Article

Our Futures in Mind Uploading: Public Perceptions and Narratives

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Abstract: Advances in neurotechnology have immense potential but also pose significant ethical challenges. While the public is a key stakeholder, this audience is understudied. My research uses mind uploading as an exemplar for hypothetical future neurotechnology and contributes new data to an under researched field. To encourage participants to connect with mind uploading, I designed a novel data collection tool and method - a website that tells the stories of two fictional mind uploaded characters. My results showed that while awareness of mind uploading has remained relatively static over the last few years, favourability towards the concept has significantly increased, reflected in an increasing number of people who would upload if their physical body was dying and search for meaning in this new afterlife. However, while the public could identify several benefits for mind uploading, primarily a continued connection to loved ones, they were clearly concerned how neurotechnology, particularly that which would augment our existing capabilities, might develop. Public concerns reflected those of policymakers and scientists and confirmed the need for regulation to ensure neurotechnology is not discriminatory and does not create an even greater divide between the privileged and disadvantaged.

Keywords: Mind Uploading, Neurotechnology, Public Research, HCI, Ethics, Transhumanism; Neurorights

1. Introduction

The concept of Mind Uploading has been around since the 1950s and although the initial author is debated, many attribute it to Arthur C. Clarke's novel The City and the Stars (1955) where individual's minds are uploaded and stored in a computer at the end of their life and can then be downloaded to artificial bodies.

In the intervening years many books, films, and dramas have revisited the topic with mind uploading featured in TV programmes like Black Mirror (Jones & Brooker, 2011–present) and Years and Years (Cellan Jones & Shindler, 2019) as well as Netflix's Altered Carbon (Lenic, 2018-2020) and Amazon's Upload (Daniels & Klein, 2020–present). Today, science fiction or sci-fi is one of the most popular genres in literature (Harari, 2018).

Mind uploading can be conceptualised as the ultimate expression of neurotechnology, transforming the human brain and mind and allowing us to exist in a non-biological form. Current neurotechnology restores normal function to patients and offers vast potential for the treatment of disease and neurological or cognitive disorders. However, when coupled with Artificial Intelligence (AI), the implications go far beyond medical/clinical applications. A recent Financial Times article (Cookson, 2023) cites Mariagrazia Squicciarini, a UNESCO economist, describing the combination of neurotechnology and Artificial Intelligence (AI) as *"like putting neurotechnology on steroids,"* and it is feasible that in the future we will be able to augment or enhance human cognition beyond what is considered 'normal.' As a

recent UNESCO report stated, *"The developments that many thought were science fiction only a few years ago are here with us already"* (Hain et al., 2023, p.7).

Mind uploading has attracted considerable attention in both popular and academic/scientific media and in recent years there has been an explosion in the number of academic publications as well as articles for public consumption. A literature search on Google Scholar using 'mind uploading' as keywords revealed over 17,000 published works since 2019 alone. However, as the subsequent Literature Review (Section 2) demonstrates, public response to neurotechnology and mind uploading is understudied (Burwell et al., 2017; MacDuffie et al., 2022).

This lack of public research and engagement falls short of the principles of responsible research and innovation (RRI), which implies *"societal participation at the early stage of envisioning research questions, technologies, and futures"* (Sovacool et al., 2020). My research addresses this gap by exploring how the public feels about neurotechnology that may transform memory and mind and ultimately allow us to mind upload. Using a novel digital storytelling website – 'Afterlives' (see Section 3 Materials and Methods), I explored and unpacked several central themes such as personal identity, subjective experience, life extension vs. immortality, and the desire for embodiment or a physical form. I ascertained the perceived benefits of mind uploading as well as the public's fears and concerns. In the Discussion (Section 6) I weave these strands together to form a tapestry telling the story of mind uploading from the public's perspective.

2.   Literature Review

The key papers on the public response to both neurotechnology and mind uploading specifically can be summarised as follows

In an early study, Arras and Cerqui (2005) surveyed over 2,000 attendees to a robotics exhibit and evaluated the concept of participants having their mobile phone implanted directly into their brain. In 2005, this futuristic concept provoked a largely negative response although a greater proportion of participants aged under 18 years accepted the brain-to-phone fusion. Limitations included a non-representative sample biased towards better-educated, younger individuals and men with an interest in robotics. The effect of age on attitudes to conceptual neurotechnology has been briefly considered in my research and additional data will be collected in the next study in 2024.

More recently, a Pew Research Center poll (Funk et al., 2016) surveyed a nationally representative sample of Americans to establish public attitudes to computer chips implanted in the brains of healthy people that may help improve their concentration and ability to process information. This quantitative data was supplemented by six focus groups. Approximately two-thirds of people were worried about the impact of such brain implants and would not want them. Participants were particularly wary of such advancements being used to boost the capacities of healthy people to create 'superhumans' which is relevant for the theme of mind uploading.

Another study by Sattler and Pietralla (2022) also demonstrated that using neurotechnology to restore 'normal' function was more likely to be accepted than 'superior' functioning even if there is a potential bias towards internet users who may have more positive views towards technologies. As mentioned above, mind uploading is discussed in the context of brain enhancement rather than on restoring lost abilities to a 'normal' level. Neurotechnology that potentially augments human cognition beyond 'normal' occupies a different perceptual space and one relevant to mind uploading (Castelo et al., 2019; Erden & Brey; Funk et al., 2016).

The public's widespread fears of increased inequality between the 'haves'' and 'have nots' are not restricted to this audience. The implications are considered in current literature such as the ICO Neurotechnology report (Information Commissioner's Office, 2023), as well as concerns of hackers gaining access to the brain implants and being able to control or manipulate them (Funk et al., 2016; Sattler & Pietralla, 2022). My research explores these themes in detail.

Sample et al. (2020) and MacDuffie et al. (2022) both investigated public attitudes to ethical issues associated with neural devices such as brain-to-computer interfaces (BCIs). Both studies also used academic literature to identify ethical issues, and MacDuffie's research also included a sample of industry experts. Both Sample et al. (2020) and MacDuffie et al. (2022) found that the vast majority of both audiences *"endorsed the need for ethical principles/guidelines,"* (as cited by Pham et al., 2018). However, the public prioritized data privacy and consent more than industry and such differences of opinion between experts and the public are explored in my work.

There are just two published studies on mind uploading and both were quantitative with the first paper (Laakasuo et al., 2018), investigating cognitive factors which may influence how people react to the concept of mind uploading. Results included an indication that people who were anxious about death and condemned suicidal acts were more accepting of mind upload. The research also found that higher science fiction literacy and/or hobby-ism strongly predicted approval of mind uploading. I also explored associations with science fiction hobby-ism in an online study (2020) and replicated Laakasuo et al.'s (2018) result.

The second paper by the same research group (Laakasuo et al., 2021), investigated if there was a link between people's acceptance of mind uploading and personality traits, specifically the Dark Triad of Machiavellianism, Psychopathy, and Narcissism. Results revealed that Machiavellianism was associated with favourable views about mind uploading although additional research is required. Samples in the 2018 and 2021 studies were biased towards well-educated participants who were likely to be more curious and open-minded than the average population and focused on 'destructive' mind uploading where the brain is destroyed as a consequence. While I did not investigate the same factors, I too chose to use destructive mind uploading in my research because currently, this is the most likely scenario (Koene, 2013).

3. Materials and Methods

This paper reports attitudinal data to mind uploading which was collected via a storytelling website – 'Afterlives' which enabled participants to engage with the concept. I discuss how each of these three elements; the theme (mind uploading), the method (storytelling) and mechanism (website) were incorporated into the study. There is a large evidence base documenting the challenges of researching the future and more specifically future technologies such as mind uploading, for example in the domain of Human-Computer Interaction (HCI; Benbasat, 2010; Coulton et al., 2016; Gaver et al., 2022) so I drew upon this research to assess potential methods for the next stage. Of the potential tools and techniques, games and digital games specifically were highly relevant to mind uploading in that they transport the player into *"fantastic, hypothetical situations"* (Simeone et al., 2022, p.3). With sufficient immersion and engagement, the player can suspend disbelief and enter fully into the gaming experience. Being able to replicate this experience was important since my earlier research had revealed strong opposing reactions to the concept of mind uploading and a reluctance to consider alternative perspectives. I was also aware of the challenges of depicting the topic in a way that encouraged participants to think deeply about the implications of mind uploading. However, there was not a commercial mind uploading game that illuminated the key themes I had identified in prior research and provided a balanced perspective of dystopian and utopian scenarios. A bespoke game was outside scope, so I created a website that incorporated elements from existing high-end productions. While there is ample evidence for this engagement or immersion in games (Coulton et al., 2016; Simeone et al., 2022), there is limited data for this on a website so in addition to collecting novel attitudinal data on mind uploading, the study would also test the effectiveness of this method. Storytelling itself is well established and known to effectively convey complex stories and increase the engagement of both the storyteller and listener or narrator (Rieger et al., 2018). Storytelling methods

typically centre on individuals telling their own stories, but this was not an option since in 2023 no one had a story of their mind uploading.

Of the existing media, the most suitable options in terms of content were an Amazon Prime drama—Upload (Daniels & Klein, 2020–present) and the first-person Role-Playing Game (RPG) mentioned previously—Soma (Frictional Games, 2015. Although these differed in style and story, both dealt with key themes identified in my previous research and can be accessed online.

Upload is set in a futuristic world where the rich and powerful can buy a utopian digital immortality. Upload is billed as a comedy and there are many light-hearted moments. However, there is meaningful commentary on many of the darker themes of mind uploading such as privacy, accessibility, and socio-economic imbalance and as the series unfolds, more dystopian aspects emerge. The main character is Nathan, a software developer, aged 27 at the time of death from a punctured lung in a car accident. He is uploaded to Lakeview, by Horizon, a virtual world populated by uploads who exist as life-like avatars.

Soma's title is derived from the Greek σῶμα, which perceives the body as distinct from the mind or the soul. This indicated that the game developers had considered one key dualist argument against mind uploading: namely, that a mind (and soul) are not an emergent function of the (emulated) brain. Soma explores many relevant themes such as consciousness, identity, the self, free will, and subjective experience. The main character, Simon, initially has his brain scanned in 2015 when he was involved in a car crash and sustained severe brain damage. He was in his late twenties at the time. However, Simon starts his existence as an upload many years later (2104) and his afterlife spanned several worlds, including an underwater facility on Earth. This is the only place to have survived a meteor collision. In the video clips, we meet another character called Catherine, a computer scientist whose brain was scanned and uploaded into a computer. The only other remnant of humanity is brain scans of people stored in a digital black box called the ARK. Simon's mission in the game is to help Catherine recover the ARK and launch it into space thus ensuring humanity continues.

From the original materials, I identified scenes I could edit and weave together to tell Nathan and Simons' stories. The clips I selected focused on key themes from prior research such as copies/clones, immortality, subjective experience, embodiment, and humanity. For a balanced view, videos were approximately the same length for each character. I created minimal written narration to link the video clips and used a third-party narrator, as this is typically seen as less persuasive than the first-person perspective (Brunyé et al., 2009; Pourgiv et al., 2003). The website narrative was linear and controlled by me as the author. Using my design concepts and a questionnaire created in Qualtrics, an experienced web designer built the website entitled 'Afterlives.' I piloted it as did colleagues, the designer, and two friends to ensure the website was fully functional and that the participant experience was as seamless as possible. Once launched, the site was hosted by the website designer with access via a one-time link.

In summary, the website collected some preliminary data on awareness of and favourability towards mind uploading before introducing the topic via a neuroscientist. Thereafter, the story introduced the two main characters, depicted the process of their brains and minds being scanned and uploaded, and then showed aspects of their experiences as uploads in different worlds via embedded video clips from the two media. At relevant points in the story, I embedded questions some of which related to the key themes identified in prior research and others which collected contextual data.

Participants then completed a section which measured their engagement with the narrative. Following this, participants completed the final set of questions, which linked back to some key concepts of mind uploading and captured awareness and favourability ratings, post experience. I also asked how the website could be improved. On average, the website took 71 minutes to experience and funding meant that fieldwork was conducted

in two stages – one in February 2023 and the other from November 2023 to February 2024 inclusive (n= 128).

Figure 1. Afterlives Website.

Link to website preview

Ethics

Copyright law had to be considered since I was using media (Upload and Soma) created by another. I made use of the University of Nottingham's exceptions whereby you can copy a 'fair' proportion of a work without the prior permission of the copyright owner. These include fair dealing for non-commercial research and private study (Non-commercial; University of Nottingham Fair Dealing).

The 128 participants were recruited using the online platform Prolific and selected demographics as defined by Prolific. The sample comprised 52% men and 48% women as defined by the sex recorded on legal/official documents with an average age of 41 years. Ethnicity was self-defined as Asian (16%), Black (20%), Mixed (19%), White (27%) and Other (18%).

I adhered to the University of Nottingham's code of research conduct and research ethics throughout which encompass Informed Consent, Confidentiality and Anonymity and Personal and Sensitive Information. Ethical definitions are taken from The Belmont Report, Ethical Principles and Guidelines for the Protection of Human Research Subjects (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research (NCPHSBBR), 1978). The older definitions refer to 'subjects' rather than 'participants,' although the latter is typically used nowadays to reflect an individual's active involvement in the research (Chalmers, 1999). Ethical approval for the storytelling website was approved by the Faculty of Engineering Ethics Committee although specific ethics codes are not part of the process.

4. Results

Before reporting on the mind uploading data, I can confirm that this storytelling website met its objective of allowing participants to take on board the temporary reality of a far future world and reflect on the concepts being explored (Coulton et al., 2016). This is demonstrated by the data on elements of engagement with the story such as transportation, engagement, and character identification. Detailed results will be the subject of a separate paper focusing on the methodological contribution. The mind uploading data is discussed below.

4.1. Prior Awareness of Mind Uploading

Before meeting the main characters—Nathan from Upload and Simon from Soma—and experiencing their story through a series of video clips, respondents were asked how aware they were of the concept of mind uploading using a five-point scale where 1 was not at all aware and 5 was extremely aware. Just under a third (31%) claimed to be 'very' or 'extremely aware' of mind uploading. The chart below (Figure 2) shows the Top 2 box (scores of 4 plus scores of 5), the Bottom 2 box (scores of 1 plus scores of 2), and net awareness (Top 2 box minus the Bottom 2 box). The net agreement is the combined percentage of those scoring 4 and 5 (Top 2 Box) minus the combined percentage of those scoring 1 or 2 (Bottom 2 Box). I used this method of reporting as it visualises the data clearly based on the rationale that moderate scores—3 on this 5-point scale—fall into a zone of indifference (Oliver, 1977).
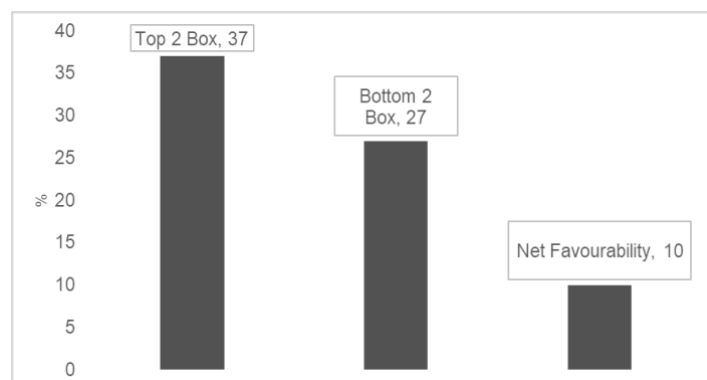
Figure 2. Prior Awareness of Mind Uploading.
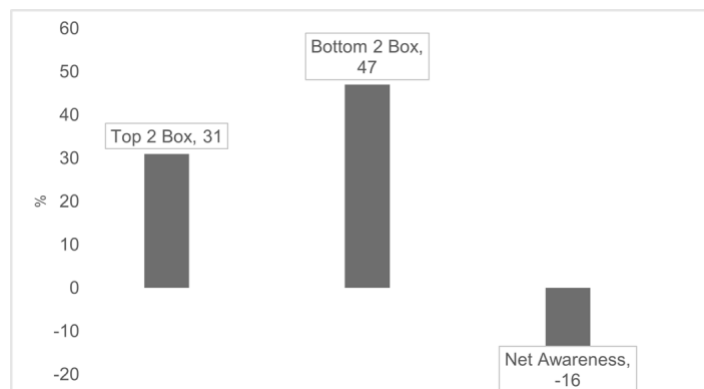
## 4.2. Prior Favourability towards Mind Uploading

Although awareness of mind uploading was limited, net favourability was marginally positive (Figure 3).

Figure 3. Prior Favourability towards Mind Uploading.

The next few questions considered potential scenarios where uploaded Simon is embodied in different forms such as a robot, which potentially changes what it means to be human. The website survey asked about using science and technology to expand our physical and mental capabilities even if this was not identified as transhumanist.

Figure 4. Belief in Using Science & Technology to Develop Both Physically and Mentally.
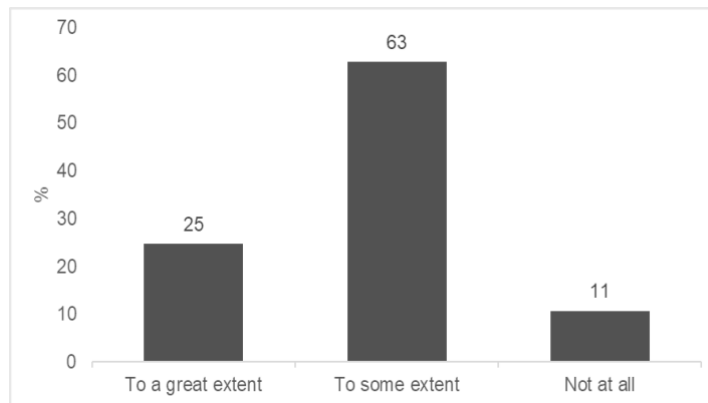
As shown in Figure 4 all but a small minority believed in using science and technology to develop. However, using science and technology to enable a robot body was less appealing (Figure 5). It may be that embodiment as a robot did not fit the panellist's perceptions of how science and technology could be used to extend their capabilities.

Figure 5. Willingness to exist in a Robot Body.
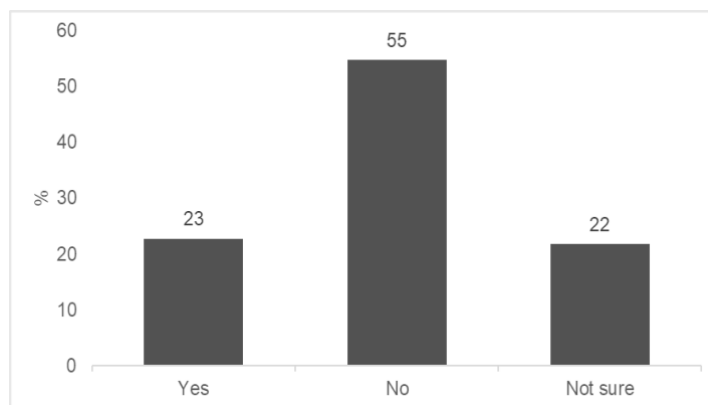
Subsequently, respondents were asked about their preference for a continued existence, either like Nathan as an avatar in a virtual world or as embodied/downloaded into a physical form like Simon (Figure 6).

Figure 6. Preference for Uploaded Form.
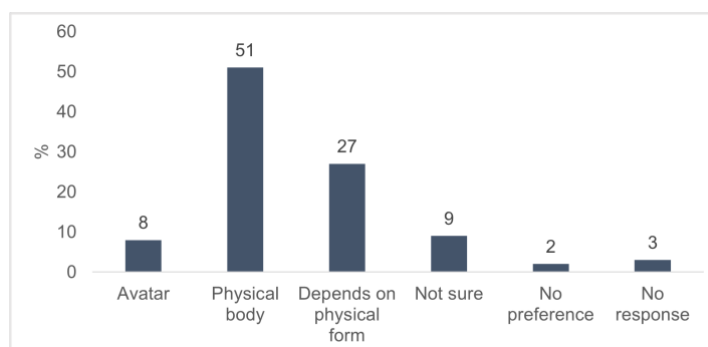
Existing as an avatar in a virtual world was the least appealing option even if virtual reality and virtual worlds are fast becoming familiar experiences. While just over half opted for a physical body, a substantial proportion stated it depended on the physical

form. The limited appeal of spending an afterlife as an avatar reinforces the importance we ascribe to being embodied and comments made throughout the research indicated some discomfort with the concept of living in a virtual, simulated environment and hence disconnecting from the real world. However, it is likely that responses were based on each participant's own frame of reference such as any experiences as an avatar in current VR worlds such as Second Life. Further research could ascertain if the reluctance to exist as an avatar would differ if future VR worlds convincingly replicated the feelings and sensations of living in a physical world.

Taken together the responses to existing in various forms are intriguing and indicate areas for further research. Participants supported the concept of using science and technology to develop but how this was realised in a mind uploading scenario was important. Most participants wanted to be downloaded or embodied and the type of physical form mattered. A robot body didn't meet most people's needs, so this warrants further investigation in subsequent studies which could potentially explore acceptable options such as 'organic' and 'hybrid' forms.

4.3. Uniqueness and Survival

The website showed an upload surviving as an original and a copy. However, as shown in Figure 7, while most would want to hold onto their originality, a substantial minority (28%), would also accept surviving as a copy.

Figure 7. Willingness to Exist as a Copy vs. an Original.
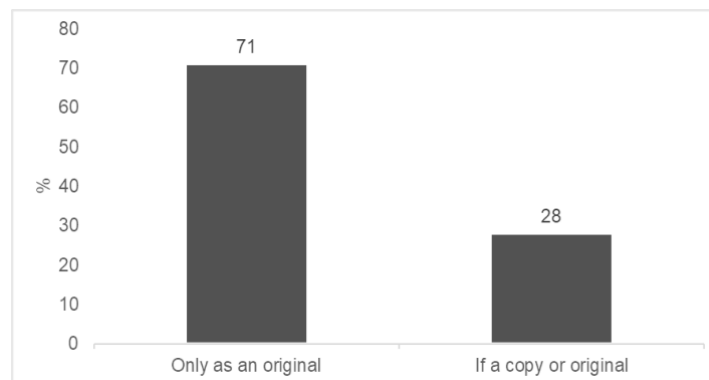
4.4. Subjective Experience

The issue of being an original and other aspects of subjective experience were explored further in subsequent questions, including how concerned respondents were that they would not truly be themselves. In this context subjective experience or the 'feelings' of consciousness, reflect current discussions exploring what it would mean if an artificial system or intelligence became conscious (Key et al., 2022). As shown in Figure 8, the majority had noticeable concerns.

Figure 8. Extent Concerned "Not Truly You".
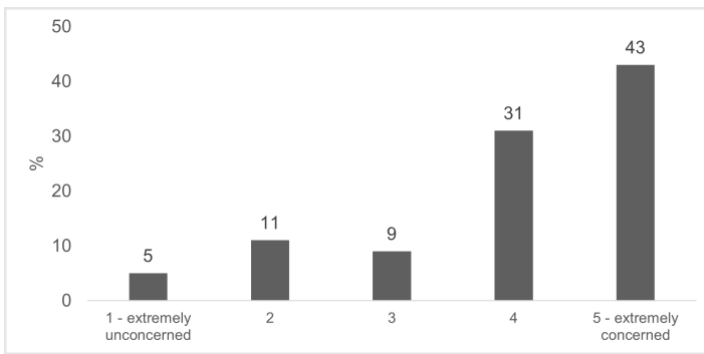
I used a projective technique where respondents had to complete the sentence, *"If I was an upload, I would feel ..."*

Such techniques yield a wider range of responses compared to direct questions and provide a better understanding of thoughts and feelings (Doherty & Nelson, 2010; Donoghue, 2000; Kujala et al., 2013). From my prior work, I knew emotional and sometimes unconscious attitudes are important when discussing mind uploading. Responses were predominantly negative although a minority could envisage some benefits. The following word clouds (Figure 9 and Figure 10) and verbatims illustrate some of the positive feelings and reactions:

Figure 9. "If I was an upload, I would feel ..." Positive Associations.

Amazed and strange at the same time because it is a whole new experience to me.

Curious about a brand (brave) new world.

Intrigued. Would I experience things the same way when I was still human?

Figure 10. "If I was an upload, I would feel ..." Negative Associations.

A bit anxious and excited at the same time.

Ethereal and disembodied until I got used to the transition, then I would be able to explore the experience, push boundaries and rationalise the abilities to build on the experience.

It would feel strange, adventurous, and rather unsettling.

I think it would feel strange, a completely different world, I would have to learn a lot of things all over again. My consciousness would also be a little disturbed.

I will feel disconnected much like Simon.

Incomplete, I would not feel like myself.

Lost and empty, without meaning and reason to live.

4.5. Subjective Experience.

In one of the clips from Soma, Simon is asked a series of structured questions about his subjective experience as an upload, and I replicated three of these questions and the pre-coded answers on the website. While these do not necessarily conform to accepted survey design principles, particularly in terms of the wording of response, they are intuitively understandable. The questions posed interesting and relevant questions about an uploaded life, such as what it means to be human, continuation of self, and whether a continued existence as a version of you would have meaning.

The three questions and response options are shown in Figure 11, 12 and 13.

Figure 11. I would be troubled by the fact that I am no longer strictly human.

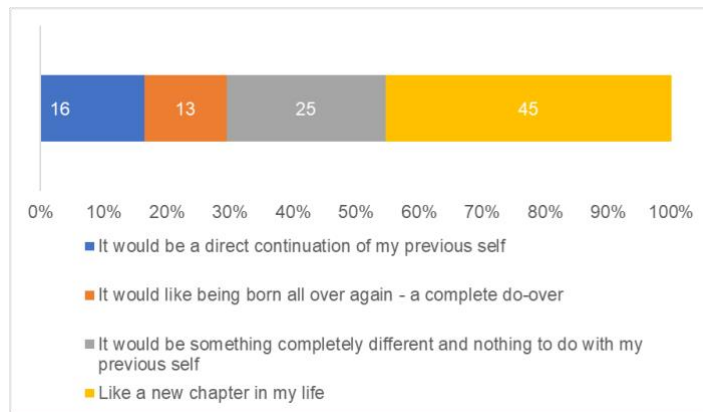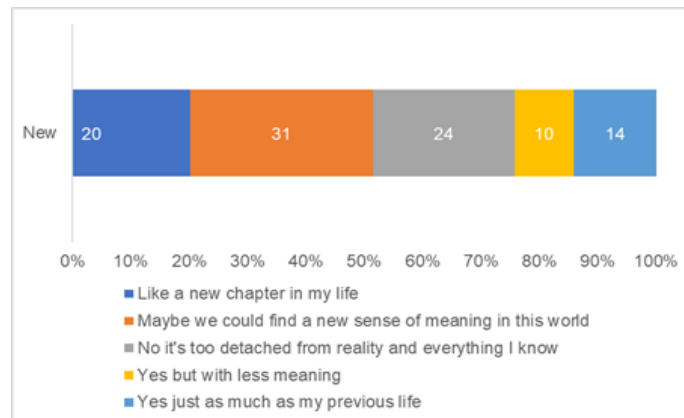Figure 12. How would you perceive your new existence.

Figure 13. Do you think this new existence would be a life worth living?

Simon's responses in the game differed from those of the participants. Simon claimed he was not troubled by the fact he was no longer strictly human. He perceived his new existence as a direct continuation of his previous self and that his new existence would be a life worth living as much as his previous life.

In contrast, most participants were troubled about no longer being strictly human and most often felt that they had lost themselves. How participants perceived their new existence varied; although, most saw it as a new chapter in their life. Unlike Simon, only a minority of participants regarded the new existence as a direct continuation of their previous self. However, the majority felt this new existence would be worth living and most reiterated it would be a new chapter.

Overall participants seemed most allied to the concept of psychological branching identity (Brueckner, 2005; Cerullo, 2015; Graziano, 2019; Walker, 2011), whereby at the point of branching (e.g., on upload the original and the copy would be the same: both "you"). This concept is considered further in the Discussion (Section 6).

Following this section, participants were asked the following open-ended question, *"What would make a new existence as an upload worth living for you"?* The wording was chosen since I did not want to be prescriptive by defining what would make this new existence worth living.

Participant's spontaneous replies were varied but some themes emerged from the analysis. By far the most prevalent was still feeling connected to others—especially loved ones—and continuing to experience feelings and emotions.

Having real-life quality relationships, and emotions. Having true to life familiar people around me, as avatars.)

Just living a normal life and being able to be near my loved ones.

Having loved ones around me, still having problems to solve—could be abstract like math, some research, art.

Having my loved ones around me.

Thereafter, life as an upload would be worth living for new possibilities and experiences and one or two relished the prospect of no boundaries or limits.

More possibilities than my previous life.

I think that learning or doing things that I didn't dare to do in my previous life would make it worth it. Also having the possibility to talk and engage with people that I didn't get to spend much time with.

To experience things that I did not dare before.

However as reported elsewhere, several felt that they would need a purpose or a cause to make existence worthwhile.

A purpose in the world I found myself in.

Maybe if we could help towards a cause?

4.6. Immortality vs. Life ExtensionR

Respondents were asked about the appeal of living forever/immortality vs. life extension: The latter was defined as *"a fixed term of extra life which you decide."* I chose this definition to indicate that participants could control the span. However, I acknowledge that the term 'life extension' could have conveyed an assumption that immortality as an upload constitutes life which could be debated.

A defined extension was more appealing than living forever and most (41%) chose this option. Just under a quarter did not choose either.
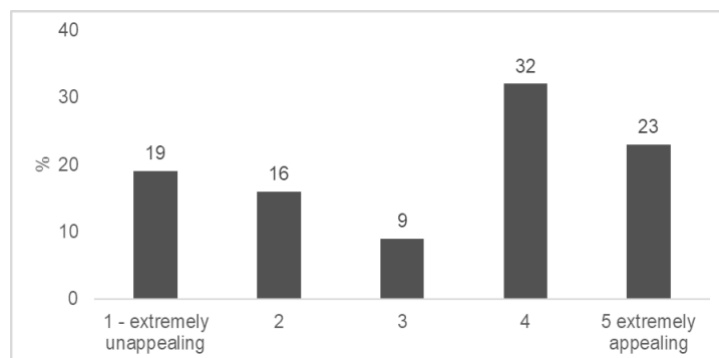
Figure 14. Appeal of Immortality.
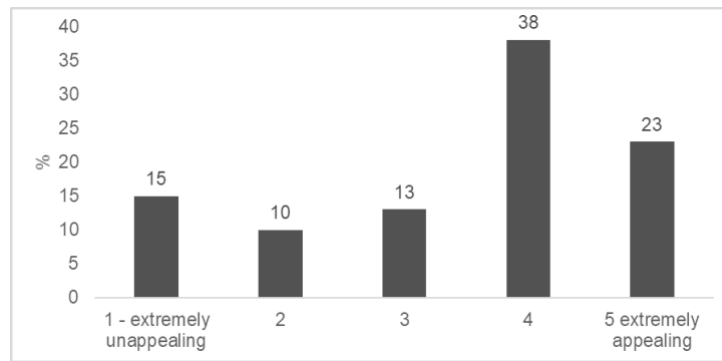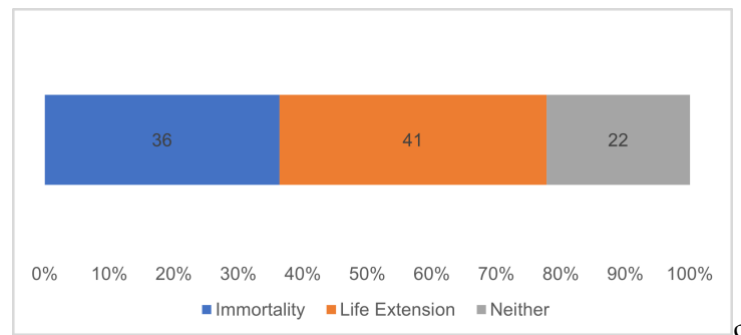

Figure 15. Appeal of Extension.

Figure 16. Extension vs. Immortality.

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Several respondents opted for extension to ensure they would have time to say their goodbyes to loved ones and/or to allow them more time to experience life and pursue their goals and dreams. An extension gave them control and certainty by allowing them to choose when they died – a *"planned death"*. The following verbatims illustrate these views.

> *Life extension as an option can minimise the grief of a sudden, unexpected loss, too early under circumstances, as a sort of second chance on Earth.)*

> *I get to decide whether I want to continue living or not.*

> *Immortality seems too lonely and boring. On the other hand, if you die too early life extension could help you achieve what you didn't have enough time to do while you were alive.*

> *Life extension is the best option, living forever could be kinda boring.*

> *To finish my purpose and say goodbye to people who are dear to me.*

However, the rest chose life extension as the 'safer' option due to concerns and fears about immortality. These included:
- The unknown, the uncertainty
- Experiencing too much
- A very different world, an "out of body" experience
- Living in a world that they don't like or a desolate planet
- Ending up lonely, alone/last of humanity
- Becoming "bored" or "exhausted" or "tired" of living
- Losing their purpose
- Serving a "life sentence" with no option to die

- The "magic," "precious gift" of life becomes meaningless

After living for a very, very, long time you could simply get tired of living. With immortality you would have no choice but to live. This could be worse than dying.

Immortality seems too lonely and boring.

Living forever brings me more fear than not living forever, uncertainty is something scary.

Living forever/immortality could be very unpleasant if I do not like the world I'm uploaded into.

I don't think I could understand and accept the idea of immortality as a whole. I think that knowing that I will die helps me give purpose to my life and get the most out of life. I think that if I were to live forever at some point I would be bored, or exhausted.

Immortality sounds like serving a 'life sentence' indefinitely, removing some of the excitement or magic of the precious gift that life is.

However, over a third, opted for immortality and had two main reasons for doing so. First was a fear of death and a wish to avoid it for themselves and loved ones so that they could continue these relationships. Second was a love of life and the wish to carry on discovering and experiencing the world and to have the time to accomplish all their goals. A few were also curious how the world and humanity might change. Individuals stipulated that immortality needed to be without pain and suffering both mental and physical. The following verbatims highlight these views.

Because life is beautiful and there are many ideas and things to be discovered in the future.

I am fearful of death, the idea of living as long as I'd like to is very appealing, but only if I also had to choose to end my life if I wished to.

I am scared of death and want to go through experiences for a very long time. I don't want life to be short.

Living forever is most appealing to me because I have a fear of dying, I want to live forever and experience what life is evolving to.

However, around a quarter of participants did not want an extension or immortality. For some, both options went against their religious beliefs, and others stated that death is a natural part of life, and they accepted that. As one said *"I feel comfortable with the cycle of life. There is a charm in becoming compost."* A few also believed that we already became immortal via a spiritual afterlife. The following comments expand on these thoughts.

I am religious, so I feel like God has a plan for my life and I am only supposed to live a certain amount of time.

I do not find the idea of living forever appealing because I feel that as humans, we should not try to be God. We were created to die one day so we should all come to terms with that and not try to find ways to live forever.

Life has its value because it ends, and you have to enjoy it while you can.

Death is a part of life. You live and you die, that's it. Immortality doesn't exist in the natural world. Even the universe dies in the end.

Possibly without knowing it, respondents touched on some of the philosophical discussions around immortality. Buben (2022) summarises Sartre's writings such as his play No Exit (1989) where three recently deceased people arrive and interact with each other in an afterlife. For many, this is a prime example of Sartre's comment that *"Hell is other people"* and hell seems to be through the judgment that others make on the way you have lived your life and your weaknesses.

Buben (2022) adds his examples of other *"hellish"* ways to spend immortality such as *"in solitary confinement, in excruciating physical agony, floating aimlessly through empty space, or even in a state of boredom."* While respondents did not seem to consider hell as other people, in fact for many that was the reason for a continued existence, they certainly considered loneliness, boredom, a lack of purpose or meaning, and the uncertainty of living forever.

4.7. Key Positive and Negative Attributes of Mind Uploading

Drawing on prior research and published literature as well as popular culture, I identified 13 positive attributes for mind uploading. This list was based on my understanding of the field supported by current science and technology and, as such, may not be exhaustive. I asked respondents to rank the three most appealing attributes in order from one to three, where one was the highest. First place was allocated three points per vote, second two points, and third one point. I used colour coding to highlight the top three choices.

Analysis of these ranked responses showed that being there for loved ones after death was the most important attribute followed by increased happiness and well-being and no physical pain.

The full list of attributes, their points, and placings are shown below in Table 2. First place was allocated three points per vote, second two points, and third one point. Colour coding is used to highlight the top three choices.

Table 1. Most Appealing Attributes of Mind Uploading.

Attribute	Number of Points	Placing
New perspectives and experiences	62	5
Continuing to learn and develop	75	4
Being there for loved ones after death	165	1
No physical limitations	59	=6
No physical pain	81	3
May allow humanity to survive	48	8
Preserving brilliant minds	59	=6

Being able to control emotions/feelings	15	11
Increased happiness and well-being	98	2
Being able to enhance cognitive abilities	32	9
Backing up memory so that nothing is lost or forgotten	32	=9
Instant communication with other uploads	11	13
Less consumption/impact on the planet	13	12

Using the same approach, I also identified thirteen negative attributes for mind uploading and asked respondents to rank the three most worrying from one to three. The biggest concern was mental abuse/torture, followed by the fear that life would lose its meaning. Equal third was the risk of hacking/lack of privacy and just being a copy or a clone.

The full list of attributes, their points, and placings are shown in Table 4.10. First place was again allocated three points per vote, second two points, and third one point.

Table 2. Most Worrying Attributes of Mind Uploading.

Attribute	Number of Points	Placing
Against religion/spiritual beliefs	64	=4
Against natural laws	57	5
Just a copy or clone	66	=3
Mental abuse/torture	95	1
Hacking/lack of privacy	66	=3
Ownership of my mind	64	=4
Corrupt/evil minds preserved	38	8
Life should be finite	30	11
No physical body	36	9
Unequitable access e.g., only rich and powerful	49	6
Life would lose its meaning	71	2
Impact on humanity as a species	32	10
We need sensory input and output	9	13
Hardware failure e.g., servers storing our data/minds	40	7

While participants in the 2020 online study were less favourable to mind uploading overall, some of the comments recorded on the website expressed the same thoughts, such as the desire to be there for loved ones after death and an interest in being able to continue to exist and evolve.

Some of the same concerns were also re-iterated, such as the risk of abuse and exploitation and violation of their privacy. Similarly, some felt mind uploading violated

natural laws or religious/spiritual beliefs. The continuity and convergence of these themes across multiple sources indicates credibility via triangulation of both data and method (Johnson et al., 2020).

4.8. Willingness to Mind Upload when Physical Body is Dying

In the online survey in 2020 (n=82), while just over a quarter would upload, almost twice as many would not. The website audience was more favourable, with 38% willing to upload.

However, as in the pilot, a sizeable proportion were unsure which probably reflects the lack of knowledge and exposure to future technology.

Figure 17. Willingness to Mind Upload.
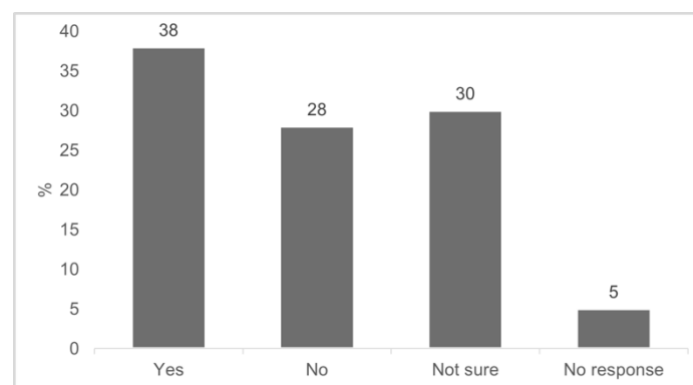
The finding that most did not reject mind uploading outright may reflect our *"pervasive struggle for existence and survival (self-preservation instinct)"* (Nishanth & Jha, 2022), as well as our search for meaning (Steger et al., 2008).

4.9. Pre-Experience Exposure to Media

Toward the end of the questionnaire, I asked if respondents had ever seen the drama Upload or played the game Soma. The vast majority had not experienced it either. Only five (4%) had played Soma although three others might have. Exposure to Upload was slightly higher although only thirteen (10 %) had definitely watched the show and another three may have.

5. Limitations

This research was constrained by funding which resulted in a relatively small sample size for a predominantly quantitative study (n= 128). Limited funding also meant that a control group -which would have isolated the effect of the storytelling component – was not included. The use of video clips to tell the mind uploading stories of two fictional characters may have encouraged engagement but biased participant's responses for example by their level of identification with Simon and Nathan and the situations depicted. The lack of a control group potentially compromises the internal validity of the study and replicating and/or extending the study would give greater confidence in the results.

However, the website data triangulated via different participants with three prior studies, a semi-structured online study (n=82) and two qualitative studies. The continuity and convergence of these themes across multiple sources indicates credibility via triangulation of both data and method (Johnson et al., 2020).

Overall, the design and flow of the website were favourably received although the embedded video clips were small rather than full screen. This did not limit response but

has been addressed ahead of future research. The rationale for using a storytelling website as a method is discussed in Materials & Methods, Section 3). Scores for aspects of narrative engagement together with participant's own spontaneous comments demonstrate the effectiveness of his method in engaging participants with hypothetical far future technology. However, this benefit is offset by the potential priming effects of using video clips to show different scenarios which may have resulted in response bias.

Furthermore, the video clips depicting mind uploading covered several of the key themes but were not exhaustive and do not represent all potential scenarios although given that mind uploading is a far future concept its scope is unknown. There were noticeable differences in both the type of media: drama (Upload) vs. a game (Soma) and the perspective (observer (Upload) vs first person role play (Soma). However, the two media I chose were the "best fit" for the main topics of mind uploading. Although participants identified with both main characters, they were young, white males, so lacking in diversity. This could be addressed in future work by allowing participants to contribute to and/or individualise the characters.

The mind uploading questions were comprehensive but I acknowledge that there is some ambiguity – for example in the immortality question which allowed participants to form their own interpretation. This is offset to some extent by the inclusion of open-ended questions which provided insight into some of the responses. There may have also been issues in comprehension for those respondents for whom English is a second language. Having said this, the quantity and quality of verbatim comments indicate that this was not a substantive limitation.

Drawing on prior research and published literature as well as popular culture, I identified a selection of positive and negative attributes for mind uploading. I acknowledge that this list may not be exhaustive, but an analysis of other comments at the end of the website did not indicate any substantive missing areas.

I was cognizant of the participant burden associated with a lengthy questionnaire (be that online, face to face or telephone) and pre-tests had indicated the duration was approximately 71 minutes. However, this did not seem to be an issue since only a few partially completed the survey and several specifically requested a longer, more detailed narrative. While I acknowledge that the study lacked built in attention checks, the quantity and quality of the verbatim responses together with the scores for narrative engagement indicate that participant's focus was sustained. However, while the survey was comprehensive it measured a single point in time namely on exposure to the stories. Future work could re-contact participants and – with their permission – re-administer certain key questions such as attitudes to mind uploading to see if these persisted.

I was unable to obtain commentary from the designers of Soma on their rationale for including the questions on Simon's subjective experience. I was hoping to better understand why they had asked these questions and how they had decided on the response options. In the absence of this, my analysis of the three questions lacks context and deeper understanding.

My research has consistently indicated that participant's religious and/or spiritual beliefs can influence their attitudes to mind uploading. However, other cultural factors such ethnicity/race, social class and education may also be influential and were not investigated in detail.

The participants were predominantly recruited via Prolific. Prolific's database has considerable geographic reach, is well-populated, and offers many demographic filters. However, those who participated reflect the self-selection bias inherent in all research and may also demonstrate rapid response bias.

6. Discussion

My research was designed to address the fact that the public are an understudied audience – yet surely a key stakeholder – in neurotechnology that may transform memory and mind and ultimately allow us to mind upload. This research makes a threefold

contribution to existing knowledge; the first of which is a novel data collection method in the form of a story telling website. The data collected demonstrates the effectiveness of this approach in engaging non experts with far future concepts and neurotechnology such as mind uploading. Secondly it adds a non-expert perspective to some of the popular debates around key considerations for mind uploading such as embodiment, immortality, theology, personal identity and subjective experience. Thirdly the research provides new data on the public response to future neurotechnology such as mind uploading and as such can inform expert discussions around policy and governance. In this section, I will focus on the contribution of mind uploading data rather than of the effectiveness of the method.

While mind uploading is often associated with transhumanism (Laakasuo et al; 2021), I chose not to present it in this way to avoid any preconceptions that participants may have had. I did, however, ascertain the extent to which participants accepted the use of science and technology to develop themselves mentally and/or physically. The majority were happy to do so in theory but there were limits. For example, most would want to be embodied rather than existing as an avatar in a virtual world, although the nature of the physical form would be influential. This desire for embodiment not only indicates the participant's desire for sensory and physical interaction but also reflects the prevalent view of experts that a brain and mind exist by experiencing the world around it.

Those working towards emulated or uploaded humans tend to consider robotic or virtual personas/avatars as options (Linssen & Lemmens, 2016; McKeown & Lawrence, 2021). However, my research suggests that people would prefer a physical form rather than a virtual one, and given that embodiment in a robot is unappealing, hybrid and organic options should be considered.

Mind uploading carries with it the potential to extend life and potentially achieve immortality. While immortality looks out of reach for now the idea of life extension is not as farfetched as it might sound, with some experts believing "we may be at the threshold of a new ageing paradigm, one that replaces the generally accepted limits of human life" (Masci, 2013). For participants in this study the uncertainty around an uploaded life made it both exciting and frightening and when given a choice between an extension and immortality, an extension was preferred. This option offered more control and certainty and allowed them to delay death but without the fear that life everlasting would be intolerable.

However, to reiterate Laakasuo et al. (2018) - who cited Geraci, 2010 and Hughes, 2007 - "mind upload technology has obvious theological implications" and, for some, mind uploading in any context was morally and ethically repugnant. One potential reason for this is that mind uploading challenges the norms of life and death (Maciel & Pereira, 2013) and can be antagonistic to those with strongly held spiritual and religious beliefs. Some felt that mind uploading was in opposition to their belief that God had a plan for their life which included time of death. Others felt that those pursuing mind uploading were trying to be Gods rather than humans which went against the laws of creation. Future research could explore this in more detail and how the concept of a digital afterlife may change how we perceive, define, and relate to religion (Steinhart, 2014).

There is an opportunity to expand upon this and the other benefits that mind uploading may offer humanity, such as knowledge retention and a more 'ethical' society. More ethical meant different things to different people but examples included a more peaceful world and preserving knowledge so that future (mind uploaded) generations could be saved from making the same mistakes. This would also contribute to existing data which showed that many Americans feared the impact of people living much longer due to the impact on society and resources. Participants also shared the view that such advances would only be available to the wealthy (Pew Research Center, 2013).

Mind uploading has been the subject of often heated debate about the big questions of consciousness and personal identity. The latter has been variously defined but I am referring to personal identity as "those properties I take to define me as a person or make

me the person I am" (Olsen, 2023, section 8). While my research was not designed to explore these thorny philosophical issues in depth it generated some interesting results about participant's willingness to survive as an "original" upload or a "copy" and the implications for their personal identity. Let's start with public reaction to their continued existence either as the original self or a copy of themselves. While the majority would only want to survive as 'an original' over a quarter of participants would also accept surviving as a copy. To place this into context, the video clip shown at this point in the questionnaire reveals that Simon feels he is just a copy that has been left behind while 'original' Simon survives to be sent into space in the ARK. In the video Simon says the copies are 'not us' which raises the distinction between the personal identity of the original and a copy. The question about being willing to survive as an original or a copy follow this video clip and another showing the questions Simon answers on subjective experience. Unlike Simon, only a minority of participants regarded the new existence as a direct continuation of their previous self. The other response options shown in the video of being 'born over' or as completely different to the previous life seem to distinguish between being the same or a different person. (The other response of seeing an upload as a new chapter in your life is somewhat ambiguous). Hence, I believe that both the stimulus material and questions raise the issue of whether an original and a copy share the same identity so at some level participants did consider this.

When considering personal identity, but I am using a philosophical analysis by Chalmers (2010), which cites three main theories of personal identity: biological, psychological, and closest continuer. According to Cerullo (2015), who reviews these theories in the context of mind uploading, these can be summarised as follows:

- Biological theory - the continuity of the physical brain is essential for identity and the continuity of consciousness.
- Psychological theory - psychological continuity is required to reserve identity.
- Closest continuer theory - consciousness will continue in whatever entity is most identical to the original.

Cerullo (2015) and others such as Brueckner (2005), Walker (2011), and Graziano (2019) expand upon the psychological theory and consider psychological branching identity as a means of allowing identity to continue in multiple selves. In mind uploading this would take the form of the 'original' biological entity and immediately after 'scan and copy' (the most likely route to whole brain emulation), the simulated or copy. In his 2019 article, Graziano stated that the point of branching, then the original and the copy would be the same (both "you"). However, thereafter, different experiences would cause the copy or copies to diverge from the original you.

Participants may not have been aware of these theoretical distinctions of personal identity but it is interesting to consider the way they perceived their new existence as an upload.

Participants tended to feel that they would still be able to find meaning 'living' as an upload even if that meaning might differ from their previous life. This may reflect our drive to find meaning in our existence and more specifically the meaning of our life (or afterlife) at a given moment Frankl (1985).

While we may be many years away from finding out the full implications of far future neurotechnology such as mind uploading, existing neurotechnology that restores function such as the groundbreaking brain-computer interface (BCI) that allowed a paralyzed woman to communicate through a digital avatar. This advancement marks the first-ever synthesis of speech or facial expressions directly from brain signals. The system can convert these signals to text at an impressive rate of nearly 80 words per minute, significantly surpassing existing technologies. The study "reading the brain" presents a significant leap toward restoring comprehensive communication for paralyzed individuals (Metzger et al., 2023).

As a result, organisations such as The Neurorights Foundation are working to safeguard the future of our neural data in five key areas namely mental privacy, personal

identity, free will, fair access and protection from bias. While these themes were not presented to study participants, several were represented in their responses. Although their priorities sometimes differed, public concerns reflected those of policymakers and scientists including protecting private and personal neural data and keeping it private, and secure. Taking a more global view participants were aware that access to new developments may not be fair and equitable and may create an even greater divide between the privileged and disadvantaged.

Such reservations have been apparent since my early research in 2020 but while awareness of mind uploading has remained relatively static over the last few years, favourability towards the concept has significantly increased, reflected in an increasing number of people who would upload if their physical body was dying and search for meaning in this new afterlife. The reasons for this are unknown but it may demonstrate an increased acceptance of the role technology plays in our lives and potentially our afterlives.

6.1. Subsection

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