

Do pretty women inspire men to discount the future?

Margo Wilson* and Martin Daly

Department of Psychology, McMaster University, Hamilton, Ontario L8S 4K1, Canada

* Author for correspondence (wilson@mcmaster.ca).

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Organisms ‘discount the future’ when they value imminent goods over future goods. Optimal discounting varies: selection should favour allocations of effort that effectively discount the future relatively steeply in response to cues promising relatively good returns on present efforts. However, research on human discounting has hitherto focused on stable individual differences rather than situational effects.

In two experiments, discounting was assessed on the basis of choices between a smaller sum of money tomorrow and a larger sum at a later date, both before and after subjects rated the ‘appeal’ of 12 photographs. In experiment 1, men and women saw either attractive or unattractive opposite-sex faces; in experiment 2, participants saw more or less appealing cars. As predicted, discounting increased significantly in men who viewed attractive women, but not in men who viewed unattractive women or women who viewed men; viewing cars produced a different pattern of results.

Keywords: future discounting; sex differences; sexual selection; attractiveness

1. INTRODUCTION

Present goods are preferred over future goods, both because deferred benefits may be lost altogether and because earlier reproduction generally yields a higher intrinsic rate of increase than later reproduction. The rate at which future goods are devalued with delay indexes ‘impatience’ or ‘future discounting’. Optimal discounting depends on how quickly expected future utility or fitness declines. For example, the optimal discount rate varies with extrinsic mortality risk (Williams 1957).

Facultative responses to cues predicting the future are often effectively equivalent to adaptive adjustment of discount rates. For example, worker bees assume more dangerous foraging activities both as their wings wear and in response to infections that reduce their expected lifespan (Woyciechowski & Kozlowski 1998). Response to cues of rising mortality risk or temporal foreclosure may also be manifest as thresholds change. For example, female wasps (*Leptopilina heterotoma*) accept a wider range of oviposition sites in response to such cues (Roitberg *et al.* 1992, 1993), and male scorpionflies (*Panorpa cognate*) court females of lower quality as the season progresses (Engqvist & Sauer 2002).

For similar reasons, cues promising relatively good returns on present efforts should inspire allocations of

effort that effectively discount the future relatively steeply. If the availability of courtship-worthy targets inspires an escalation of present mating effort, for example, this must typically be achieved at the expense of future efforts. This line of reasoning inspired the study reported here: will stimuli chosen to induce a ‘mating opportunity mindset’ engender steeper discounting in a standard laboratory measure of personal discount rates?

Human discounting is typically assessed by offering real or hypothetical choices between different monetary sums after different delays (e.g. Frederick *et al.* 2002). Such research has not been greatly influenced by evolutionary theories of life-history trade-offs. Instead, researchers usually compare discount rates between types of people, not situations, implicitly treating ‘impatience’ as a relatively stable personality attribute (but see Laibson 2001). For example, heroin addicts have been found to have higher discount rates than controls (Kirby *et al.* 1999). However, even in this research, there is some evidence that discount rates vary facultatively; for example, addicts’ discount rates increase with delay since their last injection (Giordano *et al.* 2002).

A sex difference in discounting is predictable. Because men have always had some chance of gaining fitness from short-term expenditures of mating effort, whereas successful reproduction typically requires more prolonged parental investment by women, men should have evolved to discount the future more steeply than women, and sex differences in age-specific mortality confirm this expectation (e.g. Arias 2002). Men also have higher discount rates than women in choices of monetary rewards (Kirby & Marakovic 1996).

We hypothesized that inducing a ‘mating opportunity’ mindset by presenting pictures of attractive women would raise men’s discount rates in a monetary choice task, whereas men who viewed pictures of relatively unattractive women would show no such effect. The predicted mindset could make men more present-oriented in general or have specific effects related to the fact that money itself can be used in mating effort; in either case, cues suggesting an elevated present utility of such effort should raise the value of present money relative to that of future money. Women might respond similarly to images of attractive men if, for example, improving one’s appearance to attract desirable men is achieved by resource expenditure, but because fitness gains from mating effort increments have presumably always been higher for men, we predicted that such a response would be smaller or non-existent in women. Finally, to assess whether discount rates might be elevated by more general affective or acquisitive responses, rather than by the specific induction of a mating effort mindset, we ran a parallel experiment in which subjects viewed relatively appealing versus unappealing consumer goods, namely cars.

2. MATERIAL AND METHODS

Research participants were 96 male and 113 female undergraduates (age: 19.45 ± 2.25 years) who volunteered for a study of ‘preferences for things we like’ for introductory psychology course credit. They were randomly divided into four experimental conditions ($n = 23$ to 29) within each experiment (‘faces’ or ‘cars’) in a 2×2 between-groups factorial design: [sex] \times [images pre-selected for either high (‘hot’) or low (‘not’) appeal].

Participants were informed of the procedures to follow, and told that they could win some money with a lucky throw of dice at the end of the experiment, in which case they would receive one of their choices, randomly selected, so they should make each choice as if it

Table 1. Mean and s.e.m. (*n*) ratings of 'how appealing' subjects in the experimental groups rated the 12 images with which they were presented. Rating scale: 1, 'unappealing' to 7, 'very appealing'.

subjects	image category			
	'hot' faces	'not' faces	'hot' cars	'not' cars
males	4.47 ± 0.21 (22)	2.35 ± 0.19 (24)	5.83 ± 0.14 (25)	3.42 ± 0.14 (22)
females	3.58 ± 0.23 (28)	2.50 ± 0.20 (26)	4.42 ± 0.18 (25)	3.90 ± 0.16 (27)
both sexes	3.97 ± 0.17 (50)	2.43 ± 0.13 (50)	5.12 ± 0.15 (50)	3.68 ± 0.11 (49)

were actually to be paid off. They were then seated privately in separate rooms at computers that presented them with three successive tasks: (i) an initial set of nine monetary choices, from which we computed initial discount parameters; (ii) a series of 12 images, presented individually, of either opposite-sex faces or cars, to be rated on their appeal; and (iii) a second set of nine monetary choices, which gave us a second, post-rating-task, discount parameter.

(a) Measuring individual discount parameters

In a modification of the method of Kirby & Marakovich (1996), successive screens provided participants with choices between two monetary options: a specified sum 'tomorrow' (range over the 18 choices of \$15 to \$35) or a larger sum (range of \$50 to \$75) after a specified delay (range of 7 to 236 days).

Indifference between a smaller, earlier reward (tomorrow) and a larger, later reward (future) indicates the following hyperbolic discount parameter k (Kirby & Santiesteban 2003):

$$k = (\text{future\$} - \text{tomorrow\$}) / ((\text{delay(in days)} \times \text{tomorrow\$}) - (\text{future\$})).$$

The choice sets presented before and after the rating task had identical distributions of associated k -values, ranging from 0.000 159 (the equivalent of indifference between \$34 tomorrow and \$35 in 186 days) to 0.411 765 (the equivalent of indifference between \$20 tomorrow and \$55 in 7 days), but the specific monetary sums and delays were different. Choices over such a range reveal where one begins to prefer larger, later rewards; individual discount parameters are computed as the geometric mean of the k -values bounding this preference switch (Kirby & Marakovich 1996).

After completing all tasks, participants rolled two standard dice, and anyone who threw double ones received his/her choice on one randomly drawn pair, in the form of a cheque, post-dated to the appropriate delay (i.e. 1 to 236 days hence).

(b) Photograph rating task

Participants read: 'please rate the following pictures according to how appealing you find the person [car]'. The next 12 screens each contained an image to be rated and a 7-point Likert scale with extremes labelled 'unappealing' (1) and 'very appealing' (7). Images were face and upper-body pictures of people and advertisement-quality images of cars, taken from public-domain websites, and were cropped and centred on a black screen, above the rating scale. Image sets were identical within conditions, with the order of presentation randomized. The rationale for the rating task was to ensure that subjects attended to and effectively evaluated each image.

The human images were taken from a Web site where people post pictures for attractiveness rating: the site (<http://www.hotornot.com/>) invites visitors to rate others as 'hot or not' on a 10-point scale (1 = 'not'; 10 = 'hot'), and shows mean results. We selected photographs on the criterion that they be either highly attractive (mean rating of greater than 9) or much less attractive (rating of 4.0 to 5.9). The cars were chosen by graduate students as highly appealing or not; ratings by the experimental subjects confirmed that this categorization was successful (see § 3).

3. RESULTS

(a) Ratings of images

Participants rated 'hot' images as significantly more appealing than the 'nots' (table 1), both for faces ($F_{1,96} = 57.5$, $p < 0.0001$) and cars ($F_{1,95} = 87.8$, $p < 0.0001$), confirming that the selected images differed as intended. However, the magnitude of this 'hot versus not' difference was greater in male than female raters (sex by

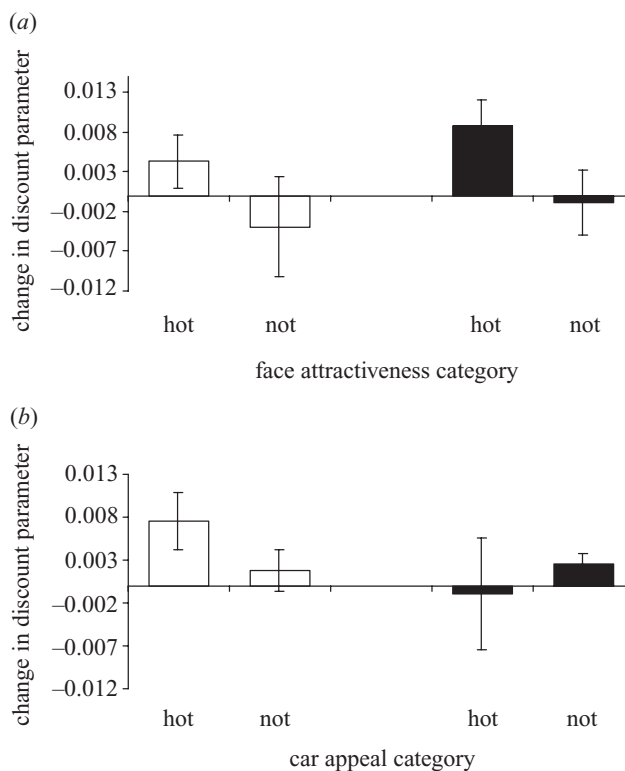


Figure 1. Change in hyperbolic discount parameter k after an image rating task, for women (open bars) and men (filled bars), after rating photographs of (a) opposite-sex faces or (b) cars that were either 'hot' or 'not'.

'hot versus not' interaction: for faces, $F_{1,96} = 6.2$, $p = 0.015$; for cars, $F_{1,95} = 36.0$, $p < 0.0001$).

(b) Changes in discounting after rating images

Figure 1 portrays the average change in the discount parameter k (that is, the value estimated from the last nine monetary choices minus that estimated from the first nine) for the four groups in the face experiment (figure 1a) and the car experiment (figure 1b).

For subjects who rated faces, 2×2 (sex \times 'hot versus not') analysis of variance revealed a significant effect only of image type: those rating 'hot' images exhibited a larger increase in k than raters of 'not' images ($F_{1,96} = 3.95$, $p = 0.050$). As predicted, it was specifically the men who rated 'hot' women who showed a significant increase ($t_{21} = 2.81$, $p = 0.006$), and in this they differed significantly from men who rated 'not' women ($t_{44} = 1.85$, $p = 0.035$). Women who rated 'hot' men exhibited a directionally similar shift, but this change was not significant ($t_{27} = 1.30$, $p = 0.103$), nor did the change in k differ

significantly between the groups of women who rated 'hot' versus 'not' men ($t_{52} = 1.17$, $p = 0.124$). The sex of subject by 'hot versus not' interaction was not statistically significant ($F_{1,96} = 0.03$, $p = 0.87$).

For subjects who rated cars, identical analyses yielded only one significant effect: women who rated 'hot' cars did exhibit a significant increase in k ($t_{24} = 2.26$, $p = 0.017$).

4. DISCUSSION

In this experimental study, men discounted the future more after considering the appeal of pictures of pretty women, unlike men who rated less attractive women. Women rating pictures of men exhibited a similar pattern of results, but group differences were smaller and non-significant. A parallel experiment with cars produced only one significant effect: women's discount parameters rose after rating 'hot' (relatively appealing) cars. With Bonferroni correction for multiple statistical tests, only one effect would remain significant, and that is precisely the one that we predicted: men's discounting increased after rating attractive women. We believe that this is the first demonstration of an experimentally induced change in human discounting.

If temporal trends in hazard and opportunity are absent or undetectable, the present value of future goods should decrease exponentially with delay. However, people and other animals typically behave as though they discount near futures at higher rates than more distant futures, such that experimentally assessed discount rates approximate a hyperbolic, rather than exponential, function of delay (e.g. Laibson 2001; Frederick *et al.* 2002; Kirby & Santiesteban 2003), and it is therefore a hyperbolic discount parameter that we calculated. Hyperbolic discounting is widely considered a costly 'error' to which decision makers are curiously prone (but see Kacelnik 1997); however, regardless of whether such 'shortsightedness' is itself maladaptive, facultative adjustment of discounting is not.

Most studies of time preference have offered payment on the spot as the more imminent option (Frederick *et al.* 2002), thereby confounding impatience with trust (will the later reward really be forthcoming?) and transaction costs (collecting the later reward is more of an effort than taking it now). To avoid these problems, we made the more imminent option 'tomorrow', and wrote post-dated cheques issued by the university-based bank for both earlier and later rewards.

We have not elucidated the psychological mechanisms mediating our results. We hypothesize that viewing pictures of pretty women was mildly arousing, activating neural mechanisms associated with cues of sexual opportunity. Functional magnetic resonance imaging data reveal that neural circuitry implicated in the valuation of rewards (the *nucleus accumbens*) is activated in men viewing pictures of attractive women, but not pictures of less attractive women or attractive men (Aharon *et al.* 2001). This nucleus is directly connected to the orbitofrontal cortex, which is activated by monetary rewards (e.g. Breiter *et al.* 2001) and sweet-tasting food rewards, as well as cues thereof (e.g. O'Doherty *et al.* 2002). Presumably, this circuitry reflects a 'final common pathway' in positive responses to rewards which in turn affects attentional and information-processing mechanisms relevant to the

stimulus domain. A comparative study of short-term modulation of temporal discounting experimentally induced by cues of mating opportunities, sweet-tasting foods or other rewards would address the question of the domain-specificity of temporal discounting and the effects reported here.

Wilson & Daly (1997) argued that the relatively short time horizons of criminal offenders, the poor and the young may not deserve pejorative terms like 'myopia' and 'impulsivity', but instead reflect modulated future discounting in response to social and economic cues of the relative values of present and future goods and opportunities (see also Laibson 2001; Frederick *et al.* 2002). The present findings reinforce the idea that future discounting varies adaptively, and suggest that it may be more vulnerable to ephemeral social experiences than has been appreciated.

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