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The appropriate response of Spanish *Gitanos*: Short-run orientation beyond current socio-economic status

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Author´s Contributions

JM performed the statistical analyses and wrote the paper; PBG designed and conducted the experiment and wrote the paper; AME designed and conducted the experiment, performed the statistical analyses and wrote the paper; JFG designed and conducted the experiment and wrote the paper; BH designed the experiment and wrote the paper.

Declaration of interest statement

The authors declare no conflict of interest.

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Abstract

Humans differ greatly in their tendency to discount future events, but the reasons underlying such inter-individual differences remain poorly understood. Based on the evolutionary framework of Life History Theory, influential models predict that the extent to which individuals discount the future should be influenced by socio-ecological factors such as mortality risk, environmental predictability and resource scarcity. However, little empirical work has been conducted to compare the discounting behavior of human groups facing different socio-ecological conditions. In a lab-in-the-field economic experiment, we compared the delay discounting of a sample of Romani people from Southern Spain (*Gitanos*) with that of their non-Romani neighbors (i.e., the majority Spanish population). The Romani-*Gitano* population constitutes the main ethnic minority in all of Europe today and is characterized by lower socio-economic status (SES), lower life expectancy and poorer health than the majority, along with a historical experience of discrimination and persecution. According to those Life History Theory models, *Gitanos* will tend to adopt "faster" life history strategies (e.g., earlier marriage and reproduction) as an adaptation to such ecological conditions and, therefore, should discount the future more heavily than the majority. Our results support this prediction, even after controlling for the individuals' current SES (income and education). Moreover, group-level differences explain a large share of the individual-level differences. Our data suggest that human inter-group discrimination might shape group members' time preferences through its impact on the environmental harshness and unpredictability conditions they face.

Keywords: Romani, delay discounting, impatience, adaptation, evolutionary psychology, life history

1. Introduction.

In nature, individuals of different species often have to choose between outcomes realized at different times (Ainslie, 1975; Rachlin & Green, 1972). These inter-temporal choices are also ubiquitous in the lives of humans, for instance, in the spheres of marriage and reproduction, education and work, as well as during social and market interactions (Espín et al., 2012, 2015; Frederick et al., 2002; Nettle et al., 2011; Woodburn, 1980). When faced with such decisions, individuals tend to discount the value of delayed rewards. The preference for sooner-smaller rewards over later-larger rewards has been referred to as delay discounting (DD) (Frederick et al., 2002; Kirby et al. 2002). DD is considered to be a measure of one of the multiple domains of impulsivity, namely "impulsive choice" (Bevilacqua & Goldman, 2013; Reynolds et al., 2006).

DD tends to be a stable individual characteristic (Ohmura et al., 2006; Kirby, 2009) – although it may be momentarily influenced by short-term state manipulations (e.g., Kidd et al., 2013; Read & van Leeuwen, 1998) – and people differ greatly in the extent to which they discount the future (Frederick et al., 2002). However, the factors underlying such inter-individual differences remain poorly understood. On the one hand, there is evidence suggesting that DD rates are heritable to some extent (Anokhin et al., 2011, 2015; Aycinena & Rentschler, 2017; Bevilacqua & Goldman, 2013). On the other hand, people's current socio-economic conditions, as proxied by variables such as education and income, also seem to be related to DD: poorer and less educated individuals have been found to discount the future more heavily (Harrison et al., 2002; Kirby et al. 2002; Tanaka et al., 2010), although the causal direction is unclear (Becker & Mulligan, 1997). In addition, a number of behavioral disorders (e.g., attention-deficit/hyperactivity disorder, aggression, suicide, and substance abuse) have been associated with high DD (Barkley et al., 2001; Bickel, & Marsch, 2001; Dombrovski et al., 2011).

The latter evidence has been taken to support the notion of high DD as a maladaptive trait. However, under certain socio-ecological conditions, discounting the future can be a contextually appropriate response. To be more specific, developing a preference for the short-run may be fitness-maximizing in harsh and unpredictable environments (Becker & Mulligan, 1997; Daly & Wilson, 2005; Frankenhuis et al., 2016; Hill et al., 2008; Pepper, & Nettle, 2017).

According to Life History Theory (Del Giudice et al., 2015; Kaplan & Gangestad, 2005; Roff, 1993), variation in life history traits (e.g., size and number of offspring, parental investment, longevity, time to first reproduction, sociability) can be understood in terms of trade-offs in the allocation of resources to competing life functions such as maintenance, growth, and reproduction. The accumulated set of resource allocation decisions during life constitutes the individual's life history strategy, which leads to the development of an integrated collection of life history traits. The most common approach to life history strategies poses a continuum from slow to fast (Promislow & Harvey, 1990). Leading models based on Life History Theory rely on this slow-to-fast approach to predict variation of traits and strategies both between and within species. In this vein, unpredictable and harsh environments are particularly related to the development of fast life history strategies that divert resources from long-term outcomes in favor of short-term outcomes, while predictable and secure settings lead to strategies in the opposite, slow end of the continuum (Kaplan & Gangestad, 2005).

Life history strategies are often seen as species-distinctive characteristics but humans (as well as other organisms) have evolved mechanisms of phenotypic plasticity that allow them to adjust life history strategies to match local conditions during their lifetime (Belsky et al., 1991; Brumbach et al., 2009; Ellis, 2004; McCullough et al., 2013; Nettle et al., 2010, 2011; Worthman, 2003). These strategies would lead to the maximization of individuals' average lifetime inclusive fitness (Del Giudice et al., 2015; Kaplan & Gangestad, 2005; Roff, 1993). However, it is worth noting that existing theories are almost entirely based on verbal models, or on formal models designed to study the evolution of variation in life history strategies between species/populations, which tend to ignore the plasticity in life history strategies within species/populations.[1] Few formal models to date have examined how suits of traits (e.g., onset of puberty, number of offspring, investment per offspring) should covary as a result of phenotypic plasticity (e.g., along a fast-slow continuum), depending on environmental conditions (Mathot & Frankenhuis, 2018). For pioneering verbal models of within-species/populations variation in life history traits along the fast-slow continuum, see Belsky et al. (1991), Ellis et al. (2009) and Reale et al. (2010).

Yet, although the theoretical literature on life history clearly stresses the role of environmental conditions in shaping individuals' DD, more research needs to be conducted to assess this link empirically. While a number of individual-level studies provide support for the hypothesized relationships by showing, for example, a connection between high DD and variables such as low income and education, which can be considered as proxies for unfavorable (potentially harsh and/or unpredictable) conditions (Becker & Mulligan, 1997; Chipman & Morrison, 2015; Green et al., 1996; Griskevicius et al., 2011; Kirby et al. 2002; Pender, 1996), few studies to date have examined to what extent the conditions of harshness and future-unpredictability faced by different groups can predict individual differences in DD. Given that those individual-level studies do not use grouping variables that are

[1] We thank Reviewer 1 for pointing out this important issue.

exogenous to the individual, they cannot put the focus on an environment-based analysis, as prevails in the theoretical literature. Ramos et al. (2013) is, to the best of our knowledge, the first study directly approaching the question. Consistent with the theoretical predictions, the authors show that slum-dwelling youth in Brazil (highly exposed to violence) discount future hypothetical rewards more heavily than university students from more affluent neighborhoods. A more recent study enlarged the number of comparison groups (46 countries were used as observation units) and found that country-level life expectancy can predict the average DD in a sample of university students from the country (Bulley & Pepper, 2017), also as hypothesized by a life history approach. Finally, Lee et al. (2018) extended the latter analysis to a larger sample from 54 countries using individual-specific life expectancy (i.e., age-, sex-, year-, and country-specific life expectancy), and show that the theoretical relationship holds especially when waiting is arguably more beneficial, that is, when the later-larger reward is relatively high and delay is short. While these pieces of work have significant value, in the three cases, the authors compare groups of young individuals who, moreover, differ in a large number of uncontrolled characteristics that are not necessarily related to harsh and unpredictable living conditions but may influence DD. Among those are neighborhood facilities (which may translate into different access to services, for instance), geography, political regime, climate, and so forth. Furthermore, the tasks used to elicit the participants' time preferences (i) did not allow for a parametrization of the individuals' discount functions and (ii) were survey-based, without real incentives. In this paper we further contribute to fill this empirical gap.

To test the predictions of the evolutionary framework of Life History Theory, this study explores the differences in DD between two populations which often face different socio-ecological pressures even if they live in the same geographic areas, even in the same villages and neighborhoods. More specifically, using data from an economic experiment involving real monetary rewards, we compare the discounting behavior of a sample of Romani people from Southern Spain (*Gitanos*, or *Calé,* as they typically refer to themselves) with that of their non-Romani neighbors (i.e., the majority Spanish population).[2] Technically speaking, we set up a quasi-experimental design where ethnicity is the only variable that a priori differs between treatment and control groups. Note that a pure experimental design cannot be applied here because the socio-ecological conditions under which the individuals develop, as proxied by their ethnicity, cannot be exogenously manipulated for obvious reasons. We consider that this design is as close to a controlled experiment as a study of these characteristics can be since ethnicity and its associated socio-ecological conditions are eminently exogenous, thus leaving little room for endogenous determination.

The localities where we conducted our experiments are characterized by a particularly high concentration of *Gitano* people, amounting to over 25% of the total population, compared to 1-1.5% in the whole of Spain (Gamella, 1996; Gamella et al., 2014). However, the *Gitano* population is clearly differentiated in their demographic and cultural profile, and faces a markedly different socio-economic "ecology" than the majority. Hence it constitutes a paradigmatic ethnic group for the goal of this study. Notwithstanding this, it is worth noting that theoretically identical opportunities (Rawls, 1971; Sen, 1992) in terms of access to public education, social benefits and healthcare, are provided (at least legally, on paper) to the *Gitano* population, at least since the advent of democracy in Spain, four decades ago.

Compared to the dominant majority, the *Gitano* population of Spain is characterized by a lower socio-economic status (SES), including lower income and education, and also by

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[2] Spanish *Gitanos* have been barely studied using experimental economics methods. We are only aware of two studies: Brañas-Garza et al. (2006) explores how *Gitanos* play the Ultimatum Game, while Espín et al. (2018) analyzes punishment in the Public Goods Game.

poorer health, lower life expectancy and higher fertility rates (Casals et al., 2011; Cook et al., 2013; Gamella, 2011; Gamella et al., 2014; La Parra Casado et al., 2016; MSC-FSG, 2005). These processes have generated a differentiated demographic profile. For instance, in the study area, the *Gitano* population had a mean age of 27 years compared to the near 42 of the overall local population (Gamella, 2011). Life expectancy at birth has increased in this population almost continuously since the mid 1940s. But still today it seems to be from 5 to 10 years below that of their non-*Gitano* neighbors (Gamella, 2011; MSC-FSG, 2005). This may have resulted in a different set of aggregated needs and outlooks.

However, despite a long-lasting coexistence in many local areas, social exclusion, forced assimilation and discrimination by the majority have considerably influenced the lives of *Gitanos* as well as of other Romani groups in almost every part of the world (Matras, 2015). In Spain this still affects the lives of *Gitano* people, particularly in the most segregated areas. Several distinctive features of *Gitano* social life seem to reflect adaptations to these negative environmental and historical conditions. For instance, *Gitanos* maintain a strong and oppositional sense of identity and high levels of ethnic and familial endogamy. In the study area the *Gitano* minority presented rates of inbreeding five to eight times larger than those of the general population, and have maintained these until the present (Gamella & Martín, 2007; Martín & Gamella, 2005; Núñez Negrillo, 2016). These endogamous strategies tend to increase their social and perhaps their genetic homogeneity (Bittles, 2012). However they also might work as a protection against external threats associated with the discriminatory environments that *Gitano* confronted as a group (Fraser, 1995; Gamella et al., 2013; Matras, 2015). Interestingly, the rate of incarceration of *Gitanos* is still nowadays much higher than that of the majority population. As an example, in a number of recent studies, *Gitano* women accounted for over 25% of the female prison population, a huge over-representation (Cerezo, 2016; Feintuch, 2013).

In addition, most *Gitano* groups, as other Romani groups through Europe, also maintain patterns of early and pronatalist marriage. *Gitano* women in the study area were found to have a mean age of first childbirth of 18-19 years (over a decade earlier than the Spanish average), and total fertility rates that doubled and even tripled those of the Spanish population at large (Gamella, 2011; Martín & Gamella, 2005). Infant mortality rates displayed by *Gitanos* have declined sharply during the last 60 years but are still nowadays considerably larger (about 40%) than those observed in the non-*Gitano* population (Gamella & Martín, 2017; Martín & Gamella, 2005; MSC-FSG, 2005).

These patterns of *Gitanos* can be understood as life history strategies situated at the (relatively) fast end of the fast-slow continuum, which are typically adopted by people who grow up in unpredictable and harsh environments (Brumbach et al., 2009; Dickins et al., 2012; Frankenhuis et al., 2016; Johns et al., 2011). When the future is uncertain or *predictably harsh* (Bulley et al., 2017; McGuire & Kable, 2013), therefore, the appropriate response might be to develop a short time horizon (Becker & Mulligan, 1997; Daly & Wilson, 2005; Pepper & Nettle, 2017) and to adopt strategies such as giving birth, as soon as possible, to the maximum number of offspring (Dickins et al., 2012; Johns et al., 2011; Nettle et al., 2011; Worthman, 2003). In these ecologies, long-term resource allocation may not pay off because there is uncertainty (i.e. the distribution of outcomes has unknown properties such as the mean or SD due to random variation) that the organism will live until late adulthood. Although environmental harshness (risk of mortality-morbidity) and unpredictability (stochastic variation in salient environmental conditions which prevents ex-ante accurate predictions due to factors such as a lack of information or excessive complexity) are theoretically and empirically dissociable and may have differential effects on several life history traits (Belsky et al., 2012; Brumbach et al., 2009; Ellis et al., 2009), an orientation to the short-run is by definition predicted by both factors (Ellis et al., 2009; Frankenhuis et al., 2016; Roff, 1993). In addition, the evidence suggests that the effects of environmental harshness and unpredictability on life history strategies are additive, not interactive (Brumbach et al., 2009). We further expand on this point in the Discussion section.

In this vein, the aforementioned models based on Life History Theory predict that *Gitanos* will tend to display higher DD rates than their non-Romani neighbors, due to the different ecologies faced. Moreover, it is expected that individual socio-economic factors such as current (at adult age) education and income account for some but not all of the difference because life-history-related behavioral traits such as temporal orientation are thought to be mainly shaped in earlier stages of development (e.g., Belsky et al., 1991; Griskevicius et al., 2011; McCullough et al., 2013; Mell et al., 2018). Group differences should indeed explain a large share of the individual differences, given the shared environmental influences during development within each group.

2. Methods

2.1. Protocol and participants

Five lab-in-the-field experimental sessions were conducted in five similar semi-rural towns in Southern Spain (see Espín et al. 2012 for more details). From a total of 160 participants, nine were excluded from the analyses due to missing information in some of the key variables of this study. The final sample thus consists of 151 participants (63.6% females). Among these, 64 are (self-)identified as *Gitanos*, whereas 87 belong to the majority, non-Romani population. Average age in our sample was 46.8 (range 17-82) years old. All the sociodemographic data were gathered in a post-experimental face-to-face interview, where age and years of schooling were obtained as continuous variables, while bins were used for income information (“no income (0€)”, “less than 500€”, “500€ or more but less than 1000€”, and so on; see Table 1).

We did not ask participants directly about their ethnicity. Instead we took advantage of researchers with extensive experience in the field to help us identify potential participants from both ethnic affiliations. In these villages, ethnicity is common knowledge and often verbalized – as was confirmed during the post-experimental interviews.

We have reported all the measures obtained and the experimental conditions that are relevant to the current study. Data exclusions are reported and justified below. The initial sample size (160 observations) was identical to Ramos et al. (2013) and allows us to obtain moderate differences (effect size, d=0.45) between the two groups with 80% power and α=0.05, accounting for representativeness in the relative sample sizes of the two groups (i.e., *Gitanos* represent between 1/5 and 2/5 of the towns’ population).

Our procedure excluded two *Gitanos* from the sample for having missing income information and seven non-*Gitanos*, three for missing education achievement and four for missing income information. Except for three cases (one *Gitano* and two non-*Gitanos*) in which the participant did not know, or did not want to report, the income information, all missing values arise from interviewer’s mistakes (failing to ask one of the questions). The later means that missing values can be considered random so that excluding those nine observations should not produce distortions. An alternative method based on the imputation of missing values to the sample average yields qualitatively similar results (see Text S3 in the Supplementary Materials).

The experimental sessions consisted of 32 participants each. The setting was nearly identical in each of the five towns. The Town Hall provided us with a large room, where we set up the "artefactual" lab consisting of a whiteboard, and 32 chairs and desks. Figure 1 shows one of the five assembled labs. As shown in Figure 1, cardboards were used to prevent visual contact between participants in order to ensure private decisions. Three of the authors plus a group of four assistants supervised all the sessions. The instructions were read aloud always by the same experienced researcher (see Text S1 in the Supplementary Materials).

Figure 1. Representative "artefactual" lab. Location: Deifontes, Granada.

2.2. Delay discounting task and measures

To measure the participants' DD, we employed a multiple-price-list task (Harrison et al., 2002) with a one-month front-end delay (Espín et al., 2012). Using a decision sheet (see Figure S1 in the Supplementary Materials), the task consisted of 20 decisions in which the participant had to choose between receiving €150 in one month time and receiving a higher amount (increasing from €151.50 to €225 across decisions) in seven months time by marking the preferred option with a cross. These increasing amounts to be received after seven months were also presented in terms of simple interest rates. The lowest amount in the seven-month option (i.e., €151.50) added €1.50 to the €150 of the one-month option, which entails an increase of 1% in six months, that is, an annual simple interest rate of 2%. The highest amount in the seven-month option (i.e., €225) added €75 to the €150 of the one-month option, which entails an increase of 50% in six months, that is, an annual simple interest rate of 100%. All participants were presented with same decisions in the same (ascending) order. The fact that both the sooner-smaller and the later-larger reward were delayed, so that there was no "today" option, allows capturing long-term discounting behavior and alleviates the effect of distrust (about the experimenters actually coming back to the town to pay participants) on decisions. However, as detailed in the Discussion section, the use of this type of task entails some limitations that might influence our results.

In every session, one participant was randomly chosen to receive the real payment (on the specific date) associated with the participant's choice in one randomly-selected decision. Please refer to the Supplementary Materials (Text S1) for a more detailed explanation of the experimental procedure.

2.3. Delay discounting measures.

In the literature on DD there is considerable debate over which particular functional form better characterizes individuals' discounting (Andersen et al., 2014; Frederick et al., 2002). The most common measures of DD are based on either exponential (constant-discounting) or hyperbolic (decreasing-discounting) functional forms. For robustness, we test our hypothesis using both characterizations. In particular, we obtained a discounting parameter *K* for each individual using the following equations:

- For the hyperbolic functional form (henceforth *Hyper-K*)

$$V_d = \frac{V_u}{(1 + Kd)}$$

- For the exponential functional form (henceforth *Exp-K*)

$$V_d \ = \ V_u e^{-Kd}$$

Where V_d stands for the reward's discounted subjective value, V_u refers to its undiscounted value and *d* is the delay until its receipt (in years). The *K* parameter is derived from equalizing the discounted value of the sooner-smaller reward to that of the later-larger reward at the individual's indifference point between both rewards (see next subsection for an explanation of the different indifference points considered in the different analyses). The higher the *K*, the more heavily future rewards are discounted and thus the more short-run oriented the individual is.

The stability and external validity of DD measures have been evaluated in a number of previous studies. The test-retest stability of discount rates has been found to be in the range that is typically obtained for personality traits (Anokhin et al., 2015; Kirby, 2009; Ohmura et al., 2006). While some null results exist (e.g., Eisenstein et al., 2015; Mejía-Cruz et al., 2016; Stojek et al., 2014), evidence abounds that supports the validity of DD measures to predict behaviors with future consequences, such as addictions and drug consumption (Baker et al., 2003; Bickel & Marsch, 2001; Yi et al., 2010), physical activity and obesity/overweight (Chabris et al., 2008; Reimers et al., 2009; Weller et al., 2008), and savings and loan use (Meier & Sprenger, 2010, 2012; Sutter et al., 2013).

2.4. Statistical analysis

We first report descriptive statistics for all the variables analyzed, separately for the *Gitano* and majority samples, in Table 1. Zero-order Spearman's correlations between all the variables are presented in Table 2. Since the variables used in these initial analyses are categorical and/or arguably not normally distributed, parametric methods such as t-test or Pearson's correlation are not justified, and thus we stick to non-parametric analysis. Although for some secondary analyses other approaches such as Fisher's exact or Mann-Whitney tests tend to be more suitable, in the main text we report only correlations (Table 2) for the sake of brevity and, when appropriate, refer to the p-values from those other tests, which are developed in more detail in Text S2 in the Supplementary Materials.

In Figure 2, we visually compare the DD of *Gitanos* with that of the majority employing different approaches (comparing cumulative distribution functions and subgroups in terms of age and income). For all these analyses, we consider that the smallest amount at which an individual is willing to wait the six months longer (i.e., seven months instead of one) represents her indifference point between the sooner-smaller and the later-larger reward (as in Espín et al., 2012).

For the second and main analysis, we estimated individuals' *K* parameters using interval regressions (Harrison et al., 2002). In this set of regressions, the indifference point of an individual is estimated to be in the interval between the later-larger amount offered in the decision immediately before the individual switched from the sooner-smaller to the later-larger reward and that offered in the switching decision (for those individuals who never switched, the interval is assumed to be open; note that participants were specifically instructed not to follow multiple-switching, inconsistent patterns, as explained in more detail in Text S1). The interval regression method, thus, does not force us to assume an arbitrary, fixed indifference point (for instance, at the midpoint or the upper/lower bound) within each interval since it is instead estimated from the participants' choices. This exercise cannot be done with other estimation methods such as ANOVA, OLS or Tobit. The regression analysis also allows us to control for key individual variables which could mediate a potential difference in DD between *Gitanos* and the majority.

All the analyses were conducted using Stata v12 (StataCorp, Texas, USA). Unless otherwise stated, reported p-values were calculated from two-tailed tests.

2.5. Data availability

The data and code associated with this research are available at [link].

3. Results

Regarding demographic differences between the *Gitano* and majority samples, the former were younger and more likely to be males (see Table 1; both ps<0.03 according to Mann-Whitney and Fisher's exact test, respectively, Text S2). For current SES, we observe that *Gitanos* were less likely to have a regular monthly income source, and reported a lower monthly income (both own income and other household's income) and a lower number of years of schooling, compared to the majority (all ps<0.01, see Table 1 and Text S2). These differences are an indication of the representativeness of our *Gitano* and majority samples but also reflect the necessity of controlling for these variables in a regression analysis.

In panel A of Figure 2, a stochastic dominance approach is used to compare the responses of the two ethnic groups in the DD task. In panels B and C, respectively, we display the mean *Hyper-K* and *Exp-K* of the two groups for each age tercile (note that we split age into terciles for visual clarity in the figure as it is the minimal split to observe potential non-linear relationships; all statistical analyses were performed using age as a continuous variable, though). Finally, in panels D and E, we perform the same comparison but now the sample is split into below-median and above-median total household income (given by the combination of own income and other household's income).

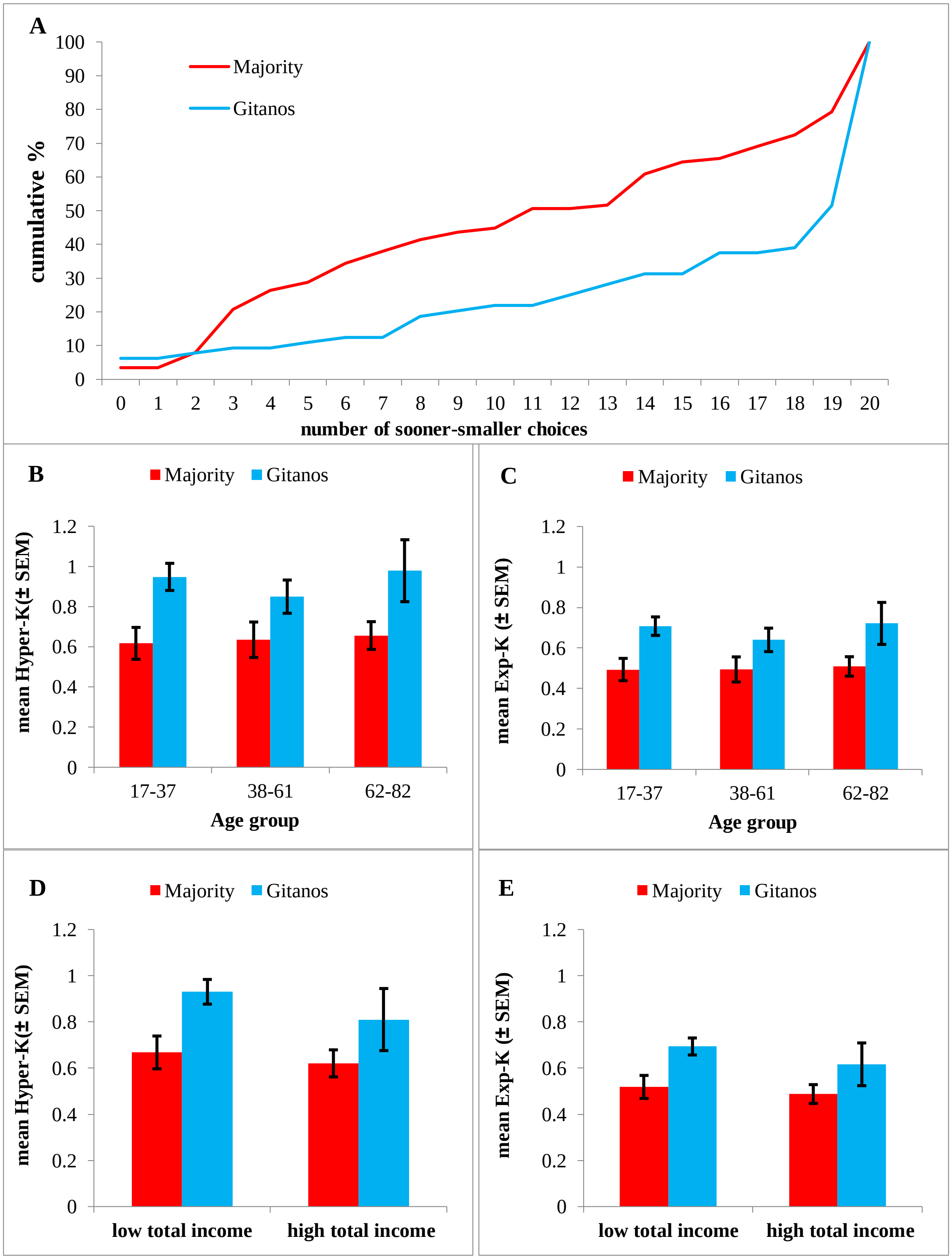

Figure 2. Comparison of DD between the *Gitano* and the majority samples. Stochastic dominance analysis (panel A); mean *Hyper-K* and *Exp-K* for each age tercile (panels B and C); mean *Hyper-K* and *Exp-K* for below- and above-median total household income (panels D and E).

We observe that, on average, *Gitanos* discount the future more heavily than the majority (mean differences of 0.272 and 0.181 for *Hyper-K* and *Exp-K*, respectively; see Table 1). For both characterizations of *K*, the raw (without controls) difference between *Gitanos* and the majority is significant according to Mann-Whitney test (p<0.01, Text S2) and interval regression (ps<0.01, Table 3, model 1). Similarly, as shown in panel A of Figure 2, the DD of the majority is stochastically dominated by that of *Gitanos*. More specifically, strict dominance is observed for all values (number of sooner-smaller choices) higher than two. From Figure 2A we can also see that our DD measure is strongly right-censored, especially for *Gitanos* (48% and 21% of the *Gitano* and majority individuals, respectively, chose the sooner-smaller option in every decision), which implies that reported differences will tend to underestimate the true underlying effect.

However, as mentioned, *Gitanos* differ from the majority according to all the variables which will serve as individual-level controls. More importantly, some of these variables are also correlated with DD, in particular those used as proxies for current SES: income (both one's own and household's income) and years of schooling are negatively related with DD, although in some cases the correlation is only marginally significant (ps<0.07, Table 2). Therefore, the aforementioned ethnic differences in DD might actually be driven by individual socio-economic factors.

After controlling for these potential individual-level confounds, however, *Gitanos* still display higher discount rates than the majority according to both DD characterizations (ps<0.03, models 2-4 in Table 3; see also panels B-E in Figure 2). Comparing model 1 with models 2-4 in Table 3, we observe that the addition of control variables does not substantially reduce the coefficient of ethnicity. Furthermore, among the control variables, only the highest category of own income (*€2000-€3000*) remains significant or marginally significant when ethnicity is taken into account ($ps<0.06$); although as can be seen in Table 1 there are no *Gitanos* in this category, so this result is arguably trivial. Both education and household's income become non-significant ($ps>0.40$). Thus, it is the group-level differences that appear to explain a large portion of the individual-level differences, not the opposite. While our interval regressions do not allow us to compare the partial variance explained by each explanatory variable, an approximation using hierarchical OLS regressions (assuming known indifference points as for the previous secondary analyses, see the Statistical Analysis section) yields useful insights. On the one hand, if entered first, ethnicity explains 9.8% and 9.1% of the variance of *Hyper-K* and *Exp-K*, respectively (both $ps<0.01$), and adding current SES (income and education variables) increases R^2 by 2.6% and 2.8%, respectively. The explanatory power added by current SES is non-significant, however (both $ps>0.33$). On the other hand, if entered first, current SES explains 7.7% and 7.6% of the variance of *Hyper-K* and *Exp-K*, respectively (both $ps<0.01$), and adding ethnicity increases R^2 by 4.7% and 4.3%, respectively. The explanatory power added by ethnicity is significant (both $ps<0.01$).

Finally, another prediction of an adaptationist approach to DD is that age will show a U-shaped relationship with *K*: both young and old individuals must discount the future more heavily than middle-aged individuals (Becker & Mulligan, 1997; Read & Read, 2004) because external hazards are perceived to be higher at younger ages (i.e., young people do not yet know if their world is risky or safe) whereas the true risk of death increases with age (Sozou & Seymour, 2003). We indeed observe a slight U-shaped relationship between age and *K*, in particular among *Gitanos* (see panels B and C in Figure 2), with a minimum *K* at about 44 yr. according to the regression estimates (see models 2-4 in Table 3), similarly to (Read & Read, 2004). Yet, the coefficients of age and age squared would become only close to significance even using one-tailed hypothesis testing (which is justified if the U-shape hypothesis is considered directional; ps<0.20 and ps<0.10 for two- and one-tailed tests, respectively).

4. Discussion

These results contribute to the scarce empirical literature on group-level differences in discounting behavior. Our data supports the adaptationist arguments of leading models built upon Life History Theory (e.g., Ellis et al., 2009; Frankenhuis et al., 2016; Kaplan & Gangestad, 2005). That is, participants from the ethnic group which faces harsher and more unpredictable ecological conditions discount the future more heavily even after controlling for the individuals' current SES. Those adaptationist arguments applied to our results would entail that *Gitanos* discount the future heavily due to environmental uncontrollable factors which turn a preference for the present to be contextually appropriate, at least at the developmental time when this trait is established. Moreover, current SES loses nearly all its explanatory power once ethnicity is taken into account (although it is true that our current SES measures could not cover the whole spectrum of SES-related variables and there might be not enough variability, especially among *Gitanos*). This may ultimately imply that some fraction of the previously-reported relationship between socio-economic variables and DD (Harrison et al., 2002; Kirby et al., 2002; Read & Read, 2004; Tanaka et al., 2010) could be driven by unobserved factors related to the ecological conditions under which individuals developed, rather than by the individuals' current SES.

Recent research shows that individuals from small-scale societies with immediate-return systems display higher DD rates than individuals from agricultural societies in which resource accumulation is more pervasive (Salali & Migliano, 2015). The authors argue that in egalitarian immediate-return economic systems, discounting the future may be a group-level adaptive strategy to the extent that it prevents resource accumulation and, consequently, the formation of hierarchies which could threat within-group equality (Salali & Migliano, 2015; Woodburn, 1982). More research is required, however, to determine whether the existence of group-level selective pressures is a necessary prerequisite for the emergence of this kind of inter-group behavioral differences.

In sum, further empirical research should systematically assess the extent to which inter-individual differences in DD can be better characterized as inter-group differences. Ours is only a first step in this direction which must be complemented with data from a larger number of ethnic groups before being able to draw firmer conclusions. The study of only two ethnic groups which differ in a number of current and historical ecological factors (such as life expectancy, health and socio-economic status, discrimination and persecution rates) prevents a systematic dissection of the partial effects of each one of these group-level differences on DD. A recent study using survey data from more than 40 countries finds that the proportion of "impatient citizens" (i.e., those who chose the sooner-smaller reward in a single hypothetical survey question) in a country is negatively related to the country's average life expectancy (this result has been replicated by Lee et al. 2018 using a different approach), and that adding life expectancy to the equation eliminates the negative country-level relationship between impatience and age at first birth (Bulley & Pepper, 2017). The latter results, although not directly addressing causality due to the cross-sectional nature of the data, suggest that it is environmental mortality cues (as proxied by life expectancy) that influence both short-run orientation and early-reproduction decisions.

With the present data, causality cannot be assessed either and many questions remain unanswered. For instance, future research should try to elucidate which part of the inter-ethnic differences in DD might be understood as reflecting group-level (culturally transmitted) adaptations rather than individual-level adaptations to group-level conditions (Cavalli-Sforza, & Feldman, 1981; Lumsden & Wilson, 1981; McElreath et al., 2003). Life history traits may be acquired through cultural transmission (Boyd & Richerson, 1988; Lumsden & Wilson, 1981). In our case, the historical common experience of discrimination and persecution of the *Gitano* population, which are nowadays much reduced as compared to past centuries, is an obvious candidate to represent a cultural influence on the *Gitanos*' discounting behavior. Only the study of a larger number ethnic groups with varying group-level differences (in terms of both current and historical socio-ecological conditions), however, can effectively tackle this question. Yet, such an exercise would unavoidably lead to loss of experimental control since the inclusion of a larger number of ethnic groups, to the extent that they do not live in the exact same place, implies that many confounding factors are at play, such as geography, natural resource availability, weather, and political regime.

Finally, our method to measure DD imposes several limitations that merit consideration. Although we focus on the differences between groups rather than on the exact estimated discount rates of participants, with the type of DD task we use, the elicited discount rates may be confounded by a series of factors. First, note that if *Gitanos* were less able than the majority to access and exploit the capital market (which seems reasonable), this might translate into higher estimated discount rates which are not related to pure time preference but to the (im)possibility of intertemporal arbitrage (Frederick et al, 2002). Although we consider that the relatively small monetary rewards offered in the task are not treated by subjects as susceptible for market arbitrage, and we also control for a number of income-related variables, whether this factor can explain part of the difference between *Gitanos* and the majority is an interesting endeavor for future research. Second, another possible confound relates to the concavity of the utility function. Our method assumes that individuals' utility functions are approximately linear over the range of stakes involved (this is common in the experimental literature on DD). However, a more concave utility function can be confounded with a higher discount rate (Andersen et al., 2008; Frederick et al, 2002; Lopez-Guzman et al., 2018). In this vein, our results could also be partially explained if *Gitanos* have a more concave utility function compared to the majority. Yet, this would mean that *Gitanos* are more risk averse since individual risk aversion is measured by the concavity of the utility function. Such an argument, while possible, is difficult to sustain given the evidence reviewed earlier (for instance, on incarceration rates).

Third, the preference for sooner-smaller rewards over later-larger ones might be due to uncertainty about the future (Frederick et al, 2002). If any subject feels that the later reward will probably not be delivered then she can take the sooner reward in order to avoid the uncertainty. Therefore, she may appear as impatient while she is not. To alleviate this concern, we used a front-end delay methodology (Harrison et al., 2002) in which both the sooner and the later reward are delayed: the sooner reward is delayed by one month and the later by seven months. Hence, if there is uncertainty/distrust about future payments then both choices will be equally dubious. Note that if the sooner payment is immediate (instead of delayed) – as e.g. in Anokhin et al. (2011), Barkley et al. (2001), Dombrovski et al. (2011), Kirby et al. (2002) – then the respondent may choose it to reduce uncertainty instead of due to pure time preferences. Therefore our results might be explained by uncertainty only if *Gitanos* perceive the future (not the delayed payments in the task per se) as more uncertain than the majority. This is exactly what our paper argues: since the environment of *Gitanos* is harsher and the future is more uncertain for them, they are more focused on the short-run than the majority.

Fourth, a higher expectation of future inflation may lead an individual to prefer sooner-smaller rewards without the influence of time preference, simply because the money is worth less in the future (Frederick et al, 2002). If this confound explains part of our results, it would mean that *Gitanos* expect higher inflation than non-*Gitanos*. In principle, we consider this to be counterintuitive since *Gitanos* should instead be potentially assumed to care less about the possibility of inflation due to their poorer knowledge of economic dynamics – i.e. they should be more, not less, affected by "money illusion". Even assuming that *Gitanos* expect higher inflation than non-*Gitanos* (due to any unobserved differential experience they might have), it is worth noting that the DD differences between the two groups are remarkable. To explain the current results in absence of time preferences, *Gitanos* should expect a differential inflation >25% than the majority. However, the maximum inflation rate that Spain has experienced in the last 30 years was about 7%, with an average of about 3%. Thus, it sounds sensible to conclude that different expectations of inflation do not crucially drive our results. Fifth, if someone believes she will be richer in the future, she might associate a lower relative value to the future rewards – and thus look as more impatient - without any true effect of time preference (Frederick et al, 2002). Applied to our results, this would mean that *Gitanos* expect to be relatively richer in seven months (vs. one month) compared to non-*Gitanos*. In order to test the validity of this concern, we compared the DD of the two groups only for those individuals who have a regular monthly income source. People with regular income are expected to exhibit more homogeneous beliefs about their future wealth than those individuals with irregular income sources. Thus, if this confound is partially driving our results, we would expect that the DD differences between the two groups would be reduced for the subsample of subjects with regular income. However, among those with regular monthly income (n=58), the difference in estimated exponential discount rate between

Gitanos and the majority is about 0.50 (p<0.01; controlling for demographic variables) while among those with more irregular incomes (n=93) the difference is about 0.30 (p<0.02). Therefore, we conclude that this result does not support the hypothesis of expectations of changing utility. In any case, please note that the gap between the two options is only 6 months, short enough to avoid large changes in expected wealth.

In sum, our results suggest that discounting the future heavily might be a contextually appropriate response under the environmental conditions faced by *Gitanos*. A preference for the short-run could thus be developed as an adaptive response to uncertain and harsh ecologies, which talks against the view of impatience as dysfunctional, even if it may yield undesirable outcomes such as drug consumption and other unhealthy behaviors. The latter, however, opens the door for reverse or bi-directional causality in the sense that high DD may trigger morbidity and lower life expectancy. One potential source of reverse causality is genetics: if DD is heritable (Anokhin et al., 2011, 2015; Aycinena & Rentschler, 2017; Bevilacqua & Goldman, 2013), a negative relationship between life expectancy and impatience (Bulley & Pepper, 2017; Lee et al., 2018), for instance, might be led by genetic variation rather than life history calibrations (see Zietsch, 2016 for a discussion).[3] Regarding the current results, it might seem plausible that genetic differences between *Gitanos* and non-*Gitanos* help explain the DD differences. Since inbreeding and endogamy should have increased genetic homogeneity/isolation among *Gitanos* (Cavalli-Sforza et al., 2004; Kalaydjieva et al. 2001, 2005), it follows that if genetic variation drives behavioral variation, *Gitanos*' DD should display lower variance than that of the majority. Yet, variance tests cannot reject the hypothesis that behavioral heterogeneity is the same in the two groups. Indeed, even if *Gitanos* exhibit slightly lower variance in DD (0.40 vs. 0.42 for *Hyper-K* and

[3] We thank Reviewer 2 for suggesting us this discussion.

0.27 vs. 0.29 for *Exp-K*), the difference is largely insignificant (both ps>0.55, two-tailed). Moreover, recall that *Gitanos* were more likely to choose the sooner-smaller reward in every decision (48% and 21% of the *Gitano* and majority individuals, respectively, chose the sooner-smaller option in every decision; see Figure 2A). This fact, arising from the task design, arguably increases the relative behavioral homogeneity among *Gitanos* artificially. The same variance tests conducted excluding those individuals still do not yield significance but show that variation is even slightly higher among *Gitanos* (0.38 vs. 0.34 for *Hyper-K* and 0.27 vs. 0.25 for *Exp-K*; both ps>0.44). These results, therefore, do not favor a gene-based explanation of the between-groups DD differences.

Further research should systematically unpack the relative influences that each one of the specific environmental factors defining individuals' living ecologies have on discounting behavior. In particular, our data indicate that the formation of individuals' time preferences might be importantly shaped by group-level social factors such as discrimination and segregation through their direct impact on environmental harshness and unpredictability.

Ethics statement

All participants provided consent prior to participation. Oral informed consent was obtained because literacy was not a requirement to participate due to the (expected) low educational level of many participants; only being able to read and write numbers was required to participate. This study was conducted in accordance with the Declaration of Helsinki for human research. All participants were treated anonymously by assigning them a numerical code in accordance with the Spanish Law 15/1999 on Personal Data Protection.

References

Ainslie, G. (1975). Specious reward: a behavioral theory of impulsiveness and impulse control. *Psychological Bulletin*, *82*(4), 463.

Andersen, S., Harrison, G. W., Lau, M. I., & Rutström, E. E. (2008). Eliciting risk and time preferences. *Econometrica*, *76*(3), 583-618.

Andersen, S., Harrison, G. W., Lau, M. I., & Rutström, E. E. (2014). Discounting behavior: A reconsideration. *European Economic Review*, *71*, 15-33.

Anokhin, A. P., Golosheykin, S., Grant, J. D., & Heath, A. C. (2011). Heritability of delay discounting in adolescence: a longitudinal twin study. *Behavior Genetics*, *41*(2), 175-183.

Anokhin, A. P., Grant, J. D., Mulligan, R. C., & Heath, A. C. (2015). The genetics of impulsivity: evidence for the heritability of delay discounting. *Biological Psychiatry*, *77*(10), 887-894.

Aycinena, D., & Rentschler, L. (2017). Discounting and digit ratio: Low 2D: 4D predicts patience for a sample of females. *Frontiers in Behavioral Neuroscience*, *11*, 257.

Baker, F., Johnson, M. W., & Bickel, W. K. (2003). Delay discounting in current and never-before cigarette smokers: similarities and differences across commodity, sign, and magnitude. *Journal of Abnormal Psychology*, *112*(3), 382.

Barkley, R. A., Edwards, G., Laneri, M., Fletcher, K., & Metevia, L. (2001). Executive functioning, temporal discounting, and sense of time in adolescents with attention deficit hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD). *Journal of Abnormal Child Psychology*, *29*(6), 541-556.

Becker, G. S., & Mulligan, C. B. (1997). The endogenous determination of time preference. *The Quarterly Journal of Economics*, *112*(3), 729-758.

Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development*, *62*(4), 647-670.

Belsky, J., Schlomer, G. L., & Ellis, B. J. (2012). Beyond cumulative risk: distinguishing harshness and unpredictability as determinants of parenting and early life history strategy. *Developmental Psychology*, *48*(3), 662.

Bevilacqua, L., & Goldman, D. (2013). Genetics of impulsive behaviour. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, *368*(1615), 20120380.

Bickel, W. K., & Marsch, L. A. (2001). Toward a behavioral economic understanding of drug dependence: delay discounting processes. *Addiction*, *96*(1), 73-86.

Bittles, A. H. (2012). *Consanguinity in context* (Vol. 63). New York: Cambridge University Press.

Boyd, R., & Richerson, P. J. (1988). *Culture and the evolutionary process*. University of Chicago press.

Brañas-Garza, P., Cobo-Reyes, R. & Dominguez, A. (2006). Si él lo necesita: Gypsy fairness in Vallecas. *Experimental Economics*, *9*(3): 253-264.

Brumbach, B. H., Figueredo, A. J., & Ellis, B. J. (2009). Effects of harsh and unpredictable environments in adolescence on development of life history strategies. *Human Nature*, *20*(1), 25-51.

Bulley, A., & Pepper, G. V. (2017). Cross-country relationships between life expectancy, intertemporal choice and age at first birth. *Evolution and Human Behavior*, *38*(5), 652-658.

Bulley, A., Pepper, G. V., & Suddendorf, T. (2017). Using foresight to prioritise the present. *Behavioral and Brain Sciences*, *40*.

Casals, M., Pila, P., Langohr, K., Millet, J. P., Caylà, J. A., & Roma Population Working Group. (2011). Incidence of infectious diseases and survival among the Roma population: a longitudinal cohort study. *The European Journal of Public Health*, ckq204.

Cavalli-Sforza, L. L., & Feldman, M. W. (1981). *Cultural Transmission and Evolution: A Quantitative Approach* (No. 16). New Jersey: Princeton University Press.

Cavalli-Sforza, L. L., Moroni, A., & Zei, G. (2004). *Consanguinity, inbreeding, and genetic drift in Italy* (Vol. 39). Princeton University Press.

Cerezo, A. I. (2016). Women in Prison in Spain: The Implementation of Bangkok Rules to the Spanish Prison Legislation. *European Journal on Criminal Policy and Research*, *23*(2), 133-151.

Chabris, C. F., Laibson, D., Morris, C. L., Schuldt, J. P., & Taubinsky, D. (2008). Individual laboratory-measured discount rates predict field behavior. *Journal of Risk and Uncertainty*, *37*(2-3), 237.

Chipman, A., & Morrison, E. (2015). Experimentally induced stress decreases ideal female reproductive timing. *Psychoneuroendocrinology*, *62*, 89-95.

Cook, B., Wayne, G. F., Valentine, A., Lessios, A., & Yeh, E. (2013). Revisiting the evidence on health and health care disparities among the Roma: a systematic review 2003–2012. *International Journal of Public Health*, *58*(6), 885-911.

Daly, M., & Wilson, M. (2005). Carpe diem: Adaptation and devaluing the future. *The Quarterly Review of Biology*, *80*(1), 55-60.

Del Giudice, M., Gangestad, S. W., & Kaplan, H. S. (2015). Life history theory and evolutionary psychology. *The handbook of evolutionary psychology. Vol. 1. Foundations*, 88-114.

Dickins, T. E., Johns, S. E., & Chipman, A. (2012). Teenage pregnancy in the United Kingdom: A behavioral ecological perspective. *Journal of Social, Evolutionary, and Cultural Psychology*, *6*(3), 344.

Dombrovski, A. Y., Szanto, K., Siegle, G. J., Wallace, M. L., Forman, S. D., Sahakian, B., ... & Clark, L. (2011). Lethal forethought: delayed reward discounting differentiates high- and low-lethality suicide attempts in old age. *Biological Psychiatry*, *70*(2), 138-144.

Eisenstein, S. A., Gredysa, D. M., Antenor–Dorsey, J. A., Green, L., Arbeláez, A. M., Koller, J. M., ... & Hershey, T. (2015). Insulin, central dopamine D2 receptors, and monetary reward discounting in obesity. *PloS one*, *10*(7), e0133621.

Ellis, B. J. (2004). Timing of pubertal maturation in girls: an integrated life history approach. *Psychological Bulletin*, *130*(6), 920.

Ellis, B. J., Figueredo, A. J., Brumbach, B. H., & Schlomer, G. L. (2009). Fundamental dimensions of environmental risk. *Human Nature*, *20*(2), 204-268.

Espín, A. M., Brañas-Garza, P., Herrmann, B., & Gamella, J. F. (2012). Patient and impatient punishers of free-riders. *Proceedings of the Royal Society of London B: Biological Sciences, 279*(1749), 4923-4928.

Espín, A. M., Brañas-Garza, P., Gamella, J.F., Herrmann, B. & Martín, J. (2018). Bringing together “old” and “new” ways of solving social dilemmas: the case of Spanish *Gitanos*. *Unpublished*.

Espín, A. M., Exadaktylos, F., Herrmann, B., & Brañas-Garza, P. (2015). Short-and long-run goals in ultimatum bargaining: impatience predicts spite-based behavior. *Frontiers in Behavioral Neuroscience*, *9*, 214.

Feintuch, S. (2013). *Power, Perceptions, and Incarceration: An Analysis of Spain‘s New External Units for Imprisoned Mothers and Children*. Doctoral dissertation, Central European University.

Frankenhuis, W. E., Panchanathan, K., & Nettle, D. (2016). Cognition in harsh and unpredictable environments. *Current Opinion in Psychology*, *7*, 76-80.

Fraser, A. (1995). *The gypsies*. Oxford: Wiley-Blackwell.

Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature*, *40*(2), 351-401.

Gamella, J. F. (1996). *La población gitana en Andalucía: un estudio exploratorio de sus condiciones de vida*. Sevilla: Consejería de Trabajo y Asuntos Sociales, Junta de Andalucía.

Gamella, J. F., Martín, E. (2007). Vien avec moi cousine. Le mariage entre cousins germains chez le Gitans Andalous. *Etudes Tsiganes*, *30*(2), 110-151.

Gamella, J. F. (2011). *Historias de éxito. Modelos para reducir el abandono escolar de la adolescencia gitana*. Madrid: Ministerio de Educación, Gobierno de España.

Gamella, J. F., Martín Carrasco-Muñoz, E., & Núñez Negrillo, A. M. (2013). Oculocutaneous albinism and consanguineous marriage among Spanish Gitanos or Calé–a study of 83 cases. *Collegium Antropologicum*, *37*(3), 723-734.

Gamella, J. F., Martín Carrasco-Muñoz, E., & Quesada Garrido, A. (2014). New methodological approaches in the anthropological demography of Romani groups. An example from the study of the evolution of the infant and child mortality of the Gitanos or Calé of Spain (1871-2007). *Sociologia de Universidade Do Porto*, 175-204.

Gamella, J.F., & Martín, E. (2017). The decline of infant and child mortality among Spanish Gitanos or Calé (1871-2005). A microdemographic study in Andalusia. *Demographic Research*, *36*, 945-988.

Green, L., Myerson, J., Lichtman, D., Rosen, S., & Fry, A. (1996). Temporal discounting in choice between delayed rewards: the role of age and income. *Psychology and Aging*, *11*(1), 79.

Griskevicius, V., Tybur, J. M., Delton, A. W., & Robertson, T. E. (2011). The influence of mortality and socioeconomic status on risk and delayed rewards: a life history theory approach. *Journal of Personality and Social Psychology*, *100*(6), 1015.

Harrison, G. W., Lau, M. I., & Williams, M. B. (2002). Estimating individual discount rates in Denmark: A field experiment. *The American Economic Review*, *92*(5), 1606-1617.

Hill, E. M., Jenkins, J., & Farmer, L. (2008). Family unpredictability, future discounting, and risk taking. *The Journal of Socio-Economics*, *37*(4), 1381-1396.

Johns, S. E., Dickins, T. E., & Clegg, H. T. (2011). Teenage pregnancy and motherhood: How might evolutionary theory inform policy?. *Journal of Evolutionary Psychology*, *9*(1), 3-19.

Kalaydjieva, L., Gresham, D., & Calafell, F. (2001). Genetic studies of the Roma (Gypsies): a review. *BMC Medical Genetics*, *2*(1), 5.

Kalaydjieva, L., Morar, B., Chaix, R., & Tang, H. (2005). A newly discovered founder population: the Roma/Gypsies. *Bioessays*, *27*(10), 1084-1094.

Kaplan, H. S., & Gangestad, S. W. (2005). Life history theory and evolutionary psychology. *The Handbook of Evolutionary Psychology*, 68-95.

Kidd, C., Palmeri, H., & Aslin, R. N. (2013). Rational snacking: Young children's decision-making on the marshmallow task is moderated by beliefs about environmental reliability. *Cognition*, *126*(1), 109-114.

Kirby, K. N., Godoy, R., Reyes-Garcia, V,, Byron, E., Apaza, L., Leonard, W., Perez, E., Vadez, V. & Wilkie, D. (2002). Correlates of delay-discount rates: Evidence from Tsimane' Amerindians of the Bolivian rain forest. *Journal of Economic Psychology*, *23*(3), 291-316.

Kirby, K. N. (2009). One-year temporal stability of delay-discount rates. *Psychonomic Bulletin & Review*, *16*(3), 457-462.

La Parra Casado, D., Gil González, D., & de la Torre Esteve, M. (2016). The social class gradient in health in Spain and the health status of the Spanish Roma. *Ethnicity & Health*, *21*(5), 468-479.

Lee, A. J., Debruine, L. M., & Jones, B. C. (2018). Individual-specific mortality is associated with how individuals evaluate future discounting decisions. *Proceedings of the Royal Society of London B: Biological Sciences*. DOI: 10.1098/rspb.2018.0304.

Lopez-Guzman, S., Konova, A. B., Louie, K., & Glimcher, P. W. (2018). Risk preferences impose a hidden distortion on measures of choice impulsivity. *PLoS ONE*, *13*(1), e0191357.

Lumsden, C. J., & Wilson, E. O. (1981). *Genes, mind, and culture: The coevolutionary process*. MA: Harvard University Press.

Martín, E., & Gamella, J. F. (2005). Marriage practices and ethnic differentiation: The case of Spanish Gypsies (1870–2000). *The History of the Family*, *10*(1), 45-63.

Mathot, K. J., & Frankenhuis, W. E. (2018). Models of pace-of-life syndromes (POLS): a systematic review. *Behavioral Ecology and Sociobiology*, *72*(3), 41.

Matras, Y. (2015). *The Romani Gypsies*. Cambridge: Harvard University Press.

McCullough, M. E., Pedersen, E. J., Schroder, J. M., Tabak, B. A., & Carver, C. S. (2013). Harsh childhood environmental characteristics predict exploitation and retaliation in humans. *Proceedings of the Royal Society of London B: Biological Sciences*, *280*(1750), 20122104.

McElreath, R., Boyd, R., & Richerson, P. (2003). Shared norms and the evolution of ethnic markers. *Current Anthropology*, *44*(1), 122-130.

McGuire, J. T., & Kable, J. W. (2013). Rational temporal predictions can underlie apparent failures to delay gratification. *Psychological review*, *120*(2), 395-410.

Meier, S., & Sprenger, C. (2010). Present-biased preferences and credit card borrowing. *American Economic Journal: Applied Economics*, *2*(1), 193-210.

Meier, S., & Sprenger, C. D. (2012). Time discounting predicts creditworthiness. *Psychological Science*, *23*(1), 56-58.

Mejía-Cruz, D., Green, L., Myerson, J., Morales-Chainé, S., & Nieto, J. (2016). Delay and probability discounting by drug-dependent cocaine and marijuana users. *Psychopharmacology*, *233*(14), 2705-2714.

Mell, H., Safra, L., Algan, Y., Baumard, N., & Chevallier, C. (2018). Childhood environmental harshness predicts coordinated health and reproductive strategies: A cross-sectional study of a nationally representative sample from France. *Evolution and Human Behavior*, *39*(1), 1-8.

Ministerio de Sanidad y Consumo - Fundación Secretariado Gitano (2005). *Health and the Roma Community*. Madrid: Ministerio de Sanidad y Consumo, Gobierno de España. https://www.msssi.gob.es/fr/profesionales/saludPublica/prevPromocion/promocion/desigualdadSalud/docs/Health_and_the_Roma_Community.pdf (accessed 2017-03-18).

Nettle, D., Coall, D. A., & Dickins, T. E. (2010). Birthweight and paternal involvement predict early reproduction in British women: evidence from the National Child Development Study. *American Journal of Human Biology*, *22*(2), 172-179.

Nettle, D., Coall, D. A., & Dickins, T. E. (2011). Early-life conditions and age at first pregnancy in British women. *Proceedings of the Royal Society of London B: Biological Sciences*, *278*(1712), 1721-1727.

Núñez Negrillo, A. M. (2016). *Un siglo de matrimonios consanguíneos en la archidiócesis de Granada (1900-1999). Un análisis antropológico*. PhD Dissertation, University of Granada.

Ohmura, Y., Takahashi, T., Kitamura, N., & Wehr, P. (2006). Three-month stability of delay and probability discounting measures. *Experimental and Clinical Psychopharmacology*, *14*(3), 318.

Pender, J. L. (1996). Discount rates and credit markets: Theory and evidence from rural India. *Journal of Development Economics*, *50*(2), 257-296.

Pepper, G. V., & Nettle, D. (2017). The behavioural constellation of deprivation: causes and consequences. *Behavioral and Brain Sciences*, 40, E314. doi:10.1017/S0140525X1600234X.

Promislow, D. E., & Harvey, P. H. (1990). Living fast and dying young: A comparative analysis of life-history variation among mammals. *Journal of Zoology*, *220*(3), 417-437.

Rachlin, H., & Green, L. (1972). Commitment, choice and self-control. *Journal of the Experimental Analysis of Behavior*, *17*(1), 15-22.

Ramos, D., Victor, T., Seidl-de-Moura, M. L., & Daly, M. (2013). Future discounting by slum-dwelling youth versus university students in Rio de Janeiro. *Journal of Research on Adolescence*, *23*(1), 95-102.

Rawls J. (1971). *A Theory of Justice*. Cambridge, MA: Harvard University Press.

Read, D., & Read, N. L. (2004). Time discounting over the lifespan. *Organizational Behavior and Human Decision Processes*, 94(1), 22-32.

Read, D., & Van Leeuwen, B. (1998). Predicting hunger: The effects of appetite and delay on choice. *Organizational behavior and human decision processes*, *76*(2), 189-205.

Reimers, S., Maylor, E. A., Stewart, N., & Chater, N. (2009). Associations between a one-shot delay discounting measure and age, income, education and real-world impulsive behavior. *Personality and Individual Differences*, *47*(8), 973-978.

Réale, D., Garant, D., Humphries, M. M., Bergeron, P., Careau, V., & Montiglio, P. O. (2010). Personality and the emergence of the pace-of-life syndrome concept at the population level. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *365*(1560), 4051-4063.

Reynolds, B., Ortengren, A., Richards, J. B., & de Wit, H. (2006). Dimensions of impulsive behavior: Personality and behavioral measures. *Personality and Individual Differences*, *40*(2), 305-315.

Roff, D. (Ed.). (1993). *Evolution of life histories: theory and analysis*. New York: Chapman & Hall.

Salali, G. D., & Migliano, A. B. (2015). Future discounting in Congo basin hunter-gatherers declines with socio-economic transitions. *PLoS ONE*, *10*(9), e0137806.

Sen, A. (1992). *Inequality Reexamined*. Oxford, NY: Clarendon Press.

Sozou, P. D. & Seymour, R. M. (2003). Augmented discounting: interaction between aging and time-preference behavior. *Proceedings of the Royal Society of London B: Biological Sciences* 270, 1047-1053

Stojek, M. M., Fischer, S., Murphy, C. M., & MacKillop, J. (2014). The role of impulsivity traits and delayed reward discounting in dysregulated eating and drinking among heavy drinkers. *Appetite, 80*, 81-88.

Sutter, M., Kocher, M. G., Glätzle-Rützler, D., & Trautmann, S. T. (2013). Impatience and uncertainty: Experimental decisions predict adolescents' field behavior. *The American Economic Review*, *103*(1), 510-531.

Tanaka, T., Camerer, C. F., & Nguyen, Q. (2010). Risk and time preferences: linking experimental and household survey data from Vietnam. *The American Economic Review, 100*(1), 557-571.

Weller, R. E., Cook, E. W., Avsar, K. B., & Cox, J. E. (2008). Obese women show greater delay discounting than healthy-weight women. *Appetite*, *51*(3), 563-569.

Woodburn, J. (1980). *Hunters and gatherers today and reconstruction of the past*. US: Soviet and Western Anthropology.

Woodburn, J. (1982). Social dimensions of death in four African hunting and gathering societies. *Death and the Regeneration of Life*, 187-210.

Worthman, C. M. (2003). Energetics, sociality, and human reproduction: life history theory in real life. *Offspring: Human Fertility Behavior in Biodemographic Perspective*, 289-321.

Yi, R., Mitchell, S. H., & Bickel, W. K. (2010). Delay discounting and substance abuse-dependence. In: *Impulsivity: The behavioral and neurological science of discounting* (Eds.: G. McFadden & W. Bickel), 191-211, Columbia: APA Publishers.

Zietsch, B. P. (2016). Individual differences as the output of evolved calibration mechanisms: Does the theory make sense in view of empirical observations?. *Current Opinion in Psychology*, *7*, 71-75.

Tables

Table 1. Descriptive statistics for the *Gitano* and majority samples

	Gitanos					*Majority*				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Hyper-K	64	0.912	0.397	0.020	1.211	87	0.640	0.419	0.020	1.211
Exp-K	64	0.682	0.273	0.020	0.877	87	0.501	0.293	0.020	0.877
Gender (male)	64	0.469	0.503	0	1	87	0.287	0.455	0	1
Age	64	38.860	14.799	17	73	87	53.276	19.027	17	82
Regular income	64	0.250	0.436	0	1	87	0.483	0.503	0	1
Own income										
€0	64	0.297	0.460	0	1	87	0.322	0.469	0	1
(€0, €500)	64	0.516	0.504	0	1	87	0.126	0.334	0	1
[€500, €1000)	64	0.156	0.366	0	1	87	0.437	0.499	0	1
[€1000, €2000)	64	0.031	0.175	0	1	87	0.080	0.274	0	1
[€2000, €3000)	64	0	0	0	0	87	0.034	0.184	0	1
Other household's income										
€0	64	0.391	0.492	0	1	87	0.322	0.469	0	1
(€0, €500)	64	0.453	0.502	0	1	87	0.092	0.291	0	1
[€500, €1000)	64	0.109	0.315	0	1	87	0.276	0.450	0	1
[€1000, €2000)	64	0.047	0.213	0	1	87	0.172	0.380	0	1
[€2000, €3000)	64	0	0	0	0	87	0.103	0.306	0	1
≥€3000	64	0	0	0	0	87	0.034	0.184	0	1
Years schooling	64	2.906	3.022	0	6	87	6.632	4.232	0	15

Notes: Number of observations, mean, standard deviation, minimum value and maximum value for each of the variables used in the analyses, separately for the *Gitano* and majority samples. Note that the average educational level of our participants is rather low as compared to the country's official statistics due to the facts that (i) the experiments were conducted in a semi-rural and low-income area, and (ii) that the participants were older than the average Spanish population (older adults are still nowadays less educated than younger ones in Spain, especially in rural and poor areas; see the strong negative correlation between age and years of schooling in Table 2).

Table 2. Bivariate Zero-Order Correlations

	DD	Ethnicity (*Gitano*)	Gender (male)	Age	Regular income	Own income	Other h's income
Ethnicity (*Gitano*)	0.3172*** 0.0001	-					
Gender (male)	0.0039 0.9625	0.1863** 0.0220	-				
Age	-0.0868 0.2895	-0.3838*** 0.0000	-0.0616 0.4525	-			
Regular income	-0.1118 0.1716	-0.2365*** 0.0035	0.2228*** 0.0060	0.3314*** 0.0000	-		
Own income	-0.1602** 0.0494	-0.2161*** 0.0077	0.2781*** 0.0005	0.3222*** 0.0001	0.6676*** 0.0000	-	
Other household's income	-0.1581* 0.0524	-0.3082*** 0.0001	-0.1727** 0.0339	-0.2532*** 0.0017	-0.1306 0.1100	-0.1799** 0.0271	-
Years Schooling	-0.1506* 0.0649	-0.4194*** 0.0000	0.0540 0.5103	-0.3831*** 0.0000	0.0387 0.6373	0.0282 0.7309	0.3282*** 0.0000

Notes: Spearman's rho coefficients and p-values. *Ethnicity*, *Gender* and *Regular income* are dummy variables taking the value of one if the participant is *Gitano*, male and has a regular income source, respectively; zero otherwise. *Own income* and *Other household's income* are coded as ordered discrete variables. Since these are rank-order correlations, the measure of DD here is merely given by the number of sooner-smaller choices in the task, which is independent from the functional form used to characterize DD. * p<0.1, ** p<0.05, *** p<0.01, two-tailed.

Table 3. Interval regression estimation of individuals' DD (*K*)

	1a	1b	2a	2b	3a	3b	4a	4b
dep. var.:	*Hyper-K*	*Exp-K*	*Hyper-K*	*Exp-K*	*Hyper-K*	*Exp-K*	*Hyper-K*	*Exp-K*
Ethnicity (*Gitano*)	0.375***	0.264***	0.444***	0.311***	0.403***	0.280***	0.399**	0.277**
	(0.097)	(0.069)	(0.105)	(0.075)	(0.123)	(0.087)	(0.176)	(0.125)
Gender (male)			-0.091	-0.069	-0.037	-0.030	-0.041	-0.031
			(0.104)	(0.074)	(0.106)	(0.076)	(0.122)	(0.087)
Age			-0.024	-0.017	-0.021	-0.016	-0.021	-0.015
			(0.016)	(0.011)	(0.015)	(0.011)	(0.016)	(0.011)
Age^2			0.027	0.020	0.025	0.018	0.025	0.018
			(0.018)	(0.013)	(0.017)	(0.012)	(0.017)	(0.012)
Regular Income					0.034	0.023	0.023	0.016
					(0.145)	(0.104)	(0.145)	(0.104)
own income (€0, €500)					-0.070	-0.051	-0.083	-0.059
					(0.140)	(0.099)	(0.146)	(0.103)
own income [€500, €1000)					-0.156	-0.114	-0.158	-0.116
					(0.163)	(0.116)	(0.163)	(0.116)
own income [€1000, €2000)					-0.061	-0.038	-0.109	-0.073
					(0.208)	(0.147)	(0.220)	(0.155)
own income [€2000, €3000)					-0.634**	-0.467**	-0.625*	-0.456*
					(0.287)	(0.213)	(0.324)	(0.240)
other household's income (€0, €500)							0.024	0.012
							(0.138)	(0.098)
other household's income [€500, €1000)							-0.045	-0.036
							(0.143)	(0.102)
other household's income [€1000, €2000)							-0.109	-0.075
							(0.154)	(0.109)
other household's income [€2000, €3000)							-0.176	-0.131
							(0.225)	(0.160)
other household's income ≥€3000							-0.103	-0.078
							(0.226)	(0.159)
Years schooling							0.012	0.008
							(0.018)	(0.013)
Constant	0.648***	0.510***	1.079***	0.833***	1.089***	0.840***	1.059**	0.824***
	(0.058)	(0.041)	(0.324)	(0.229)	(0.314)	(0.222)	(0.431)	(0.304)
ln sigma Cons.	-0.607***	-0.945***	-0.618***	-0.956***	-0.632***	-0.971***	-0.638***	-0.978***
	(0.075)	(0.077)	(0.073)	(0.075)	(0.073)	(0.075)	(0.074)	(0.075)
chi^2	14.910***	14.516***	19.180***	18.757***	28.613***	27.437***	34.569***	34.463***
ll	-395.167	-390.9827	-393.4772	-389.2568	-391.6776	-387.3093	-391.1013	-386.7487
Pseudo-R^2	0.094	0.091	0.114	0.112	0.135	0.134	0.141	0.141
N	151	151	151	151	151	151	151	151

Notes: Interval regression estimates. Model 1 tests the effect of ethnicity on DD without control variables. In model 2, demographic controls are included (Age^2 refers to $Age^2/100$). Whether the individual has a regular income source and the individual's own monthly income (omitted category: €0) are also controlled for in model 3. Finally, model 4 also controls for other household's income (omitted category: €0) and years of schooling. For each model specification, *Hyper-K* and *Exp-*

K are the dependent variable in column (a) and (b), respectively. Robust standard errors in parentheses. Pseudo-R^2 refers to Cox-Snell's index. * $p<0.1$, ** $p<0.05$, *** $p<0.01$, two-tailed.

SUPPLEMENTARY MATERIALS

for

"The appropriate response of Spanish *Gitanos*: Short-run orientation beyond current socio-economic status"

S1. The delay discounting task

For the experiment, we used an adaptation of the intertemporal choice task used by Harrison et al. (2002; see main text). We decided to use a front-end delay procedure to capture long-term discounting behavior and minimize the effect of distrust (in terms of whether the experimenters will effectively come back to the town to pay participants) on individuals' choices. To do this, we employed a task consisting of 20 categories ranging from 2% to 100% simple annual interest rate (*r*). The procedure was as follows.

Four assistants delivered the delay discounting decision sheet to the participants (each session consisted of 32 individuals, always with the same instructor [PBG] conducting the experiments). As can be seen in Figure S1, the decision sheet contained a table with two main columns (options A and B) and 20 rows. In each row, option A offered €150 to be received one month after the experiment, while option B offered a higher amount to be received seven months after the experiment. In an extra column, the participants could see the interest rate associated with the six-month wait (that is, with choosing option B), which increases across rows from 2% to 100%. Thus, option B in the first row offered €151.50 (i.e. $r = 0.02$) and option B in the twentieth row offered €225 ($r = 1$). The participants had to choose between option A and B in each of the 20 rows by marking with a cross on the corresponding column.

In order to avoid mistakes and, more specifically, inconsistent choices – a frequent problem with multiple-price-list tasks, where multiple switching patterns are often observed, even among university students –, the instructor conducted the task row by row. Subjects were asked, scenario by scenario, to choose between A and B. Moreover, they were advised that once option B was reached they should stay at that point, given that once B has been already chosen it makes no sense to switch to option A again in the next row. Given the (expected) low educational level of a non-negligible proportion of our participants (see Table 1 in the main text), we believe that this systematic procedure importantly reduced the number of mistakes. Since inconsistent choices impede the estimation of an individual's discount rate, we thus reduced a potentially high number of missing observations to zero.

The participants were told that because of financial constraints only one, randomly selected individual per session would be paid for this part of the experiment. Once the decision sheets were collected, the "winner" and the "prize" (row) were randomly selected by picking numbered balls from an opaque bag in front of the participants. The average earnings of the five selected participants were €166.50. One member of the team [AME] phoned each of them in order to arrange a meeting for payment after one or seven months depending on the option chosen by the participant in the randomly selected row. This was common knowledge among participants when making their decisions. Since both options in the task were delayed (front-end delay), our design avoids the problem of different transaction costs between options – including different levels of trust in getting actually paid.

Figure S1. Screenshot of the delay discounting decision sheet (translated from Spanish)

Mark with an X the chosen option

	1 MONTH OPTION A	7 MONTHS OPTION B	INTEREST	A	B
1	150.00 €	151.50 €	2%		
2	150.00 €	154.00 €	5%		
3	150.00 €	157.50 €	10%		
4	150.00 €	161.00 €	15%		
5	150.00 €	165.00 €	20%		
6	150.00 €	169.00 €	25%		
7	150.00 €	172.50 €	30%		
8	150.00 €	176.00 €	35%		
9	150.00 €	180.00 €	40%		
10	150.00 €	184.00 €	45%		
11	150.00 €	187.50 €	50%		
12	150.00 €	191.00 €	55%		
13	150.00 €	195.00 €	60%		
14	150.00 €	199.00 €	65%		
15	150.00 €	202.50 €	70%		
16	150.00 €	206.00 €	75%		
17	150.00 €	210.00 €	80%		
18	150.00 €	214.00 €	85%		
19	150.00 €	217.50 €	90%		
20	150.00 €	225.00 €	100%		

S2. Robustness checks for secondary analyses

In this section, we complement the statistical analysis reported in the main text based on Spearman correlations (Table 2). In particular, we check the robustness of those analyses which include at least one binary variable to more appropriate statistical tests (i.e. either Mann-Whitney test or Fisher's exact test in the case of two binary variables; two-tailed).

According to Mann-Whitney test,

- compared to a non-*Gitano*, the probability that a *Gitano*: chooses the sooner-smaller reward more often in the DD task is 68.2% ($p<0.001$); is older is 27.6% ($p<0.001$); reports a higher personal income is 37.9% ($p=0.008$); reports a higher (other) household's income is 32.6% ($p<0.001$); reports a higher number of years of schooling is 27.1% ($p<0.001$).
- compared to a female, the probability that a male: chooses the sooner-smaller reward more often in the DD task is 50.2% ($p=0.962$); is older is 46.3% ($p=0.451$); reports a higher personal income is 65.9% ($p<0.001$); reports a higher (other) household's income is 40.0% ($p=0.034$); reports a higher number of years of schooling is 53.0% ($p=0.509$).
- compared to someone without regular income, the probability that a participant with regular income: chooses the sooner-smaller reward more often in the DD task is 43.5% ($p=0.171$); is older is 69.7% ($p<0.001$); reports a higher personal income is 87.9% ($p<0.001$); reports a higher (other) household's income is 42.5% ($p=0.110$); reports a higher number of years of schooling is 52.1% ($p=0.636$).

According to Fisher's exact test,

- compared to non-*Gitanos*, *Gitanos* are 18.2% more likely to be male (46.9% vs. 28.7%; $p=0.027$) and 23.3% less likely to report a regular income (25.0% vs. 48.3%; $p=0.004$).
- compared to females, males are 21.0% more likely to be *Gitano* (54.5% vs. 35.4%; $p=0.027$) and 22.5% more likely to report a regular income (52.7% vs. 30.2%; $p=0.009$).

- compared to those without regular income, participants with regular income are 24.0% less likely to be *Gitano* (27.6% vs. 51.6%; p=0.004) and 22.0% more likely to be male (50.0% vs. 28.0%; p=0.009)

S3. Robustness checks for the treatment of missing values

Table S1 replicates the set of regressions presented in Table 3 in the main text but replacing the nine missing values with the sample average of the variable in each case.

Table S1. Interval regression estimation of individuals' DD (*K*) without exclusions

dep. var.:	1a *Hyper-K*	1b *Exp-K*	2a *Hyper-K*	2b *Exp-K*	3a *Hyper-K*	3b *Exp-K*	4a *Hyper-K*	4b *Exp-K*
Ethnicity (*Gitano*)	0.395***	0.279***	0.455***	0.320***	0.432***	0.303***	0.359**	0.250**
	(0.098)	(0.070)	(0.106)	(0.076)	(0.124)	(0.088)	(0.174)	(0.124)
Gender (male)			-0.092	-0.068	-0.039	-0.030	-0.036	-0.028
			(0.103)	(0.074)	(0.107)	(0.076)	(0.121)	(0.086)
Age			-0.027*	-0.020*	-0.022	-0.016	-0.023	-0.016
			(0.016)	(0.016)	(0.016)	(0.011)	(0.016)	(0.011)
Age^2			0.029*	0.021*	0.025	0.018	0.024	0.018
			(0.018)	(0.013)	(0.017)	(0.012)	(0.017)	(0.012)
Regular Income					0.080	0.058	0.072	0.053
					(0.141)	(0.101)	(0.141)	(0.101)
own income: (€0, €500)					-0.141	-0.103	-0.165	-0.119
					(0.143)	(0.102)	(0.148)	(0.105)
own income: [€500, €1000)					-0.213	-0.155	-0.222	-0.162
					(0.161)	(0.115)	(0.160)	(0.115)
own income: [€1000, €2000)					-0.121	-0.080	-0.175	-0.120
					(0.205)	(0.145)	(0.219)	(0.155)
own income: [€2000, €3000)					-0.711**	-0.523**	-0.651**	-0.477**
					(0.288)	(0.214)	(0.317)	(0.235)
other household's income: (€0, €500)							0.058	0.036
							(0.138)	(0.098)
other household's income: [€500, €1000)							-0.064	-0.049
							(0.144)	(0.103)
other household's income: [€1000, €2000)							-0.172	-0.122
							(0.154)	(0.110)
other household's income: [€2000, €3000)							-0.237	-0.174
							(0.225)	(0.160)
other household's income: ≥€3000							-0.197	-0.144
							(0.220)	(0.155)
Years schooling							0.007	0.005
							(0.018)	(0.013)
Constant	0.651***	0.512***	1.165***	0.895***	1.134***	0.871***	1.233***	0.946***
	(0.058)	(0.041)	(0.330)	(0.238)	(0.318)	(0.225)	(0.427)	(0.301)
ln sigma Cons.	-0.581***	-0.917***	-0.592***	-0.928***	-0.607***	-0.944***	-0.616***	-0.954***
	(0.075)	(0.077)	(0.073)	(0.075)	(0.073)	(0.075)	(0.074)	(0.075)
chi^2	16.28***	15.85***	20.34***	19.89***	30.13***	28.84***	37.85***	37.77***
ll	-413.482	-410.038	-411.638	-408.136	-409.395	-405.740	-408.366	-404.743
Pseudo-R^2	0.097	0.095	0.118	0.116	0.142	0.142	0.153	0.153
N	160	160	160	160	160	160	160	160

Notes: Interval regression estimates. Model 1 tests the effect of ethnicity on DD without control variables. In model 2, demographic controls are included (*Age^2* refers to *$Age^2/100$*). Whether the individual has a regular income source and the individual's own monthly income (omitted category: €0) are also controlled for in model 3. Finally, model 4 also controls for other household's income (omitted category: €0) and years of schooling. For each model specification, *Hyper-K* and *Exp-K* are the dependent variable in column (a) and (b), respectively. Robust standard errors in parentheses. Pseudo-R^2 refers to Cox-Snell's index. * p<0.1, ** p<0.05, *** p<0.01, two-tailed.