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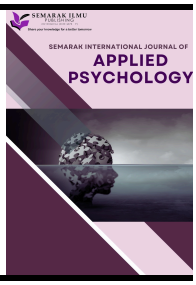

A Moderated Mediation Model of the Intention to use Neural Implants: The Influence of Free Will and Fatalistic Determinism

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ABSTRACT

In the ever-growing exploration of using neural implants beyond therapeutic contexts, researchers are turning their focus to the intriguing connection between the pursuit of perfection and the desire to embrace these technologies. Applying self-discrepancy theory, this study integrates the mediating influence of dissatisfaction with imperfection, while introducing free will and fatalistic determinism as enthralling moderators. Engaging 402 digitally native higher education students from Austria, Spain, Netherlands, and Portugal, the results illuminate a positive link between the quest for perfection and the inclination to adopt neural implants, with dissatisfaction with imperfection acting as a pivotal mediator. Moreover, the findings unveil nuances in the mediation effect based on one's belief in free will and fatalistic determinism, highlighting a more pronounced association for those with a robust belief in free will compared to their counterparts with a diminished belief in fatalistic determinism. These outcomes not only enrich the literature on psychological predictors but also provide insights into the intricate motivations and mechanisms shaping individuals' readiness to embrace neural implants. The implications extend to those championing the concept of a human-machine hybrid and to those voicing concerns about the trajectory of neural implant technologies.

1. Introduction

The invention of the neural implant is an evolutionary leap that encourages the possibility for individuals to enjoy an enhanced capacity of memory to access and process any forms of information fast, to control machines remotely by using their thoughts, and to be eternally connected to the internet [1,2]. Neural implants are categorized into two types, namely therapeutic and capacity-enhancing. Therapeutic implant involves correcting disabilities or treating diseases, while capacity-enhancing implant refers to the increase in a human body's capability [3,4].In general, the use of neural implants for therapeutic purposes has received a favorable acceptance from the public [4,5]. On the other hand, the use of neural implants for capacity enhancement is often regarded as controversial because it has relinquished ethical, physical, and psychological concerns to the future

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for non-therapeutic purposes could become mainstream because people seek to boost their cognitive abilities as much as technology permits [11]. For example, the Opinium Research survey conducted in 16 countries found that 63% of 14,50 people are willing to consider augmenting their bodies with technology to emulate their physical abilities [12].

The growing popularity of technologies for self-enhancement purposes has recently gained the attention of various scholars to investigate further the cognitive, affective, normative, and ethical predictors guiding the intention to use neural implants [2-5,13]. Yet, research on the psychological predictors of the intent to use neural implant is still limited. The present study incorporates perfectionism discrepancy to explain the intention to use neural implants for non-therapeutic purposes. Based on Higgin's [14] self-discrepancy theory, individuals will experience a discrepancy from perfection when their ideal and actual self is experienced as a mismatch. Often the discrepancy between one's actual performance and superior standards is problematic if it is associated with a disclosure experience where individuals who feared being viewed as imperfect have suppressed their emotions [15]. Thus the intention to use neural implants would be higher in individuals who want to close the gap between their actual performance and their recognized personal standards. Furthermore, when individuals undergo perfectionism discrepancy (whereby they cannot fulfill their expectations), they experience some dissatisfaction with being imperfect [14,16]. For example, Wade and Tiggemann [17] found that a Body Mass Index (BMI) discrepancy is often associated with body dissatisfaction and concern over mistakes. Other researchers like Kim and Damhorst [18] have discovered that self-discrepancy is linked to body dissatisfaction which is then related to worries about the overall appearance. Thus, individuals facing discrepancy may feel dissatisfaction, and this experience may motivate their intention to rely on neural implants to fulfil their expectations and overcome dissatisfaction.

Although there might be an association between dissatisfaction with being imperfect and the intent to use neural implants, the strength of the relationship between the two feelings could be different depending on personal factors. As a result, two possible moderators, namely free will and fatalistic determinism, were suggested to moderate the direct effect of dissatisfaction with being imperfect on the intent to use neural implants. The intensity of belief in free will and fatalistic determinism varies across individuals [19,20]. Free-will believers believe that individuals have total control over their actions and behaviors [20,21]. In contrast, fatalistic determinism individuals believe that their future is determined by fate and that individuals do not have total control over their lives [20]. Individuals with free will think more for themselves instead of conforming to others and pursue a strong desire for self-control [22,23]. Such individuals enjoy making choices and feel capable of decision-making [19,22] because they believe that there are various possibilities for them to choose from. As a result, it can be predicted that the free will belief would strengthen the positive relationship between dissatisfaction with being imperfect and the intention to use neural implants. On the other hand, fatalism determinism could weaken the positive relationship between dissatisfaction with being imperfect and the intention to use neural implants. This is because individuals with high fatalism determinism limit their choices as they believe everything in life is predetermined. Such individuals are also less open to experiences and new events [20,24]. Individuals high in fatalism determinism are generally concerned about technology usage as they believe it is beyond their control [25-27]. Subsequently, these individuals may not use neural implants even though they experience dissatisfaction with their lives.

Thus, using self-discrepancy theory, the current study is aimed to examine (1) the significant relationship between discrepancy from perfection and the intent to use a neural implant, (2) the mediation effect of dissatisfaction with being imperfect on this relationship, (3) the possible moderating role of free will and fatalistic determinism in the relationship between dissatisfaction

with being imperfect and the intent to use neural implants and (4) the moderation effect of free will and fatalistic determinism in the relationship between discrepancy from perfection and the intent to use a neural implant mediated through dissatisfaction with being imperfect.

2. Theoretical Review and Research Hypotheses

2.1 Discrepancy from Perfection and Intent to Use Neural Implants

Discrepancy is "the central and defining negative aspect of perfectionism" and is defined as "the difference between the standards one has for oneself and one's actual performance" [28]. Discrepancy in this study is conceptualized using the self-discrepancy theory by Higgins [14]. According to Higgins [14], the self-discrepancy theory includes individuals with different types of self, the actual self that includes the attributes one possesses, and the ideal self that consists of the qualities that one perceives as ideal. The actual self is typically understood as "self-concept," while the ideal self is understood as "self-guides" or "self-directive standards" [29]. The self-discrepancy theory posits that beliefs about the attributes that an individual possesses (self-concept) can either be compatible with the attributes set as standards (self-guides) or incompatible [29]. While some individuals are motivated to reach a condition where their self-concept matches their self-guides, others have no motivation to meet the self-guide expectations [14,29]. As such, discrepancy from perfection occurs when individuals perceive their performance as discrepant from the high standards or attributes they set as ideal for themselves [30].

Individuals, who perceive their performance as discrepant, engage in various behaviors in response to the standards they set [31-33]. For example, higher levels of perceived actual-ideal self-concept discrepancy were associated with undergoing cosmetic procedures to reach the socially defined standards of the ideal appearance [34]. Similarly, the relationship between photo manipulation on social media (i.e., editing photos before sharing), positive attitude, and intention to undertake cosmetic procedures were stronger in young Australian women with a high score on appearance-based self-discrepancy [35]. Accordingly, Vartanian's [36] research demonstrated that upward social comparison instils self-directed negative feelings, leading individuals to do plastic surgery to diminish or remove the self-discrepancy they suffer because they are dissatisfied with their physical appearance. Other researchers have found that negative feelings also generate behavioral and cognitive eating disorders [37]. Studies have also found that discrepancy from comparing the current self against the perceived ideal self and other's expectations has increased the individual's self-presentation desire. This desire has motivated individuals to buy digital items such as avatar clothing, wallpaper, theme, characters, and game equipment to enhance their self-esteem and self-gratification [38]. Such studies suggest that the discrepancy from perfection can prompt individuals to make decisions that will help them diminish or eliminate the disparity between their actual and desired attributes. These individuals will indulge in procedures or actions that will help them gain the qualities they want.

Similarly, there exists limited evidence on the influence of discrepancy between perceived intelligence and ideal intelligence by individuals. Research has indicated that discrepancy between where one actually is and where one would like to be in intelligence encourages individuals to seek a "brain training program". Such programmes have proven to reduce the discrepancy that individuals face and boost their intelligence [39]. Similarly, subjects who were confident about their intelligence selected an object associated with intelligence (like a fountain pen) over an object unrelated to intelligence (like a candy) [40].

Thus, building on the self-discrepancy theory and the empirical results reviewed above, the current study postulates that individuals with higher perfection discrepancies are more likely to be

agreeable with neural implants. Neural implants guarantee a performance well matched with the self-directive standards, thus minimising or removing the gap between the actual performance and the ideal performance they desire to have. Hence, based on past studies and literature, the following hypothesis is developed (see Fig 1):

H1: Discrepancy from perfection positively correlates with the intent to use neural implants

2.2 The Mediating Effect of Dissatisfaction with being Imperfect

According to the self-discrepancy theory, the positive relationship between discrepancy from perfection and intention to use neural implants has the potential to be expanded to an indirect relationship when using dissatisfaction from being imperfect as a mediator to explain the underlying mechanism of the relationship. The present study hopes to advance the existing literature on this relationship by intending to examine the indirect association between discrepancy from perfection and the intent to use neural implants through dissatisfaction from being imperfect. Dissatisfaction is "a strong affective, evaluative component interpreted as a negative emotional reaction to imperfection" [41]. According to Higgins [29], the root of dissatisfaction is the gap between individuals' actual attributes and the ideal attributes they consider (self-directive standards or self-guide). The deeper the discrepancy, the more dissatisfied the individuals will be.

Hamachek [42] asserted that dissatisfaction is a central component of neurotic perfectionism. Neurotic perfectionists cannot derive pleasure and satisfaction from their performance because anything less than perfection is interpreted as a failure [42]. Flett *et al.*, [41] confirms that if the perfectionists fall short of expectations, they are bound to experience dissatisfaction. Empirical evidence also corroborates that dissatisfaction is a part of the perfectionism construct, and a strong relationship exists between dissatisfaction and discrepancy from perfection [43]. Thus, individuals who feel imperfect tend to engage in excessive cognitive contemplation and unfavorable social comparisons and therefore experience adverse effects on their well-being [44]. Above and beyond the perceived progress in performance, the influence of performance-goal discrepancies also appeared to predict performance satisfaction and goal revision [45]. Self-critical perfectionism was also linked to dissatisfaction with academic performance [46].

Discrepancy from perfection and resulting dissatisfaction have been well-documented in the expanding literature. For example, young Japanese adults who experienced a wide discrepancy between self and ideal body (physical self-ideal discrepancy) were found to have lower levels of body satisfaction [47]. Likewise, those Instagram users who perceived their appearance as discrepant from their ideal ones reported less satisfaction with their bodies [48]. Individuals with an eating disorder perceived their current weight as abnormal from their ideal body weight and demonstrated negative feelings about their bodies [49]. Johnson and Snell [50] found that discrepancy between an individual's self-perceived and ideal intelligence is positively associated with more significant depression. Similarly, self-discrepancies in self-confidence were found as a strong predictor of performance and cognitive anxiety [51]. As a result, those who scored high on discrepancy from perfection reported having decreased self-esteem [52]. They were also significantly more at risk for suicide [53].

The extensive literature has also provided evidence on the influence of dissatisfaction on psychological and behavioral outcomes. Dissatisfaction with academic performance appeared to be the primary concern for suicidal thoughts [54,55]. Research showed that the more dissatisfied the individuals were with their performance, the more inferior they rated their performance compared to their confederate [56], and they were likely to be more depressed [57]. Dissatisfaction with

performance appraisal was found to increase work-life conflict and job stress and decrease life satisfaction [58,59].

Individuals' personal goals are influenced by their perceived self-efficacy and self-satisfaction [60]. Those unhappy about themselves and dissatisfied with their accomplishments on the job showed the tendency to evaluate themselves negatively and experience the burnout syndrome [61,62]. Studies have also shown that selfie-editing is positively associated with facial dissatisfaction, leading to cosmetic surgery consideration [63]. Overall, these results testify that dissatisfaction with being imperfect can host further disappointed and lead to behaviors that reduce negative feelings.

In conclusion, grounded on the self-discrepancy theory and the literature reviewed above, a performance may create dejected feelings, including dissatisfaction, which can encourage individuals to think of a way to free themselves from such undesirable feelings. As such, the current study proposes that discrepancy from perfection could influence dissatisfaction, which could be associated with the intent to use a neural implant. The following hypothesis is developed (see Fig 1):

H2: Dissatisfaction with being imperfect mediates the positive relationship between discrepancy from perfection and the intent to use neural implants.

2.3 The Moderating Effect of Free Will and Fatalistic Determinism

Although dissatisfaction would be positively associated with the intent to use neural implants, not all dissatisfied individuals may be equally inclined to neural implants. Therefore, it is essential to examine moderators that may intensify or weaken the relationship between dissatisfaction with being imperfect and the intent to use neural implants. The present study examines the moderating effect of free will and fatalistic determinism on the direct impact of dissatisfaction and the intent to use neural implants and the indirect result of discrepancy from perfection and the intent to use neural implants.

Individuals have a life scheme that gives them a purpose in life. A life scheme refers "to a cognitive representation of life which organizes perspectives about the world and oneself, goals one wishes to attain, and events that are relevant to those goals" [64]. Free will and fatalistic determinism have been conceptualized as life schemes providing frameworks to make sense of oneself, life, and the world [65]. Free will refers to the belief that individuals have causal control over their decisions, actions, and the occurrence of events and consequences [19,66]. This contradicts fatalistic determinism, believing that "the future has already been determined by fate and one's actions have no effect on what happens" [67].

Free will believers believe that no event in the world is fixed and the outcome of anything is probabilistic [68]. Individuals with free will are more likely to resist external forces [22]. This supports earlier research that free will believers have a higher internal locus of control, allowing them to deliberately choose their actions [67,22]. Research showed that free will is positively associated with self-control and desire for self-control where individuals can regulate their thoughts, actions, and decisions [19,22]. Based on free will, freedom and choice are also regarded as two realities in human experiences [65,22]. With free options, believers in free will emphasize their responsibility and consciousness [19]. Stillman *et al*., [69] demonstrated that belief in free will was positively correlated with conscientiousness and openness to experience. Free will can also be positively associated with extraversion, suggesting that those who are more socially confident also believe more strongly in their autonomy [22].

People differ in their belief in free will [19,20,71], Individuals characterize free will as a free action, including striving for long-run goals and achieving goals, making decisions based on deliberation and

conscious thoughts, and overcoming obstacles [69]. Higher levels of free will beliefs can be associated with meaningfulness [71] and less perceived helplessness [22]. Increased belief in free will reduces conformity in individuals, thus empowering them to make the efforts required for autonomous action and to resist temptations and pressures to conform [72]. On the other hand, reduced free will beliefs contribute to passive inaction (less readiness potential) [73]. Belief in free will has an association with individual responsibility. Free will believers are more likely to blame people with obesity and mental health issues because they believe that the health conditions are in individuals' control and adverse health conditions result from a lack of responsibility [74]. Similarly, individuals' belief in free will was positively correlated with victim-blaming, the tendency to make victims responsible for their bad luck [75]. These results signify that belief in free will can promote thinking of multiple possibilities and taking responsibility for one's actions, and hence it promotes consideration of alternative and potentially more desirable actions [21].

Individuals high on belief in free will are expected to be more agreeable to neural implants. Past research showed that free will believers are more willing to exert self-control [76] and seek opportunities to enhance their self-control [22]. With a neural implant, not only would human free will be preserved [78], but the sense of self as an agent, autonomy and free will would be enhanced and restored [78,79]. Free will believers are also open to experience [69]. Openness characterizes independent thinking, a willingness to examine unfamiliar ideas, and an inclination to try new things [80]. These characteristics are relatable to those who tend to use neural implants. Free will is associated with self-efficacy, which can indicate individuals' tendency to recognize the ability to produce change in one's own life events [22]. A neural implant can be a source of change in free will believers' life through which they can improve their internal locus of control because they characterise free will with having capacities such as the ability to make decisions and act as they want without constraints [81]. Given this, free will would strengthen the positive relationship between dissatisfaction with being imperfect and the intention to use neural implants. Therefore, the following hypothesis is proposed (see Fig 1):

H3: Free will moderates the positive relationship between dissatisfaction from being imperfect and the intent to use neural implants.

Furthermore, the indirect effect of discrepancy from perfection on the intent to use neural implants through dissatisfaction could be more substantial in those who score high on free will. The introduction of free will into the mediated model (where dissatisfaction with being imperfect links with discrepancy from perfection and the intent to use neural implants) might explain why some individuals have a higher tendency to use neural implants. Discrepancy from perfection could drive individuals to be dissatisfied with themselves [18,48,49], and such an unpleasant feeling may predispose them to use neural implants. This mechanism would more likely be seen in those who score high on free will because free will is tied to a broad sense of wanting to exert control over one's life and believing that one can [19,22,67,70]. To test this, the following hypothesis is developed (see Fig 1):

H4: Free will moderates the positive relationship between discrepancy from perfection and intent to use neural implants mediated by dissatisfaction with being imperfect such that those who score high on free will are more likely to use neural implants.

However, unlike free will attributes, the central claim of fatalistic determinism is the rejection of ultimate control. Individuals with fatalistic determinism believe that none of their actions are agent-

caused because they lack ultimate control over their actions. In other words, actions do not have any causes derived from minds and thoughts [82]. Fatalistic determinism appeared to be positively associated with external forces (i.e., chance and power) while negatively with internal parties [22]. Fatalistic determinism was also positively linked with neuroticism [22,66,84] and negatively related to openness to experience [24]. Individuals with fatalistic determinism are characterized by a helpless worldview where they believe the future has already been determined and our actions have no effect on our future [84].

Fatalistic determinism appeared to be a barrier to a wide variety of behaviors. High fatalistic determinism was found to curb cancer prevention behaviors (such as regular exercise, avoidance of smoking, sunscreen use, and cancer screening) [86-88], health literacy and cancer information seeking [89,90]. Individuals who believed in fatalism also showed reluctance to comply with preventive behaviors against COVID-19 [90]. Research showed that fatalistic determinism could increase the risk of developing depression and can reduce individuals' resilience and self-control [92-94]. In addition, fatalistic determinism was found to cause resistance to technological innovations. The diffusion of innovations theory states that earlier adopters of technologies are less fatalistic than later adopters [94]. An individual is more likely to adopt an innovation if they believe that they are in control, rather than thinking that the future is determined by fate. Studies have shown that individuals who believe in traditionalism and fatalism are less likely to use innovative solar panels [27] and e-government services [25]. Fatalistic determinism also limits the pursuit and adoption of transhumanist technologies, substantially lengthening innate human capacity. Fatalists expressed that technological changes are beyond human control and raised their concerns about the negative impacts of transhuman technologies on the integrity of human nature [26]. Cyborg technologies at the forefront of causing changes to human capability are seen as attacking the core of human identity [13] because they entail a remarkable body transformation [95], not in line with the belief of fatalistic determinism.

Drawing on the above literature, the present study posits that fatalistic determinism would weaken the positive relationship between discrepancy from perfection and the intention to use neural implants. Fatalism delineates that humans have no power to affect their futures, actions, and choices [65]. Therefore, they accept whatever happens as having been bound to or decreed to happen and that their life's path is a matter of fate rather than personal choice [83]. Such an attitude of mind may constitute a barrier to accepting neural implants and act as an insurrection against dissatisfaction with being imperfect. Individuals dissatisfied with performance may prompt them to make choices such as using memory implants to reduce their sad fee Individuals dissatisfied with performance may prompt themselves to make choices such as using neural implants to reduce their sad feelings. However, those who have a helpless worldview may not seek opportunities for change as they come to believe that they are unable to change the situation [85]. Therefore, fatalistic determinism overpowers the role of dissatisfaction in predicting the acceptance of neural implants.

Moreover, fatalists are not open to experience [24], while dissatisfaction with being imperfect arising from discrepancy from perfection may direct individuals to experience new preferences to combat their lack of satisfaction. Therefore, it can be hypothesized that a high level of fatalistic determinism negatively influences the positive relationship between dissatisfaction and the intention to use neural implants. Based on this assumption, the following hypothesis is proposed (see Fig 1):

H5: Fatalistic determinism moderates the positive relationship between dissatisfaction with being imperfect and the intent to use neural implants.

From the literature reviewed above, we would postulate that fatalistic determinism could moderate the relationship between dissatisfaction and the intent to use neural implants. A fatalistic outlook on life can impact one's perception of a human-machine hybrid [26]. This philosophy could compel an individual to look to neural implants as a technology that may affect their integrity while believing that human fate is predetermined. Integrating fatalism into the mediation model hypothesized above introduces a moderated mediation model. Thus, the indirect relationship between discrepancy from perfection and the intention to use neural implants, mediated by dissatisfaction, would be weaker for those with high levels of fatalistic determinism. To test this, the following hypothesis is developed (see Fig 1):

H6: Fatalistic determinism moderates the positive relationship between discrepancy from perfection and the intent to use neural implants mediated by dissatisfaction with being imperfect such that those who score high on fatalistic determinism are less likely to adopt neural implants.

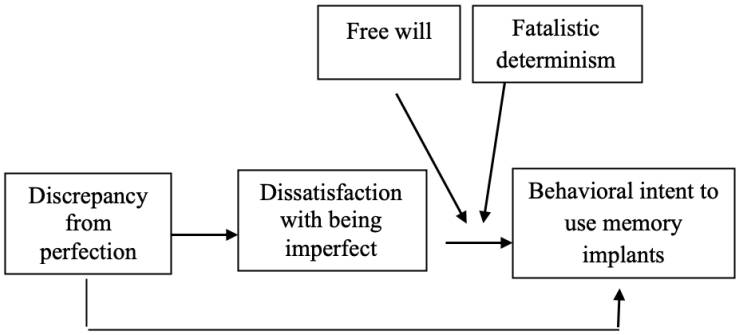

Fig. 1. Research framework

3. Method

3.1. Participants

The sample for the current study comprised of 197 males (49%) and 205 females (51%), with a mean age of 23.14 (SD=2.63), of which 101 were from Austria, 100 from Spain, 100 from the Netherlands, and 101 from Portugal. In terms of academic performance, nearly half of the participants (50.2%) reported feeling neutral, while 25.1% said they were satisfied and 18.2% expressed dissatisfaction. Around 6.5% of the participants were very dissatisfied with their academic performance. Regarding intelligence, slightly more than one-third of the participants (34.8%) perceived their intelligence as medium, followed by 30.8% and 25.9 % who reported having excellent and poor intelligence, respectively. Furthermore, 8.5 percent of the participants perceived their intelligence as poor. In terms of academic fields, 48.7% of the participants were enrolled in formal and applied sciences, followed by 30.8% from humanities and social sciences, and 20.6% from natural sciences. Table 1 shows the demographic profile of participants.

3.2. Research Design and Data Collection Procedure

The present study used a cross-sectional survey to collect the required data. The Ethics Committee of Xiamen University Malaysia approved the study protocol to ensure compliance with ethical principles (No: REC-2104.01). Following past studies [13,96] about the intention to use neural implants, we selected a heterogeneous sample of digital natives from four countries i.e., Austria,

Spain, Netherland and Portugal as the locale for data collection in order to avoid cultural biases as much as possible. The direct link to the online survey was posted on various social media platforms. The first section of the study included an informed consent form where participants were provided with information on the research purpose and ethical principles such as the anonymity of the survey, the confidentiality of the responses, and voluntary participation. Following past research, participants were also provided with an explanation of neural implants due to their novelty: "A memory or neural implant is a technological device implanted in a healthy person's brain. It is not for medical or health-related purposes but to increase memory capacity. A pilot test conducted by Wake Forest University and the University of Southern California has demonstrated the effectiveness of memory implant" [2]. The next section of the survey inquired about participants' demographic profiles, and the following areas solicited information about dependent and independent variables. Participants were required to answer all questions to ensure the absence of missing data. Data collection took two months, from October 15th to December 14th, 2021.

3.3. Measurements

3.3.1. Discrepancy from perfection and dissatisfaction

Flett *et al*., [41] conducted a psychometric analysis of the 12-item unidimensional APS-R Discrepancy subscale of the Almost Perfect Scale-Revised (APS-R) developed by Slaney *et al*., [28]. The results of the psychometric analyses distinguished a pure five-item discrepancy factor and a second four-item factor measuring dissatisfaction with being imperfect. The five-item factor was recommended as a brief measure of discrepancy from perfection (sample items, "My best just never seems to be good enough for me", "I rarely live up to my high standards," and "I am seldom able to meet my own high standards for performance") and the four-item factor is recommended as a measure of dissatisfaction with being imperfect (sample items, "I am never satisfied with my accomplishments," "I am not satisfied even when I know I have done my best," and "I hardly ever feel that what I've done is good enough"). All nine items were rated on the five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Flett *et al*., [41] demonstrated that both discrepancies from perfection and dissatisfaction have an excellent internal consistency (α for discrepancy from perfection = 0.88 and for dissatisfaction = 0.84). In the present study, the value of Cronbach's Alpha for discrepancy from perfection was 0.80 and for dissatisfaction was 0.79.

3.3.2. Free will and fatalistic determinism

Paulhus and Carey [67] developed the Free Will and Determinism Plus scale (FAD Plus) comprising four subscales, i.e., Free Will, Fatalistic Determinism, Scientific Determinism, and Unpredictability. For the present study, we used the Free Will subscale with seven items (e.g., "People have complete control over the decisions they make," "People can overcome any obstacles if they truly want to." and "People must take full responsibility for any bad choices they make") and the Fatalistic Determinism scale with five items (e.g., "I believe that the future has already been determined by fate," "No matter how hard you try, you can't change your destiny" and "Fate already has a plan for everyone." All items were rated on the five-point Likert scale from 5= strongly agree to 1= strongly disagree. Cronbach's Alpha for the subscales of the Free Will and the Fatalistic Determinism in the present study were 0.86 and 0.75, respectively, which were comparable to those in the original scale (α for the Free Will scale = 0.69 and for the Fatalistic Determinism = 0.82) [67].

3.3.4. Intent to use neural implants

To measure willingness to use neural implants, we used two adapted items used by Reinares-Lara *et al*., [2]. The two items included "I intend to use the memory implant" and "I predict that I will use the memory implant." Items were rated on the five-point Likert scale from 5= strongly agree to 1= strongly disagree. The internal consistency for the scale reported in Reinares-Lara *et al*.'s [2] study was 0.93. In the present study, the value of Cronbach's Alpha for the scale was 0.72.

3.4. Assessment of Standard Method Biases

Considering the common bias caused by measurement methods, we used procedural and statistical remedies to remove standard method variance (CMV) in designing our survey. For procedural remedies, we ensured that (1) questions on the predictor and criterion constructs were asked in no particular order, (2) our respondents were assured of their anonymity and confidentiality of their responses, and (3) they were also given an explanation that there is no correct or incorrect response to the items and encouraged to provide their honest responses [97]. For statistical remedies, Harman's single-factor test was conducted to assess common method bias [98]. The factor analysis results showed that the eigenvalues of 23 factors were more significant than 1.0. The total variance explained by one factor was 37.73%, which was less than 50%, indicating the absence of common method bias.

3.5. Data Analysis

We first analyzed descriptive statistics (frequency, percentage, mean, standard deviation, Skewness, and Kurtosis) and correlation coefficient in the present study to determine the relationships between all study variables using IBM SPSS Statistics version 26. Second, the mediation model was tested using Model 4 of the PROCESS macro [99] in SPSS. Third, the PROCESS macro in SPSS was used to test the moderated mediation model (Model 14). The moderation analysis was conducted separately for each moderating variable. A bootstrapping of 5000 resamplings was performed with a confidence interval of 95%.

4. Result

4.1. Descriptive Statistics and Correlation

The descriptive statistics and correlation matrix are presented in Table 1. Normality of the study variables was also examined, and all Skewness and Kurtosis values were within an acceptable range [100, 101]. There was a significant positive relationship between discrepancy from perfection and the intent to use neural implants ($r = .58$, $p < .001$), supporting Hypothesis 1. While dissatisfaction with being imperfect ($r = .52$, $p < .001$) and free will ($r = .74$, $p < .001$) showed a significant and positive relationship with the intent to use neural implants, fatalistic determinism was significantly and negatively associated with the intent to use neural implants ($r = -.73$, $p < .001$) as shown in Table 1.

4.2. Mediation Model Testing

Hypothesis 2 proposed that dissatisfaction with being imperfect mediates the relationship between discrepancy from perfection and the intention to use neural implants. Table 2 displays the mediation model test results. The total effect of discrepancy from perfection on the intent to use

neural implants was found significant, B = .28, t = 23.60, p < .001. Discrepancy from perfection had a significant direct effect on dissatisfaction, B = .66, t = 42.60, < .001 and dissatisfaction had a significant direct effect on the intent to use neural implants, B = .10, t = 4.47, p < .001. The direct effect of discrepancy from perfection on the intent to use neural implants was significant, B = .21, t = 11.13, p < .001. The indirect effect of discrepancy from perfection on the intent to use neural implants via dissatisfaction was found significant, indirect effect = .07, SE = .01, 95% CI [.04, .10]. This finding supported Hypothesis 2, in which dissatisfaction with being imperfect significantly mediated the positive relationship between discrepancy from perfection and the intent to use neural implants.

Table 1
Correlations between all study variables

	1	2	3	4	M (SD)	Skewness	Kurtosis	VIF	Tolerance
1) DP	1				14.83 (4.07)	0.05	-1.03	2.83	.35
2) DS	.78***	1			11.87 (3.41)	0.10	-1.09	2.74	.37
3) FW	.52***	.51***	1		22.45 (5.47)	0.13	-1.21	2.48	.40
4) FD	-.51***	-.49***	-.75***	1	15.32 (3.80)	-0.16	-1.30	2.42	.41
5) IUNI	.58***	.52***	.74***	-.73***	6.22 (1.96)	0.13	-1.04		

Note. N= 402, DP = Discrepancy from perfection; DS = Dissatisfaction; FW = Free will; FD = Fatalistic determinism; IUNI = Intent to use neural implant. ****p* < .001.

Table 2
Testing the mediating effect of dissatisfaction

Outcome	Predictors	R^2	F value (*df1, df2*)	*B*	*SE*	*t*	*p*	LLCI	ULCI
IUNI (Total model)		.33	557.14*** (*1,1108*)						
	DP			.28	.01	23.60	< .001	.26	.30
DS (Partial model)		.62	1815.09*** (*1, 1108*)						
	DP			.66	.02	42.60	< .001	.63	.69
IUNI (Partial model)		.35	293.35*** (*2, 1107*)						
	DP			.21	.02	11.13	< .001	.17	.25
	DS			.10	.02	4.47	< .001	.06	.15

Note. Bootstrap sample size = 5,000. DP = Discrepancy from perfection; DS = Dissatisfaction; IUNI: Intent to use neural implant; CI = Confidence interval; LL = Lower limit; UL = Upper limit. ***p < .001.

4.3. Moderated Mediation Model Testing

Hypotheses H3 and H4 were analysed using the moderated mediation model (Model 14) in PROCESS macro. Table 3 shows that discrepancy from perfection had a significant direct effect on dissatisfaction, B = .66, t = 42.60, p < .001, and the intent to use neural implants, B = .12, t = 7.59, p < .001. The direct effect of dissatisfaction on the intent to use neural implants was also significant, B =

-.14, t = -2.59, p = .010. The association between dissatisfaction and the intent to use neural implants was significantly moderated by free will, which supported Hypothesis H3, B = .007, t = 3.09, p = .002. Based on the conditional effects, the association between dissatisfaction and the intent to use neural implants was found significant for high free will but not significant for participants with moderate and low free will. Participants with high free will, B = .06, SE = .02, 95% CI [.02, .11] are more likely to use neural implants when their dissatisfaction with being imperfect is high (see Table 4 and Figure 2).

Table 3
The moderated mediating effect of discrepancy from perfection on the intent to use neural implant

Predictors	On DS			On IUNI		
	B	*t*	*p*	*B*	*t*	*p*
DP	.66	42.60	< .001	.12	7.59	< .001
DS				-.14	-2.59	.010
DS x FW				.007	3.09	.002

Note. DP = Discrepancy from perfection; DS = Dissatisfaction; FW = Free will; IUNI: Intent to use neural implant

Table 4
Conditional effects of discrepancy from perfection on the intent to use neural implant by free will

					95% *CI*	
FW	Effect	*SE*	*t*	*p*	LL	UL
Low	-.02	.02	-1.00	.317	-.07	.02
Moderate	.01	.02	0.68	.496	-.02	.05
High	.06	.02	2.64	.008	.02	.11

Note. FW = Free will; *CI* = Confidence interval; LL = Lower limit; *UL* = Upper limit

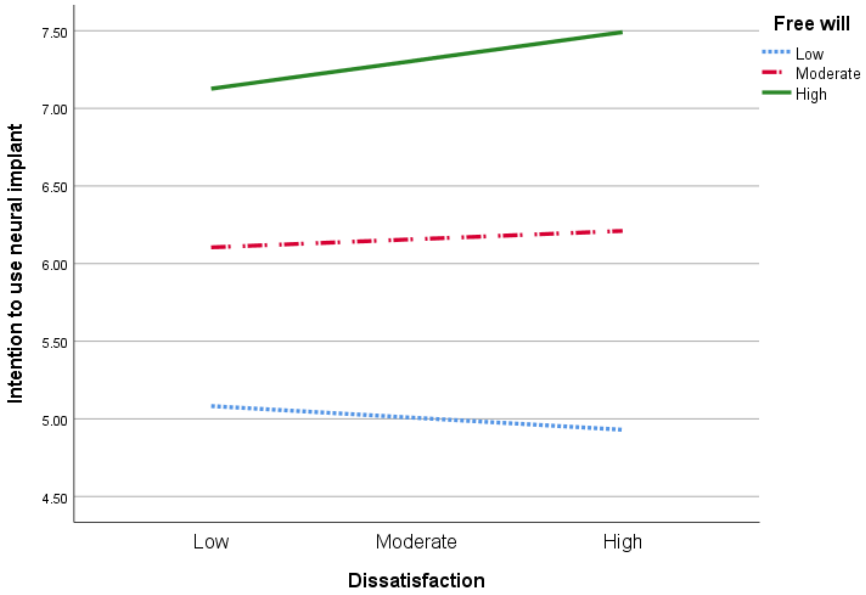

Fig. 2. Interaction effect between dissatisfaction and free will on the intent to use neural implant

Hypothesis H4 was supported with a significant moderated mediation effect at B = .005, SE = .002, 95% CI [.001, .008]. This result indicated that free will significantly moderate the indirect discrepancy from perfection to the intention to use neural implants by intensifying the mediating effect of dissatisfaction on the intention to use neural implants. The indirect effect of discrepancy from

perfection on the intention to use neural implants via dissatisfaction was significant for participants with high free will, B = .04, SE = .02, 95% CI [.01, .07]. However, the indirect effect of discrepancy from perfection on the intention to use neural implants via dissatisfaction with being imperfect was not significant for participants with moderate free will, B = .01, SE = .01, 95% CI [-.02, .03], and low free will, B = -.02, SE = .02, 95% CI [-.04, .02].

Table 5 shows that discrepancy from perfection had a significant direct effect on dissatisfaction, B = .66, t = 42.60, p < .001, and the intent to use neural implants, B = .12, t = 7.67, p < .001. The direct effect of dissatisfaction on the intent to use neural implants was also significant, B = .15, t = 2.81, p = .005. The association between dissatisfaction and the intent to use neural implants was significantly moderated by fatalistic determinism, which supported Hypothesis H5, B = -.008, t = - 2.52, p = .012. Based on the conditional effects, the association between dissatisfaction and the intent to use neural implants was significant for low fatalistic determinism but not significant for participants with moderate and high fatalistic determinism. Participants with low fatalistic determinism, B = .06, SE = .02, 95% CI [.01, .10] are more likely to use neural implants when their dissatisfaction with being imperfect is high (see Table 6 and Figure 3).

Table 5
The moderated mediating effect of discrepancy from perfection on the intent to use neural implant

Predictors	On DS			On IUNI		
	B	*t*	*p*	*B*	*t*	*p*
DP	.66	42.60	< .001	.12	7.67	< .001
DS				.15	2.81	.005
DS x FD				-.008	-2.52	.012

Note. DP = Discrepancy from perfection; DS = Dissatisfaction; FD = Fatalistic determinism; IUNI: Intent to use neural implant

Table 6
Conditional effects of discrepancy from perfection on the intent to use neural implant by fatalistic determinism

					95% *CI*	
FD	Effect	*SE*	*t*	*p*	LL	UL
Low	.06	.02	2.53	.012	.01	.10
Moderate	.02	.02	0.95	.345	-.02	.05
High	-.02	.02	-0.62	.537	-.06	.03

Note. FD = Fatalistic determinism; *CI* = Confidence interval; LL = Lower limit; UL = Upper limit

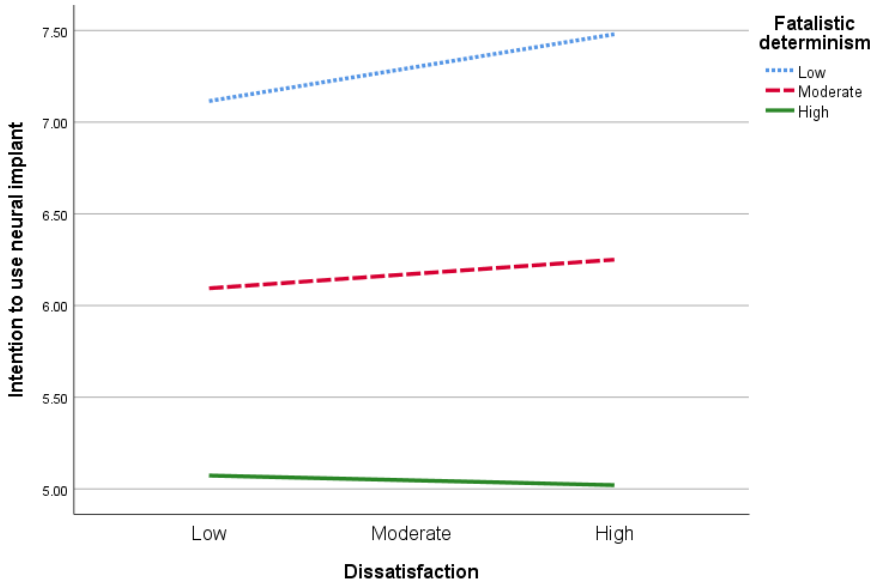

Fig. 3. Interaction effect between dissatisfaction and fatalistic determinism on the intent to use neural implant

Hypothesis H6 was supported as a significant moderated mediation effect was found, B = -.005, SE = .002, 95% CI [-.010, -.001]. This result indicated that fatalistic determinism significantly moderated the indirect effect of discrepancy from perfection and the intention to use neural implants by buffering the mediating effect of dissatisfaction on the intent to use neural implants. The indirect effect of discrepancy from perfection on the intention to use neural implants via dissatisfaction was significant for participants with low fatalistic determinism, B = .04, SE = .02, 95% CI [.01, .07]. However, the indirect effect of discrepancy from perfection on the intention to use neural implants via dissatisfaction was not significant for participants with high fatalistic determinism, B = -.01, SE = .02, 95% CI [-.04, .02], and moderate fatalistic determinism, B = .01 SE = .01, 95% CI [-.01, .04].

5. Discussion

The innovative nature of human-technology hybrid could appeal to younger generations who have been standing at the forefront of this technology [3,101]. The present study hypothesized that those with higher scores on discrepancy from perfection are more likely to be agreeable to using neural implants, and dissatisfaction with being imperfect would mediate the positive relationship between discrepancy from perfection and the intent to use neural implants. Further, free will and fatalistic determinism were postulated as moderators, respectively strengthening and weakening the positive relationship between discrepancy from perfection and the intention to use neural implants mediated through dissatisfaction with being imperfect.

5.1 Discrepancy from Perfection and Intent to Use Neural Implants

Results from the present study showed a significant positive relationship between discrepancy from perfection and the intent to use neural implants (H1). This positive relationship can be approached within the framework of Higgin's [14] self-discrepancy theory, where self-directive standards overshadow self-concept, thus inducing individuals to pursue behaviors to meet the criteria. Neural implants can fill the gap between the innate capacity and the ideal one that

individuals wish to have. The positive association between discrepancy and the intent to use neural implants could reflect the low self-acceptance level. Low unconditional self-acceptance has a negative association with perfectionism, as found in the study of Flett *et al*., [102]. Only those with a low level of unconditional self-acceptance have a strong internal drive for perfectionism, which could explain the desire to improve self-worth through neural implants.

Secondly, the positive association between discrepancy from perfection and the intent to use neural implants could indicate adaptive personality psychology. Research demonstrated that openness and consciousness strongly correlate with high standards and self-oriented perfectionism [80]. People with more adaptive personality traits were more likely to engage in perfectionism, where they are motivated to achieve ideal perfection by themselves. Other research also showed that internal locus of control is more pronounced in individuals who believe that striving for perfection and being perfect is important and those who set excessively high standards for themselves [103,104]. This disposition can be similarly found among the participants of the present study. Participants were prone to believe that they are in control over their lives; thus, they can make any changes, such as deploying neural implants, that they consider life-improving.

5.2 The Mediating Effect of Dissatisfaction with Being Imperfect

The present study supported the mediation effect of dissatisfaction with being imperfect in the relationship between discrepancy from perfection and the intent to use neural implants (H2). According to the self-discrepancy theory, the root of dissatisfaction can be attributed to unmet expectation [29]. Flett *et al*., [41] found that high levels of discrepancy substantially suggest dissatisfaction in their study. Those who are cognitively preoccupied with the attainment of perfection often undermine performance and thus experience a sense of dissatisfaction with performance. Discrepancy from perfection could imbue dissatisfaction. The results of the present study showed that participants might believe that anything short of perfection is deemed a failure and those who found their actual performance incompatible from the perfect one perceived themselves as a failure. Even in some instances, perfectionists who are non-discrepant from perfection or exceptionally accomplished and close to or at the standard (or far exceed the criteria) can still feel quite dissatisfied [41].

The mediation effect of dissatisfaction with being imperfect in the relationship between discrepancy from perfection and the intent to use neural implants also validates that self-discrepancy theory is a “transdiagnostic framework” where the actual-ideal discrepancy is positively associated with depression and anxiety [37]. The association between actual-ideal discrepancy and psychopathology was found to be robust across domains where the self-discrepancy was related to the negative effect positively and the positive effect negatively [17,48,51,52]. The transformation of discrepancy from perfection to the final intention to use neutral implants is realized by the negative effect associated with the current situation. If people were not dissatisfied with discrepancy between the actual and ideal self, the self-driven perfectionism behaviors would be less salient [57,63]. The present study might have engaged in behaviors that will uplift them from their dissatisfaction.

5.3 The Moderating Effect of Free Will

Freewill, an ingrained feature of human life, was found to be a moderator of the direct relationship between dissatisfaction with being imperfect and the intent to use neural implants (H3), as well as on the indirect influence of discrepancy from perfection and the intent to use neural implants through dissatisfaction (H4). Only those with a relatively high level of free will are more

likely to try the neural implants to solve their problem of discrepancy from perfection and their dissatisfaction with being imperfect. As free will believers experience a low level of helplessness [67], they approach everything in the world with gratitude [105]. In the present study, neural implants are appreciated by participants who experience high free will. Adopting such technologies ultimately enhances human capacity in various aspects [10]. The dissatisfaction with imperfect and free will intensified participants' inclination to neural implants. Free will belief is associated with the perception of actions as choices and the freedom in making those choices [23]. Hence, the everyday social reality of free will is a matter of how people think and feel about their choice. To free will believers, anything based on one's choice is cherished [82]. Thus, these individuals will intend to use neural implants because they can enhance accomplishment in their lives.

Likewise, free will believers trust their capacity for decision-making and choices [23]. Free will attributes were found to be positively associated with the frequency of spontaneous deliberate decision-making actions and to be linked with perceived decision-making abilities [22,69]. Individuals would also experience increased satisfaction if they assumed that decision-making was not difficult and believed that free will belief could be "a socially cognitive elaboration of the feeling of control" [23]. The principle motivation for making choices and believing in free will may give rise to the desire for control [77]. Therefore, free will believers are expected to be more engaged in self-regulatory behaviors as they believe they are in control [22]. The desire for power makes people seek satisfaction by engaging in behaviors including making independent choices like adopting products that can enhance their capability. Accordingly, constructing a life scheme that emphasizes free will in the present study indicates participants are inclined to use neural implants. Hence, making decisions like adopting neural implants would be less difficult for free will believers. This choice not only helps them to enhance their capabilities but also contributes to intensifying their satisfaction with themselves.

5.4 The Moderating Effect of Fatalistic Determinism

The results of the present study provided support for Hypothesis H5 and H6, where fatalism was hypothesized to moderate the relationship between discrepancy from perfection and the intent to use neural implants as mediated by dissatisfaction with being imperfect. Only those with a relatively low level of fatalist determinism would consider using neural implants for discrepancy from perfection and dissatisfaction with being imperfect. These findings supported a growing body of research revealing that fatalism may hinder seeking opportunities for change [88,91], including the deployment of innovative technologies [25-27].

People with a high level of fatalist determinism deem themselves as having little or no control over their lives. These individuals consider themselves subject to external forces like divine powers and fate [67]. Fatalistic determinist's lack of internal control leads them to believe that they cannot master the environment and effectively interact with it [92,93]. Past studies have shown that fatalists do not believe that world affairs/life could have any form of deterministic role in their lives as they have no control over their lives. Those with fatalistic determinism might be less likely to adapt to change because they believe that fate will determine their destiny [91] and that humans have no power to influence their futures, actions, and choices [65]. These individuals assume that whatever they do will make no difference in their fixed destiny. Thus, instead of actively searching for opportunities to change, participants of the present study with high fatalistic determinism are reluctant to adopt neural implants for capacity enhancement even when they recognize a discrepancy from the ideal self and are dissatisfied with their current self. Moreover, the present

study's findings have indicated that fatalistic determinism will lessen the likelihood of actual-ideal discrepancy and dissatisfaction.

The current study has revealed that the presence of a negative correlation between fatalistic determinism and discrepancy from perfection as well as dissatisfaction with being imperfect. The more the individuals believe in external forces, the less likely they are to perceive the gap between the actual self and the ideal self. The participants of the study are less dissatisfied because of the assumed imperfection. This result was contradictory to the previous study on job dissatisfaction by Rodríguez et al., [106] and body dissatisfaction by Pokrajac-Bulian and Živčić-Bećirević [107], where the researchers found the externality of control to be positively related with dissatisfaction. This was possible because although the external locus of control is similar to fatalist determinism, the two concepts are entirely different constructs [108]. Attribution of what happens in the world to destiny or fate is just one kind of external locus of control. When people develop a life scheme that stresses fatalistic determinism, they perceive themselves as behaving in line with divine power. They will instead follow than act according to their own will [65]. Thus, individuals may believe their current performance is the will of divinity, and they should accept the status quo rather than wish for a better situation.

Fatalistic determinism is a negative contributing factor to behavioral intent to use neural implants. Belief in fatalistic determinism involves a sense of self-impossibilities and the idea that we cannot do things beyond our control [65]. Individuals with a fatalistic orientation believe that as fatalistic determinists, they should oppose any actions that foster the dissolution of human identity or dehumanization [26]. These individuals assert that the divine power creates the universe and makes it function for a particular purpose and that they should behave following the divine purpose. Hence, opting for neural implants could destroy the original and divinely shaped human body. As a result, fatalistic determinists in the present study refuse the chance of capacity enhancement by neural implants even if they were not satisfied with their capability due to their imperfection. Thus, fatalistic determinism prevented neural implant user intent in this study.

6. Implications

The findings from the present study should be of interest to researchers who are interested in the mechanism of how people adopt new technologies. To the best of our knowledge, this is the first scholarly attempt to examine the direct association between discrepancy from perfectionism and intention to use neural implants drawing on self-discrepancy theory. Second, this study demonstrates the underlying mechanism for the relationship between discrepancy from perfectionism and the intention to use neural implants by incorporating the mediator- dissatisfaction with being imperfect. Third, this study expanded the proposed mediation model by introducing free will and fatalistic determinism as moderators. Collectively, the results confirmed that free will belief positively moderated the mediation effect of dissatisfaction with being imperfect in the relationship between discrepancy of perfection and the intent to use neural implants. Fatalistic determinism negatively influenced the effect of discrepancy from perfection on the intent to adopt neural implants through dissatisfaction with being imperfect. The findings draw attention to the interconnectedness among discrepancy from perfection, dissatisfaction with imperfection, fatalism, and free will as life schemes, and the intent to use neural implants. It implies that many factors that influence the new technology adoption process are emotional, psychological, and cognitive factors.

This study has implications for the concerned pushing back on neural implant technologies. The findings underscore the importance of addressing society's social, mental health problems, dissatisfaction with being imperfect, and possibly taking corrective actions to reduce the acceptance

of neural implants. Those who are going through dissatisfaction with being imperfect should acknowledge that they can improve the situation if they set a realistic goal for themselves rather than a perfection target since the root of dissatisfaction is attributed to unmet expectations [29]. According to Flett *et al*., [41], perfectionists will still be dissatisfied even when they have already exceeded expectations. Therefore, individuals should understand themselves and develop a personalized standard that guides them in their performance based on realistic expectations.
Additionally, these individuals are recommended to increase self-acceptance because unconditional self-acceptance mediates the relationship between perfectionism and depression [102]. If individuals can develop a high level of self-acceptance, they will be able to appreciate their self-worth and self-value unconditionally. Hence, even if they are short of perfection, their self-worth and self-value will not be affected by discrepancy of perfection.

Education institutions should design specific campaigns to address the social, mental health problem and provide educational materials to help students overcome their dissatisfaction due to imperfection. These institutions should also demonstrate the importance of self-worth and self-acceptance to ordinary people and teach them to maintain a positive self-evaluation under various social pressures and internal-driven stress. In addition, to prevent people from becoming maladaptive perfectionist, psycho-educational prevention schemes should be introduced to reinforce the importance of life meaning rather than perfection. People should be educated that there is no perfection in anything and that mistakes or shortcomings are inevitable for everyone.
Findings from this study yield insightful guidance for neural implant campaigners. The results indicate the significant role of free will and fatalistic determinism in the intent to use neural implants. To persuade people to accept and deploy the neural implant devices, technology marketers and campaigners should focus on arousing free will within audiences and reinforcing the concept of freedom, autonomy, and agency. By connecting neural implants with the autonomous decision for self-enhancement and improvement, free will believers will be more likely to accept and adopt this innovative technology because a human free will can be preserved, enhanced, and restored by making an autonomous decision to use neural implants [77]. On the other hand, the findings highlight the need to counter people's concern over the negative impacts of neural implants on human identity and the integrity of human nature [26] because it entails a considerable change in the human body [95]. People with a fatalistic determinism life scheme believe in their duty to preserve humanity and follow the divine purpose's guidance [65]. As a result, if they connect the neural implant usage with the transformation of the natural body from divinity, it will dehumanize them and turn them against neural implants. It is sensible that technical communicators should address the above concerns in their future campaigns.

7. Limitations

Although the present study adds to understanding the psychological mechanism of neural implant acceptance, it is not without limitations. First, our research design was limited to the cross-sectional design, thus unable to demonstrate the causal links in the results. Therefore, we recommend experimental studies to be conducted to test the causal associations between discrepancy between perfection, dissatisfaction, free will, and fatalism determinism and the intent to use neural implants. According to life-span theory, the intensity of self-discrepancy varies across life [109]. In addition, the intensity of free will is not fixed, instead, there are fluctuations across time according to changing circumstances [110]. Therefore, a longitudinal study is needed to examine the long-term evolution of the intent to use neural implants.

Second, the literature showed that fatalism may take on different forms, including "active fatalism as the belief in a predestined personal and global future, combined with the belief that one must do their part to bring this predestined future into fruition." [111]. Each form of fatalism may impact the intent to use neural implants differently. Therefore, future research could delve deeper into this concept and find out how different forms of fatalism can affect the intent to use implants alone and together.

Third, the findings might not be generalizable to populations of non-digital natives. This study collected data from university students who are very active online. People of different ages may hold various life schemes and react differently to neural implants. Studies have shown that older people are more likely to be digitally exclusive [112,113]. Hence, future research should be conducted with a diverse population.

8. Conclusion

In conclusion, the current study expands the self-discrepancy theory. The study examines the underlying mechanism of the effect of discrepancy from perfection on intent to use neural implants by testing the mediation role of dissatisfaction and moderating role of free will and fatalistic determinism. The study has found that discrepancy of perfection has a positive association with the intention to use neural implants, and this relationship is mediated by dissatisfaction with being imperfect. Free will and fatalistic determinism moderate the direct effect of dissatisfaction and being imperfect on the intent to use neural implants, as well as the indirect effect of discrepancy from perfection on the intent to use neural implants through dissatisfaction with being imperfect. The study advances the knowledge of the underlying mechanism of the effect of discrepancy in perfection and the intent to use neural implants.

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