The Influence of Personality on Intertemporal Decision-making

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Abstract

Intertemporal decision-making is the behavior of choosing between a smaller, more immediate reward and a larger, delayed reward. Delay Discounting (DD) is the process by which the subjective value of an identified gain decreases as the delay in receiving it increases. Individuals with a high rate of DD tend to overvalue immediate benefits and make choices with detrimental long-term consequences. The present study aimed to assess the influence of the Big Five personality traits on intertemporal decision-making, considering the effects of sociodemographic covariates and psychopathological symptoms (anxiety, depression, and stress). The sample consisted of 520 Brazilian adults, with a mean age of 27.3 years (*SD* = 4.7) and 70.2% female. They completed an online survey, which included the Big Five Inventory (BFI-5), the Depression, Anxiety, and Stress Scale (DASS-21), and the Monetary Choice Questionnaire (MCQ-27). The results indicated that approximately 9% of the variance in DD is explained by mean family income, anxiety, agreeableness, neuroticism, and extraversion. Specifically regarding the influence of personality, 1.7% of DD was explained by agreeableness, 0.7% by extroversion, and 0.6% by neuroticism. These findings suggest that specific personal attributes contribute to increased DD, regardless of mean family income and emotional health status.

Keywords: Delay discounting, Personality, Extraversion, Psychological, Neuroticism, Mental Health

A INFLUÊNCIA DA PERSONALIDADE NA TOMADA DE DECISÃO INTERTEMPORAL

Resumo

Decisão intertemporal é o comportamento de escolher entre um ganho menor mais imediato e um ganho maior atrasado. Desvalorização pelo atraso (DD) é o processo pelo qual o valor subjetivo de um ganho identificado diminui à medida que aumenta o atraso de recebimento. Indivíduos com alta taxa de DD tendem a supervalorizar benefícios imediatos e a fazerem escolhas com consequências prejudiciais no longo prazo. O presente estudo teve como objetivo avaliar a influência dos traços de personalidade do modelo *Big Five* na tomada de decisão intertemporal, considerando o efeito de covariáveis sociodemográficas e sintomas psicopatológicos (ansiedade, depressão e estresse). A amostra foi composta por 520 adultos brasileiros, com média de idade de 27,3 anos (DP = 4,7), sendo 70,2% do sexo feminino. Eles responderam uma pesquisa on-line, que incluiu o Inventário dos Cinco Grandes Fatores de Personalidade (IGFP-5), Escala de Depressão, Ansiedade e Estresse (DASS-21) e o Questionário de Escolha Monetária (MCQ-27). Os resultados apontaram que aproximadamente 9% da variância do DD é explicada por renda média familiar, ansiedade, amabilidade, neuroticismo e extroversão. Especificamente sobre influência da personalidade, o DD foi explicado em 1,7% por amabilidade, 0,7% por extroversão e 0,6% por neuroticismo. Esses achados indicam que certos atributos pessoais contribuem para o aumento do DD, independentemente da renda média familiar e do estado de saúde emocional.

Palavras-chave: Desvalorização pelo Atraso, Personalidade, Extroversão Psicológica, Neuroticismo, Saúde mental

LA INFLUENCIA DE LA PERSONALIDAD EN LA TOMA DE DECISIONES INTERTEMPORALES

Resumen

Decisión intertemporal es el comportamiento de elegir entre una ganancia más pequeña y inmediata y una ganancia mayor retrasada. El descuento por demora (DD) es el proceso por el cual el valor subjetivo de una ganancia identificada disminuye a medida que aumenta la demora de recepción. Las personas con una alta tasa de DD tienden a sobrestimar los beneficios inmediatos y toman decisiones con consecuencias perjudiciales a largo plazo. El presente estudio tuvo como objetivo evaluar la influencia de los rasgos de personalidad del modelo de los Cinco Grandes en la toma de decisiones intertemporales, en función del efecto de las covariables sociodemográficas y los síntomas psicopatológicos (ansiedad, depresión y estrés). La muestra estuvo compuesta por 520 adultos brasileños, con una edad media de 27,3 años (DE = 4,7). 70,2% fueron de sexo femenino. Los participantes completaron una encuesta en línea, que incluía el Inventario de los Cinco Grandes Factores de Personalidad (IGFP-5), la Escala de Depresión, Ansiedad y Estrés (DASS-21)

y el Cuestionario de Elección Monetaria (MCQ-27). Los resultados mostraron que aproximadamente el 9% de la varianza del DD se explica por el ingreso familiar promedio, la ansiedad, la amabilidad, el neuroticismo y la extraversión. Específicamente sobre la influencia de la personalidad, el DD se explica en un 1,7% por la amabilidad, un 0,7% por la extraversión y un 0,6% por el neuroticismo. Estos hallazgos indican que ciertos atributos personales contribuyen al aumento de DD, independientemente del ingreso familiar promedio y el estado de salud emocional.

Palabras-clave: descuento por demora, personalidad, extraversión psicológica, neuroticismo, salud *mental*

People frequently face having to choose between an immediately gratifying option and one that, although less attractive at the time, is more advantageous in the long run. Decision-making problems like these are observed in daily life, for example, when one must choose between the pleasure of a sweet treat now or persisting with a diet for future weight reduction, going on a new trip or saving to buy a home, discontinuing medical treatment or waiting for effective results at the end, etc. Intertemporal decision-making is the term for choosing between a smaller, more immediate reward and a larger, future reward (Keidel et al., 2021). In this type of decision, the valuation of potential outcomes tends to be negatively affected by temporal delay, which occurs when the value assigned to a gain option depends on the length of time one must wait to receive it (Hélie et al., 2017). Delay discounting (DD) is the process by which the subjective value of a reward decreases as the waiting time to obtain it increases (Lempert et al., 2019). Cognitive psychologists and behavioral economists suggest that people opt for smaller immediate gains because they subjectively devalue larger future gains (Wan et al., 2023; Read et al., 2018).

The rate of discounting (the outcome of a DD task) varies along a continuum, with all individuals discounting future benefits to some degree (Lempert et al., 2019). Individuals with high rates of DD exhibit a strong preference for the immediate and are often identified as impulsive in their choices (Hamilton et al., 2015). The increase in this index is associated with a variety of maladaptive behaviors, including drug addiction (MacKillop et al., 2011), risky sexual behavior (Johnson & Bruner, 2012), and suicide attempts (Bettis et al., 2022). Additionally, it is related to low rates of routine medical check-ups (Bradford, 2010), poorer glycemic control in type 2 diabetes patients (Lebeau et al., 2016), lack of physical exercise (Daugherty & Brase, 2010), and excessive credit card debt (Meier & Sprenger, 2012). Therefore, understanding the psychological processes that make some individuals more prone to systematically devaluing the future in their decisions is a crucial step in addressing these problems associated with high rates of DD. This could pave the way for developing new intervention strategies to promote self-control and prudent behaviors in specific groups of individuals.

Personality traits may influence individual differences in DD rates. In the context of personality and intertemporal decision-making research, most studies have focused on the association between DD and impulsivity-related traits assessed through psychometric scales. These include the Barratt Impulsiveness Scale (Patton et al., 1995) and the UPPS-P Impulsive Behavior Scale (Whiteside & Lynam, 2001), with the belief that performance in DD tasks reflects a broader impulsivity factor (Strickland & Johnson, 2021). Specifically, previous studies (Gustavson et al., 2020; MacKillop et al., 2016) revealed that increased DD scores were associated with higher levels of motor impulsivity (tendency to act on the spur of the moment), lack of planning (inability to plan and think carefully), lack of premeditation (tendency not to think and reflect on the consequences of an act before executing it), and positive urgency (tendency to respond to a very positive mood state). However, the strength of these associations is generally weak, indicating that DD measures reflect a distinct self-regulatory capacity, a construct called

impulsive choice to differentiate it from the construct underlying psychometric measures of impulsivity, designated as impulsive traits (Strickland & Johnson, 2021; MacKillop et al., 2016).

Regarding the dominant model in personality research, the Big Five personality traits (McCrae & Costa, 1999), relatively few studies have focused on DD. This model consists of the following traits: openness to experience (tendency to experience new things), agreeableness (tendency to be affectionate), conscientiousness (tendency to be responsible), extraversion (tendency to be sociable), and neuroticism (tendency to be emotionally unstable). Studies exploring the relationship between these traits and performance in DD tasks reported that increased DD rates were associated with higher levels of extraversion (Mahalingam et al., 2014; Hirsh et al., 2010) and neuroticism (Deng et al., 2023; Kennedy, 2020; Mahalingam et al., 2014). Conversely, an increase in DD was followed by a decrease in levels of openness to experience (Yeh et al., 2021; Kennedy, 2020; Mahalingam et al., 2014) and conscientiousness (Deng et al., 2023; Kennedy, 2020; Mahalingam et al., 2014). Concerning agreeableness, the direction of its relationship with DD is uncertain. Kennedy (2020) identified a positive correlation, while Yeh et al. (2021) highlighted a negative correlation. However, it should be emphasized that similar to impulsive traits, all these associations are of small magnitude.

There is a growing body of literature indicating associations between the Big Five factors and DD. However, it is not yet clear exactly how these stable personal attributes influence the process of valuing future rewards. Some observations should be made about the aforementioned findings. First, the number of studies available on this topic is relatively limited, and the results reported, including significance and direction of correlations, vary considerably among these studies, contributing to some controversy in understanding these associations. Second, only the study by Yeh et al. (2021) controlled for the effect of socioeconomic variables when analyzing these interactions, which is crucial since increased income and education have been associated with increased rates of DD (Keidel et al., 2021).

Furthermore, no study considered the effect of mental health variables in their analyses. This is necessary because high levels of DD are associated with the presence of mental disorders, such as Major Depressive Disorder (Levitt et al., 2022; Amlung et al., 2019; Jackson & MacKillop, 2016), as well as increased levels of depression (Levin et al., 2018), anxiety (Levin et al., 2018; Xia et al., 2017), and stress (Malesza, 2019) in the general population. Therefore, to understand the differential effect of personality on intertemporal decision-making, it is also necessary to consider the impact of relevant mental illness variables on DD.

This study aimed to investigate the influence of the Big Five personality traits on intertemporal decision-making, controlling for identified sociodemographic covariates and psychopathological symptoms such as anxiety, depression, and stress. The evidence from the reviewed literature raised the hypothesis that an increase in DD would be significantly associated with increased levels of extraversion and neuroticism while conversely related to decreased levels of openness to experience and conscientiousness.

Method

Participants

Using an observational, analytical, cross-sectional research design, a convenience sample of 525 Brazilian adults was obtained within the specified data collection period. Five participants were excluded for not meeting the criterion of achieving a minimum of 75% consistency in their responses in the intertemporal choice task. The method for assessing the degree of consistency is detailed in the "Procedures" subsection. The final sample, therefore, comprised 520 respondents (70.2% women, n = 365), with ages ranging from 18 to 35 years (M = 27.3; SD = 4.7). Of this total, 67.9% were single, 31.3% had incomplete higher education, and 49.6% had a family income of up to 3 minimum wages (1 minimum wage = R$1,212.00 in 2021). Further descriptive information can be found in Table 1.

Table 1

Frequency (%) of sociodemographic characteristics of the sample (N = 520)

Variable	n	%
Region		
Central-West	32	6.2%
North	24	4.6%
Northeast	124	23.8%
Southeast	243	46.7%
South	97	18.7%
Gender		
Female	365	70.2%
Male	155	29.8%
Marital status		
Single	353	67.9%
Married/Common-law marriage/Cohabiting	158	30.4%
Divorced/Separated	9	1.7%
Self-declared race/ethnicity		
White	274	52.7%
Mixed-race	161	31.0%
Black	71	13.7%
Asian	10	1.9%
Indigenous	4	0.8%
Education		
Completed doctorate	33	6.3%
Incomplete doctorate	71	13.7%
Completed master's	40	7.7%
Incomplete master's	53	10.2%
Completed bachelor's	129	24.8%
Incomplete bachelor's	163	31.3%
Completed high school/technical education	24	4.6%
Incomplete high school/secondary education	7	1.3%
Mean family income		
Above 9 minimum wages	60	11.5%
From 3 to 9 minimum wages	187	36.0%.
Up to 3 minimum wages	258	49.6%
No income	15	2.9%

Note. Due to rounding up, the percentages may not add up to 100%.

Instruments

Sociodemographic Questionnaire: including questions covering age, gender, marital status, race/ethnicity, education, and mean family income.

Big Five Inventory (BFI-5; John, Donahue & Kentle, 1991; adapted by Andrade, 2008). The BFI-5 assesses the five personality traits of the Five-Factor Model of Personality (Openness to Experience, Conscientiousness, Extraversion, Neuroticism, and Agreeableness). The Brazilian adaptation of the instrument consists of 32 items answered on a Likert-type scale (1 = Strongly Disagree; 5 = Strongly Agree) and presents satisfactory reliability coefficients, with values ranging from .68 to .76 (Guttman's Lambda 2).

Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995; adapted by Vignola & Tucci, 2014). The DASS-21 assesses psychopathological symptoms experienced in the previous week. The scale consists of 21 items answered on a Likert-type scale (0 = Did Not Apply to Me at All; 3 = Applied to Me Very Much, or Most of the Time), with seven items each assessing depressive, anxiety, and stress symptoms. The adaptation and validation of the instrument for the Brazilian context revealed satisfactory Cronbach's Alphas, reaching .86 for anxiety, .90 for stress, and .92 for depression.

Monetary Choice Questionnaire (MCQ-27; Kirby et al., 1999). The MCQ-27 is a behavioral task of intertemporal choice that assesses DD. It consists of 27 choices between smaller immediate and larger delayed rewards (e.g., item 19: "R\$165 today or R\$400 in 14 days?"). The instructions were given in Brazilian Portuguese, and to avoid currency effects, the original amounts were converted from US dollars to the local currency (BRL) at an exchange rate of R\$5.00. The items and their respective hypothetical monetary gains are grouped into three magnitudes: small, R\$55–R\$175; medium, R\$100–R\$300; large, R\$155–R\$425. Delays range from 7 to 189 days. Each choice contributes to the estimation of the discounting rate, which was estimated using Mazur's equation (1987): $V = A / (1 + kD)$, where V is the subjective value of reward A at delay D, and k is the parameter indicating the degree of DD. This equation is commonly used to understand how people assign value to choice options leading to rewards in intertemporal decision-making problems. This procedure allows the present value of a future reward to be calculated based on its nominal value and associated waiting period. This results in obtaining an estimate reflecting the individual's indifference toward available choice alternatives. For example, in the case of item 19, choosing the smaller immediate gain indicates that the amount of "R\$400 in 14 days" is subjectively equivalent to receiving "R\$165 today." The parameter k quantifies this indifference when the equation is solved. Higher values in this index indicate more pronounced DD, i.e., a higher likelihood of choosing the smaller immediate reward. An automated scoring tool for the MCQ-27 (Kaplan et al., 2016) was used to calculate the geometric mean of k values across the three gain magnitude conditions, thus obtaining an overall estimate of k. This overall score was logarithmically transformed and used as the discounting rate for each participant (the MCQ-27 result).

Procedures

Data was collected online between November and December 2021 through a questionnaire created in Google Forms. Participants were invited to participate in the study through email invitations and promotion on social media platforms (e.g., Facebook, Instagram, and WhatsApp), using a snowball technique (Patton, 1990), where interested participants shared the research questionnaire link with other potential respondents. All respondents agreed to the consent terms extensively described in the online protocol. The research was approved by the Research Ethics Committee of the Federal University of Minas Gerais (CAAE: 48810121.9.0000.5149).

The tool developed by Kaplan et al. (2016) used in this study to compute the MCQ-27 data, in addition to estimating the overall DD rate, determined the degree of consistency of responses for each participant. According to the authors, consistency scores below 75% could indicate a lack of attention and random responses to the task items, and excluding these cases is recommended. Five cases with scores below 75% were identified and excluded from the sample.

Data Analysis

The data collected for the research were initially recorded in an Excel spreadsheet. After careful verification, they were transferred to the IBM SPSS software, version 26, to perform descriptive and inferential statistical analyses. It is important to emphasize that all participants completed all questionnaires included in the research protocol, and there were no missing data occurrences. For all studies conducted, a confidence interval of 95% and a significance level of 5% ($p \leq .05$) were adopted.

The normality hypothesis of the data was rejected for all quantitative variables in Shapiro-Wilk and Kolmogorov-Smirnov tests. Therefore, non-parametric statistics were used in all uni- and bivariate analyses. Spearman's correlation coefficient was calculated to assess associations between the continuous variables. Mann-Whitney U and Kruskal-Wallis tests were conducted to evaluate significant associations between variables with two or more groups and the DD rate, respectively. After the Kruskal-Wallis tests, post-hoc analyses were performed using multiple Mann-Whitney tests with Bonferroni correction (α adjusted = significance value/ number of comparisons). The effect size of the difference between groups was calculated using the equation $r = z/\sqrt{n}$ (Field, 2009). All effects found were interpreted as follows: small effect, $r = .10$ to $.29$; medium effect, $r = .30$ to $.49$; large effect, $r = .50$ (Cohen, 1992).

The five personality measures and variables significantly associated with DD (mean family income, anxiety, depression, and stress) were entered as predictor variables in a multiple regression model, where the predicted variable was the overall DD rate. It should be emphasized that income variable levels were entered into the model as dummy variables, with "income above nine minimum wages" as the reference group. The best combination of these explanatory variables was determined using the forward entry method, a procedure in which predictors are sequentially incorporated into the model based on their partial correlation with the outcome.

This approach was adopted due to its parsimonious nature and ability to provide the coefficient of determination (R^2) for each statistically significant predictor. This study reported adjusted R^2 as a more robust estimate of the quality and explanatory power of the regression model (Field, 2009). Changes in adjusted R^2 (ΔR^2) resulting from the inclusion of a new predictor are reported in the text of this manuscript. However, unadjusted ΔR^2 values are provided as a reference in Table 3.

All assumptions for this analysis were tested. The normal distribution of residuals was checked with standard probability plots, and linearity and homoscedasticity were assessed using standardized residuals versus predicted value plots. Residuals met the assumption of independence (Durbin-Watson statistic = 2.101). Collinearity statistics, on the other hand, indicated no multicollinearity issue (anxiety, tolerance = .732 and VIF = 1.366; Agreeableness, tolerance = .918 and VIF = 1.089; Neuroticism, tolerance = .726 and VIF = 1.378; Dummy income up to 3 minimum wages, tolerance = .370 and VIF = 2.704; Dummy income from 3 to 9 minimum wages, tolerance = .377 and VIF = 2.650; Dummy no income, tolerance = .817 and VIF = 1.223; Extraversion, tolerance = .928 and VIF = 1.077). Finally, Cook's distance was within recommended limits, with values below 1.

G*Power software (Faul et al., 2007) was used to conduct a post-hoc statistical power analysis to assess the sufficiency of the sample size obtained for conducting multiple regression testing. Results indicated a power of 100%, considering a sample of 520 participants, a significance level of 5%, and a small effect size (f^2 = .10), as per Cohen's criteria (1992).

Results

In the study sample, the mean of the individual DD rates transformed into logarithms was −2.198 (SD = 0.654; mean of raw scores = 0.020, SD = 0.046). Regarding sociodemographic variables, no significant effects were found for the participants' region of residence ($H(4)$ = 4.954, p = .292), gender (U = 25355.0, z = −1.872, p = .061), marital status ($H(2)$ = 3.771, p = .152), self-declared race/ethnicity ($H(4)$ = 8.611, p = .072), and education level ($H(7)$ = 7.678, p = .362) concerning DD. Similarly, DD scores were not significantly associated with the participant's age (r = .052; p = .240). The exception was the mean family income variable ($H(3)$ = 18.662, p = .000), where respondents who reported incomes up to three minimum wages (z = 4.311; p = .000, r = .19) and between three to nine minimum wages (z = 3.445; p = .001, r = .15) discounted larger future rewards significantly more than those with incomes above nine minimum wages.

Table 2 presents interactions between personality traits, psychopathological symptoms, and DD. Significant but weak positive associations were observed between the DD measure and the traits of agreeableness (r = .12; p = .006), extraversion (r = .11; p = .017), and neuroticism (r = .15; p = .001). However, DD did not significantly correlate with openness to experience (r = .02; p = .590) or conscientiousness (r = −.02; p = .610). The results also indicated a weak yet

significant positive association between DD and all evaluated psychopathological symptoms, namely depression ($r = .11$; $p = .010$), anxiety ($r = .18$; $p = .000$), and stress ($r = .18$; $p = .000$).

Table 2

Spearman's correlation analyses between personality traits, psychopathological symptoms, and delay discounting (n = 520)

Variable	Delay Discounting
Openness to Experience	.02
Agreeableness	.12**
Conscientiousness	−.02
Extraversion	.11*
Neuroticism	.15**
Anxiety	.18**
Depression	.11*
Stress	.18**

Note. * = $p < .05$; ** = $p < .01$.

The results of the multiple linear regression model were significant ($F(7, 512) = 8.168$, $p = .000$, $R^2_{adjusted} = .088$), indicating that approximately 9% of the variance in DD rates was explained by mean family income, anxiety, agreeableness, neuroticism, and extraversion. The remaining predictors, including openness to experience ($B = −.009$, $t = −0.205$, $p = .837$), conscientiousness ($B = .022$, $t = 0.512$, $p = .609$), depression ($B = .040$, $t = 0.692$, $p = .490$), and stress ($B = .041$, $t = 0.584$, $p = .560$), did not significantly impact intertemporal decision-making. Table 3 presents the coefficients for all significant predictors. As can be seen, compared to the reference group "Income above 9 minimum wages," the groups Income up to 3 minimum wages ($B = .320$, $t = 4.643$, $p = .000$, $R^2_{adjusted} = .007$), Income from 3 to 9 minimum wages ($B = .268$, $t = 3.924$, $p = .000$, $R^2_{adjusted} = .017$), and No income ($B = .106$, $t = 2.292$, $p = .022$, $R^2_{adjusted} = .007$) significantly influenced DD rates, together explaining 3.1% of its variation. Conversely, anxiety explained nearly 2.7% ($B = .112$, $t = 2.288$, $p = .023$, $R^2_{adjusted} = .027$) of the variance in rates, being the only mental distress factor to reach statistical significance. Regarding the impact of personality traits, 1.7% of the variance in DD was explained by agreeableness ($B = .135$, $t = 3.078$, $p = .002$, $R^2_{adjusted} = .017$), 0.7% by extraversion ($B = .096$, $t = 2.201$, $p = .028$, $R^2_{adjusted} = .007$), and 0.6% by neuroticism ($B = .105$, $t = 2.135$, $p = .033$, $R^2_{adjusted} = .006$). Increases in the levels of all these predictors resulted in a significant increase in future discounting and preference for immediate smaller gains. However, the percentage of variance explained by each predictor was low, suggesting that other variables may have influenced the intertemporal decisions of the participants in this study.

Table 3

Results of the multivariate linear regression with Anxiety, Agreeableness, Neuroticism, Mean Family Income (Dummy), and Extraversion predicting Delay Discounting (n = 520)

Variable	Standardized Beta	t	Sig.	$R^2_{adjusted}$	ΔR^2
(Constant)	–	–15.973	.000	–	–
Anxiety	.112	2.288	.023	.027	–
Agreeableness	.135	3.078	.002	.044	.018
Neuroticism	.105	2.135	.033	.050	.008
Income up to 3 minimum wages (dummy)	.320	4.643	.000	.057	.009
Income from 3 to 9 minimum wages (dummy)	.268	3.924	.000	.074	.018
No income (dummy)	.106	2.292	.022	.081	.009
Extraversion	.096	2.201	.028	.088	.009

Note. Result: $F(7, 512)$ = 8.168, p = .000, $R^2_{adjusted}$ = .088.

Discussion

The present study aimed to evaluate the influence of the personality constructs of the Five Factor model on intertemporal decision-making in a sample of Brazilian adults. The results obtained revealed that specific personality traits, namely agreeableness, extraversion, and neuroticism, are predictors of greater devaluation of future rewards, even after controlling for important identified covariates such as mean family income and symptoms of anxiety, depression, and stress. These findings highlight the underlying complexity of intertemporal decision-making in everyday life, emphasizing the importance of considering factors such as mean family income and anxiety symptoms, which together explained 5.7% of the variance in DD. However, the results also suggest that the influence of stable personal characteristics on DD occurs independently of these circumstantial factors.

From the analysis of the individual importance of personality traits for intertemporal decision-making, it was observed that around 2% of the variation in DD is explained by the trait of agreeableness. Consistent with the findings of Kennedy (2020), this study demonstrated that increasing levels of agreeableness led to increased rates of DD. Individuals with high agreeableness tend to demonstrate empathic concern, a willingness to accommodate others' goals, and motivation to minimize conflicts (Graziano & Tobin, 2017). Additionally, they are prone to debt, saving less money (Matz & Gladstone, 2020), and have lower chances of achieving higher salaries and career promotions (Judge et al., 1999). Therefore, it is argued that they are inclined to "sacrifice" larger future gains due to placing a higher value on the immediate benefit of their prosocial behavior. For example, a generous fisherman with high DD levels may forego buying a larger boat in the future because he always shares about 15% of his catch with friends who recurrently await his return from the sea.

The trait of extraversion contributed approximately 1% of the variance in DD. This result aligns with previous findings (Mahalingam et al., 2014; Hirsh et al., 2010) that identified a positive association between these constructs. Extraversion reflects a propensity to experience and display positive effects and characteristics such as spontaneity, sociability, and a strong desire for interaction (Wilt & Revelle, 2017). Several studies have shown that this trait is linked to the functional properties of dopamine pathways, making more extroverted individuals more sensitive to releasing this neurotransmitter in response to reward cues (Wacker & Smillie, 2015). Consequently, options for immediate rewards, even if smaller, may have a stronger subjective appeal to these individuals (Hirsh et al., 2010). Therefore, for example, it can be expected that more extroverted individuals would be the first to attend a party (immediate reward) when it would be more advantageous to focus on a personal project (delayed reward) that would require foregoing weekend socialization.

Nearly 1% of the variance in DD was explained by neuroticism, corroborating previous findings (Deng et al., 2023; Kennedy, 2020; Mahalingam et al., 2014). Neuroticism reflects a tendency to experience negative effects. Individuals with high scores on this trait are characterized by impulsivity and emotional instability (Mahalingam et al., 2014), being more likely to show poor emotional regulation and inefficient coping strategies, such as avoidance (Tackett & Lahey, 2017). Therefore, choosing immediate gain may have a self-regulatory function for them, as the immediate receipt of the reward would likely result in the relief of negative effects (Augustine & Larsen, 2011). For example, students with high neuroticism scores may watch a movie (immediate reward) instead of studying for a final exam (delayed reward) to avoid contact with aversive internal experiences. Another way to interpret this finding is based on the fact that increased neuroticism is associated with a perception of uncontrollability regarding future challenges and an inability to deal with these events (Barlow et al., 2014), as well as a greater aversion to uncertainty (Hirsh & Inzlicht, 2008). In this context, it is argued that among the participants in this study, this trait may have contributed to an overvaluation of choice options that led to "safer" rewards, such as those available immediately, at the expense of delayed reward options, which may have elicited cognitions and emotions related to lack of control and uncertainty.

It is relevant to highlight that the associations observed between the personality dimensions mentioned and DD, both in the bivariate and multivariate analyses, were of small magnitude, consistent with results reported in previous studies involving large samples (Yeh et al., 2021; Kennedy, 2020; Mahalingam et al., 2014). For example, in the survey by Mahalingam et al. (2014) involving 5,888 young adults, the associated traits individually explained between 0.3% and 1.0% of the variance in DD, indicating that the Big Five constructs exert little influence on intertemporal decision-making. This was partly expected because DD, as demonstrated, is consistently associated with mean family income and anxious symptoms, in addition to other relevant psychological variables not considered in this investigation, such as intelligence, inhibitory control, future-oriented cognitive styles (Keidel et al., 2021), and mental disorders (Amlung et al., 2019). Additionally, there is evidence that the propensity for devaluing future

gains is partially innate, with estimated heritability at ~57% (Anokhin et al., 2015). However, the small associative effect between DD and the mentioned personal traits describes correlations between different constructs, favoring the hypothesis that performance in DD tasks does not reflect self-reported impulsivity traits (MacKillop et al., 2016). If the DD measure used in this study operationalized an impulsivity trait, as suggested by authors such as Mahalingam et al. (2014), significant and larger magnitude associations between DD and the Big Five factors recognized to be linked to impulsivity, such as conscientiousness, extraversion, and neuroticism (DeYoung, 2011), should have been found.

It is equally essential to mention some potential limitations of the present study that should be considered when interpreting the results. First, as is common in most intertemporal decision-making research, the DD task used in this investigation involved only monetary gain options. Although this method effectively assesses the relationship of DD with personality traits and emotional states, other types of rewards (e.g., social) could be more salient for these factors, possibly because they serve as primary reinforcers (Odum & Rainaud, 2003). There is evidence that non-monetary gains are more pronouncedly devalued; however, the correlation between the devaluation of these rewards and the devaluation of monetary rewards is strongly positive (Odum et al., 2020). Second, the effect of variables related to mental distress was considered when analyzing the impact of personality on DD. However, the DASS-21 may not have been comprehensive enough to capture core aspects of anxiety and depression known to be linked to DD. Specifically, the scale does not contain items related to future cognitions, such as uncertainty and hopelessness, variables that can increase the urgency for the immediate (Luhmann et al., 2011; Worthy et al., 2014; Pulcu et al., 2014). Therefore, a broader underlying effect of these symptom clusters may not have been adequately controlled. Using more comprehensive instruments to estimate them may improve understanding of the overall importance of these factors for DD.

A third limitation relates to the sample composition, which, as in previous studies (Yeh et al., 2021; Mahalingam et al., 2014), consisted mainly of young adults, limiting the generalizability of the reported results to older individuals. There was also a predominance of female participants (70.2%). Although no significant difference in DD rates between genders was observed, it is important to note that the test used for this analysis had a statistical power of only 39%. This limitation is relevant in light of previous findings indicating that men tend to exhibit higher DD rates than women (Gaillard et al., 2021). Therefore, future studies could investigate the generalizability of the findings in a broader and balanced sample.

The convenience sampling adopted in this study should also be mentioned as a possible limitation. Participants who responded to the research questionnaire may differ in characteristics from those who did not participate or were not reached by the strictly online survey dissemination. This may have introduced bias into the sample, consequently limiting the ability to generalize the results of this study to the general population. Finally, these results are also limited by the study's cross-sectional design. This design does not allow temporality between explanatory

variables and outcomes to be established, limiting the ability to determine, for example, whether anxiety symptoms lead to higher DD rates or, conversely, whether higher DD rates confer vulnerability to psychopathological symptoms. To address this issue in future research, conducting a longitudinal follow-up of individuals with specific traits, such as high neuroticism, may be relevant to investigate how these traits affect their intertemporal decisions, considering variations in their mental health status over time.

Final Considerations

The evidence presented underscores the importance of considering the personality traits of the Five Factor model when studying intertemporal decision-making, as they play a significant role in this process. Despite the highlighted limitations, these findings corroborate previous research, revealing that agreeableness, extraversion, and neuroticism substantially impact how individuals devalue the future and choose alternatives, leading to smaller immediate gains. It is relevant to emphasize that the influence of these traits persists even after controlling for factors such as mean family income and the individual's emotional health status, suggesting that these constructs have independent relevance in valuing future outcomes during intertemporal decision-making. However, it is essential to consider that increasing these personality dimensions may contribute to maladaptive DD functioning, potentially resulting in choices with harmful long-term consequences.

Accordingly, the findings of this study have the potential to contribute to enhancing existing treatment approaches by focusing on increasing self-control and prudent behaviors in specific groups of individuals. For example, interventions targeted at individuals with high levels of neuroticism, considering DD as a treatment target, could encompass strategies to increase tolerance to emotional discomfort and reduce the urge to act during periods of heightened excitement (Mathias et al., 2011). Similarly, those with higher scores in agreeableness and extraversion could benefit from training in episodic future thinking. This intervention effectively reduces DD by promoting the ability to visualize events and future outcomes vividly (Rösch et al., 2022; Ye et al., 2022). This study highlights how personality influences intertemporal decision-making, supporting previous research and providing insights for new intervention strategies.

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