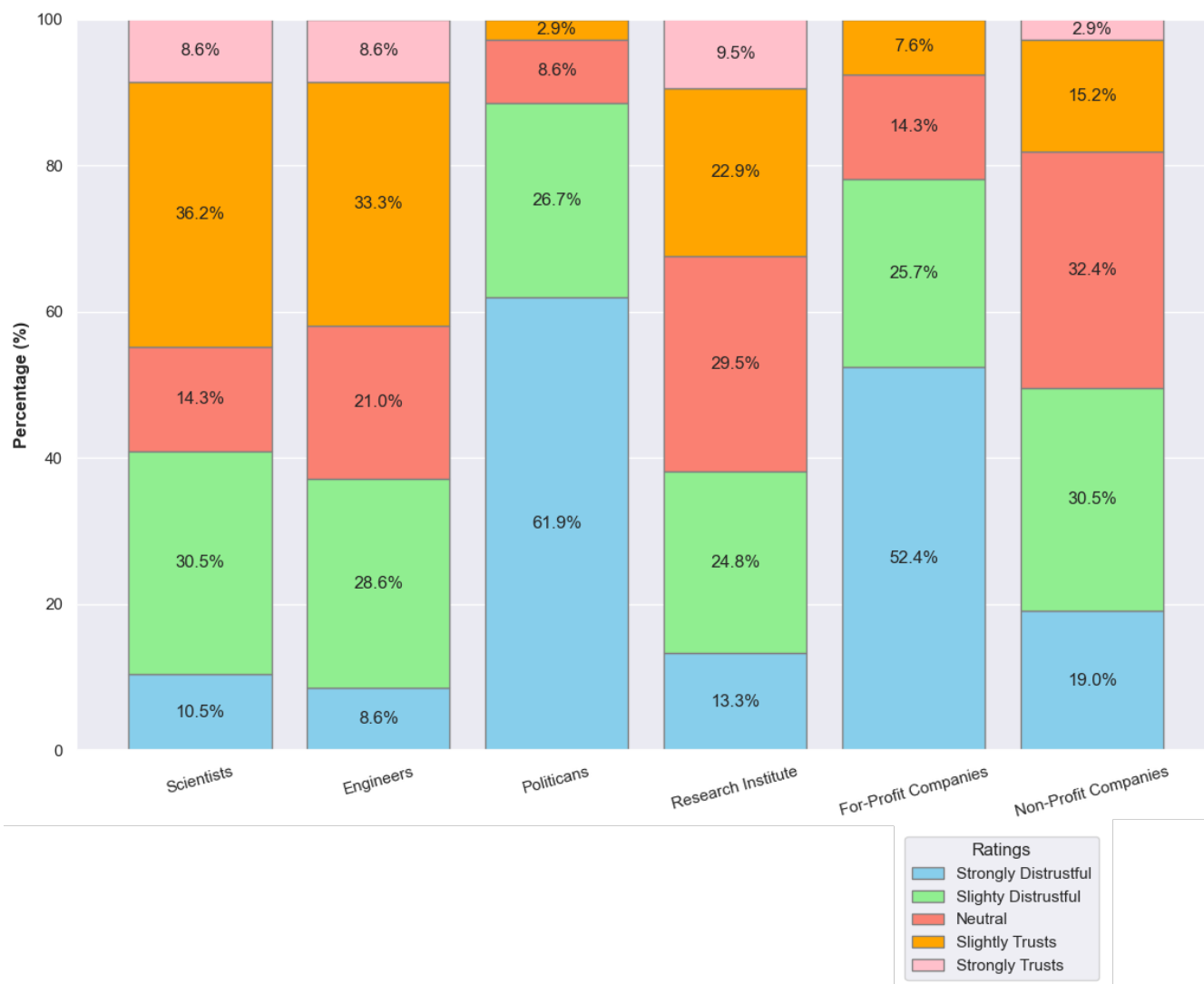
Figure 4: Stacked Distribution of Responses Regarding Privacy Concerns in Certain Situations (%)



Note: $N = 105$

Figure 4 examines brain implant-related privacy issues. Throughout the range of opinions, there are notable concerns, with the issue of "Third Parties Reading Data" being extremely concerning among participants. Almost 90% of respondents regard this issue as worrying. While all other issues were also "extremely worrying," according to almost all of the participants, this demonstrates a widespread agreement on the necessity of privacy protections in the use of this technology.

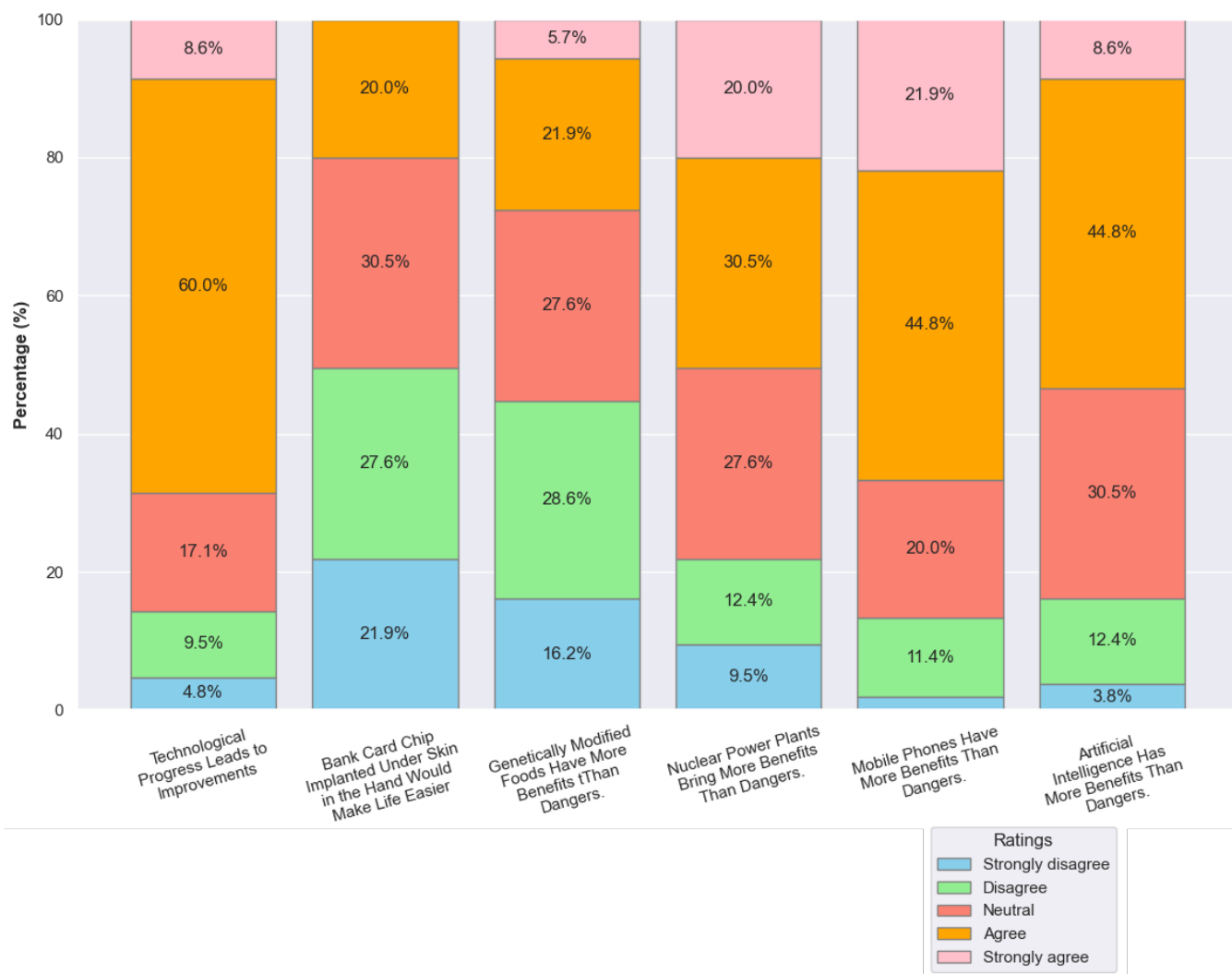
Figure 5: Stacked Distribution of Responses Regarding Trust in Stakeholders (%)



Note: $N = 105$

An examination of trust levels among various entities uncovers interesting observations. (Figure 5) Scientists and engineers are perceived as the most reliable entities, receiving the majority of trust from participants. On the other hand, governmental entities and for-profit enterprises inspire less trust, indicating a possible doubt about their intentions or perceived abilities, while non-profit companies are also distrusted.

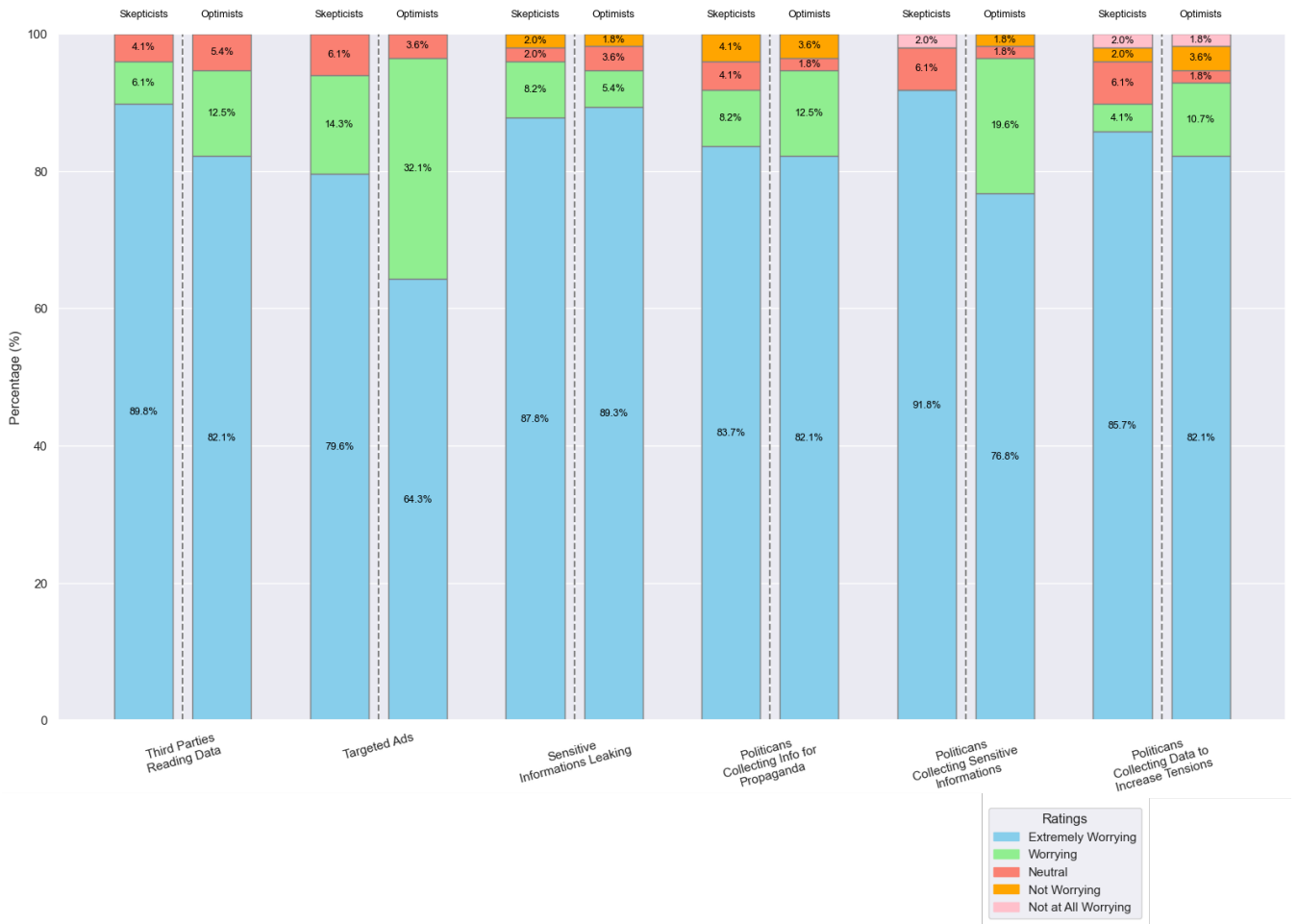
Figure 6: Stacked Distribution of Responses Regarding Controversial Technologies (%)



Note: $N = 105$

Figure 6 illustrates the perspectives on different technical breakthroughs. A significant majority of respondents (60%) strongly agree that technology growth leads to improvements, reflecting a prevalent optimism about technological development. On the other hand, a notable portion of participants express doubt about genetically modified foods, pointing out worries about the balance between their perceived advantages and risks (28% disagree). Most respondents either agree or are neutral regarding these technologies.

Figure 7: Stacked Distribution of Responses Regarding Privacy Concerns in Certain Situations categorized by Technological Attitudes (%)

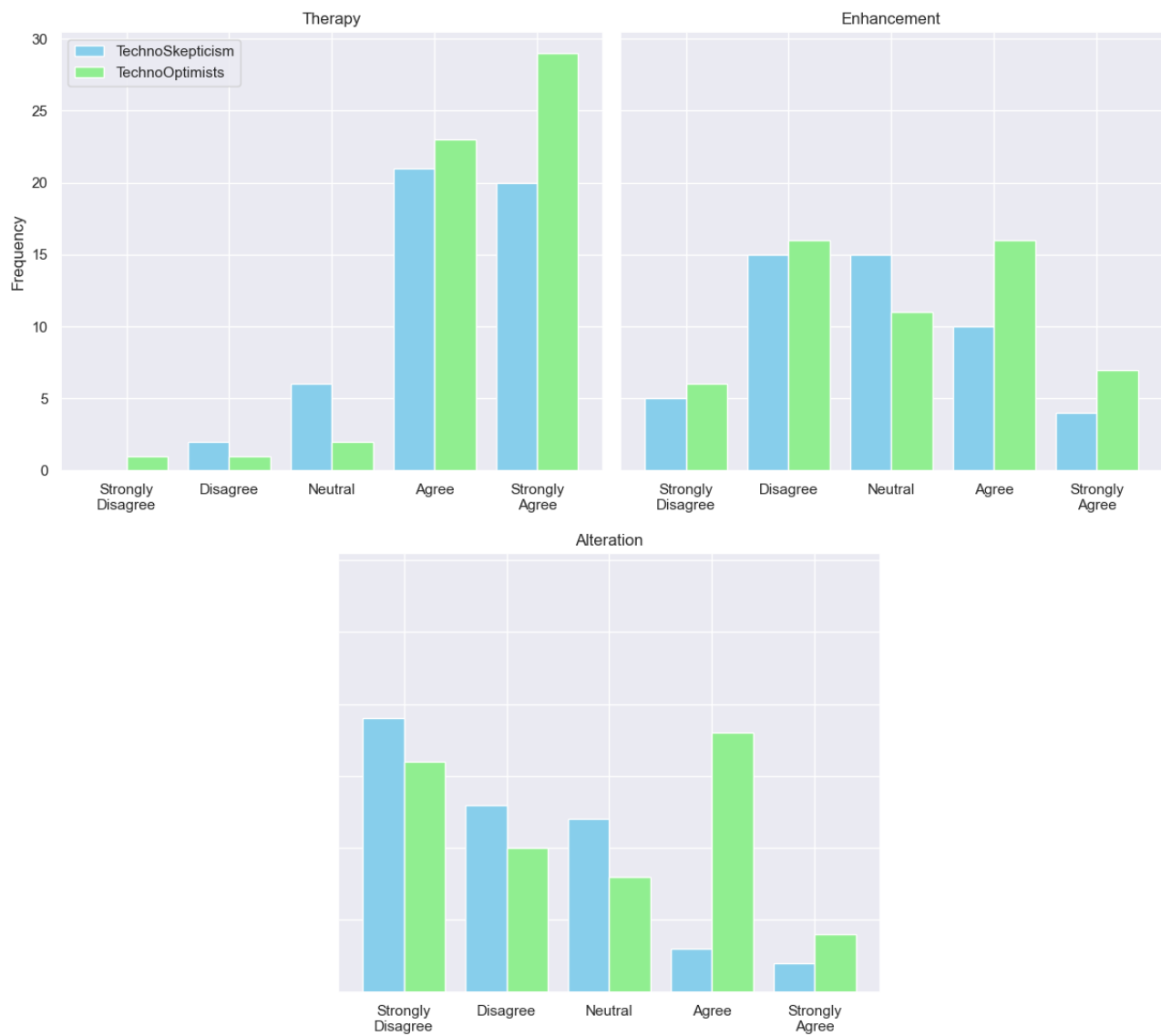


Note: $N = 105$

The data analysis demonstrates differing levels of concern over multiple privacy concerns of Techno-Optimists and Techno-Skeptics among respondents. (See Figure 7). The results indicate that a significant majority of participants express varying degrees of concern over every privacy concern discussed. A noteworthy observation is the significant level of anxiety around "Third Parties Reading Data," with almost 90% of participants calling it worrisome to highly worrisome. This signifies a robust public sentiment regarding the imperative need for rigorous data privacy regulations.

On the other hand, concerns about "politicians collecting data to increase tensions" also generate significant fear, but there is a noticeable decrease in the amount of anxiety compared to data privacy among respondents. This indicates a little more nuanced public perspective on the subject. However, the core issue remains evident: a widespread feeling of discomfort with privacy in the digital domain persists, with considerable focus on data management, targeting, and potential political motives. The little response in the categories among participants is indicating a neutral or unconcerned attitude highlighting widespread agreement on the significance of tackling these matters.

Figure 8: Frequency of Ratings for the Level of Use of Brain Implants: Therapy, Enhancement, and Alteration Categorized by Technological Attitudes



Note: $N = 105$

Within the field of therapy, individuals who have a techno-optimistic perspective are most inclined towards the utilisation of brain implants, as indicated by their prevalent endorsement of the 'Strongly Agree' option. This indicates an acknowl-

edgment of the possible advantages that these implants could provide in medical situations. In contrast, techno-skeptics show a lower level of support compared to techno-optimists. When evaluating enhancement applications, both groups express a notable hesitation, with the majority of comments falling within the 'Neutral' category. This indicates a shared uncertainty or mixed feelings concerning brain implants that have applications beyond only medical treatment. Techno-optimists, in particular, show a broader range of consensus, suggesting a slightly more positive perspective on the ability of brain implants to improve human capacities. The concept of alteration evokes a wide range of responses. Techno-optimists tend to maintain a neutral position, indicating a state of balance or uncertainty regarding the modification of human functioning through brain implants. Techno-skeptics exhibit strong resistance, as evidenced by the high number of respondents who strongly disagree. This indicates a profound hostility towards the notion of modifying human talents or traits using technology.

Table 1: Responses Regarding Gender Categorized by Technological Attitudes

	Techno-Skeptics		Techno-Optimists	
Female	23	50.0%	14	25.0%
Male	23	50.0%	42	75.0%

Note: N = 105

The Techno-Skeptics group consists of 23 people, with an equal distribution of males and females, each comprising 50% of the group. (Table 1) However, the Techno-Optimists group exhibits a notable gender imbalance, with males comprising a greater percentage (75%, n = 42) in comparison to females (25%, n = 14). The data indicates that both genders exhibit scepticism towards technology to a similar extent. However, there is a higher prevalence of optimism among males in this particular sample.

Table 2: General Techno-Optimism and Whether the Respondent Would Use Invasive Brain Implant Technology on Themselves (part1)

	Techno-Sceptics		Techno-Optimists	
	#	%	#	%
Treatment for paralysis. (invasive)				
Not at all	3	6.1%	2	3.6%
Rather not	1	2.0%	3	5.4%
Neutral	9	18.4%	4	7.1%
Rather yes	18	36.7%	22	39.3%
Completely	15	30.6%	21	37.5%
I do not want to answer	3	6.1%	4	7.1%
Treatment for memory loss. (invasive)				
Not at all	6	12.2%	4	7.1%
Rather not	10	20.4%	4	7.1%
Neutral	8	16.3%	6	10.7%
Rather yes	11	22.4%	23	41.1%
Completely	12	24.5%	15	26.8%
I do not want to answer	2	4.1%	4	7.1%
Treatment for depression. (invasive)				
Not at all	11	22.4%	12	21.4%
Rather not	16	32.7%	15	26.8%
Neutral	10	20.4%	11	19.6%
Rather yes	7	14.3%	10	17.9%
Completely	4	8.2%	7	12.5%
I do not want to answer	1	2.0%	1	1.8%

Note: N = 105

The survey results on opinions on invasive brain implants are displayed in Tables 2 and 3, organised according to people’s overall technological perspective, specifically categorised as ”techno-sceptics” and ”techno-optimists.” When it comes to addressing medical concerns, the responses in Table 2 show a diverse range of support among respondents. Regarding the treatment of paralysis, both groups demonstrate significant endorsement, with the majority of responses leaning towards ”rather yes.” Techno-optimists display a somewhat higher level of enthusiasm, which aligns with their overall positive perspective on technology among participants. When it comes to treating memory loss, most members of the techno-optimist group are in favour,

although sceptics also express considerable support for the option of "rather yes." However, when it comes to treating depression, there is no clear majority in any specific group in this particular sample, indicating a more cautious approach. However, the response "not at all" was significant for both groups.

Table 3: General Techno-Optimism and Whether the Respondent Would Use Invasive Brain Implant Technology on Themselves (part2)

	Techno-Sceptics		Techno-Optimists	
	#	%	#	%
Easing work as a healthy person. (invasive)				
Not at all	25	51.0%	19	33.9%
Rather not	11	22.4%	14	25.0%
Neutral	6	12.2%	6	10.7%
Rather yes	5	10.2%	7	12.5%
Completely	1	2.0%	8	14.3%
I do not want to answer	1	2.0%	2	3.6%
Making everyday life easier as a healthy person. (invasive)				
Not at all	24	49.0%	22	39.3%
Rather not	11	22.4%	13	23.2%
Neutral	7	14.3%	7	12.5%
Rather yes	4	8.2%	4	7.1%
Completely	2	4.1%	8	14.3%
I do not want to answer	1	2.0%	2	3.6%
Enhancing already good memory. (invasive)				
Not at all	23	46.9%	25	44.6%
Rather not	11	22.4%	11	19.6%
Neutral	7	14.3%	5	8.9%
Rather yes	6	12.2%	5	8.9%
Completely	1	2.0%	8	14.3%
I do not want to answer	1	2.0%	2	3.6%

Note: N = 105

The issue of enhancing work capacity is divisive (Table 3), with a substantial portion of both techno-sceptics and techno-optimists expressing strong opposition ("not at all") among participants. However, there is also considerable support for

this idea, with some respondents indicating a moderate level of agreement ("Rather yes") and others expressing complete agreement ("Completely"). The division is also evident in the pursuit of simplifying daily tasks. Nevertheless, the frequency of the word "completely" is greater among optimists in this sample. When considering improving an already proficient memory, both groups exhibit a distinct reluctance, with the majority responding "Not at all," which suggests resistance to boosting memory beyond its typical capabilities. The response "I do not want to answer" on both tables could indicate apprehension about the consequences of these technologies or hesitation to reveal personal opinions on a potentially controversial topic among respondents. Techno-optimists, as anticipated, are more inclined to endorse the use of brain implants. However, this endorsement is not consistent and differs depending on the specific application of the technology. The replies indicate that both groups are more receptive to the use of invasive brain implants for medical purposes as opposed to upgrades for those who are already healthy.

Table 4: General Techno-Optimism and Whether the Respondent Would Use Non-Invasive Brain Implant Technology on Themselves (part1)

	Techno-Sceptics		Techno-Optimists	
	#	%	#	%
Treatment for paralysis. (non-invasive)				
Not at all	0	0.0%	1	1.8%
Rather not	3	6.1%	0	0.0%
Neutral	4	8.2%	1	1.8%
Rather yes	17	34.7%	14	25.0%
Completely	21	42.9%	38	67.9%
I do not want to answer	4	8.2%	2	3.6%
Treatment for memory loss. (non-invasive)				
Not at all	0	0.0%	1	1.8%
Rather not	3	6.1%	2	3.6%
Neutral	9	18.4%	5	8.9%
Rather yes	19	38.8%	17	30.4%
Completely	17	34.7%	28	50.0%
I do not want to answer	1	2.0%	3	5.4%
Treatment for depression. (non-invasive)				
Not at all	5	10.2%	5	8.9%
Rather not	14	28.6%	10	17.9%
Neutral	11	22.4%	11	19.6%
Rather yes	8	16.3%	18	32.1%
Completely	10	20.4%	10	17.9%
I do not want to answer	1	2.0%	2	3.6%

Note: N = 105

Tables 4 and 5 present a comparison of opinions about non-invasive brain implants with the previous answers to invasive technologies from Tables 2 and 3.

Survey responses are higher in favour of non-invasive medical condition treatments than invasive ones, as seen in Table 4: There is a noticeable shift towards "completely" in both techno-sceptics and techno-optimists when it comes to non-invasive treatment for paralysis, with the techno-optimists showing greater overall support among participants. Regarding memory loss, both groups exhibit significant endorsement for non-invasive treatments, but techno-optimists demonstrate a greater tendency. Opinions about non-invasive treatment for depression vary, with

techno-sceptics expressing a substantial preference for "rather not." Nevertheless, both categories consist of a significant proportion of respondents who express complete approval.

Table 5: General Techno-Optimism and Whether the Respondent Would Use Non-Invasive Brain Implant Technology on Themselves (part2)

	Techno-Sceptics		Techno-Optimists	
	#	%	#	%
Easing work as a healthy person. (non-invasive)				
Not at all	12	24.5%	9	16.1%
Rather not	12	24.5%	12	21.4%
Neutral	12	24.5%	8	14.3%
Rather yes	8	16.3%	17	30.4%
Completely	5	10.2%	8	14.3%
I do not want to answer	0	0.0%	2	3.6%
Making everyday life easier as a healthy person. (non-invasive)				
Not at all	13	26.5%	11	19.6%
Rather not	11	22.4%	12	21.4%
Neutral	13	26.5%	9	16.1%
Rather yes	8	16.3%	13	23.2%
Completely	2	4.1%	9	16.1%
I do not want to answer	2	4.1%	2	3.6%
Enhancing already good memory. (non-invasive)				
Not at all	15	30.6%	10	17.9%
Rather not	11	22.4%	17	30.4%
Neutral	10	20.4%	7	12.5%
Rather yes	9	18.4%	11	19.6%
Completely	4	8.2%	9	16.1%
I do not want to answer	0	0.0%	2	3.6%

Note: $N = 105$

The answer to the idea of using non-invasive methods to make work simpler for healthy individuals demonstrates a tendency towards cautious acceptance (Table 5) among respondents. Techno-optimists once again demonstrate a greater level of complete approval. When it comes to simplifying daily life, a consistent pattern of careful

optimism arises. Nevertheless, techno-sceptics exhibit a significant number of "not at all" responses. Using non-invasive techniques to enhance an already proficient memory elicits caution, as opinions remain evenly distributed and no dominant viewpoint emerges among participants. This mirrors the invasive category's cautious approach, albeit with a slightly more receptive attitude towards the non-invasive method.

When comparing the invasive and non-invasive responses, it is evident that non-invasiveness is generally viewed as a favourable feature by respondents. Both techno-sceptics and techno-optimists are increasingly accepting non-invasive treatments, particularly in the context of medical procedures among participants. Nevertheless, the level of acceptance decreases when the technology is presented as an enhancement for people who are already in good health. Even among techno-optimists, there is no complete and unquestioning acceptance of brain implant technologies among respondents. This reflects a complicated relationship between the perceived advantages and the worries about these technologies, regardless of how invasive they are.

8 Discussion and Conclusion

The objective of the study was to analyse the complex public perceptions regarding brain implants, investigating the level of acceptance in several contexts, including therapy, enhancements, and alterations. The study has validated two of our early assumptions while refuting another, yielding useful insights into the interaction between technical progress and societal conventions.

Firstly, Hypothesis 1 claims that gender disparities will impact the acceptance of brain implant technologies. The collected data provided evidence for this theory, demonstrating notable disparities in views towards these technologies based on gender among respondents. This discrepancy highlights the necessity of implementing comprehensive communication strategies that acknowledge and honour the varied concerns and expectations of all prospective user populations.

Hypothesis 2 posited that the general population will have a greater inclination towards utilising brain implants for therapeutic objectives as opposed to enhancements and alterations. Research findings demonstrated a significant level of acceptance for therapeutic uses among participants, such as the treatment of paralysis or memory loss. However, there was a notable amount of scepticism and resistance towards the use of brain implants for enhancement purposes. Even among those who are generally optimistic about technology, the concept of enhancement and alteration was met with significant scepticism for respondents.

Hypothesis 3 predicted that people who hold a favourable perspective towards technology, known as techno-optimists, will exhibit reduced levels of worry over brain implants. Surprisingly, our research revealed that worries regarding privacy and the possible abuse of technology were universally common, even among those who are generally optimistic about technology. Techno-optimists generally supported the use of brain implants for therapeutic purposes, such as treating medical conditions or restoring bodily functions. However, they were hesitant about using implants to enhance human capabilities beyond natural limits and somewhat opposed any alterations that could affect personal identity or cognitive processes. The lack of major differences in acceptance between non-invasive and invasive implant methods suggests that the extent of surgical involvement does not play a significant role in influencing public opinions. However, the primary problems that are of utmost importance to all groups are the ethical implications and the potential for misuse. These findings emphasise the urgent requirement for strong regulatory frameworks and explicit ethical principles. It is critical to establish these criteria in order to promote confidence and proper integration of brain implants into society. This will ensure that technological progress is in line with societal values and ethical issues.

In conclusion, although there is a cautious yet evident willingness towards the therapeutic potential of brain implants, the augmentation and modification of human skills through these technologies encounter substantial doubt in this particular sample. These findings indicate a potential directive for governments and industry leaders to give priority to the creation of secure, moral, and properly controlled technologies.

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APPENDIX

Agyi implantátumok: Közvélemény és Aggodalmak

Üdvözlünk! A felmérés célja, hogy megértsük a közvélemény nézőpontjait és aggodalmait. az agyi implantátumok kapcsán.

Az agyi implantátumok olyan eszközök, amelyek képesek javítani a fiziológiai, és kognitív képességeket és akár más képességeket is adnak, például az egér irányítását gondolatok útján.

Nem kell semmit sem tudnod a témáról: még akkor is, ha egyáltalán nem ismered a témát, a válaszaid nagyon hasznosak számunkra. Biztosítjuk, hogy az anonimitásod a felmérés során végig megmarad. A kutatás Ágoston József, BCE hallgató szakdolgozatához kapcsolódik. A kitöltők között jutalmakat sorsolunk ki!
Köszönjük a hozzájárulásod!

A felmérés kitöltése körülbelül 10 percet vesz igénybe.

* Required

I. BLOKK

Mint ahogy azt említettük: Az agyi implantátumok olyan eszközök, amelyek az agyhullámokat olvasva képesek javítani az érzékelést, a memóriát, a kognitív képességeket és akár más képességeket is adnak, például az egér irányítását gondolatok útján.

1. Mennyire értesz egyet az agyi implantátumokkal kapcsolatos alábbi állításokkal? *

	Egyáltalán nem értek egyet	Nem értek egyet	Semleges	Egyetértek	Teljes mértékben egyetértek
Jó dolognak tartom az egészségügyi célú agyi implantátumokat (Segítség betegség és fogyatékosság esetén.)	☐	☐	☐	☐	☐
Jó dolognak tartom, ha egészséges emberek fejlesztetik az agyműködésüket implantátumokkal (Jobb memória, probléma megoldó képesség fejlesztése.)	☐	☐	☐	☐	☐
Jó dolognak tartom, ha egészséges emberek nem hagyományos képességeket szereznek az implantátummal (Számítógépet a gondolatnál irányítani.)	☐	☐	☐	☐	☐

2. Mit gondolsz az agyi implantátumokról, amikor azokat ilyen esetekben használják? *

	Rendkívül aggódok	Közepesen aggódok	Enyhén aggódok	Semleges	Enyhén optimista vagyok	Közepesen optimista vagyok	Rendkívül optimista vagyok
Ha hazugságvizsgálóknál használják? (rendőrségi kihallgatások)	☐	☐	☐	☐	☐	☐	☐
Az egészségügyi célú használat, hogy betegeket gyógyítsanak?	☐	☐	☐	☐	☐	☐	☐
Ha bizonyos munkahelyeken egészséges emberként kötelezően használni kellene?	☐	☐	☐	☐	☐	☐	☐
Ha arra használják, hogy álmainkból képeket rajzoljanak ki?	☐	☐	☐	☐	☐	☐	☐
Ha mindennapi tevékenységeinkre vonatkozó adatok gyűjtésére használják?	☐	☐	☐	☐	☐	☐	☐
Ha egészséges emberek fejleszteni szeretnék az agyi működésüket agyimplantátummal?	☐	☐	☐	☐	☐	☐	☐
Ha egészséges emberek nem hagyományos képességeket szeretnének szerezni, mint például rácsatlakozni a számítógépre?	☐	☐	☐	☐	☐	☐	☐

3. Mennyire valószínű, hogy használnál egy kicsi méretű és **levegő** agyműködést támogató viselhető eszközt az alábbi szituációkban, **saját magadon?** *

	Egyáltalán nem	Inkább nem	Semleges	Inkább igen	Teljes mértékben	Nem akarok válaszolni
Mozgásképtelenség gyógyítására.	☐	☐	☐	☐	☐	☐
Memóriavesztés em gyógyítására.	☐	☐	☐	☐	☐	☐
Depresszió gyógyítására.	☐	☐	☐	☐	☐	☐
Munkavégzés megkönnyítése egészségesként.	☐	☐	☐	☐	☐	☐
Mindennapi élet megkönnyítése egészségesként.	☐	☐	☐	☐	☐	☐
Rendben levő memóriám fejlesztésére.	☐	☐	☐	☐	☐	☐

4. Mennyire valószínű, hogy használnál egy a testedbe ültetett kicsi agyi implantátumot az alábbi szituációkban, **saját magadon?** *

	Egyáltalán nem	Inkább nem	Semleges	Inkább igen	Teljes mértékben	Nem akarok válaszolni
Mozgásképtelenség gyógyítására.	☐	☐	☐	☐	☐	☐
Memóriavesztés em gyógyítására.	☐	☐	☐	☐	☐	☐
Depresszió gyógyítására.	☐	☐	☐	☐	☐	☐
Munkavégzés megkönnyítése egészségesként.	☐	☐	☐	☐	☐	☐
Mindennapi élet megkönnyítése egészségesként.	☐	☐	☐	☐	☐	☐
Rendben levő memóriám fejlesztésére.	☐	☐	☐	☐	☐	☐

II. BLOKK

5. Az agyi implantátumok az agyhullámokat használható adatokká alakítják.

Mennyire aggasztanak az alábbi helyzetek? *

	Rendkívül aggasztó	Enyhén aggasztó	Semleges	Nem aggasztó	Egyáltalán nem aggasztó
Ha harmadik felek tudják olvasni az adataimat.	☐	☐	☐	☐	☐
Ha cégek felhasználják célzott reklámokhoz az adataimat.	☐	☐	☐	☐	☐
Érzékeny információk kiszivárgása, mint például gondolatok, érzelmek, preferenciák stb.	☐	☐	☐	☐	☐
Ha politikai szereplők propaganda készítéséhez felhasználják az adataim.	☐	☐	☐	☐	☐
Ha politikai szereplők hozzáférnének érzékeny információkhoz, mint például gondolatok, érzelmek, preferenciák stb.	☐	☐	☐	☐	☐
Ha politikai szereplők az adatokat felhasználva csoportok/országok közötti feszültségeket növelnének.	☐	☐	☐	☐	☐

6. Az agyhullámokat ugyanolyan szinten kellene-e kezelnünk, mint a weboldalról gyűjtött információkat? *

- ☐ Igen, összehasonlíthatóak
- ☐ Nem, az agyhullámok magasabb szintű adatvédelmet igényelnek
- ☐ Nem, a weboldalon gyűjtött információk nagyobb adatvédelmi kockázatot jelentenek
- ☐ A kontextustól függ
- ☐ Nem tudom
- ☐ Nem akarok válaszolni

7. Szerinted hogyan hathat az agyi implantátumok széles körű elterjedése a társadalmunkra? (Több válasz bejelölhető!) *

- ☐ Az emberi interakciók megkönnyítése
- ☐ Az emberi interakció helyett egyre inkább a technológiára támaszkodnánk
- ☐ Vitákat és beszélgetéseket indítana az emberiség természetéről
- ☐ Ösztönözné az együttműködést és a csapatmunkát egy új szinten
- ☐ Fokozott megfigyelés és a magánélet megsértése
- ☐ Növekvő szakadék azok között, akik megengedhetik maguknak az agyi implantátumokat, és azok között, akik nem
- ☐ Az agyi implantátumokkal való visszaélés vagy manipuláció lehetősége
- ☐ Nem tudom
- ☐ Nem akarok válaszolni
- ☐ Other

8. A következő nyilatkozatok az agyi implantátumokba vetett bizalommal kapcsolatosak.
Mennyire bíz az alábbi személyekben? *

	Erősen bizalmatlan	Kissé bizalmatlan	Semleges	Valamelyest bíz	Erősen bíz
Az agyi implantátumok fejlesztéséért felelős tudósok	☐	☐	☐	☐	☐
Az agyi implantátumok fejlesztéséért felelős mérnökök	☐	☐	☐	☐	☐
Az agyi implantátumok felügyeletéért felelős politikusok	☐	☐	☐	☐	☐
Egy független kutatóintézet vagy egy egyetem, amely az agyi implantátumok fejlesztéséért felelős	☐	☐	☐	☐	☐
Egy profitorientált vállalat, amely az agyi implantátumok fejlesztéséért felelős	☐	☐	☐	☐	☐
Egy az agyi implantátumok fejlesztéséért felelős nonprofit szervezet	☐	☐	☐	☐	☐

9. Hallottál-e róla, hogy Elon Musk részt vesz agyi implantátumok fejlesztésében? Ha igen, akkor mennyire bíz meg benne?

- ☐ Erősen bizalmatlan
- ☐ Kissé bizalmatlan
- ☐ Semleges
- ☐ Valamelyest bíz
- ☐ Erősen bíz
- ☐ Nem hallottam róla
- ☐ Nem akarok válaszolni

III. BLOKK

10. Mi a nemed? *

- ☐ Nő
- ☐ Férfi
- ☐ Other

11. Melyik évben született? *

The value must be a number

12. Milyen településen élsz? *

- ☐ Falu
- ☐ Város
- ☐ Főváros

13. Milyen szakra jársz az egyetemen? (Tudományág) *

14. Speciális tanulási helyzetű tanuló vagy? *

- ☐ Nem, nincs semmilyen problémám.
- ☐ Igen, mentális egészségügyi problémáim vannak.
- ☐ Igen, fizikai egészségügyi problémáim vannak
- ☐ Nem válaszolok

15. Mennyire vagy vallásos egy 0-10-es skálán? *

0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

Egyáltalán nem

Teljes mértékben

16. Utolsó kérdésünk:

Menyire értesz egyet az alábbi állításokkal az új technológiák kapcsán? *

	Egyáltalán nem értek egyet	Nem értek egyet	Semleges	Egyetértek	Teljes mértékben egyetértek
Hiszem, hogy a technológiai fejlődés általában javulást eredményez az emberek életében.	☐	☐	☐	☐	☐
Hiszem, hogy a bőr alá a kézbe beültetett bankártya chip, megkönnyítené az emberek életét.	☐	☐	☐	☐	☐
A génmódosított élelmiszerek több előnyt hordoznak, mint veszélyt.	☐	☐	☐	☐	☐
Az atomerőművek több előnyt hordoznak, mint veszélyt.	☐	☐	☐	☐	☐
A mobiltelefonok több előnyt hordoznak, mint veszélyt.	☐	☐	☐	☐	☐
A mesterséges intelligencia több előnyt hordoz, mint veszélyt.	☐	☐	☐	☐	☐

A Kérdőív Vége

Köszönjük, hogy időt szántál a kérdőív kitöltésére! Az általad nyújtott válaszok rendkívül értékesek számunkra.

Szeretnénk megemlíteni, hogy egy kis meglepetéssel készültünk azok számára, akik részt vesznek a kérdőívünkben. Kisorsolunk két szerencsés nyertest, akik nyerhetnek 2 darab ajándék mozijegyet!

Ha szeretnél részt venni a nyereményjátékban, kérjük, add meg az email címed, hogy értesíthessünk, ha te leszel az egyik szerencsés nyertes.

Végül egy videó, ahol látható, hogy hogyan használják a kísérleti majmok a Neuralink-et.

<https://www.youtube.com/watch?v=Zcz-Hg1NP98>

Az E-mail címetek nem osztjuk meg harmadik felekkel és nem kerül feltüntetésre sehol!

Még egyszer köszönjük a részvételt és sok szerencsét kívánunk a nyereményjátékhoz!

17. E-mail cím

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