Figure 1.1 Discount Factor as a Function of Time Horizon (All Studies)
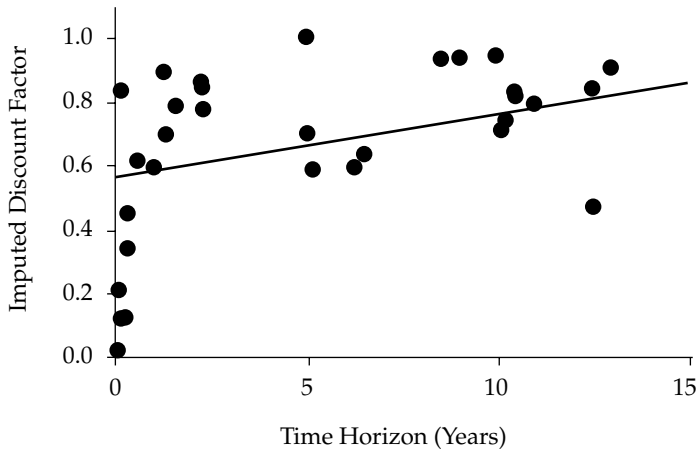
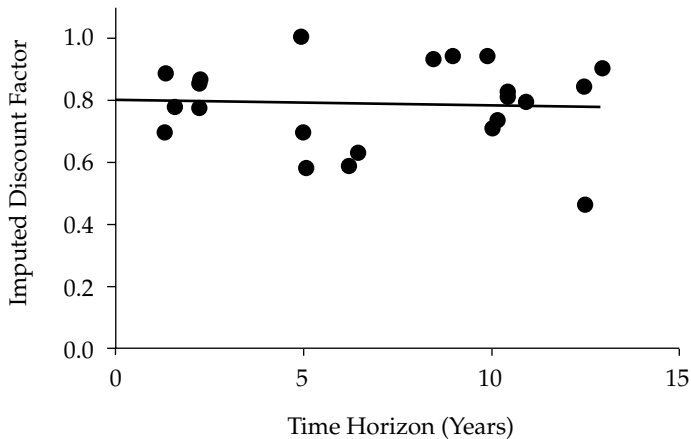**Figure 1.2   Discount Factor as a Function of Time Horizon (Studies with Average Horizons Greater Than One Year)**

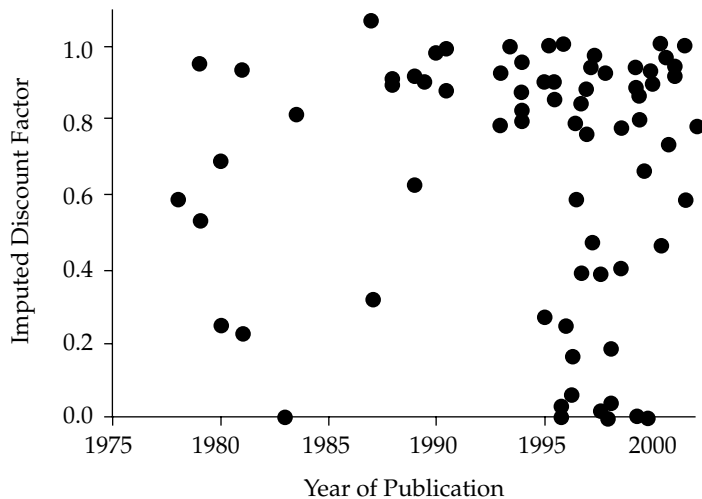**Figure 1.3   Discount Factor by Year of Study Publication**

Figure 1.4 Factors Affecting Intertemporal Choices

future consequence confers less utility	future utility is less important	
uncertainty opportunity costs	diminished identity?	impulsivity?
changing tastes increased wealth	????	????
Amount of utility	Weighting of utility	

δ

Table 1.1   Empirical Estimates of Discount Rates

Study	Type	Good(s)	Real or Hypo?	Elicitation Method
Maital and Maital 1978	experimental	money and coupons	hypo.	choice
Hausman 1979	field	money	real	choice
Gateley 1980	field	money	real	choice
Thaler 1981	experimental	money	hypo.	matching
Ainslie and Haendel 1983	experimental	money	real	matching
Houston 1983	experimental	money	hypo.	other
Loewenstein 1987	experimental	money and pain	hypo.	pricing
Moore and Viscusi 1988	field	life years	real	choice
Benzion et al. 1989	experimental	money	hypo.	matching
Viscusi and Moore 1989	field	life years	real	choice
Moore and Viscusi 1990a	field	life years	real	choice
Moore and Viscusi 1990b	field	life years	real	choice
Shelley 1993	experimental	money	hypo.	matching
Redelmeier and Heller 1993	experimental	health	hypo.	rating
Cairns 1994	experimental	money	hypo.	choice
Shelley 1994	experimental	money	hypo.	rating
Chapman and Elstein 1995	experimental	money and health	hypo.	matching
Dolan and Gudex 1995	experimental	health	hypo.	other
Dreyfus and Viscusi 1995	field	life years	real	choice
Kirby and Marakovic 1995	experimental	money	real	matching
Chapman 1996	experimental	money and health	hypo.	matching
Kirby and Marakovic 1996	experimental	money	real	choice
Pender 1996	experimental	rice	real	choice
Wahlund and Gunnarson 1996	experimental	money	hypo.	matching
Cairns and van der Pol 1997	experimental	money	hypo.	matching

Table 1.1 *Continued*

Study	Type	Good(s)	Real or Hypo?	Elicitation Method
Green, Myerson, and McFadden 1997	experimental	money	hypo.	choice
Johannesson and Johansson 1997	experimental	life years	hypo.	pricing
Kirby 1997	experimental	money	real	pricing
Madden et al. 1997	experimental	money and heroin	hypo.	choice
Chapman and Winquist 1998	experimental	money	hypo.	matching
Holden, Shiferaw, and Wik 1998	experimental	money and corn	real	matching
Cairns and van der Pol 1999	experimental	health	hypo.	matching
Chapman, Nelson, and Hier 1999	experimental	money and health	hypo.	choice
Coller and Williams 1999	experimental	money	real	choice
Kirby, Petry, and Bickel 1999	experimental	money	real	choice
van der Pol and Cairns 1999	experimental	health	hypo.	choice
Chesson and Viscusi 2000	experimental	money	hypo.	matching
Ganiats et al. 2000	experimental	health	hypo.	choice
Hesketh 2000	experimental	money	hypo.	choice
van der Pol and Cairns 2001	experimental	health	hypo.	choice
Warner and Pleeter 2001	field	money	real	choice
Harrison, Lau, and Williams 2002	experimental	money	real	choice

Table 1.1 *Continued*

| Study	Time Range	Annual Discount Rate(s)	Annual Discount Factor(s)
Maital and Maital 1978	1 year	70%	0.59
Hausman 1979	undefined	5% to 89%	0.95 to 0.53
Gateley 1980	undefined	45% to 300%	0.69 to 0.25
Thaler 1981	3 mos. to 10 yrs.	7% to 345%	0.93 to 0.22
Ainslie and Haendel 1983	undefined	96000% to ∞	0.00
Houston 1983	1 yr. to 20 yrs.	23%	0.81
Loewenstein 1987	immediately to 10 yrs.	−6% to 212%	1.06 to 0.32
Moore and Viscusi 1988	undefined	10% to 12%	0.91 to 0.89
Benzion et al. 1989	6 mos. to 4 yrs.	9% to 60%	0.92 to 0.63
Viscusi and Moore 1989	undefined	11%	0.90
Moore and Viscusi 1990a	undefined	2%	0.98
Moore and Viscusi 1990b	undefined	1% to 14%	0.99 to 0.88
Shelley 1993	6 mos. to 4 yrs.	8% to 27%	0.93 to 0.79
Redelmeier and Heller 1993	1 day to 10 yrs.	0%	1.00
Cairns 1994	5 yrs. to 20 yrs.	14% to 25%	0.88 to 0.80
Shelley 1994	6 mos. to 2 yrs.	4% to 22%	0.96 to 0.82
Chapman and Elstein 1995	6 mos. to 12 yrs.	11% to 263%	0.90 to 0.28
Dolan and Gudex 1995	1 month to 10 yrs.	0%	1.00
Dreyfus and Viscusi 1995	undefined	11% to 17%	0.90 to 0.85
Kirby and Marakovic 1995	3 days to 29 days	3678% to ∞	0.03 to 0.00
Chapman 1996	1 yr. to 12 yrs.	negative to 300%	1.01 to 0.25
Kirby and Marakovic 1996	6 hours to 70 days	500% to 1500%	0.17 to 0.06
Pender 1996	7 mos. to 2 yrs.	26% to 69%	0.79 to 0.59
Wahlund and Gunnarson 1996	1 month to 1 yr.	18% to 158%	0.85 to 0.39
Cairns and van der Pol 1997	2 yrs. to 19 yrs.	13% to 31%	0.88 to 0.76

Table 1.1 *Continued*

Study	Time Range	Annual Discount Rate(s)	Annual Discount Factor(s)
Green, Myerson, and McFadden 1997	3 mos. to 20 yrs.	6% to 111%	0.94 to 0.47
Johannesson and Johansson 1997	6 yrs. to 57 yrs.	0% to 3%	0.97
Kirby 1997	1 day to 1 month	159% to 5747%	0.39 to 0.02
Madden et al. 1997	1 week to 25 yrs.	8% to ∞	0.93 to 0.00
Chapman and Winquist 1998	3 months	426% to 2189%	0.19 to 0.4
Holden, Shiferaw, and Wik 1998	1 yr.	28% to 147%	0.78 to 0.40
Cairns and van der Pol 1999	4 yrs. to 16 yrs.	6%	0.94
Chapman, Nelson, and Hier 1999	1 month to 6 mos.	13% to 19000%	0.88 to 0.01
Coller and Williams 1999	1 month to 3 mos.	15% to 25%	0.87 to 0.80
Kirby, Petry, and Bickel 1999	7 days to 186 days	50% to 55700%	0.67 to 0.00
van der Pol and Cairns 1999	5 yrs. to 13 yrs.	7%	0.93
Chesson and Viscusi 2000	1 year to 25 yrs.	11%	0.90
Ganiats et al. 2000	6 mos. to 20 yrs.	negative to 116%	1.01 to 0.46
Hesketh 2000	6 mos. to 4 yrs.	4% to 36%	0.96 to 0.74
van der Pol and Cairns 2001	2 yrs. to 15 yrs.	6% to 9%	0.94 to 0.92
Warner and Pleeter 2001	immediately to 22 yrs.	0% to 71%	0 to 0.58
Harrison, Lau, and Williams 2002	1 month to 37 mos.	28%	0.78

Figure 2.1 Self-Assessed Similarity of Past and Future Selves as Judged by Different Age Groups
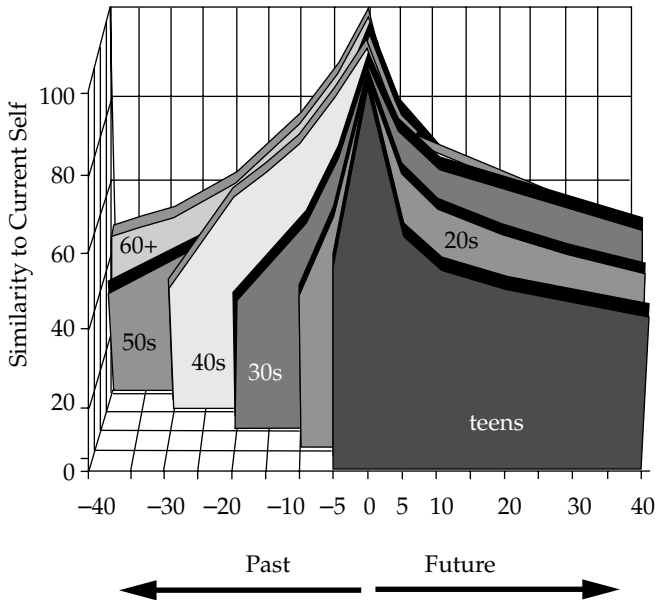
Table 2.1 Mean Self-Assessed Similarity of Current Self to Past Selves and Future Selves

Age group	(Reported Similarity)						(Predicted Similarity)				
	Forty Years Ago	Thirty Years Ago	Twenty Years Ago	Ten Years Ago	Five Years Ago	Now	Five Years Ahead	Ten Years Ahead	Twenty Years Ahead	Thirty Years Ahead	Forty Years Ahead
Teens					55	100	65	55	49	46	42
Twenties				43	64	100	75	66	59	53	49
Thirties			35	56	73	100	81	72	67	60	55
Forties		35	60	75	87	100	78	72	64	55	46
Fifties	29	38	47	61	74	100	80	69	53	38	
Sixty +	40	46	56	73	84	100	72	57	49		
Overall	33	39	48	59	72	100	76	66	58	51	49
Kruskall-Wallis sig lev	0.13	0.31	0.00	0.00	0.00	—	0.05	0.01	0.03	0.01	0.25

Source: Author's compilation.

Table 2.2 Difference Between Predicted Future Similarity and Reported Past Similarity of Older Matched Age Groups

| Predicting Group | Length of Interval | | | | |
	Five Years	Ten Years	Twenty Years	Thirty Years	Forty Years
Teens	3.4	8.2	8.3	−1.1	14.6
Twenties	5.0	10.5	−0.2	15.9	12.7
Thirties	−0.8	−1.7	22.2	16.7	18.4
Forties	−6.2	6.5	3.0	28.4	17.0
Fifties	2.5	−7.0	13.8	13.7	
Sixty +	−2.1	−13.8			
Overall	0.4	2.4	8.9	14.7	14.9

Source: Author's compilation.

Table 2.3   Median Number of Future Dollars Judged to Be Equally Attractive to $100 Tomorrow

	One Year	Five Years	Ten Years	Twenty Years	Thirty Years	Forty Years
Teens	$150 (50)	$500 (38)	$800 (23)	$1,000 (12)	$1,800 (10)	$1,800 (7)
Twenties	$180 (50)	$500 (38)	$900 (25)	$2,000 (16)	$3,000 (12)	$4,500 (10)
Thirties	$160 (60)	$500 (38)	$1,000 (26)	$1,500 (15)	$2,000 (11)	$3,500 (9)
Forties	$150 (50)	$500 (38)	$1,000 (26)	$2,000 (16)	$2,500 (11)	$3,500 (9)
Fifties	$150 (50)	$400 (32)	$1,000 (26)	$2,000 (16)	$7,500 (15)	
Sixty +	$163 (63)	$450 (35)	$900 (25)	$2,000 (16)		
Overall	$150 (50)	$500 (38)	$1,000 (26)	$2,000 (16)	$3,000 (12)	$3,750 (9)

Source: Author's compilation.
Note: Implicit discount rates (percentage) in parentheses.

Table 2.4   Median Number of Future Extra "Good Days" Judged Equally Attractive to Twenty Extra Good Days This Year

	One Year	Five Years	Ten Years	Twenty Years	Thirty Years
Teens	25 (25)	35 (12)	40 (7)	60 (6)	85 (5)
Twenties	21 (5)	38 (14)	50 (10)	84 (7)	100 (5)
Thirties	20 (0)	33 (11)	50 (10)	50 (5)	55 (3)
Forties	21 (5)	50 (20)	100 (17)	183 (12)	
Fifties	21 (5)	80 (32)	120 (20)		
Sixty +	25 (25)				
Overall	21 (5)	40 (15)	56 (11)	70 (6)	80 (5)

Source: Author's compilation.
Note: Implicit discount rates (percentage) in parentheses.

Table 2.5 Rank Correlations Between Similarity Judgments and One-, Five-, Ten-, Twenty-, Thirty-, and Forty-Year Monetary Discount Rates

Years Until Receipt of Money	Reported Similarity						Predicted Similarity				
	Forty Years Ago	Thirty Years Ago	Twenty Years Ago	Ten Years Ago	Five Years Age	Now	Five Years Ahead	Ten Years Ahead	Twenty Years Ahead	Thirty Years Ahead	Forty Years Ahead
One	0.13	0.03	−0.01	−0.05	−0.04	—	0.00	−0.02	−0.07	−0.05	−0.01
Five	0.37*	0.23	0.00	0.01	0.07	—	0.09	0.07	0.04	0.01	0.07
Ten	0.41*	0.26	0.03	0.04	0.09	—	0.09	0.08	0.04	0.00	−0.00
Twenty	0.49*	0.26	0.11	0.10	0.13	—	0.08	0.07	0.05	0.02	−0.00
Thirty	0.55*	0.24	0.08	0.08	0.12	—	0.07	0.03	−0.00	−0.02	−0.04
Forty		−0.01	−0.08	−0.03	0.04	—	0.05	0.00	−0.04	−0.02	−0.04

Source: Author's compilation.
Note: * Indicates statistically significant positive correlation.

Table 2.6   Rank Correlations Between Similarity Judgments and One-, Five-, Ten-, Twenty-, and Thirty-Year "Good Days" Discount Rates

Years Until Receipt of Good Days	Reported Similarity						Predicted Similarity				
	Forty Years Ago	Thirty Years Ago	Twenty Years Ago	Ten Years Ago	Five Years Age	Now	Five Years Ahead	Ten Years Ahead	Twenty Years Ahead	Thirty Years Ahead	Forty Years Ahead
One	0.12	−0.01	0.10	−0.08	0.02	—	−0.11	−0.13	−0.10	−0.08	−0.02
Five	0.24	0.01	0.02	0.03	0.05	—	0.08	0.04	−0.05	−0.08	−0.07
Ten	0.44	0.02	0.12	0.16	0.15	—	0.10	0.07	−0.01	−0.04	−0.07
Twenty		−0.31	0.00	0.12	0.14	—	0.03	0.01	−0.02	−0.03	−0.06
Thirty			−0.13	0.04	0.08	—	0.04	0.04	0.03	0.03	−0.02

Source: Author's compilation.
Note: * Indicates statistically significant positive correlation.

Figure 3.1 Rational Preference Reversals and Rate Maximization
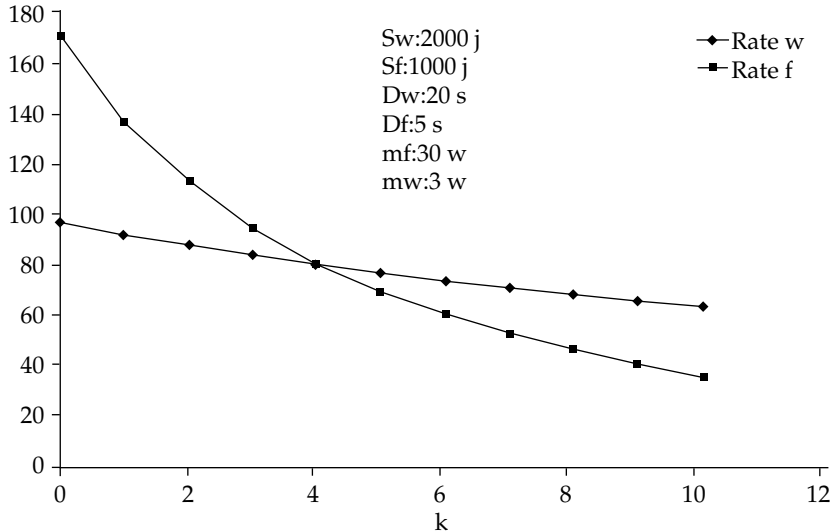
Source: Author's configuration.

Note: Rational preference reversals and rate maximization. Net rate of gain $\left(\dfrac{S_i - m_i\tau_i}{\tau_i} \right)$

for starlings using two foraging modes (walking and flying) as a consequence of adding a time constant (k) to both options. The foraging modes are denoted by the suffixes f and w. For k small, flying should be preferred while the opposite is true if $k > 4s$. S_i: Reward size in joules, D_i: time per prey in seconds, m_i: metabolic rate in joules s^{-1}. Numerical parameters are given in the figure legend.

Figure 3.2   How Birds Choose Among Foraging Modes
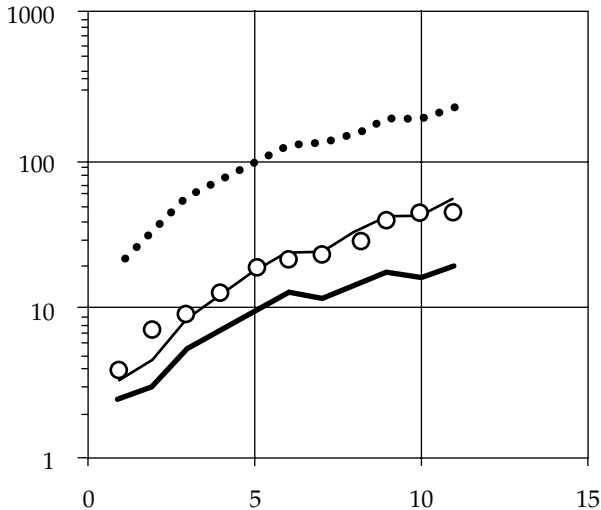
Note: Number of walks (ordinate) preferred as often as the corresponding number of flights (abscissa) by four starlings in the experiment run by Bautista et al. (2001). The lines (from top to bottom) show the predictions of three putative currencies of choice: energy gained per unit of energy spent (efficiency), net energy gain per unit of time, and gross energy gain per unit of time. The mean results (circles) coincide with the predictions of the net gain model.

Figure 3.3 A Self-Control Experiment in Pigeons: Green et al. 1981
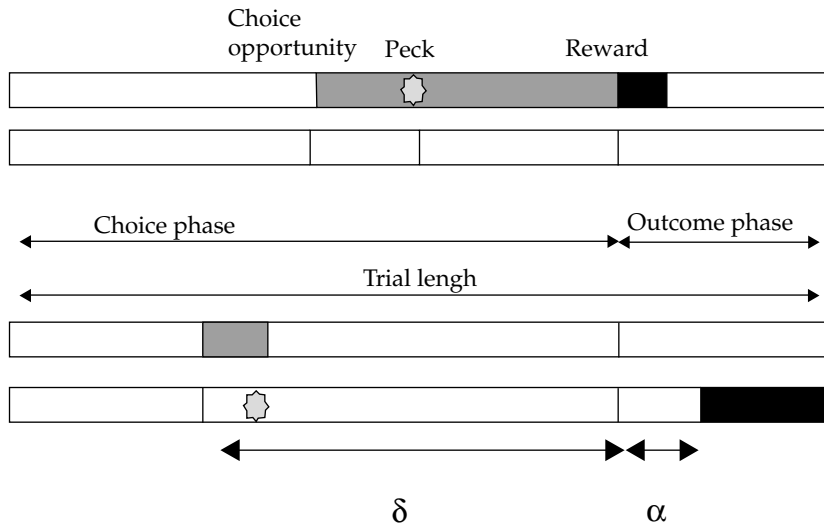
Source: Author's configuration.
Note: Design of the experiment by Green et al. (1981) using pigeons. Each trial was divided in two phases, "choice phase" and "outcome phase." The former lasted always 30 s and the latter 10 s. White bars indicate that no key was enabled and the pigeon was forced to wait. At some point during the choice phase, the pigeons had the opportunity to choose between two options, identified by different colored keys. A single peck determined the choice and had the effect of extinguishing the alternative colored key. Two exemplar trials are shown, one (two top bars) in which the pigeon chooses the Small-Soon reward and the other (two bottom bars) where the pigeon chooses the Large-Late reward. Rewards were times of access to a food hopper, shown in solid black during the outcome phase. δ: time from onset of the relevant stimulus to the onset of the outcome phase; α: time waiting for the Large-Late reward during the outcome phase. Notice that trial length, choice phase, and outcome phase did not vary.

Figure 4.1   Mean Values on the Barratt Impulsiveness Scale
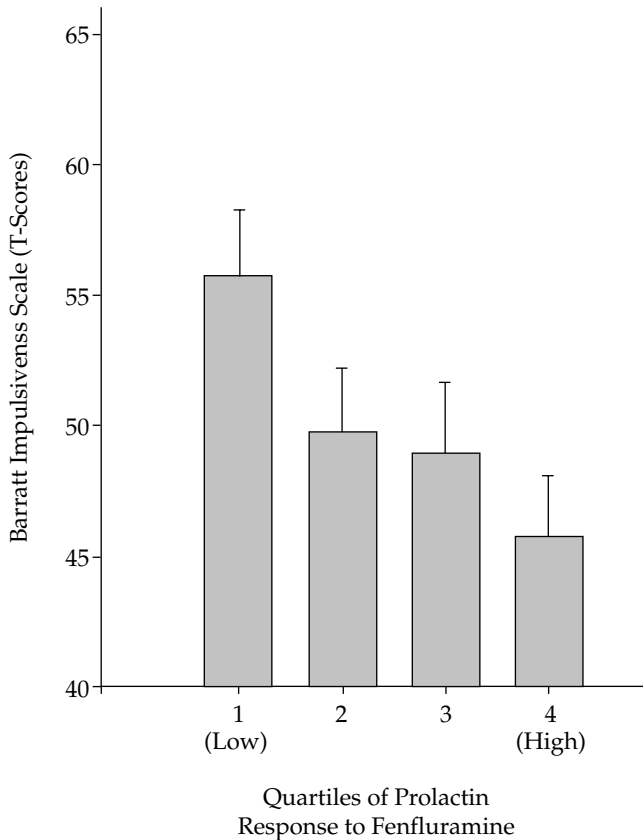
Source: Authors' compilation.
Note: Mean values on the Barratt Impulsiveness Scale (expressed as T-scores [± SEM]) of men ranked by quartile of central nervous system serotonergic responsivity, as indexed by the peak prolactin response to fenfluramine hydrochloride (adjusted for several relevant covariates, including age, body weight, weight-relative fenfluramine dose, and drug and metabolite concentrations in plasma over the 3.5-hour challenge). 1 = lowest quartile of prolactin response; 4 = highest quartile.
N = 59.

Figure 4.2 Non-Planning Impulsiveness
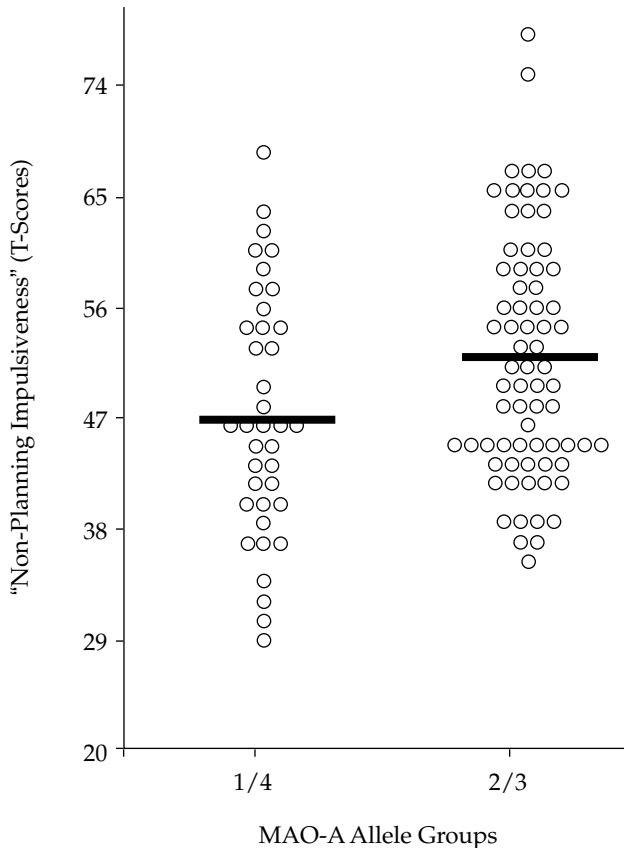
Source: Authors' compilation.
Note: Non-planning impulsiveness (expressed as T-scores) among men grouped by alleles of a promoter region polymorphism in the gene encoding monoamine oxidase A ("Low" transcription alleles: group 1/4; "high" transcription alleles: group 2/3). N = 110.

Table 7.1 Year-1 Consumption (c_1) Given \$100,000 to Allocate over Three Years[a]

| Utility Function | Naifs $\hat{\beta} = 1$ | Partial Naifs | | Sophisticates $\hat{\beta} = .7$ |
		$\hat{\beta} = .9$	$\hat{\beta} = .8$	
$u(c) = c^{1/2}$	$c_1 = \$50{,}505$	$c_1 = \$50{,}574$	$c_1 = \$50{,}812$	$c_1 = \$51{,}271$
$u(c) = \ln c$	$c_1 = \$41{,}667$	$c_1 = \$41{,}667$	$c_1 = \$41{,}667$	$c_1 = \$41{,}667$
$u(c) = -c^{-1/2}$	$c_1 = \$38{,}809$	$c_1 = \$38{,}801$	$c_1 = \$38{,}776$	$c_1 = \$38{,}725$

Source: Authors' compilation.

[a]Assuming $r = 0$ percent, $\delta = 1$, and $\beta = .7$.

Table 7.2   Year-1 Consumption (c_1) Given \$100,000 to Allocate over Four Years[a]

Utility Function	Naïfs	Sophisticates	Boundedly Rational Sophisticates
$u(c) = c^{1/2}$	$c_1 = \$40{,}486$	$c_1 = \$41{,}781$	$c_1 = \$41{,}229$
$u(c) = \ln c$	$c_1 = \$32{,}258$	$c_1 = \$32{,}258$	$c_1 = \$32{,}258$
$u(c) = -c^{-1/2}$	$c_1 = \$29{,}717$	$c_1 = \$29{,}601$	$c_1 = \$29{,}650$

Source: Authors' compilation.

[a] Assuming $r = 0$ percent, $\delta = 1$, and $\beta = .7$.

Figure 8.1   Attractiveness Ratings of Near Future and Distant Future Experimental Tasks

Interesting task, boring filler

Boring task, interesting filler
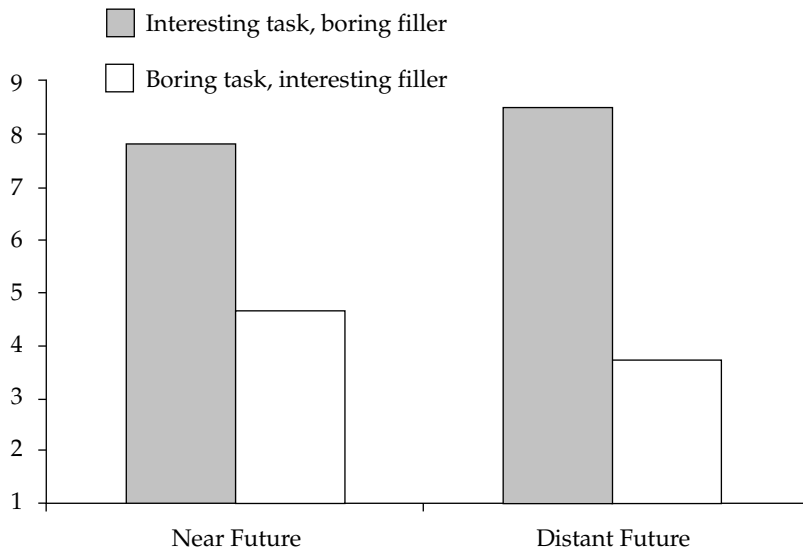
Source: Based on data from Trope and Liberman (2000).

Note: Ratings were made on a 1 (not attractive at all) to 9 (very attractive) scale.

Figure 8.2   Attractiveness Ratings of Near Future and Distant Future Academic Assignments

■ Desirability high, feasibility high
▢ Desirability high, feasibility low
□ Desirability low, feasibility high
▨ Desirability low, feasibility low
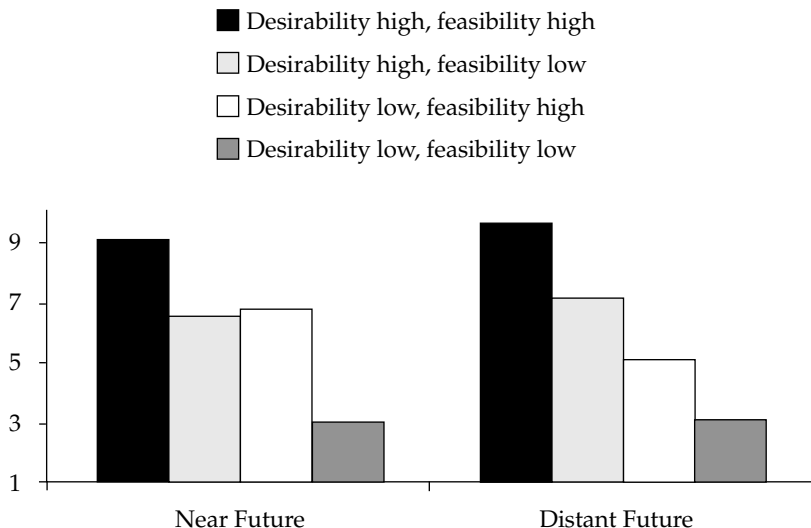
Source: Based on data from Liberman and Trope (1998).
Note: Ratings were made on a 1 (not attractive at all) to 10 (very attractive) scale.

Figure 8.3 Bids (In Dollars) for Near Future and Distant Future Bets of Equal Expected Utility by Probability of Winning
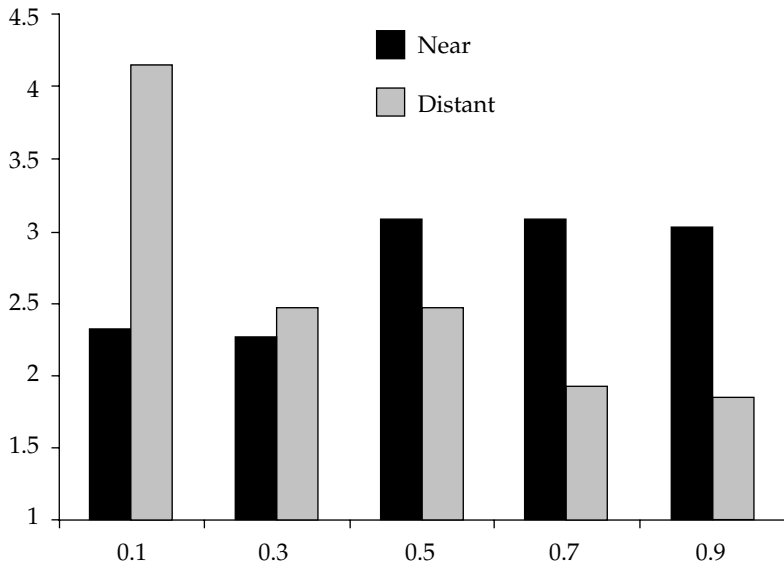
Figure 9.1 Tom's Inferences About His Intrinsic Inclination to Indulge
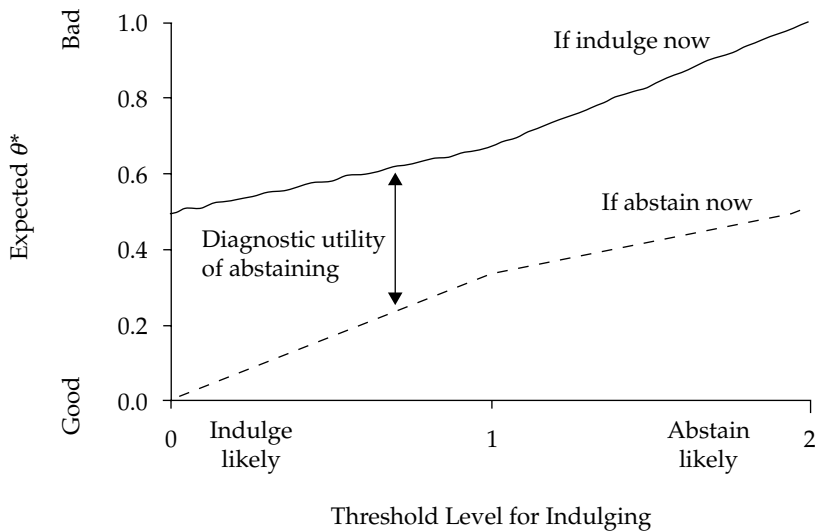
Source: Author's configuration.

Figure 9.2   Harry's Inferences About His Behavioral Propensity of Indulging
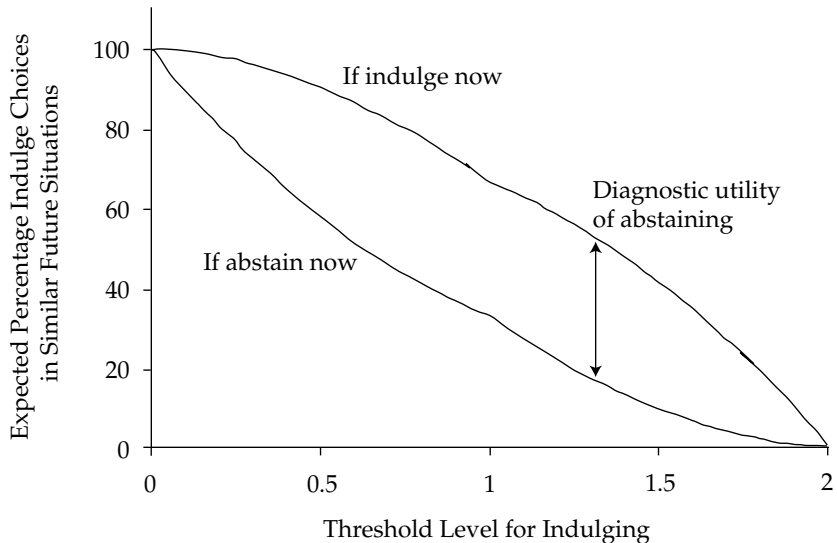
Figure 9.3 Tom's Threshold Level of Desire
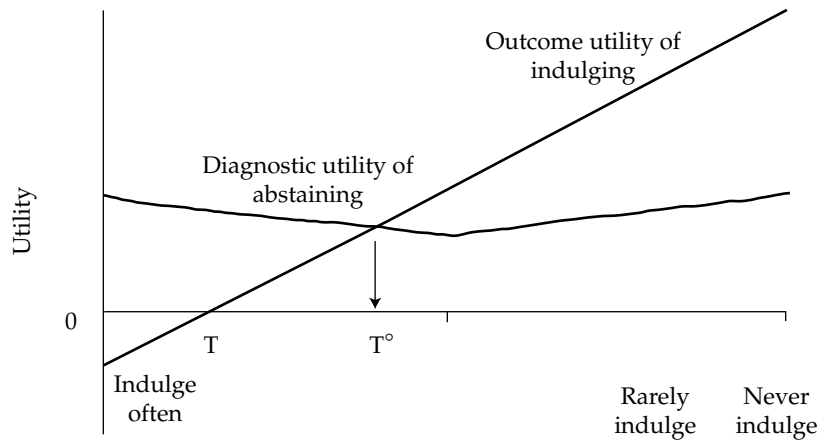
Source: Author's configuration.

T = "Natural" threshold, ignoring diagnostic utility.

T° = Threshold with true interpretations.

Figure 9.4   Harry's Threshold Level of Desire

T = Natural threshold, ignoring diagnostic utility.
T° = Threshold with true interpretations.

Table 9.1 Diagnostic Motivation and Awareness: Two Ways of Interpreting Actions

	Preferences Free from Diagnostic Utility	Preferences Subject to Diagnostic Utility
Face-value interpretations of actions	I. Standard economic model • You do as you please • Actions reveal who you are	II. Normal self-deception • You bias behavior toward actions diagnostic of good dispositions • Improve future prospects • Create overly positive intrinsic self-image
Interpretations discounted for diagnostic motivation	IV. Paranoid self-scrutiny • You do as you please • Second-guess actions for nonexistent motives • Overly negative intrinsic self-image and excessive pessimism about future prospects	III. Rational self-signaling • You seek behavioral perfection • Tend toward "always" "never" rules • Improve future prospects • Fail to improve intrinsic self-image (on average)

Source: Authors' compilation.

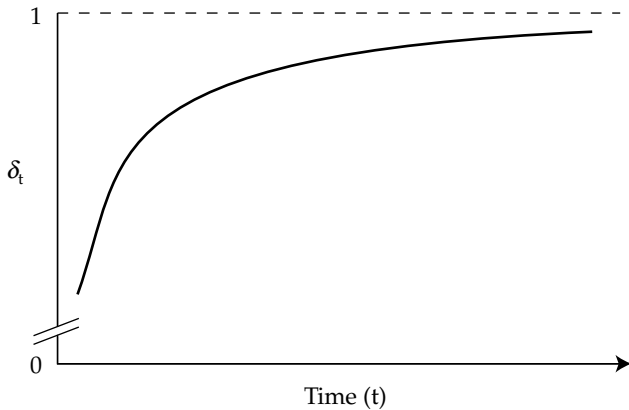**Figure 9.5   Contingent Resolutions to Never Indulge**
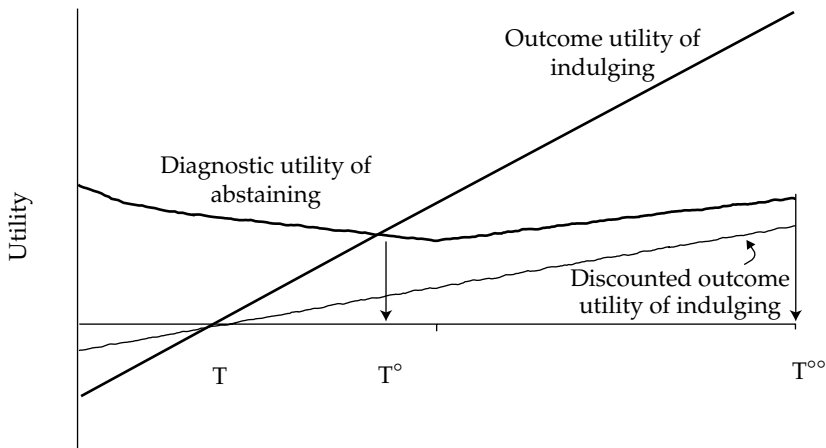
Outcome utility of
indulging

Diagnostic utility of
abstaining

Utility

Discounted outcome
utility of indulging

T   T°   T°°

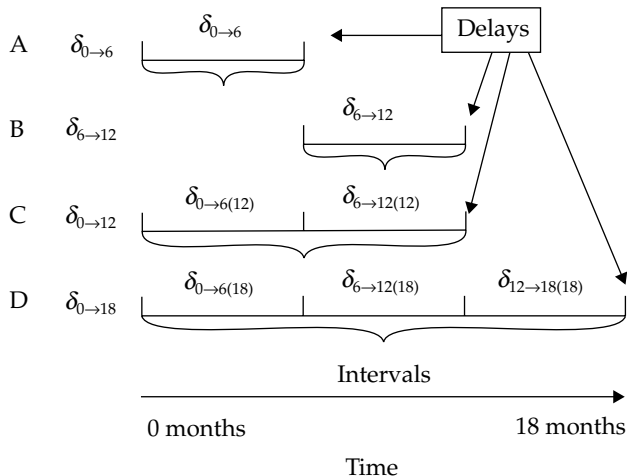**Figure 10.1   Patience (δ) Increasing as a Function of Delay: A Hyperbolic Discount Function**

Figure 10.2 Discount Periods Illustrating the Distinction Between Delay and Interval

Source: Author's configuration.

Figure 10.3   Notation and Terminology Used in Experiments
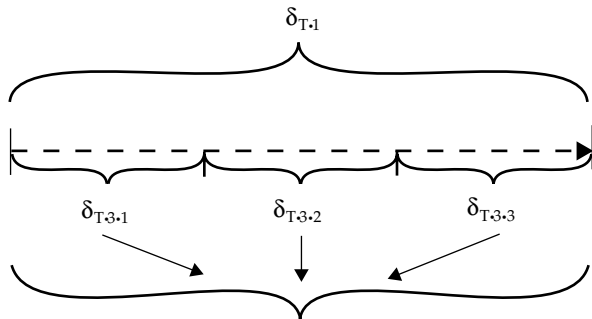
Compared to eighteen month interval of figure 10.2:

$$\delta_{T\cdot 1} = \delta_{0\to 18}$$
$$\delta_{T\cdot 3\cdot 1} = \delta_{0\to 6}$$
$$\delta_{T\cdot 3\cdot 2} = \delta_{6\to 12}$$
$$\delta_{T\cdot 3\cdot 3} = \delta_{12\to 18}$$
$$\delta_{T\cdot 3} = [(\delta_{0\to 6})(\delta_{6\to 12})(\delta_{12\to 18})]^{1/3}$$

Source: Author's configuration.

Table 10.1   Mean Discount Factors Per Year for All Conditions of Experiments 1 to 4

Study	Variable Amount	Cond.	$\delta_{T \cdot 1}$	$\delta_{T \cdot 3}$	$\delta_{T \cdot 3 \cdot 1}$	$\delta_{T \cdot 3 \cdot 2}$	$\delta_{T \cdot 3 \cdot 3}$
Exp 1: Times given as month and year; T = 24 months; N = 32.	LL	Choice	76	63	71	61	61
	SS	Choice	70	60	67	60	59
Exp 2: Times given as number of months delay; T = 24 months; N = 31.	LL	Choice	73	57	60	54	59
	SS	Choice	66	54	54	58	55
Exp 3: Times given as exact dates; T = 18 months; N = 16; "real" choice.	LL	Choice	74	55	59	53	57
	SS	Choice	75	58	61	54	62
Exp 4: Times given as exact dates; T = 36 months; N = 38; two sessions at least one day apart.	LL	Choice	81	72	72	71	72
	SS	Choice	81	77	75	77	80
	LL	Match	85	78	76	78	79
	SS	Match	85	81	79	83	83

Source: Author's compilation.
Note: Values of δ are given without leading decimal points.

Table 10.2   ANOVA Results for Crucial Main Effects, All Hypotheses of Experiment 1 to 4

Experiment	Condition	F	MSe	Df	p<
Hypothesis 1: Additivity					
1	Choice	36.8	.03	(1,30)	.0001
2	Choice	68.5	.02	(1,30)	.0001
3	Choice	57.3	.02	(1,15)	.0001
4	Choice	36.8	.004	(1,36)	.0001
4	Matching	26.7	.004	(1,36)	.0001
Hypothesis 2: Delay/interval effect					
1	Choice	5.01	.12	(1,31)	.05
2	Choice	36.8	.03	(1,30)	.0001
3	Choice	47.0	.01	(1,15)	.0001
4	Choice	32.0	.006	(1,36)	.0001
4	Matching	35.5	.005	(1,36)	.0001
Hypothesis 3a: True increasing patience					
1	Choice	16.2*	.02	(2,30)	.0001
2	Choice	0.11	.05	(2,29)	.895
3	Choice	5.0*	.02	(2,14)	.05
4	Choice	2.4	0.012	(2,35)	.13
4	Matching	5.5	0.025	(2,35)	.001
Hypothesis 3b: Hyperbolic discounting					
1	Matching	3.2	0.007	(1,36)	.1

Source: Author's compilation.
*Pattern of means inconsistent with the hypothesis of increasing patience/hyperbolic discounting. See text.

Table 10.3 Discounting Parameters Estimated from $\delta_{T,3\cdot1}$ and Observed and Predicted Values of $\delta_{T\cdot3\cdot2}$ and $\delta_{T\cdot3\cdot3}$

Interval	Timing	Parameter	δ Observed	Predicted	Diff.	t(36)	p
k-discounting							
12 to 24	SS	0.33	83	84	-1	-1.27	0.21
24 to 36	SS		83	87	-4	-3.00	0.00
12 to 24	LL	0.39	78	82	-4	-2.14	0.04
24 to 36	LL		79	85	-6	-3.39	0.00
h-discounting							
12 to 24	SS	0.37	83	87	-4	-3.86	0.00
24 to 36	SS		83	90	-7	-5.64	0.00
12 to 24	LL	0.44	78	85	-7	-4.36	0.00
24 to 36	LL		79	89	-10	-6.24	0.00

Source: Author's compilation.

Figure 11.1   Experience Profile
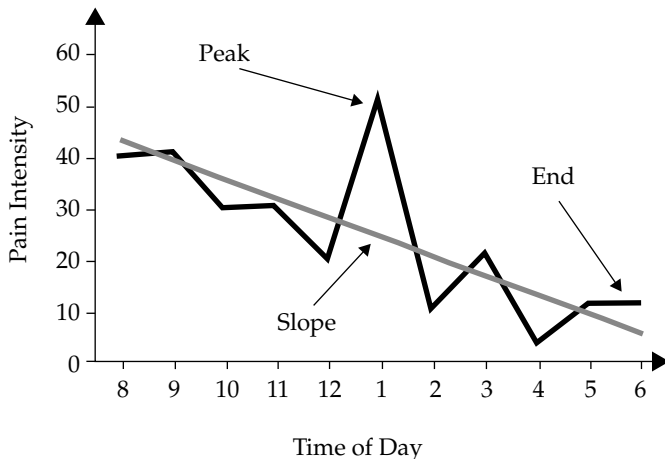
Note: An example (based on Ariely and Carmon [2000]) of an experience profile and three of its gestalt characteristics, based on the data of Subject 17 in the hospital study (assessment of a painful day at a hospital). *Peak* is the maximum intensity, *end* is the intensity at the final moment of the experience, and in this case *slope* is a single measure of the profile's overall linear trend (in gray).

Figure 11.2   Responses of Four Elicitation Methods
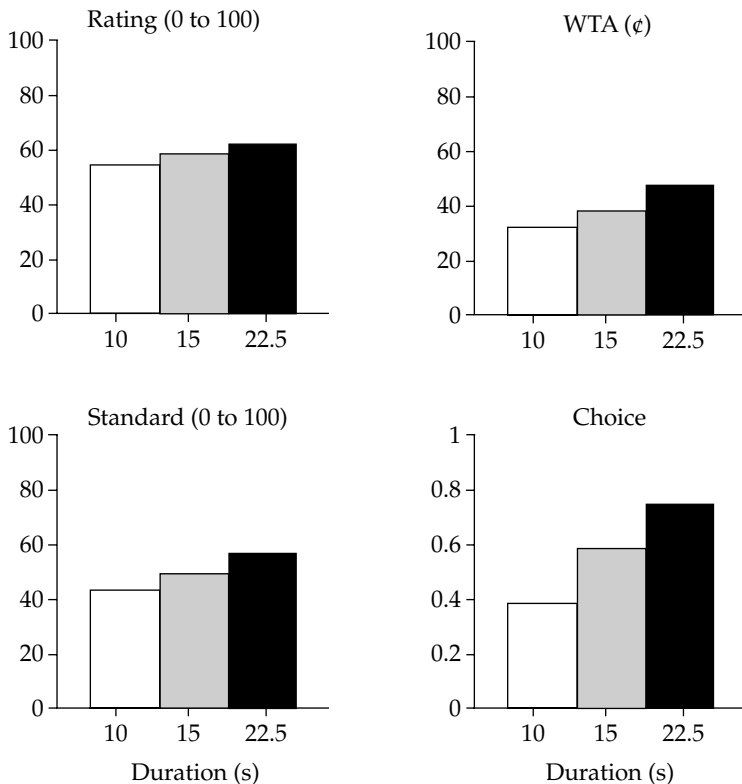
Note: Responses for the four experiments of Ariely and Loewenstein (2000), plotted separately for each experiment, and each duration. The four experiments were: 1) Ratings: ratings overall annoyance on a 0 to 100 scale. 2) Standard: ratings overall annoyance on a 0 to 100 scale, relative to a constant known standard that was 50. 3) WTA: minimum willingness to accept payments (¢) in exchange for the sounds. 4) Choice: choice of each sound relative to a constant known standard. The measures are plotted in the original response scale. Mean annoyance on a 0 to 100 scale for the Ratings and Standard experiments. A monetary scale (¢) for the WTA experiment and the proportion of choice of the standard over the focal stimuli in the choice experiment.

Table 11.1   Summary of Four Elicitation Methods

	Rating	Decision
Separate evaluation	Experiment 1 (Separate ratings)	Experiment 2 (WTA)
Comparative evaluation	Experiment 3 (Rating relative to standard)	Experiment 4 (Choice)

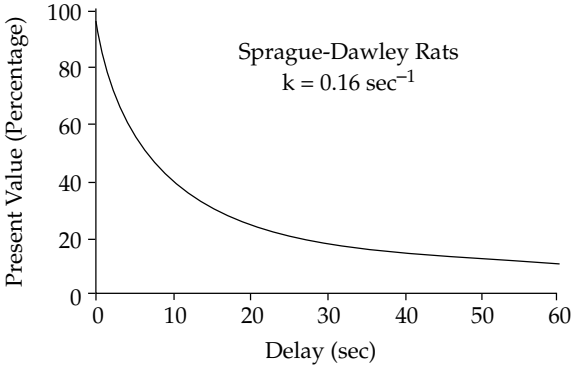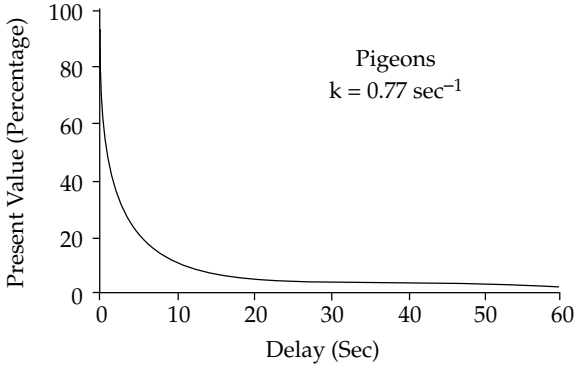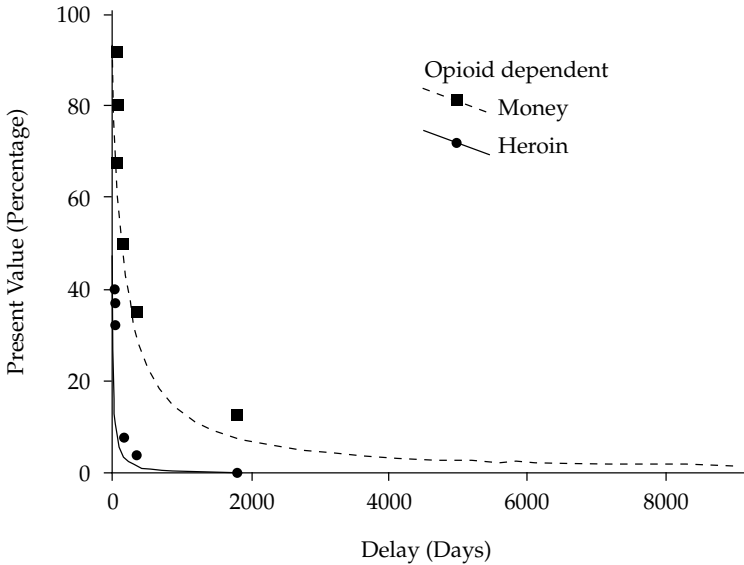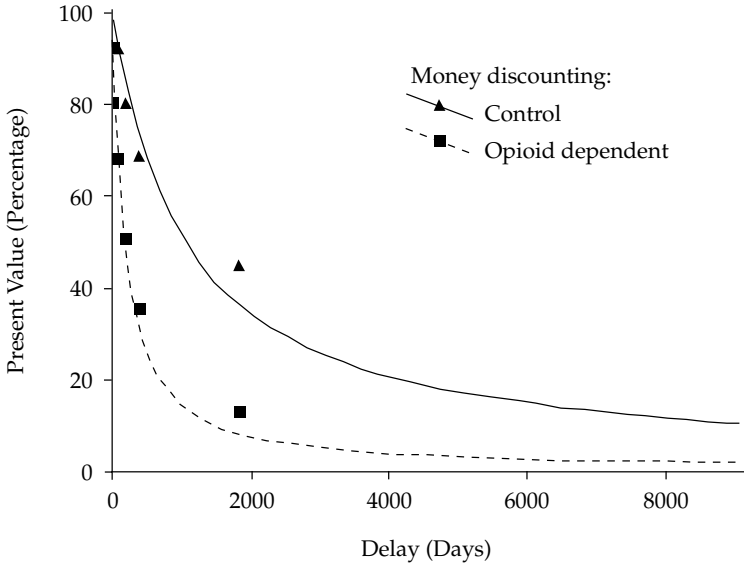*Source:* Ariely and Loewenstein (2000).

Figure 12.1   Refining Tastes
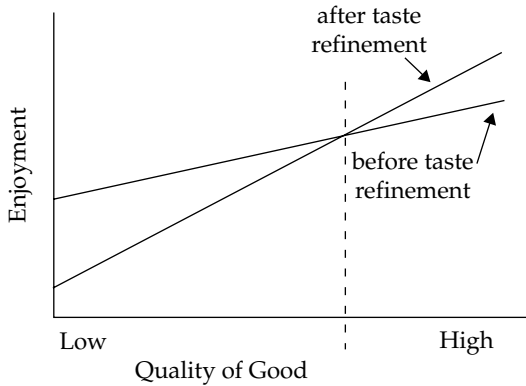
Figure 14.1 Discounting Functions for Pigeons, Rats, and Humans
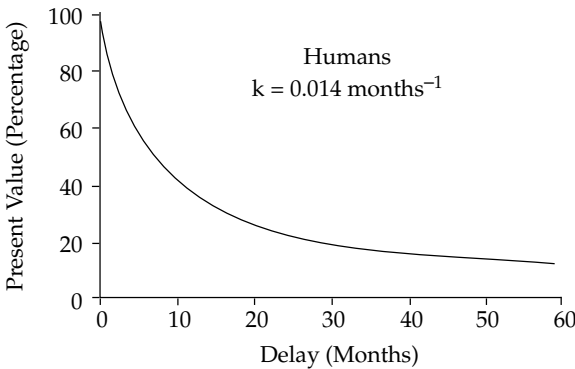
Source: Mazur (1987); Richards et al. (1997); and Rachlin et al. (1991), respectively.
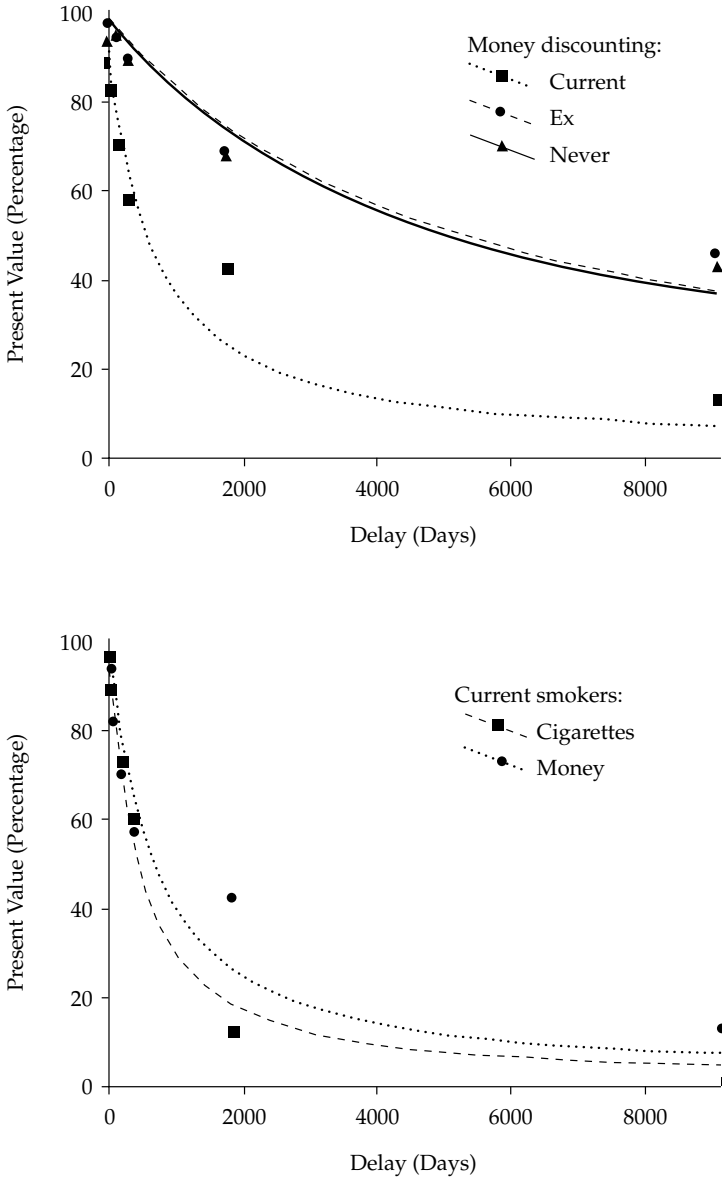
Figure 14.2   Delay Discounting

Note: The top panel describes the discounting of money by opioid-dependent individuals and controls. The bottom panel describes the discounting of money and heroin by opioid-dependent individuals.
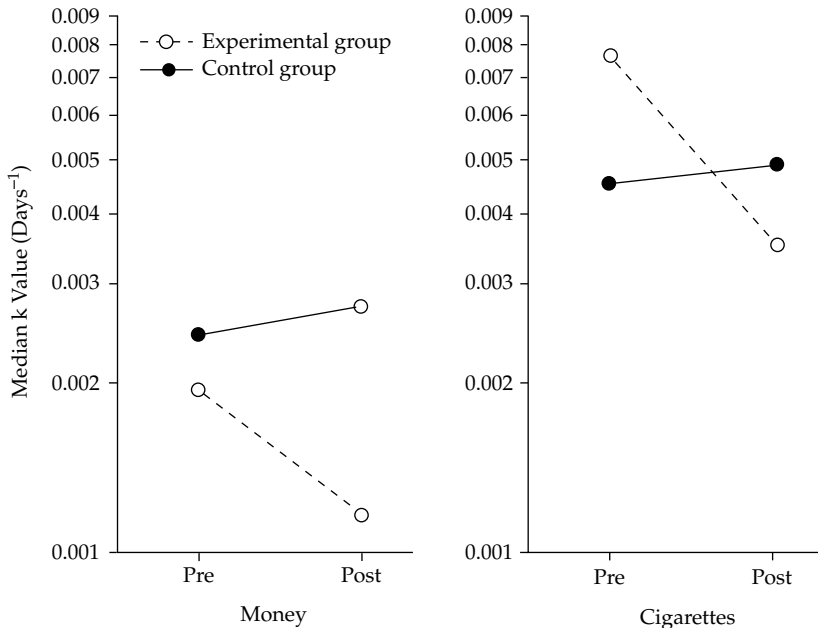
Figure 14.3   Delay Discounting of Cigarette Smokers

Note: The top panel describes the discounting of money by current, never-, and ex-smokers. The bottom panel describes the discounting of money and cigarettes by current smokers.

Figure 14.4   Delay Discounting for Money and Cigarettes

Note: Median discounting parameters (k from equation 14.1) from Bickel et al. (forthcoming) for the experimental group, which was paid money for abstinence, and the control group who smoked normally. The left panel shows discounting for money and the right panel shows discounting for cigarettes. Note the logarithmic scale for the y-axis.

Figure 17.1 Probability of Choosing Large-Purchase Quantity over Small-Purchase Quantity, Given Discounts
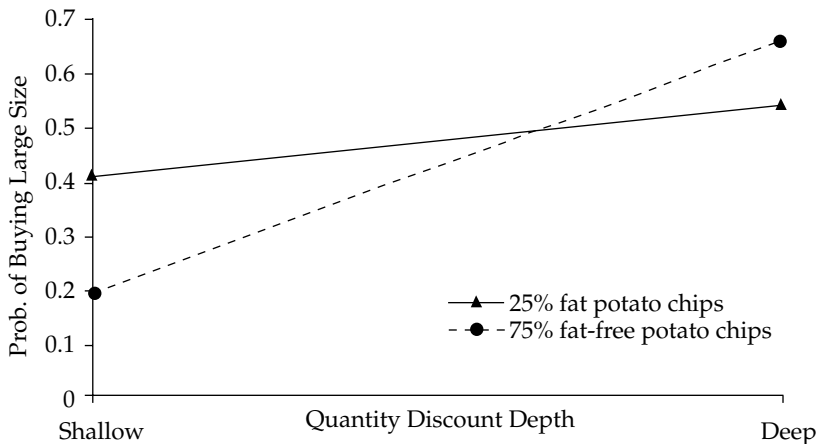
Note: Observed probability of choosing a large purchase quantity of potato chips (three six-ounce bags) instead of a small purchase quantity (one six-ounce bag), given a purchase and a shallow (7 percent) or a deep (40 percent) quantity discount for the large size (adapted from Wertenbroch 1998).

Table 17.1 Numbers of Buyers Intercepted at the Point of Sale and Endorsing Specific Reasons for Buying Different Package Sizes

Reasons	Small Size[a]		Large Size[b]	
	Cigarettes	Vitamin C	Cigarettes	Vitamin C
Self-control	21	—	—	6
Price	13	4	3	20
Convenience	—	—	—	12
Other	6	3	—	2
Buyers[c]	28	7	3	26

Source: Wertenbroch (1994).

[a]Smallest package size (pack of cigarettes, 50 milligrams of vitamin C).

[b]Any larger package size (carton of cigarettes, more than 50 milligrams of vitamin C).

[c]Column totals may exceed numbers of buyers due to endorsement of multiple reasons.

Table 17.2   Relative Vice and Virtue Product Categories in Field Study 1 (Adapted from Wertenbroch 1998)

Relative Vices	Relative Virtues	Mean Vice Rating[a]	N
Regular salad dressing	light salad dressing	2.95****	130
Regular fat cream cheese	light cream cheese	2.93****	122
Regular processed cheese	light processed cheese	2.77****	125
Regular mayonnaise	light mayonnaise	2.74****	125
Ice cream	frozen yogurt	2.69****	134
Regular yogurt	light yogurt	2.37****	125
Alcoholic beer	nonalcoholic beer	2.20****	107
Regular ice tea	low calorie ice tea	1.71****	105
Sugared cereal	low sugar cereal	1.64****	134
Regular chewing gum	sugarless chewing gum	1.50****	131
Dunkin' Donuts munchkins	Dunkin' Donuts muffins	1.44****	115
Regular soft drinks	diet soft drinks	1.35****	127
Regular coffee	decaffeinated coffee	1.34****	98
Whole milk	low fat milk	1.18****	133
Butter	margarine	1.17****	133
Beef bologna	turkey bologna	0.96****	95
Regular tea	decaffeinated tea	0.91***	116
Regular cigarettes	light cigarettes	0.68	28
Hairspray (aerosol)	hair spray (pump)	0.53	75
Dexatrim	Slimfast	0.53	30
Snacks with preservatives	snacks w/out preservatives	0.51**	136
White rice	brown rice	0.43****	134
Sugared fruit drinks	fruit juice	0.40**	134
Bleached flour	whole-wheat flour	0.23	128
Pornographic magazines	news magazines	0.22*	128
White bread	wholegrain bread	0.17	128
Deodorant (aerosol spray)	deodorant (roll-on)	0.16	123
Seltzer water	natural spring water	0.14	125
Sugar	brown sugar	0.11	133
Vegetable shortening	vegetable oil	−0.15[b]	126

Source: Reprinted by permission, Wertenbroch, Klaus, "Consumption Self-Control via Purchase Quantity Rationing of Virtue and Vice." *Marketing Science* 17(4): 317–37. Copyright 1998, the Institute for Operations Research and the Management Sciences, 901 Elkridge Landing Road, Ste. 400, Linthicum, M.D. 21090.

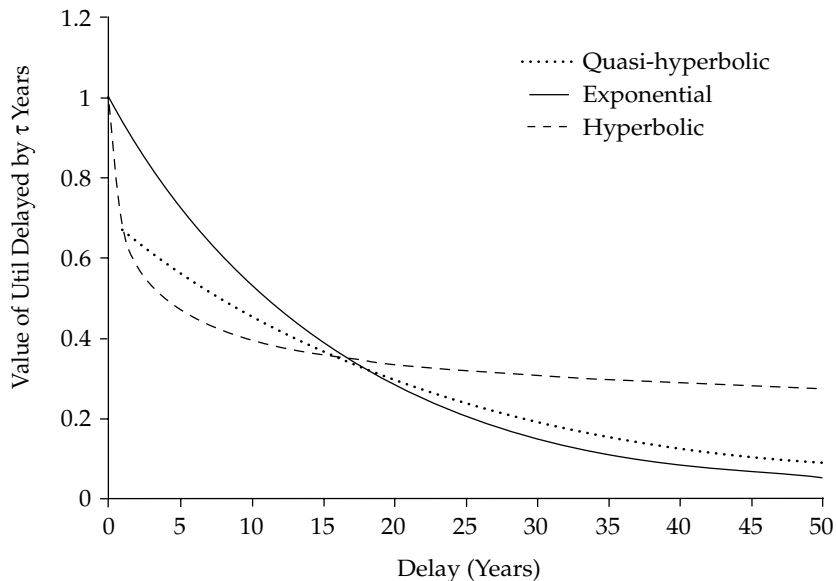[a]See Wertenbroch (1998) for details of vice-virtue rating scales.

[b]Mean vice rating was counter to hypothesized vice-virtue distinction ($p < 1$).

*$p < .05$, **$p < .01$, ***$p < .001$, ****$p < .0001$ in two-sided *t*-test.
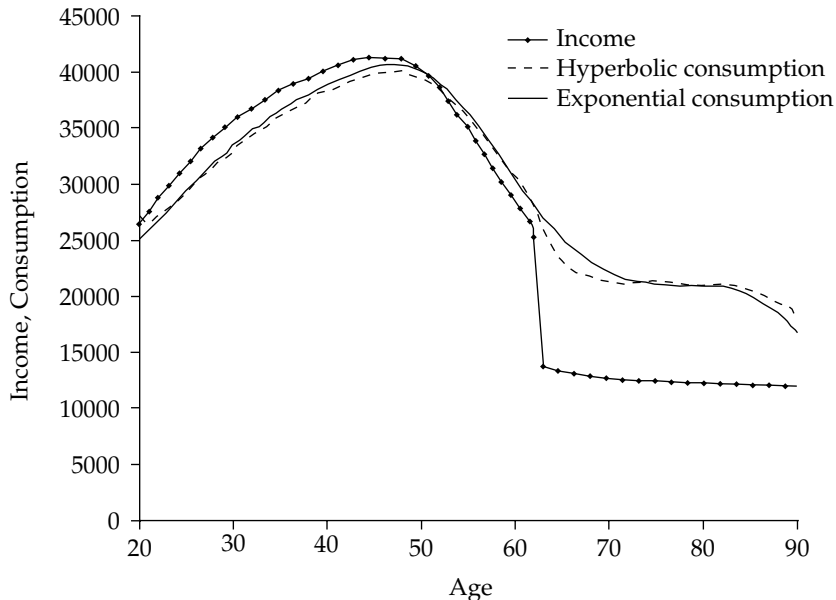
Figure 18.1   Discount Functions

Figure 18.2 Simulated Mean Income and Consumption

Source: Authors' simulations.
Note: The figure plots the simulated mean values of consumption and labor income for five thousand simulated households with high school graduate heads. The labor income process is identical for households with either exponential or hyperbolic discount functions. The income process is calibrated from the Panel Study of Income Dynamics and includes a deterministic component and both persistent and transitory shocks. Income includes government transfers and pensions, but does not include asset income. Consumption includes both direct consumption and indirect consumption flows of 5 percent of the value of the household's illiquid asset holdings.

Figure 18.3   Simulated Total Assets, Illiquid Assets, Liquid Assets, and Liquid Liabilities for Households with Exponential Discount Functions
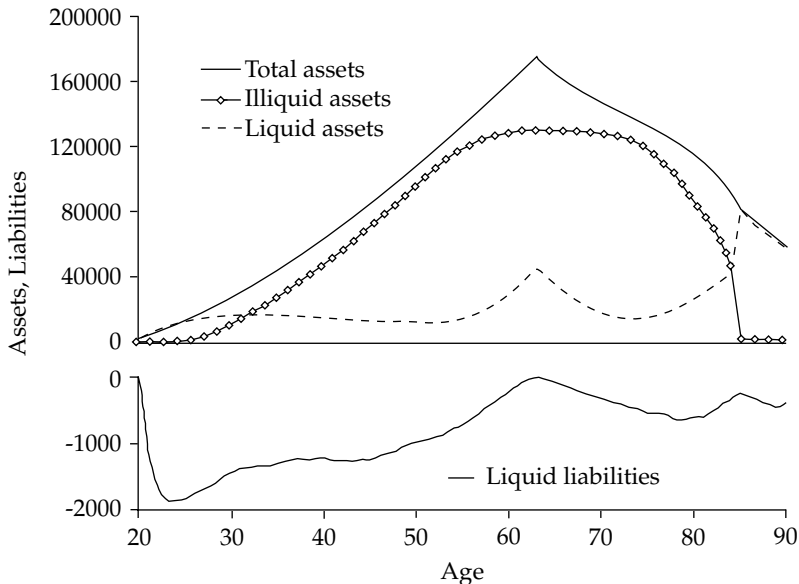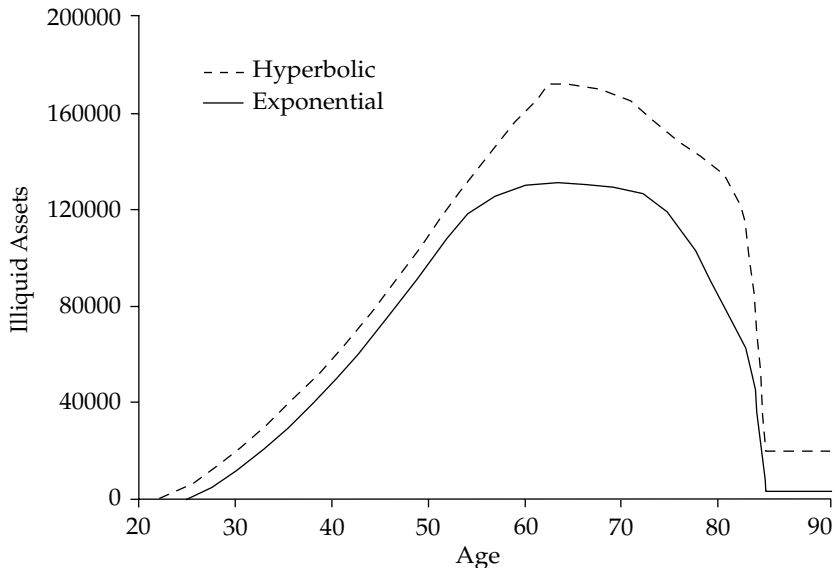

Source: Authors' simulations.
Note: The figure plots the mean level of liquid assets (excluding credit card debt), illiquid assets, total assets, and liquid liabilities (that is, credit card debt) for five thousand simulated households with high school graduate heads and exponential discount functions.

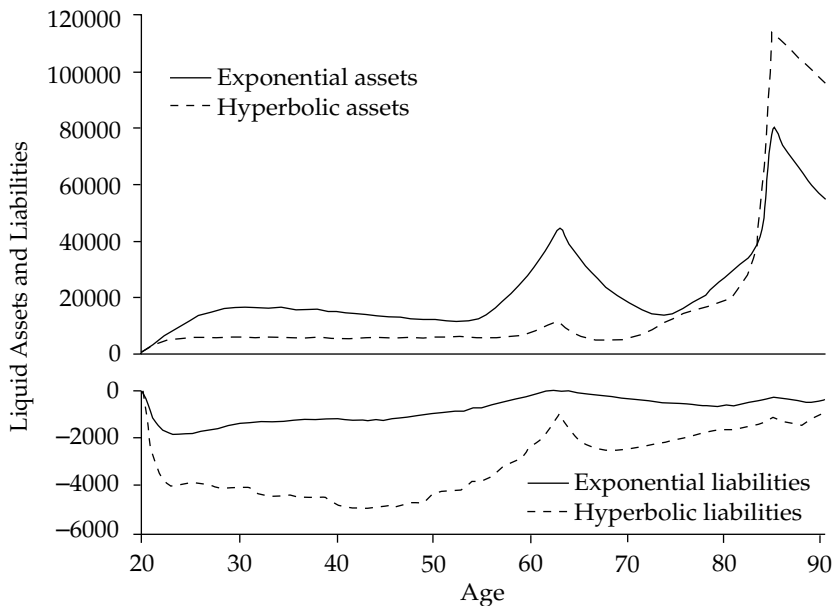**Figure 18.4   Mean Illiquid Assets of Households with Exponential and Hyperbolic Discount Functions**

Note: The figure plots mean illiquid assets for five thousand simulated households with high school graduate heads with exponential or hyperbolic discount functions.

Figure 18.5 Mean Liquid Assets and Liabilities

Source: Authors' simulations.
Note: The figure plots mean liquid assets and liabilities over the life cycle for five thousand simulated households with high school graduate heads with exponential or hyperbolic discount functions. Liquid assets include year-end liquid financial assets and 1/24 of annual labor income, representing average cash inventories resulting from monthly income.

Table 18.1 Percentage of Households with Liquid Assets Greater than One Month of Income

Age Group	Simulated Data		Survey of Consumer Finances		
	Exponential	Hyperbolic	Definition 1	Definition 2	Definition 3
All ages	0.73	0.40	0.37	0.42	0.52
20 to 29	0.52	0.34	0.18	0.19	0.26
30 to 39	0.72	0.39	0.21	0.24	0.36
40 to 49	0.72	0.38	0.26	0.31	0.42
50 to 59	0.76	0.43	0.35	0.41	0.50
60 to 69	0.91	0.42	0.58	0.58	0.76
70 +	0.77	0.46	0.62	0.71	0.78

Sources: Authors' simulations and 1995 Survey of Consumer Finances.
Note: The table reports the fraction of households who hold more than a month's income in liquid wealth. Three different definitions are used for liquid assets.
Definition 1 includes cash, checking and savings accounts.
Definition 2 includes definition 1 plus money market accounts.
Definition 3 includes definition 2 plus call accounts, CDs, bonds, stocks and mutual funds.

Table 18.2 Share of Assets in Liquid Form

	Simulations		Survey of Consumer Finances		
Age Group	Exponential	Hyperbolic	Definition 1	Definition 2	Definition 3
All ages	0.50	0.39	0.07	0.08	0.15
20 to 29	0.97	0.86	0.10	0.11	0.16
30 to 39	0.65	0.46	0.05	0.06	0.11
40 to 49	0.35	0.24	0.04	0.05	0.08
50 to 59	0.20	0.13	0.04	0.05	0.09
60 to 69	0.27	0.12	0.09	0.10	0.20
70 +	0.57	0.56	0.09	0.12	0.24

Sources: 1995 Survey of Consumer Finances and authors' simulations.

Note: Liquid asset share is liquid assets divided by total assets.

Three different definitions are used for liquid assets.

Definition 1 includes cash, checking accounts, and savings accounts.

Definition 2 includes definition 1 plus money market accounts.

Definition 3 includes definition 2 plus call accounts, CDs, bonds, stocks and mutual funds.

Three complementary definitions are used for illiquid assets.

Illiquid assets includes all assets not included in the corresponding liquid wealth definition, plus IRAs, DC plans, life insurance, trusts, annuities, vehicles, home equity, real estate, business equity, jewelry, furniture, antiques, and home durables.