Age, but not education, affects social decision-making in the ultimatum game paradigm

A idade, mas não a educação, afeta a tomada de decisão social no paradigma do jogo do ultimato

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Abstract

Background Social decision-making (SDM) is often studied through gaming paradigms, in which participants allocate resources among themselves and others based on predefined rules. In an adapted version of the ultimatum game (UG), SDM behavior was modulated in response to the degree of fairness of monetary offers and the social context of opponents, designed to generate either prosocial or punishing behaviors.

Objective To investigate whether SDM evaluated by the UG is affected by age and schooling, as it is relevant to know whether sociodemographic variables may bias UG results.

Methods A total of 131 healthy adults participated: 35 young university students and 96 participants in Universidade de São Paulo's USP 60+ program (formerly known as Universidade Aberta à Terceira Idade, a program for people aged $\geq$ 60 years to attend university). The sample was divided into 3 age groups (17–22, 60–69, and 70–79 years) and 3 schooling groups (4–8, 9–11, and $\geq$ 12 years of schooling).

Results Age and schooling did not affect performance in fair monetary offers. Differences were observed in the unfair conditions. The oldest group (70–79 years) accepted less frequently the baseline unfair offers (without social context), when compared with the 17–22 and the 60–69 years groups (17–22 = 60–69 > 70–79). Regarding the prosocial unfair and punishing unfair conditions, older adults accepted such offers more frequently (17–22 < 60–69 = 70–79). Schooling effects were not observed.

Conclusion In the context of SDM, older adults may show prosocial behaviors more frequently than younger adults. The findings suggest performance in the UG is affected by age, but not by schooling.

Keywords
- Social Cognition
- Decision Making
- Educational Status
- Aging

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Resumo

Antecedentes A tomada de decisão social (TDS) é frequentemente estudada por meio de paradigmas de jogo, em que os participantes alocam recursos entre si e outros com base em regras predefinidas. Em uma versão adaptada do jogo do ultimato (JU), o comportamento de TDS foi modulado em resposta ao grau de justiça das ofertas monetárias e ao contexto social dos oponentes, projetado para produzir comportamentos pró-sociais ou punitivos.

Objetivo Investigar se a TDS avaliada pelo JU é afetada pela idade e escolaridade, pois é relevante saber se variáveis sociodemográficas podem influenciar os resultados do JU.

Métodos Participaram 131 adultos saudáveis, sendo 35 jovens universitários e 96 participantes do programa USP 60+ (antigo Universidade Aberta à Terceira Idade). A amostra foi dividida em 3 faixas etárias (17–22, 60–69 e 70–79 anos) e 3 faixas de escolaridade (4–8, 9–11 e $\geq$ 12 anos).

Resultados Idade e escolaridade não afetaram o desempenho em ofertas monetárias justas. Diferenças foram observadas nas condições injustas. O grupo mais velho (70–79 anos) aceitou menos as ofertas injustas de referência (sem contexto social), quando comparado com o grupo de 17–22 e o de 60–69 anos (17–22 = 60–69 > 70–79). Em relação às condições pró-sociais injustas e punitivas injustas, os idosos aceitaram com maior frequência tais ofertas (17–22 < 60–69 = 70–79). Efeitos da escolaridade não foram observados.

Conclusão No contexto da TDS, os idosos podem apresentar comportamentos pró-sociais com mais frequência do que os adultos mais jovens. Os resultados sugerem que o desempenho no JU é afetado pela idade, mas não pela escolaridade.

Palavras-chave

- Cognição Social
- Tomada de Decisões
- Escolaridade
- Envelhecimento

INTRODUCTION

The effect of aging on decision-making (DM) is relevant for autonomy and quality of life in old age. Retirement decisions, the management of financial resources, health needs, among others, are some of the challenges of this period of life that may0 require complex decisions. Furthermore, we live in highly-complex social environments; therefore, many of our decisions influence not only ourselves, but also others.[1,2]

Social decision-making (SDM) requires inferences about other people's mental states and awareness of one's own preferences. Social decisions often involve conflicts between self-interest and the interests of others, such as when we decide to help someone at a personal cost. Social decisions can also involve conflicts between short-term and long-term rewards, such as managing financial resources to ensure a better quality of life in old age. And, as with individual decisions, social decisions can involve conflicts between reason and emotion; yet, such conflicts may lead to more adaptive decisions than it would be possible by reasoning alone.[3,4] Indeed, both reason and emotions provide essential input to SDM.

Studies have demonstrated that internal states, such as the need to seek rewarding stimuli and avoid aversive ones, affect social behaviors such as generosity, trust, aggression, and affiliation.[5–7] Other influences on SDM include the ability to attribute mental states, such as beliefs, intentions, and desires, to oneself and others, and it is also influenced by social norms and personality traits.[8,9]

To assess SDM, game paradigms are often used and, among them, the ultimatum game[10] (UG) stands out. In the UG, the participant receives an offer to share a sum of money with a fictitious player and they can accept or reject the offer. Players are aware that accepted offers result in payouts as proposed, while rejected ones result in no payment. Low bids are often rejected, for they are regarded as "unfair" (usually when someone's share is $\geq$ 35%). Rejecting unfair offers is interpreted as punitive behavior towards the proponent, and it may be more rewarding for the respondent than a small objective gain.[11,12] Rejecting unfair offers has often been attributed to negative emotions, to human aversion to inequality, and to reluctance to accept injustice.[13,14]

The UG paradigm presents an adequate window to investigate the interface between reason and emotion in SDM. It enables the analysis of the individual's responses to the offers, the consequences (reinforcements or punishments) of these choices, and/or the direct effects on the other individual, like in everyday social contexts.[15,16]

O'Callaghan et al.[17] adapted the UG by introducing social framing conditions to induce participants to accept more offers out of compassion/desire to help (prosocial condition), and to incite the desire to punish by rejecting offers (punishing condition). They examined 22 patients with behavioral-variant frontotemporal dementia (bvFTD) and 22 healthy controls with the standard version of the UG with the addition of the social framing version. No significant difference in acceptance rates was observed between groups in the standard version. However, the bvFTD patients showed

significant impairments in SDM modulation in response to the social context, with significantly lower rates of acceptance in the prosocial condition compared to the healthy controls. This behavior was associated with frontostriatal atrophy in specific regions, including the left dorsolateral prefrontal cortex. Thus, demonstrating that the integration of contextual social information to guide normative behavior seems to be impaired in bvFTD.

Besides bvFTD, the original UG has been used to investigate SDM in different diseases, such as major depression,[18,19] bipolar disorder,[20,21] and schizophrenia.[22,23] Such studies have shown that neuropsychiatric conditions may impact social information processing, and these impairments may be related to biomarker parameters.[24,25]

However, little is known about the effects of age and schooling on SDM assessed by the UG paradigm. Regarding age, previous studies have shown that older participants split the money more generously than younger participants. Both age groups reported being more irritated by unfair offers proposed by younger participants. However, when young people are propositioned by other young people, they reject unfair offers more often than older adults, who tend to accept them more often, regardless of the age of the proponent.[26,27] These findings imply that older adults may be more strategic in their UG behavior, as it is in their best interest to accept even small monetary amounts compared to not receiving anything.

Schooling is widely regarded as a variable with an important role in cognitive performance; however, the influence of this variable on DM has not been widely explored. Some studies[28–30] have suggested that individuals with higher levels of schooling tend to exhibit more strategic DM performance; however, no studies have been found on the influence of schooling on SDM based on the UG paradigm. Considering the limited evidence regarding the impact of age and schooling on SDM, the aim of the present study was to investigate whether performance in the UG, as adapted by O'Callaghan et al.,[17] is affected by these variables.

METHODS

Participants

A total of 131 healthy adults participated in the present study. Among them, 35 were university students and 96 were participants in Universidade de São Paulo's USP 60+ program (formerly known as Universidade Aberta à Terceira Idade, a program for people aged $\geq$ 60 years to attend university). The sample was divided into 3 age groups (17–22, 60–69, and 70–79 years) and 3 schooling groups (4–8, 9–11, and $\geq$ 12 years of schooling). Younger people were recruited during their participation in university classes and activities. The older adults were recruited during activities at USP 60+.

The inclusion criteria were participants with cognitive scores within the normal range for age and schooling and self-reported good health. The exclusion criterion was participants with any neurological or psychiatric conditions that significantly impeded their sensory, cognitive, or behavioral abilities to the extent of hindering their performance on the tests. However, it is worth noting that no participant met the exclusion criterion.

Instruments and procedures

The participants filled out a sociodemographic and health questionnaire, as well as the following cognitive tests to ascertain normal cognitive status: the Mini Mental State Examination (MMSE) and the Revised Addenbrooke Cognitive Examination (ACE-R).

The cut-off scores to determine normal cognitive performance on the MMSE were 24 points for those with 4 to 8 years of schooling, and 26 for those with $\geq$ 9 years of schooling.[31] The ACE-R scores were also used to verify normal cognitive performance according to Brazilian normative data.[32] For this instrument, performance was considered as normal if it was not below 1.0 standard deviation from the mean, reported for the participant's age and level of schooling in normative tables. Anxiety and depression were assessed using the Hospital Anxiety and Depression Scale (HADS). The cut-off scores were 8 points for anxiety and 9 for depression.[33]

Ultimatum game

The UG, as modified by O'Callaghan et al.,[17] is a task composed of two phases: baseline and social conditions. The social condition phase has two trials: prosocial and punishment. In all trials, the participants are invited to play with different proponents who will offer to hypothetically divide R$ 100.00 (one hundred reais). Offers range from fair (50/50; 60 for the proponent/40 for the player) to unfair (80/20 and 90/10). In each trial, a black-and-white photograph of a neutral face is presented, with the subtitle "[Name] wants to make you an offer", which remains on the computer screen for 4 seconds. Then, a screen with the proposed offer is presented, and there is a request for the player to "accept" or "reject" it. The decision screen is presented until the answer is given by the player. After that, a screen with "You have won [xx] reais" is displayed depending on the answer to the proposal. In the baseline condition, the participant is informed that they will play against 16 different people, and each one will share R$ 100,00 with them. The participant is informed that the proponent is free to decide how to divide, but that the participant can choose between accepting or rejecting the offer and that, in case of rejection, both are not paid any value. In the social condition, participants are informed that they will play against 16 new people, under the same rules. However, information about the current circumstances of the proponents will be provided. In the prosocial trials, proponents are presented as people in financial and social distress. In the punishing trials, the proponents are presented as persons in advantageous financial and social conditions (►**Figure 1**). The UG task was developed using the Microsoft Office PowerPoint (Microsoft Corp., Redmond, WA, United States) software, and administered to participants using a tablet with an Android operating system (Alphabet Inc., Mountain View, CA, United States).

Ethical aspects

All participants provided informed consent to participate in the study, which was approved by the Ethics Committee for the Analysis of Research Projects (Comissão de Ética para Análise de Projetos de Pesquisa, CAPPesq, in Portuguese) of Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo (HCFMUSP) under number 3.796.637/2020. The participants did not receive financial or any other compensation to participate in the study.

Statistical analyses

The age (17–22, 60–69, and 70–79 years) and schooling (4–8, 9–11, and $\geq$ 12 years) groups were compared using the analysis of variance (ANOVA) test. The normality of the data was tested using the Shapiro-Wilk test, and none of the variables followed normal distribution in the studied groups. To correct the non-normal distribution, we used bootstrap with 1,000 samples with the bias-corrected and accelerated method. The group comparisons that were statistically significant were followed by pairwise comparisons using Bonferroni correction. Sex was compared using Chi-squared tests. To verify if age or schooling interacted with the UG answers, two-way ANOVA was carried out using the age groups or the schooling groups as between-subject factors and the following comparisons as within-subject factors: baseline fair x baseline unfair; prosocial fair x prosocial unfair; punishing fair x punishing unfair; baseline fair x prosocial fair; baseline fair x punishing fair; prosocial fair x punishing fair; baseline unfair x prosocial unfair; baseline unfair x punishing unfair; and prosocial unfair x punishing unfair conditions. The effect size Omega-squared (ω^2) and the observed power of these interactions were described. To interpret the effect size, the following criteria were used (Goss-Sampson, 2019): < 0.01 = trivial; 0.01 = small; 0.06 = medium; and 0.14 = large. The analyses were performed using the Jeffreys's Amazing Statistics Program (JASP, open source), v. 0.13.1, and IBM SPSS Statistics for Windows (IBM Corp., Armonk, NY, United States), version 25.0, software. The significance level was set at 0.05.

RESULTS

Age effects

►**Table 1** presents the mean and standard deviation values for the sociodemographic characteristics, cognitive measures, anxiety, and depression inventories, and the UG answers across the age groups. The groups were equivalent regarding level of schooling, sex distribution, and socioeconomic status. The younger group presented a better performance than the older groups in the MMSE and ACE-R. In addition, the younger group had significantly fewer depression symptoms than the older groups, and the groups were equivalent regarding anxiety symptoms. All participants were below the cut off scores for major depression and generalized anxiety disorder.

The age groups answered similarly to the fair offers in the baseline, prosocial and punishing conditions of the UG. Yet, for the baseline unfair offers, the oldest group (70–79) accepted them less frequently, when compared with the 17–22 and the 60–69 groups (17–22 = 60–69 > 70–79). Regarding the prosocial unfair and punishing unfair offers, the younger group accepted them less frequently, when compared with the older participants (17–22 < 60–69 = 70–79). ►**Figure 2** presents the mean and standard error of the mean (bars) values for the answers in the UG tasks.

In ►**Figure 2**, it is possible to see that the age groups answered similarly in fair conditions, but not in the unfair conditions. The fair versus unfair conditions did not show a significant interaction with age. The interactions between unfair conditions were all significant, with the baseline versus prosocial and prosocial versus punishing showing a medium effect size, while the baseline versus punishing conditions showed a small effect.

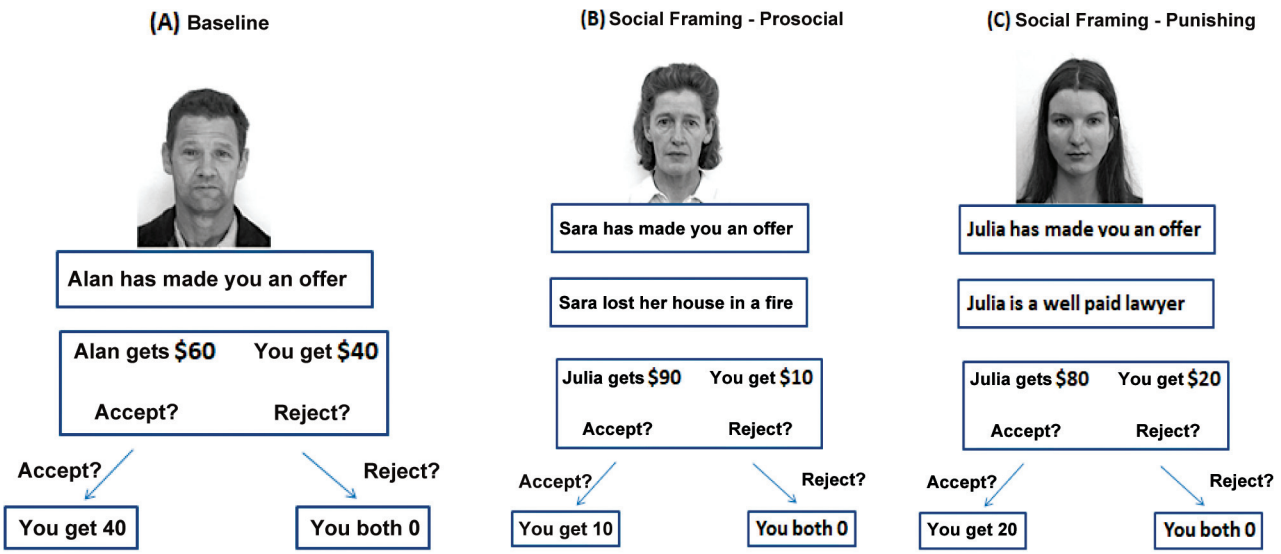

Figure 1 Examples of trials in the ultimatum game. (**A**) An example of a trial in the baseline condition; (**B**,**C**) Examples of trials from the prosocial and punishing social framing conditions.

Table 1 Sociodemographic characteristics, anxiety and depression symptoms, cognitive performance, and ultimatum game answers across age groups

	17–22 years (n = 35)	60–69 years (n = 49)	70–79 years (n = 47)	*p*-value
Age (years)	19.69 (2.11)[bc]	64.94 (2.51)[ac]	73.04 (2.71)[ab]	< 0.001
Level of schooling (years)	11.69 (0.53)	10.73 (2.94)	10.28 (3.94)	0.107
Sex (female:male)	25:10	24:25	23:24	0.073*
MMSE	28.89 (1.32)[bc]	28.04 (1.49)[a]	27.83 (1.17)[a]	0.002
ACE-R	91.63 (4.95)[bc]	83.18 (7.12)[ac]	80.15 (4.93)[ab]	< 0.001
HADS dep	2.29 (1.49)[bc]	3.33 (1.14)[a]	3.85 (1.20)[a]	< 0.001
HADS anx	2.74 (0.95)	2.71 (1.30)	2.64 (1.17)	0.912
Baseline fair	97.86 (7.1)	97.45 (7.65)	96.81 (8.43)	0.827
Baseline unfair	60.48 (32.8)[c]	46.26 (26.08)[c]	26.24 (23.25)[ab]	< 0.001
Prosocial fair	94.29 (12.26)	96.43 (8.84)	97.87 (7.05)	0.231
Prosocial unfair	42.14 (16.03)[bc]	53.57 (16.40)[a]	54.96 (15.51)[a]	< 0.001
Punishing fair	89.29 (17.45)	93.37 (13.28)	95.74 (10.83)	0.112
Punishing unfair	34.52 (14.87)[bc]	24.66 (11.66)[a]	20.57 (13.33)[a]	< 0.001

Abbreviations: ACE-R, Revised Addenbrooke Cognitive Examination total score; HADS anx, Hospital Anxiety and Depression scale – anxiety symptoms; HADS dep, Hospital Anxiety and Depression scale – depression symptoms; MMSE, Mini-Mental State Examination.
Notes: The *p*-value refers to the analysis of variance (ANOVA) comparison; *Chi-squared test; the superscript letters inform the group comparisons with Bonferroni correction: [a]different from the 17–22 group; [b]different from the 60–69 group; [c]different from the 70-79 group.

►**Table 2** presents the interaction models. The interaction between age and the UG variables was significant for all fair versus unfair conditions, with the baseline and punishing conditions showing medium effect sizes, while the prosocial condition showed a small effect.

Education effects

►**Table 3** presents the mean and standard deviation values for the sociodemographic characteristics, cognitive measures, anxiety, and depression inventories, and the UG answers across the schooling groups. The groups were equivalent regarding age and sex distribution. As expected, the group with the lowest level of schooling showed lower cognitive performance compared to the other two schooling groups. The group with the highest level of schooling presented more anxiety and depression symptoms than the others.

Regarding the UG tasks, the groups showed similar answers in the fair and unfair conditions, with the important exception of the baseline unfair condition, in which the group with ≥ 12 years of schooling accepted the offers less frequently than the other ones (►**Figure 3**).

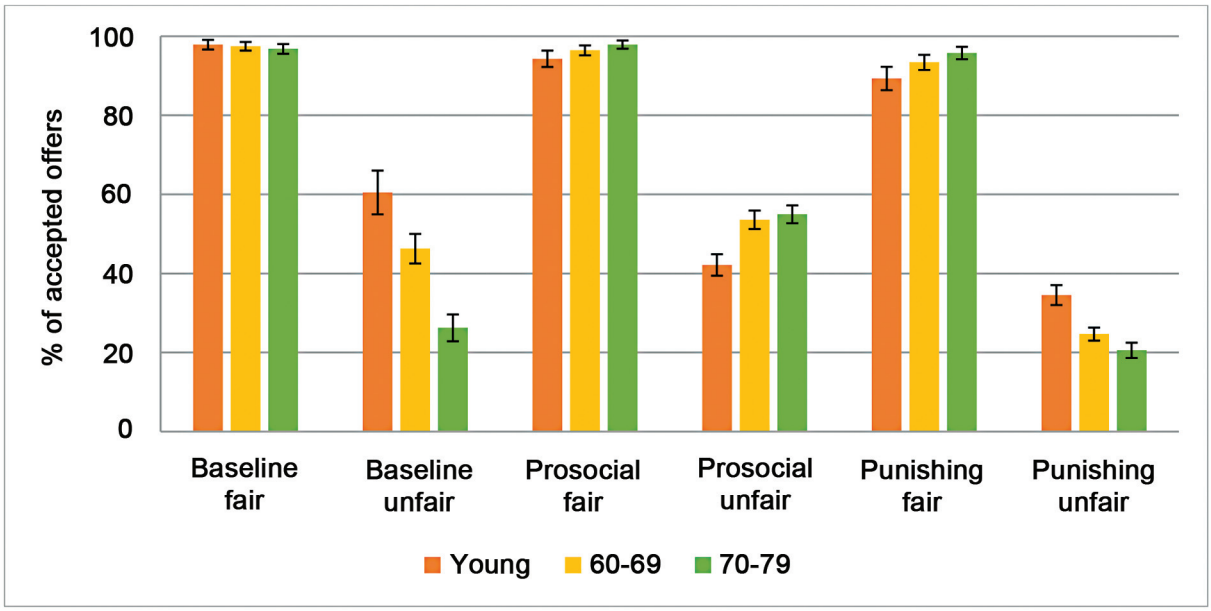

Figure 2 Mean and standard error of the mean (bars) values for the answers to the ultimatum game tasks across age groups.

Table 2 Interactions between age and ultimatum game tasks as within-subject factors

Within factors	*p*-value	ω2	Observed power
Baseline fair x unfair	< 0.001	0.065	0.999
Prosocial fair x unfair	0.040	0.012	0.617
Punishing fair x unfair	< 0.001	0.054	0.996
Baseline fair x prosocial fair	0.235	0.002	0.309
Baseline fair x punishing fair	0.105	0.007	0.459
Prosocial fair x punishing fair	0.738	< 0.001	0.098
Baseline unfair x prosocial unfair	< 0.001	0.099	1.000
Baseline unfair x punishing unfair	0.005	0.023	0.848
Prosocial unfair x punishing unfair	< 0.001	0.086	1.000

Abbreviation: ω^2, Omega-squared effect size.
Notes: The analysis of variance (ANOVA) evaluations were carried out using age groups as between-subject factors (17–22, 60–69, and 70–79 years), and the within-subject factors are described in the table.

The interaction between schooling and the UG variables is presented in ►**Table 4**. There was a significant interaction between schooling and baseline fair versus baseline unfair, baseline unfair versus prosocial unfair and baseline unfair versus punishing unfair conditions, with a medium effect size. These interactions were essentially driven by the fact that the group with $\geq$ 12 years of schooling accepted offers significantly less frequently in the baseline unfair conditions. The other variables did not significantly interact with schooling; however, these non-significant interactions showed a very small observed power. This indicates that a bigger sample would be necessary to capture such small effects.

DISCUSSION

The aim of the present study was to investigate the effects of age and schooling on the UG task. The results indicated that age and schooling did not affect performance on fair task offers, but differences were observed in the unfair conditions of the paradigm. The older groups accepted unfair offers less frequently at baseline and in punishing unfair conditions. However, when the prosocial context was added to the unfair offer, the older groups accepted the offers more frequently than the younger group. As for schooling, in the baseline unfair condition, participants with a higher level of schooling accepted fewer offers.

Table 3 Sociodemographic characteristics, anxiety and depression inventories, cognitive performance, and ultimatum game answers across schooling groups

	4–8 years (n = 27)	9–11years (n = 26)	$\geq$ 12 years (n = 26)	*p*-value
Age (years)	70.37 (2.95)	68.19 (2.77)	69.65 (4.34)	0.068
Level of schooling (years)	5.37 (1.36)[bc]	10.85 (0.46)[ac]	14.12 (1.42)[ab]	< 0.001
Sex (female:male)	14:13	17:09	12:14	0.359*
MMSE	27.00 (1.44)[bc]	28.00 (1.23)[a]	28.54 (1.10)[a]	≤ 0.001
ACE-R	76.67 (5.28)[bc]	82.58 (6.48)[a]	84.42 (5.26)[a]	< 0.001
HADS dep	3.11 (0.85)[c]	3.19 (1.20)[c]	4.27 (1.19)[ab]	≤ 0.001
HADS anx	2.78 (1.31)	2.04 (0.87)[c]	3.23 (1.24)[b]	0.002
Baseline fair	97.22 (8.01)	95.19 (10.05)	100 (0.00)	0.070
Baseline unfair	41.98 (22.11)[c]	48.72 (20.23)[c]	22.12 (28.18)[ab]	≤ 0.001
Prosocial fair	95.37 (9.90)	96.15 (9.20)	99.04 (4.90)	0.249
Prosocial unfair	56.79 (47.76)	47.76 (15.91)	51.60 (10.81)	0.062
Punishing fair	93.52 (14.86)	94.23 (10.74)	98.08 (6.79)	0.299
Punishing unfair	22.22 (10.34)	22.11 (12.23)	23.72 (15.04)	0.877

Abbreviations: ACE-R, Revised Addenbrooke Cognitive Examination total score; HADS anx, Hospital Anxiety and Depression scale – anxiety symptoms; HADS dep, Hospital Anxiety and Depression scale – depression symptoms; MMSE, Mini-Mental State Examination.
Notes: The *p*-value refers to the analysis of variance (ANOVA) comparison; *Chi-squared test; the superscript letters inform the group comparisons with Bonferroni correction: [a]different from the 17–22 group; [b]different from the 60–69 group; [c]different from the 70-79 group.

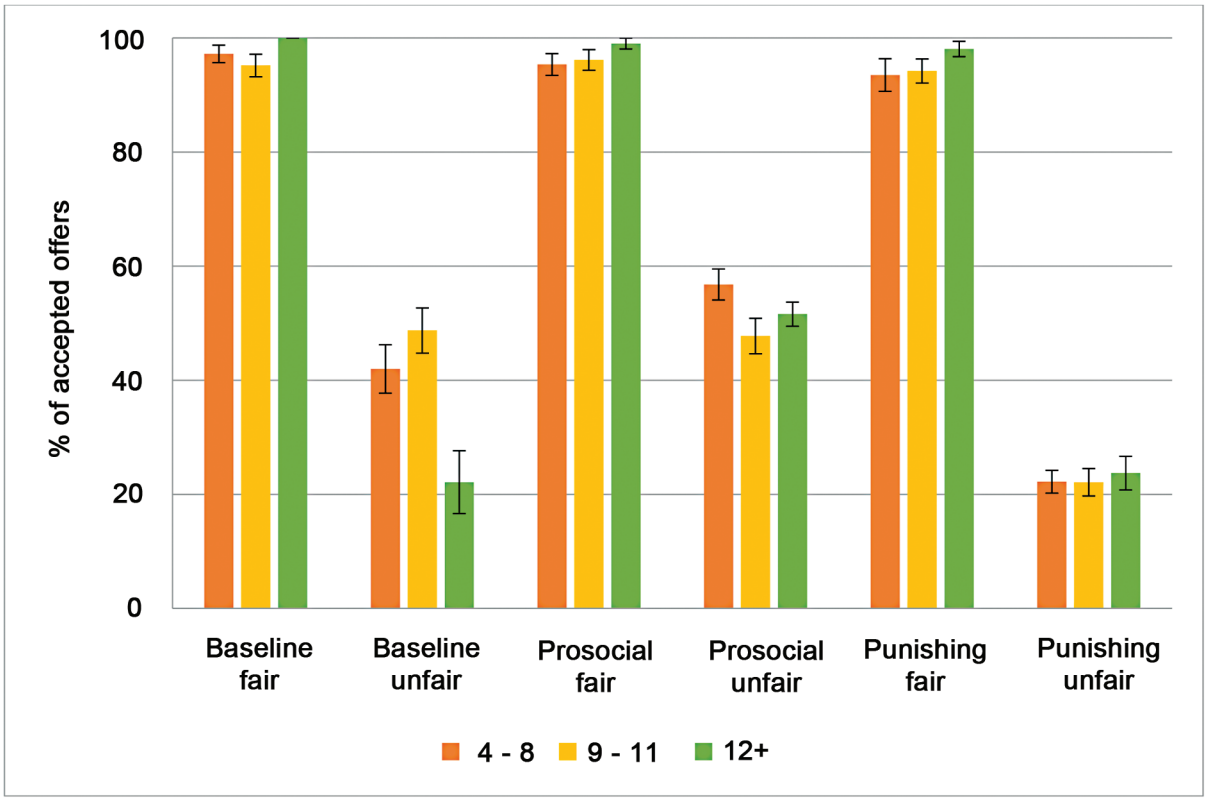

Figure 3 Mean and standard error of the mean (bars) values for the answers to the ultimatum game tasks across schooling groups.

A limited number of studies have focused on examining age differences in DM. In DM situations that require judgment based on experience and accumulated knowledge, as is the case of SDM, older adults perform as efficiently as the younger ones.[34,35] On the contrary, when the decision situation requires skills that decrease with age (such as working memory), older adults tend to perform DM tasks less efficiently.[36]

Studies on age-related differences conducted using SDM tasks have shown that older people tend to exhibit more prosocial behaviors than younger individuals, which is in agreement with the present study. For instance, Nguyen et al.[37] evaluated 129 healthy adults and compared demographic, cognitive, and personality variables among those with a rational versus irrational response pattern in the UG. The personality variables were the only ones that differentiated the two response patterns. The participants with rational UG responses (accepting any offer, no matter how fair, as they always generate monetary gains) reported higher levels of trust, or belief, in the sincerity and good intentions of others, while participants with irrational UG responses (rejecting unfair offers frequently) reported higher levels of negative affect, such as anger and contempt. Demographic factors, such as age, and cognitive variables did not differ

Table 4 Interactions between schooling and ultimatum game tasks as within-subject factors

	p-value	ω2	Observed power
Baseline fair x unfair	< 0.001	0.081	0.991
Prosocial fair x prosocial unfair	0.064	0.016	0.543
Punishing fair x punishing unfair	0.795	< 0.001	0.085
Baseline fair x prosocial fair	0.658	< 0.001	0.116
Baseline fair x punishing fair	0.755	< 0.001	0.093
Prosocial fair x punishing fair	0.964	< 0.001	0.055
Baseline unfair x prosocial unfair	< 0.001	0.063	0.981
Baseline unfair x punishing unfair	0.001	0.056	0.950
Prosocial unfair x punishing unfair	0.145	0.007	0.398

Abbreviation: ω^2, Omega-squared effect size.
Notes: The analysis of variance (ANOVA) evaluations were carried out using schooling groups as between-subject factors (4–8, 9–11, and $\geq$ 12 years), and the within-subject factors are described in the table.

between participants with rational and irrational response patterns.

On a similar note, Roalf et al.[38] evaluated the influence of risk behaviors on age-related differences in DM in social and non-social contexts among older and younger adults. The older adults proved to be less impulsive than younger participants; however, age did not affect DM performance. Older adults were more likely to reject unfair monetary offers and more likely to make equitable offers during a social-giving game.

In addition, Beadle et al.[39] evaluated SDM among younger and older participants, with a task in which empathy was induced through information about the opponent, describing their experience with cancer. Prosocial behavior was measured by the participants' monetary offers to that adversary. The older adults showed greater prosocial behavior than the younger individuals, suggesting that, in relevant social and emotional contexts, older adults may be more motivated to help others, as was observed in the present study.

Other studies have suggested that positive social information about players may affect older adults more than younger adults, due to the positivity bias and the prioritization of meaningful goals.[40] According to such theoretical approaches, relative to younger individuals, older adults tend to pay more attention to and encode positive information rather than negative or neutral ones. They also tend to make greater investments in positive social interaction. These findings may explain why older adults, in the present study, tended to accept more unfair offers when proponents were in a vulnerable social context.

As for the effects of schooling, the results of the present study have indicated that the group with the highest level of schooling accepted fewer unfair offers, but all groups changed their performance as expected when unfair offers were embedded in a prosocial context (fewer refusals) and in a punishing context (more refusals). Despite our efforts, we did not find studies which investigated schooling effects in the UG, or studies which included samples with low levels of schooling using this paradigm. The hypothesis that schooling improves economic and socioeconomic DM has been surprisingly little explored.

The limitations to the present study include the fact that the participants did not undergo a complete neuropsychological examination; therefore, older participants with mild cognitive deficits may have been included in the sample. Schooling was assessed based on the number of years of formal education, but it would have been important to investigate other qualitative and quantitative variables associated with schooling, such as the type of school, the quality of the education, and the reading level of the participants, among others. Furthermore, it is important to emphasize that the small sample size, and the resulting challenges in conducting more complex analyses, can have a significant impact on the generalization of the results herein presented.

In conclusion, the present study has shown that, in an SDM context, older adults may exhibit more prosocial behaviors than younger individuals, especially when the opponent is described as someone who is in a vulnerable situation (unfair offers in a prosocial context). The present findings also suggest that a higher level of schooling can lead to a more cautious SDM pattern in UG tasks. Future studies with the UG paradigm and other SDM tools involving individuals with low levels of schooling are justified. Early identification of difficulties in DM, especially among older adults, is paramount for public and social policies, given the importance of preserving autonomy and protecting the well-being of this population.

Authors' Contributions

LC: conceptualization, data curation, formal analysis, investigation, methodology, project administration, supervision, validation, writing of the original draft, and writing – review and editing; GCC: investigation, methodology, and writing – review and editing; MAC: data curation, formal analysis, investigation, methodology, and writing – review and editing; MSY: conceptualization, data curation, formal analysis, investigation, methodology, project administration, supervision, validation, writing of the original draft, and writing – review and editing.

Conflict of Interest

The authors have no conflict of interest to declare.

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