FIGURE P.1 Levels in the Analysis of the Quality of Life

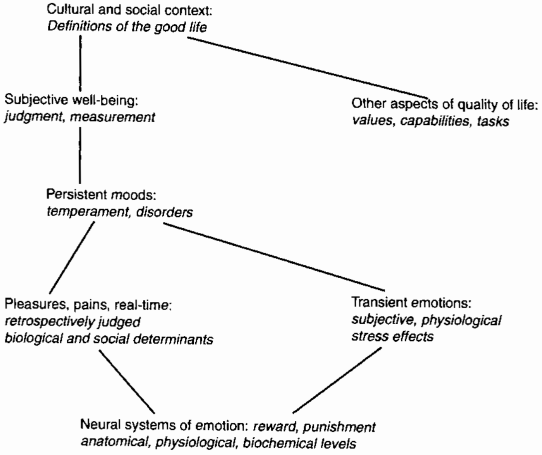
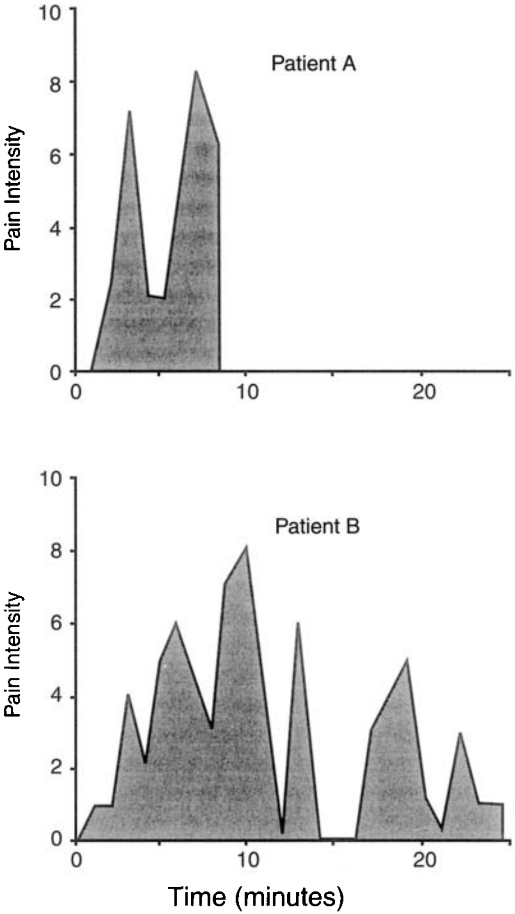


FIGURE 1.1 Pain Intensity Reported by Two Colonoscopy Patients



Source: Redelmeier and Kahneman 1996, 4. Reprinted with permission from the International Association for the Study of Pain.

FIGURE 1.2 A Typical Value Function

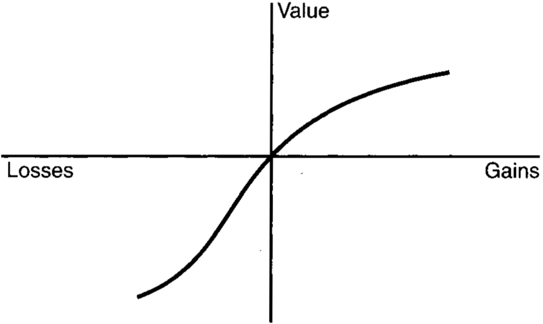


FIGURE 1.3 Multiple Reference Points for the Choice Between A and D

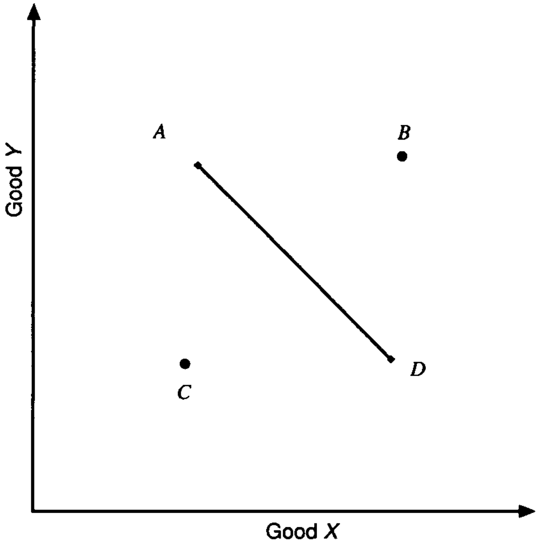


FIGURE 4.1 Asymmetries in Feature Comparison

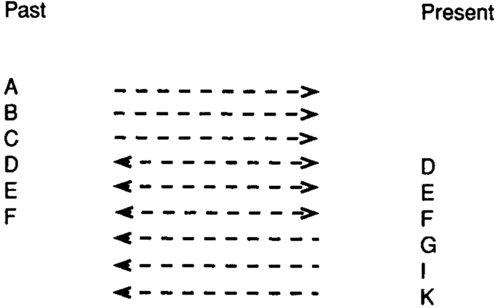


FIGURE 4.2 A Judgment Model of Subjective Well-Being

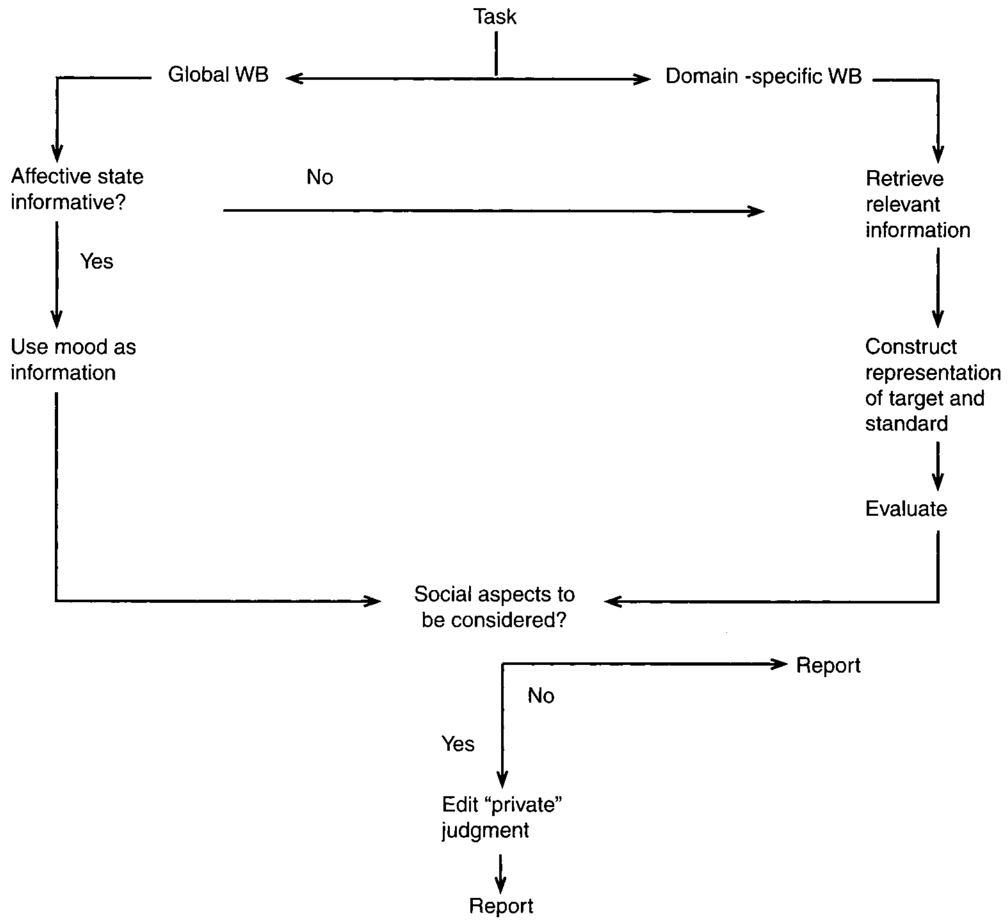


TABLE 4.1 Subjective Well-Being: The Impact of Valence of Event and Time Perspective

	Valence of Event	
	Positive	*Negative*
Time perspective		
Present	8.9	7.1
Past	7.5	8.5
Category boundary		
Not salient	8.7	7.4
Salient	6.2	8.2

Source: Top panel adapted from Strack et al. (1985, Experiment 1). Copyright 1985 by the American Psychological Association. Bottom panel from Schwarz and Hippler (unpublished data).
Notes: For the mean score of happiness and satisfaction questions, the range is 1 to 11, with higher values indicating reports of higher well-being.

TABLE 4.2 Reported Daily Television Consumption and Leisure Time Satisfaction as a Function of Response Alternatives

Low-Frequency Alternatives (Percentage)		*High-Frequency Alternatives (Percentage)*	
Reported daily television consumption			
Up to half an hour	11.5	Up to 2 1/2h	70.4
Half an hour to one hour	26.9	2 1/2h to 3h	22.2
One hour to one and a half hours	26.9	3h to 3 1/2h	7.4
One and a half hours to two hours	26.9	3 1/2h to 4h	0.0
Two hours to two and a half hours	7.7	4h to 4 1/2h	0.0
More than two and a half hours	0.0	More than 4 1/2h	0.0
Leisure time satisfaction			
	9.6		8.2

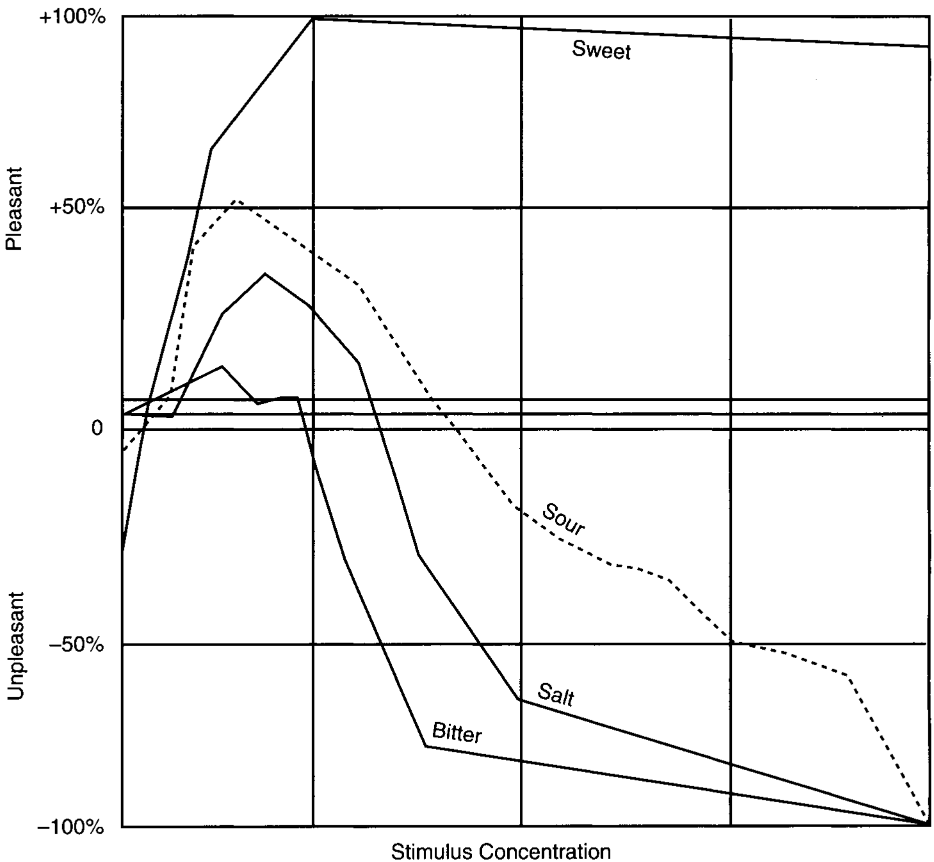
Source: Adapted from Schwarz et al. (1985, Experiment 2). Reprinted with permission from The University of Chicago Press.

TABLE 4.3 Subjective Well-being: The Impact of Style of Thinking

	Valence of Event	
	Positive	*Negative*
Detailed description	9.1	7.9
Short description	6.8	8.4
"How" description	8.2	6.3
"Why" description	7.8	8.9

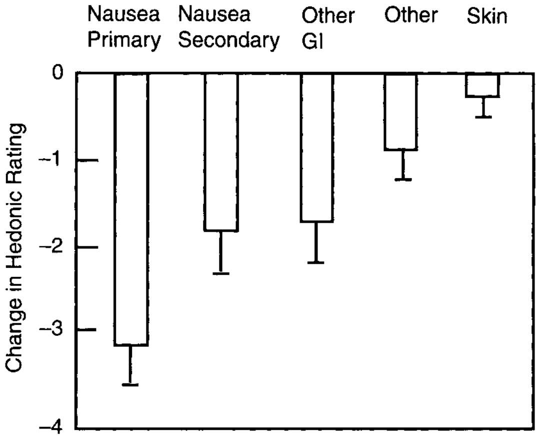
Source: Copyright 1985 by the American Psychological Association. Adapted from Strack et al. (1985, Experiments 2 and 3).
Note: For the mean score of happiness and satisfaction questions, the range is 1 to 11, with higher values indicating reports of higher well-being.

FIGURE 6.1 Pleasure Judgments in Relation to the Concentration of Taste Solutions



Source: Pfaffman 1960, 261.
Notes: The preponderance of "pleasant" or "unpleasant" judgments in relation to the concentration of taste solution. The ordinate gives percentage "pleasant" minus percentage "unpleasant." The abscissa is proportional to concentration, the full length of the baseline standing for 40 percent cane sugar, 1.12 percent tartaric acid, 10 percent sodium chlorine, and .004 percent quinine sulphate (by weight).

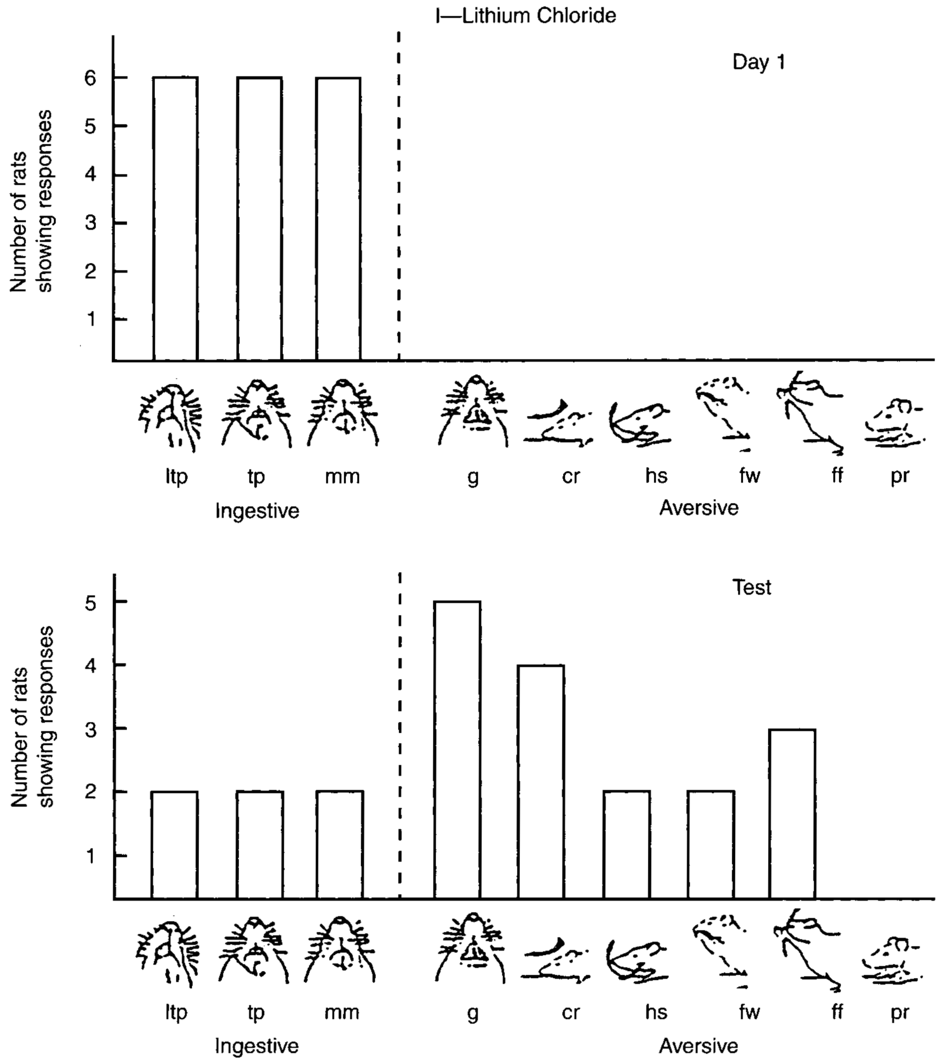
FIGURE 6.2 Relation of Human Taste Aversions to Negative Events



Source: Pelchat and Rozin 1982, 345.

Notes: Taste aversions in humans as a function of type of negative event. Subjects self-reported on experiences in which ingestion of a food was followed by a negative event. The food in question was rated on a 1 (extremely unpleasant) to 9 (extremely pleasant) scale for before and after the event. Subjects also indicated features of the negative event, designating one of these as the primary feature. The mean change in liking (rating-after minus rating-before) is presented as a function of type of negative event. Negative events are characterized, on the abscissa, as "Nausea primary" (nausea or vomiting is the primary feature), "Nausea secondary" (nausea or vomiting is a nonprimary feature), "Other GI" (gastrointestinal symptoms other than nausea or vomiting are primary), "Other" (items that did not fit in any of the other categories, such as respiratory distress, cardiovascular problems, systemic shock, or reception of very upsetting news, such as the death of a loved one), and "Skin" (skin symptoms, usually allergenic, such as rashes).

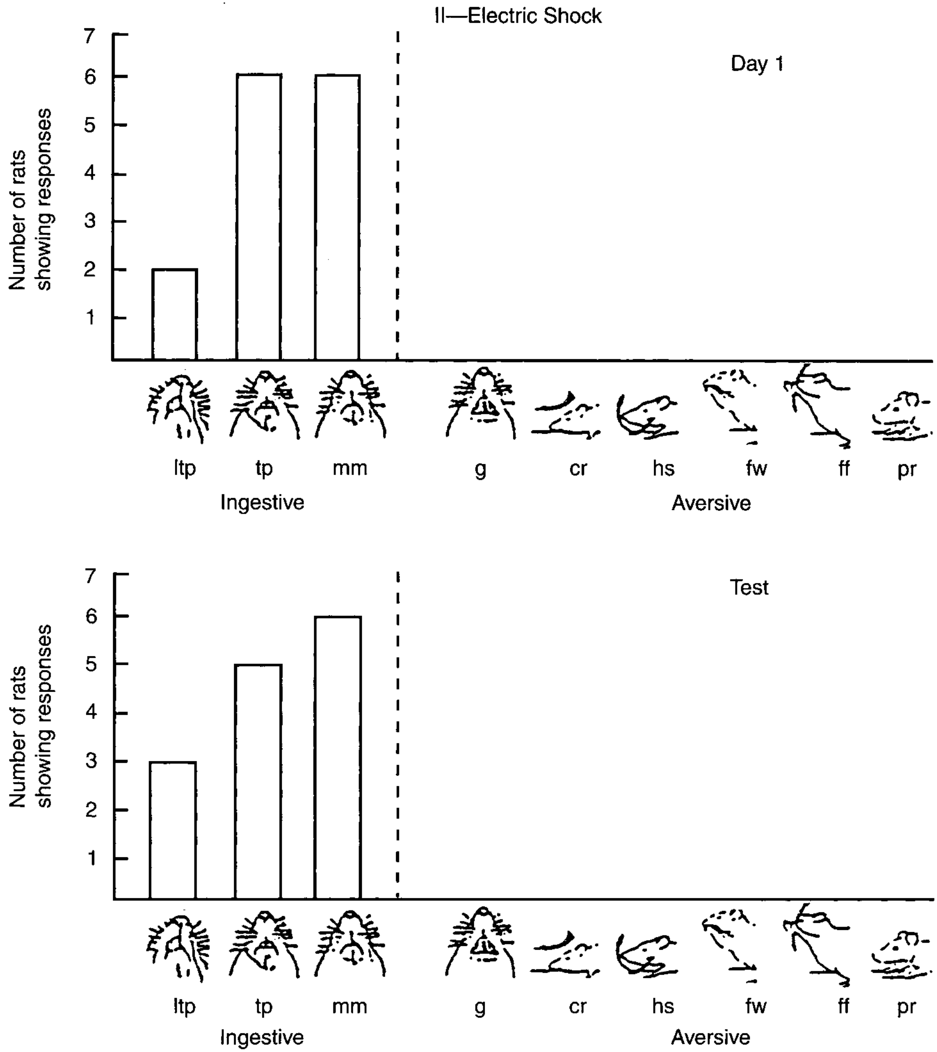
FIGURE 6.3 Orofacial Responses of Poisoned Rats to Sucrose: Relation of Taste Aversions in Rats to Negative Events



Source: Pelchat, Grill, Rozin, and Jacobs (1983). Copyright 1983 the American Psychological Association.

Notes: Orofacial responses of rats before and after exposure to pairings between sucrose ingestion and one of three negative events: (I) intragastric lithium chloride (LiCl) believed to induce nausea; (II) electric shock; (III) intragastric intubation of lactose, which induces lower gastrointestinal symptoms (such as cramps in humans) and diarrhea, but little nausea. Graphs show the number of rats (five or six per group, as indicated) who display the indicated behavior. The three positive followed by six negative orofacial responses are designated on the abscissa. ltp = lateral tongue protrusions, tp = tongue protrusions, mm = mouth movements, g = gape, cr = chin rub, hs = head shaking, fw = face washing, ff = forelimb flailing, pr = paw rubbing.

(*Figure continued on p. 122.*)


II—Electric Shock
Day 1
Number of rats showing responses
7
6
5
4
3
2
1
ltp
tp
mm
g
cr
hs
fw
ff
pr
Ingestive
Aversive
Test
Number of rats showing responses
7
6
5
4
3
2
1
ltp
tp
mm
g
cr
hs
fw
ff
pr
Ingestive
Aversive

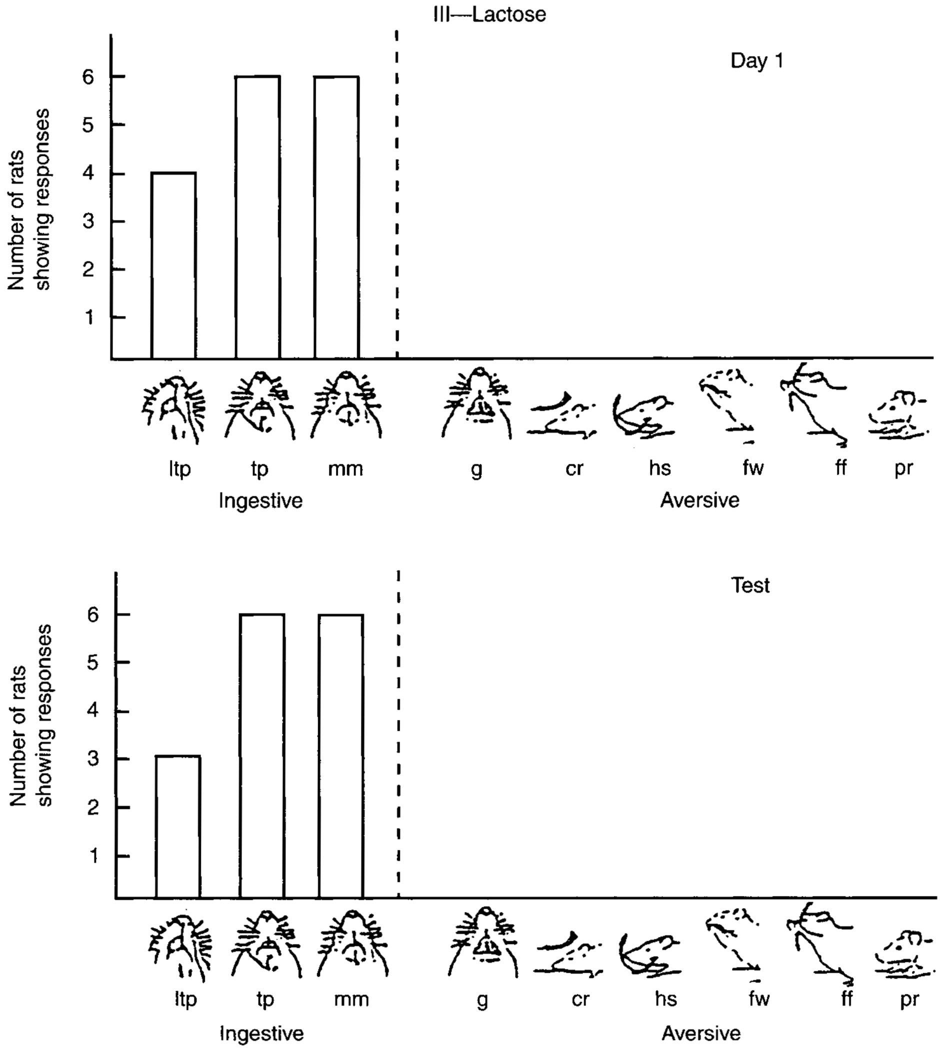
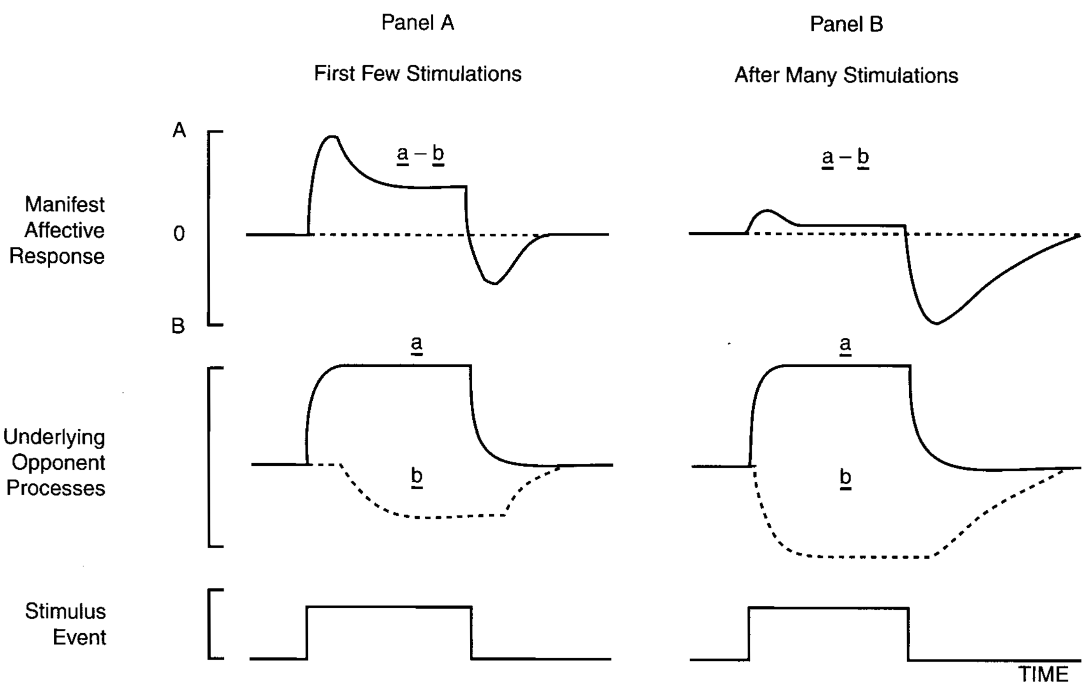

III—Lactose
Day 1
Number of rats showing responses
6
5
4
3
2
1
ltp
tp
mm
g
cr
hs
fw
ff
pr
Ingestive
Aversive
Test
Number of rats showing responses
6
5
4
3
2
1
ltp
tp
mm
g
cr
hs
fw
ff
pr
Ingestive
Aversive

FIGURE 6.4 Opponent Process Theory



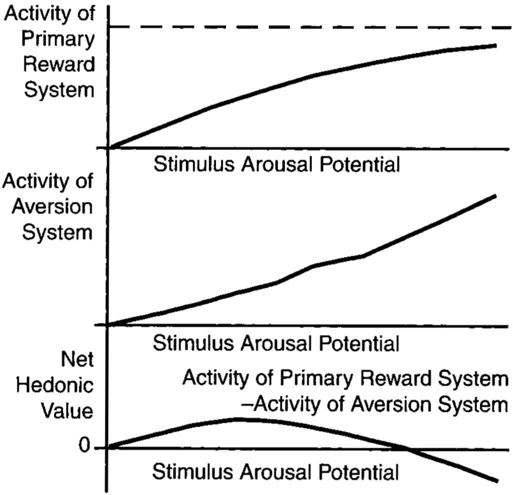
Source: Solomon 1980, 700. Copyright 1980 the American Psychological Association.
Notes: Schematic representation of opponent process theory. Panel A represents the balance of A and B responses for the first few exposures. Panel B represents the A and B responses after repeated exposures. The manifest response is the summation of the two underlying processes.

TABLE 6.1 Psychological Food Taxonomy

Dimension	*Distaste*	*Danger*	*Inappropriate*	*Disgust*	*Good taste*	*Beneficial*	*Appropriate*	*Transvalued*
Sensory/affective	—			(−)	+			(+)
Anticipated consequences		—		(−)		+		(+)
Ideational			—	—			+	+
Examples	beer chili spinach	allergy foods carcinogens	grass sand	feces insect rotted foods	saccharine favorite foods	medicine healthy foods	ritual foods	leavings of heroes, loved ones, or deities

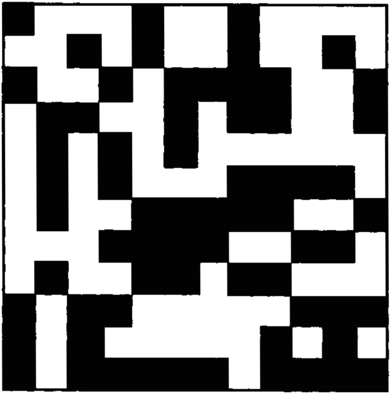
Source: Modified from Fallon and Rozin, 1983.
Note: Sign in parentheses indicates a statistical, but not a necessary relation, between a dimension and a food category.

FIGURE 7.1 The Wundt Curve



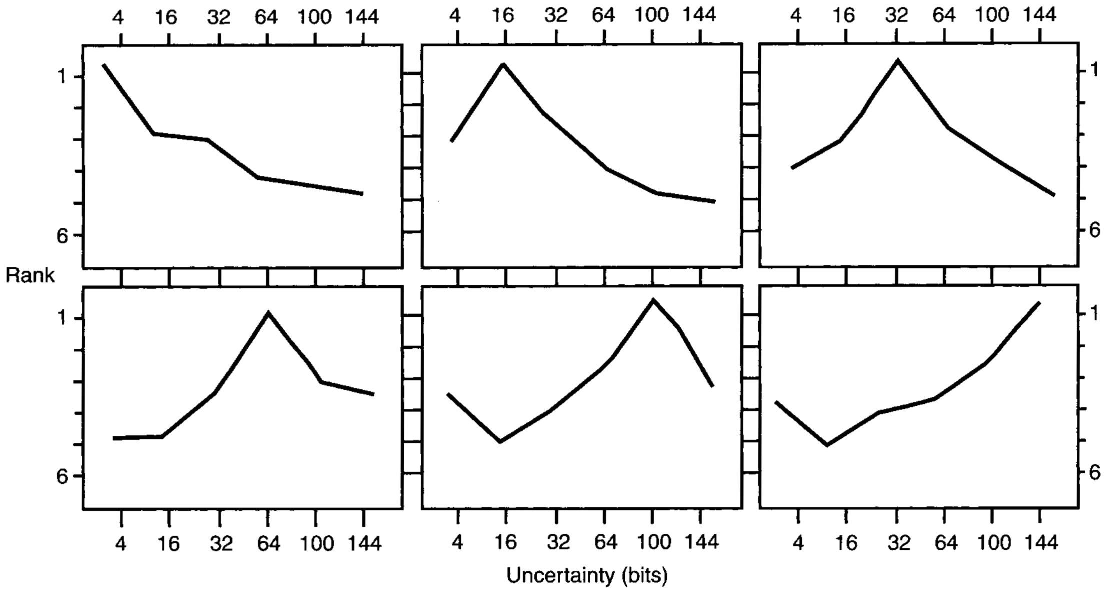
Source: Adapted From Berlyne 1971, figures 8.3 and 8.4.

FIGURE 7.2 A Pattern Based on a Twelve-by-Twelve Matrix of White or Green Tiles



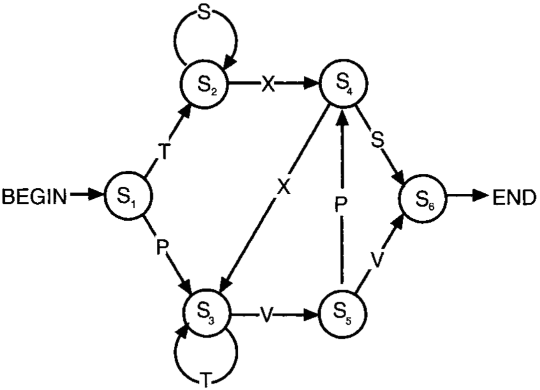
Source: Dorfman and McKenna 1966, figure 1.
Note: Black tiles signify green tiles.

FIGURE 7.3 Number of Tiles Preferred by Six Classes of Participants in Dorfman and McKenna (1966) Experiment



Source: Adapted from Dorfman and McKenna (1966), figure 2.

FIGURE 7.4 Reber's (1993) Artificial Grammar and the Eight Strings It Generates



1. TXS
2. TSXS
3. TSSXXVV
4. TSXXTVPS
5. PVV
6. PTTVPS
7. PTVPXVPS
8. PTVPXVPS

Source: Reber 1993.
Notes: Reber's artificial grammar can be learned implicitly. To generate a letter, you move from one "state" (S_1, S_2, . . . S_6) to another. When you are in a given state (the *source state*, say, S_3), you may go only to states (the *target states*, such as S_3, which generates a *T*, and S_5, which generates a *V*) that are connected with the source state by an arrow directed toward the target state.

TABLE 7.1 Comparison of Two Types of Pleasures of the Body

Source	*Tonic Pleasures*	*Pains or Discomforts*	*Relief Pleasures*
Nostrils	Aromas	Irritation (for example, horseradish, dust), disgusting odors (for example, rotting eggs)	Sneeze
Mouth	Good flavors	Burn, distastes (bitter), disgusts (rotting food)	Spit, cough, belch
Genitals	Sexual pleasure	Sexual tension	Orgasm
Urethra	?	Full bladder	Micturition
Rectum	Sexual pleasure	Full bowel, flatulence	defecation, passing gas

TABLE 7.2 Features of Emotions and Pleasures of the Mind

Emotions . . .	*Pleasures of the Mind . . .*
have a distinctive universal signal (such as a facial expression).	do not have a distinctive universal signal.
are almost all present in other primates.	at least some of them may be present in other primates.
are accompanied by a distinctive physiological response.	are not accompanied by a distinctive physiological response.
give rise to coherent responses in the autonomic and expressive systems.	do not give rise to coherent responses.
can develop rapidly and may happen before one is aware of them.	are relatively extended in time.
are of brief duration (on the order of seconds).	are usually not of brief duration.
are quick and brief; they imply the existence of an automatic appraisal mechanism.	even though neither quick nor brief, may be generated by an automatic appraisal mechanism.
are quick, brief, and involve automatic appraisal; therefore, their occurrence is unbidden.	are generally voluntarily sought out.

TABLE 7.3 Reinterpretation of Four Features of Flow

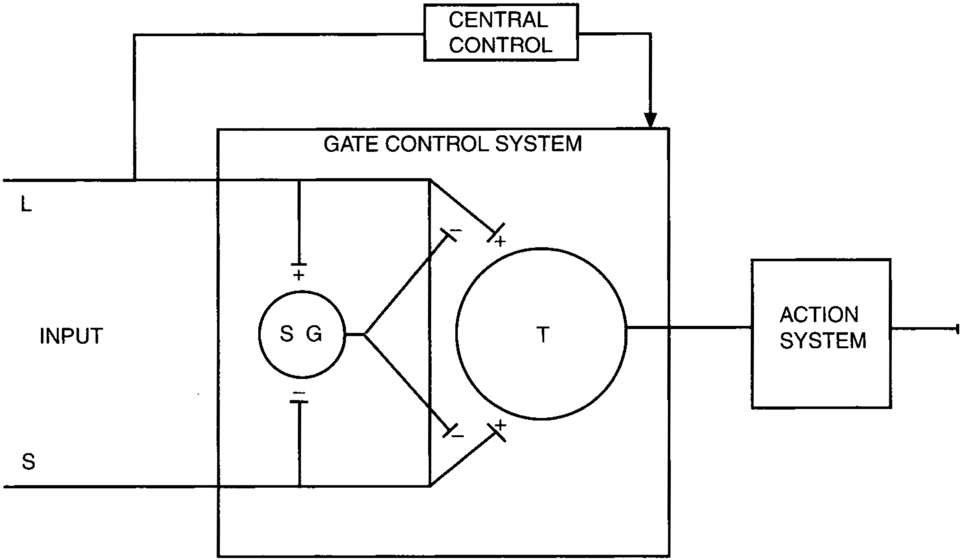
Category	*Features*	*Reinterpretation*
Nature of the activity	Neither too easy nor too hard (49–53) Has goals (54–56) Gives feedback (56–58)	Features of activities that offer opportunity to acquire virtuosity
Effect of the activity	We feel in control (59–62)	Effect of acquiring virtuosity
Nature of our involvement in the activity	We immerse ourselves in it (53–54)	Precondition of all pleasures of the mind
Effects of the activity	Makes us forget ourselves (58–59, 62–66) Time slows down (66–67)	Effects of all pleasures of the mind

Source: Csikszentmihalyi (1990). The page numbers refer to this text.

FIGURE 8.1 Descartes' Concept of the Specific Pain Pathway

Source: Descartes, 1664/1972, 35.

FIGURE 8.2 Schematic Diagram of the Original Gate Control Theory of Pain



Source: Melzack and Wall 1982, 226. Reprinted with permission from the authors.
Notes: *L* = large-diameter fibers; *S* = small-diameter fibers; + = excitation;— = inhibition. *L* and *S* fibers project to the substantia gelatinosa (*SG*) and central transmission (*T*) cells. The inhibitory effect exerted by the *SG* on afferent fiber terminals is increased by activity in *L* fibers (closing the gate) and decreased by activity in *S* fibers (opening the gate). The central control trigger is represented by a line running from *L* fibers to the central control mechanisms; these mechanisms, in turn, project back to the gate control system. The *T* cells project to the action system.

FIGURE 11.1 The Dimensions of Extraversion and Neuroticism in Eysenck's Model of Personality

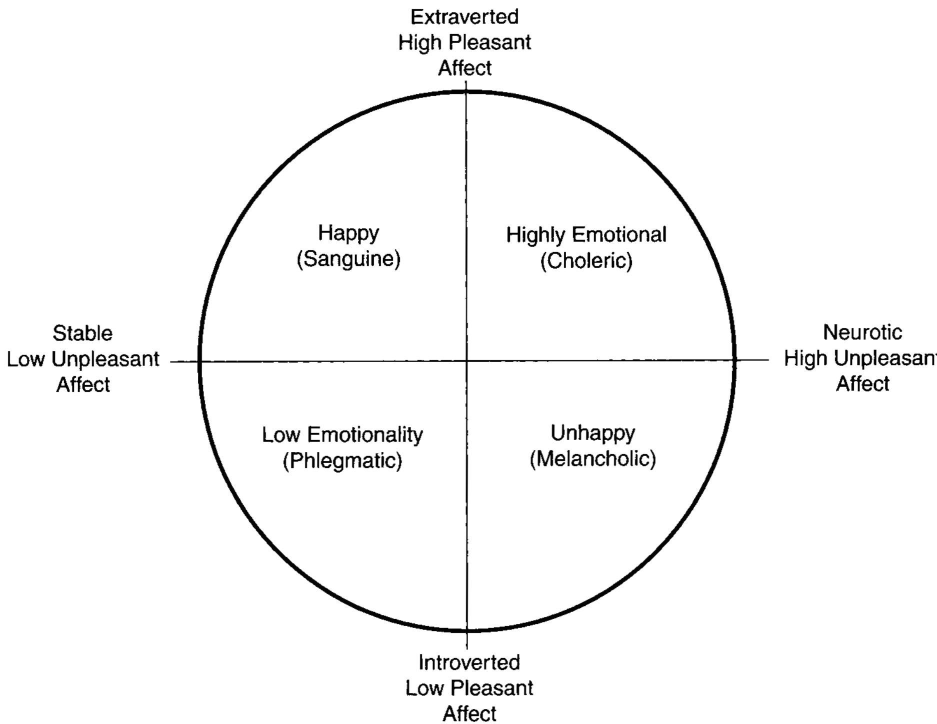


FIGURE 13.1 Psychological Variables with Distinct Relations to Promotion Focus and Prevention Focus

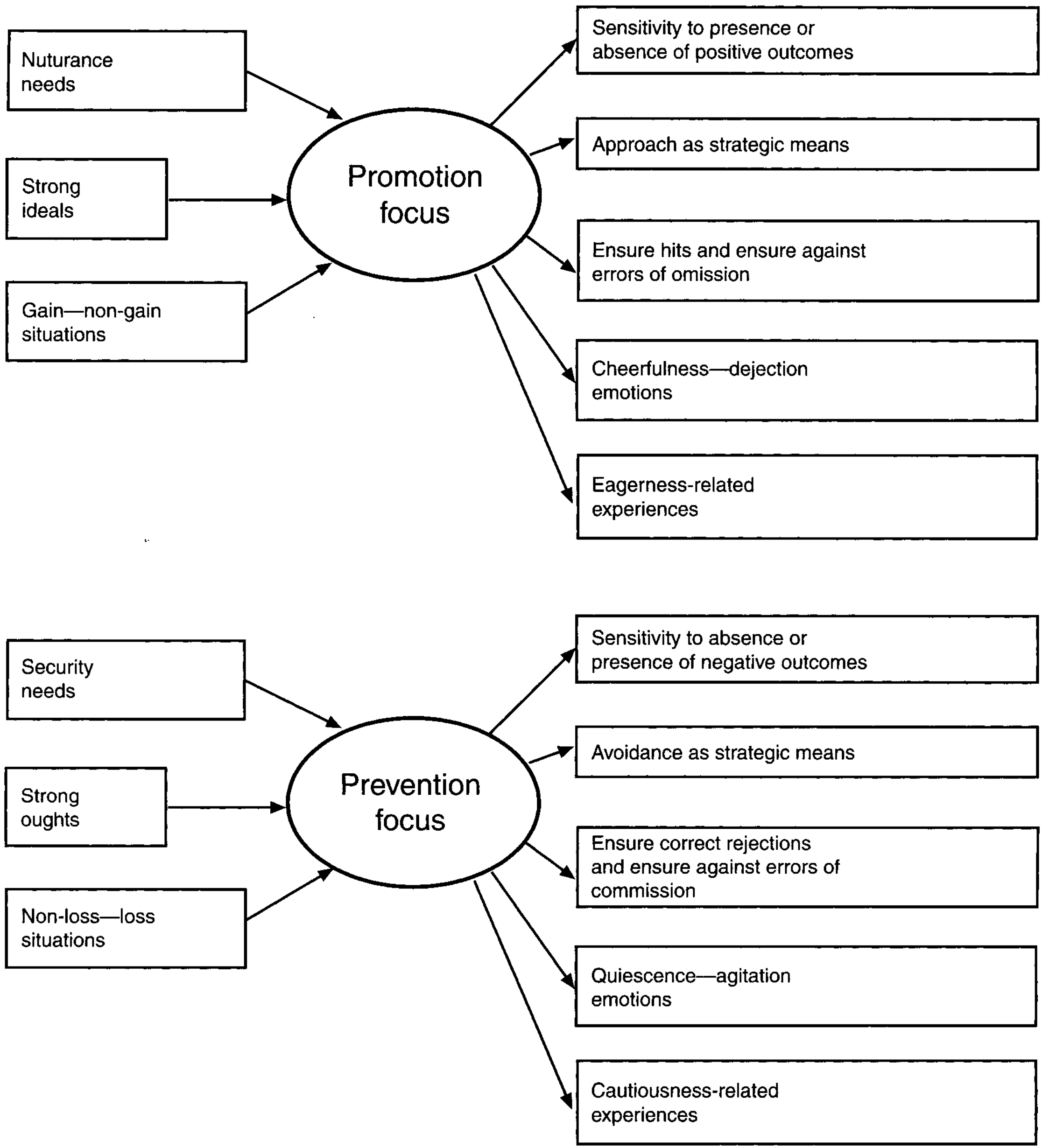


TABLE 13.1 Self-Regulatory Principles Underlying Hedonic Regulation

I. Regulatory anticipation	Avoid anticipated pain	Approach anticipated pleasure
II. Regulatory reference	Avoidance regulation in reference to undesired end-states	Approach regulation in reference to desired end-states
III. Regulatory focus	Prevention Strategically avoid mismatches to desired end-states (and matches to undesired) Ensure correct rejections Ensure against errors of commission	Promotion Strategically approach matches to desired end-states (and mismatches to undesired) Ensure hits Ensure against errors of omission

FIGURE 16.1 Prisoner's Situation Prior to Adapting to Incarceration

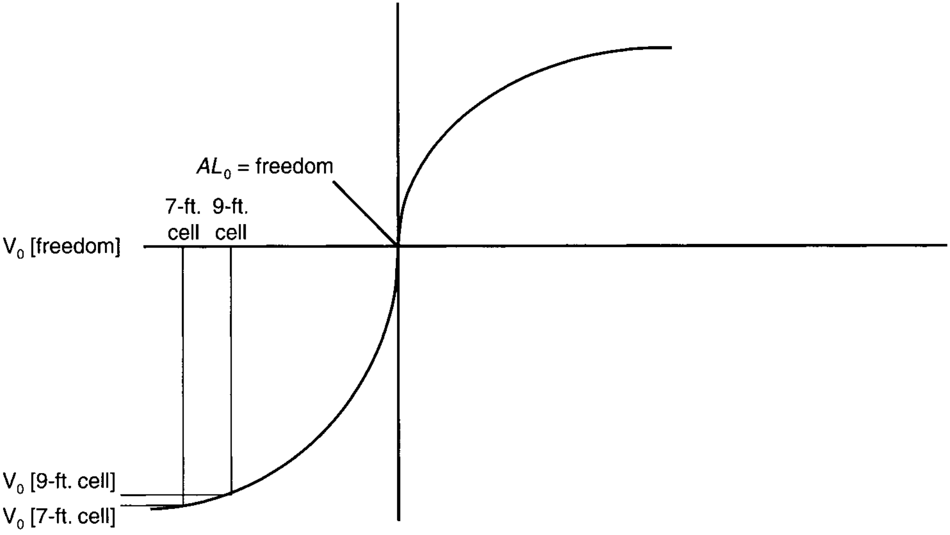


FIGURE 16.2 Prisoner's Situation Following Adaptation to Incarceration

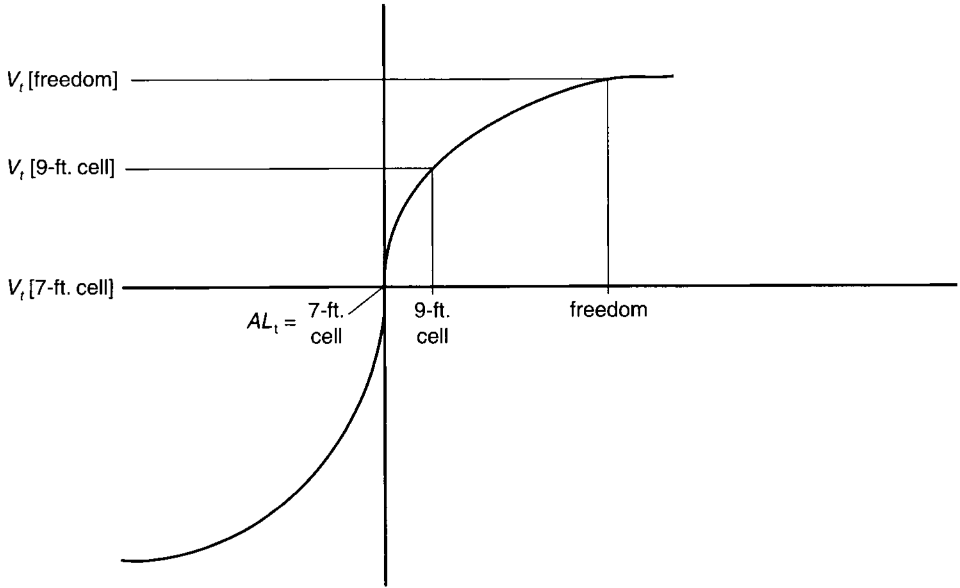


FIGURE 16.3 Sensitization and Desensitization

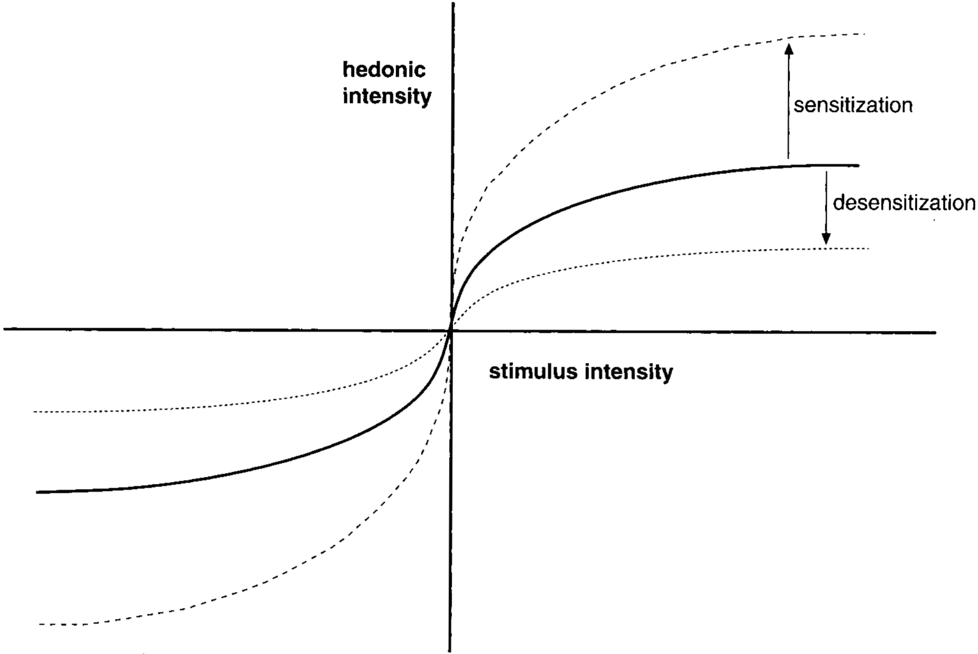


FIGURE 16.4 Hedonic Impact of Forewarning If It *Advances the Start* of Adaptation

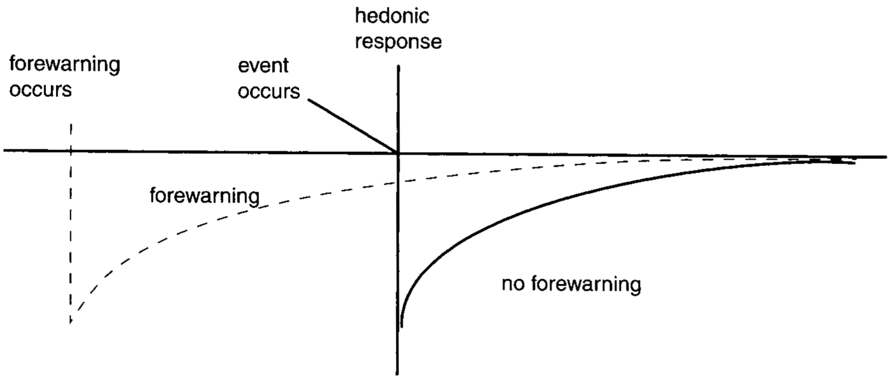


FIGURE 16.5 Hedonic Impact of Forewarning If It *Accelerates the Rate* of Adaptation

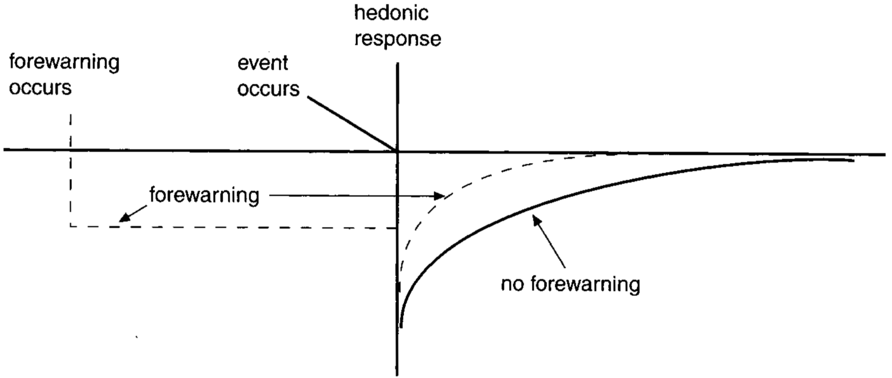
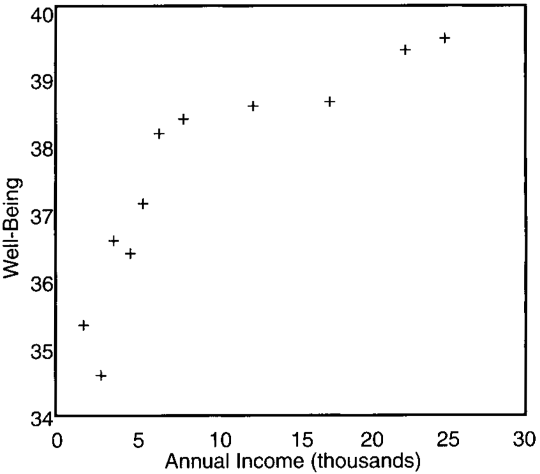
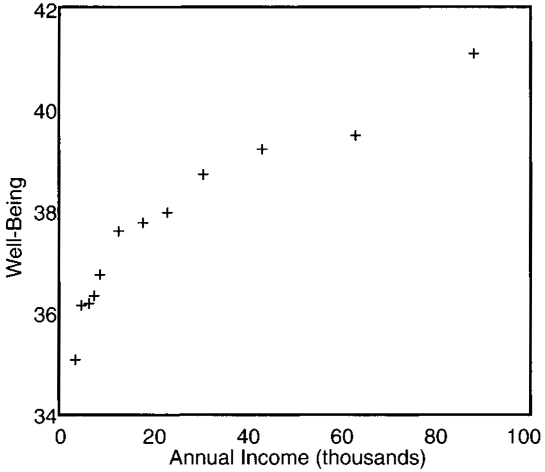


FIGURE 18.1 Income and Well-Being in the United States, 1971 to 1975



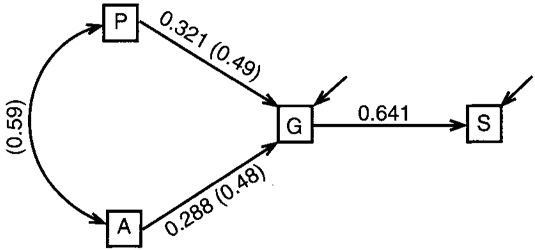
Source: Diener et al. (1993), figure 1. Reprinted with kind permision from Kluwer Academic Publishers.

FIGURE 18.2 Income and Well-Being in the United States, 1981 to 1984



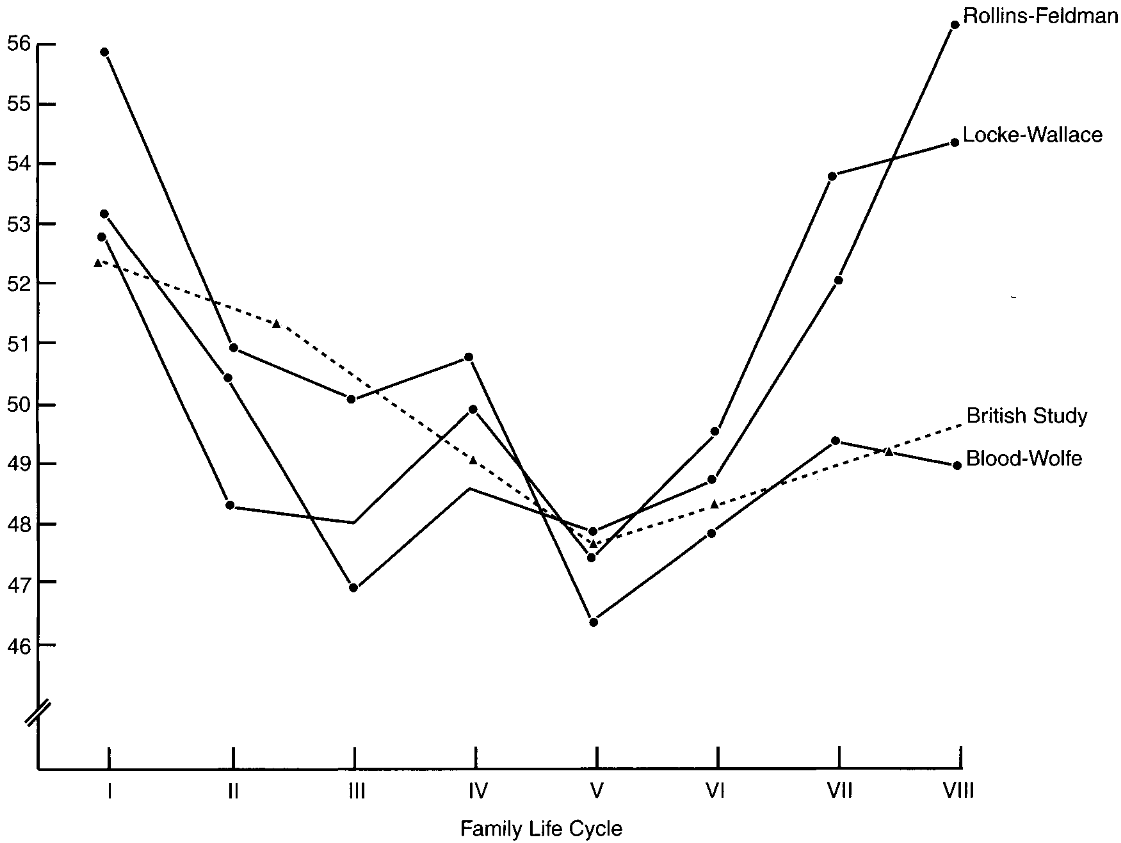
Source: Diener et al. (1993), figure 2. Reprinted with kind permission from Kluwer Academic Publishers.

FIGURE 18.3 Satisfaction with Life as a Whole: The Goal-Achievement Gap Model



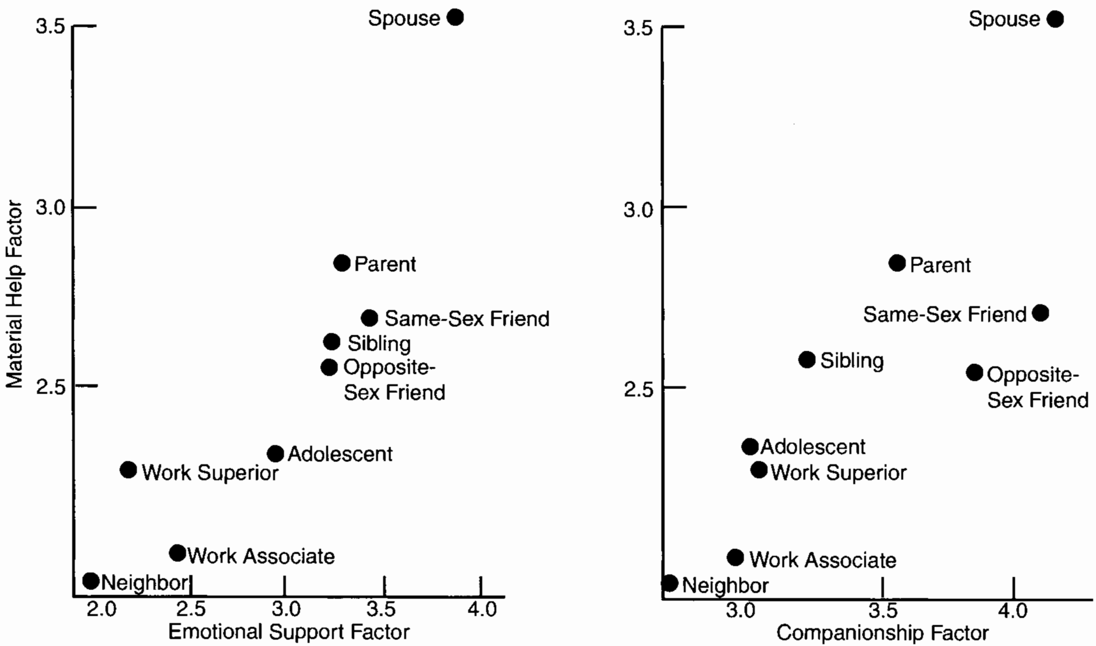
Source: Michalos (1980) (shows regression coefficients; zero-order correlations are in brackets).

FIGURE 18.4 Marital Satisfaction by Stage of Family Life Cycle



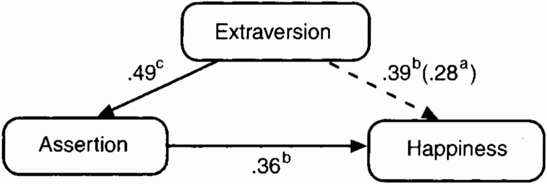
Source: Walker (1977); Rollins and Cannon (1974); *Women's Own* (1974). Reprinted with permission from the Academic Press Ltd.

FIGURE 18.5 Relationships Plotted on the Satisfaction Dimensions



Source: Argyle and Furnham (1983). Copyrighted 1983 by the National Council on Family Relations, 3989 Central Ave. NE, Suite 550, Minneapolis, MN 55421.

FIGURE 18.6 The Extraversion-Happiness Relation



Source: Reprinted from Argyle and Lu (1990) with permission from Elsevier Science.
[a] Reduced correlation between extraversion and later happiness with assertion controlled.
[b] Correlation between extraversion and later happiness.
[c] Correlation between extraversion and later assertiveness.

TABLE 18.1 Marriage and Satisfaction

	Men	*Women*
Married	79	81
Living as married	73	75
Single	74	75
Widowed	72	70
Divorced	65	66
Separated	67	57

Source: Inglehart 1990.
Note: Percentages include "satisfied" and "very satisfied."

TABLE 18.2 The Benefits of Volunteering

	Very important (%)	*Fairly important* (%)	*Not very important* (%)	*Not important at all* (%)	*Don't know* (%)
I meet people and make friends through it.	48	37	11	4	0
It's the satisfaction of seeing the results.	67	26	5	2	1
It gives me the chance to do things that I'm good at.	33	36	24	7	—
It makes me feel less selfish as a person.	29	33	24	13	2
I really enjoy it.	72	21	6	2	—
It's part of my religious belief or philosophy of life to give help.	44	22	9	23	2
It broadens my experience of life.	39	36	15	9	1
It gives me a sense of personal achievement.	47	31	16	6	—
It gives me the chance to learn new skills.	25	22	29	23	1
It gives me a position in the community.	12	16	33	38	1
It gets me "out of myself."	35	30	19	15	1
It gives me the chance to get a recognized qualification.	3	7	15	74	1

Source: Lynn and Smith (1991). Reprinted with permission from the authors.

TABLE 18.3 Happiness and Church Membership

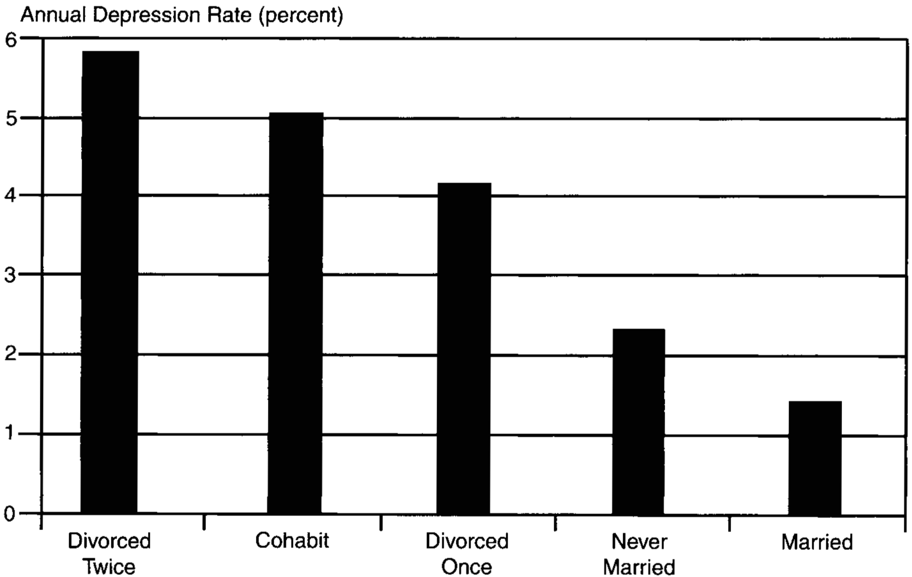
	Church leaders (%)	*Other church members (%)*	*Non-church members (%)*
Married	15	15	12
Widowed	15	11	7
Single	12	8	5
Sixty-five to seventy	18	14	10
Seventy-one to seventy-nine	15	12	7
Eighty or over	13	8	6
Fully employed	18	18	17
Partly employed	16	16	13
Fully retired	15	12	7
Health (self-rated)			
Excellent	17	14	13
Good	15	14	11
Fair	17	6	8
More active in religious organizations than in fifties	16	13	9
Less active	14	11	7

Source: Moberg and Taves (1965).

FIGURE 19.1 Marital Status and Happiness

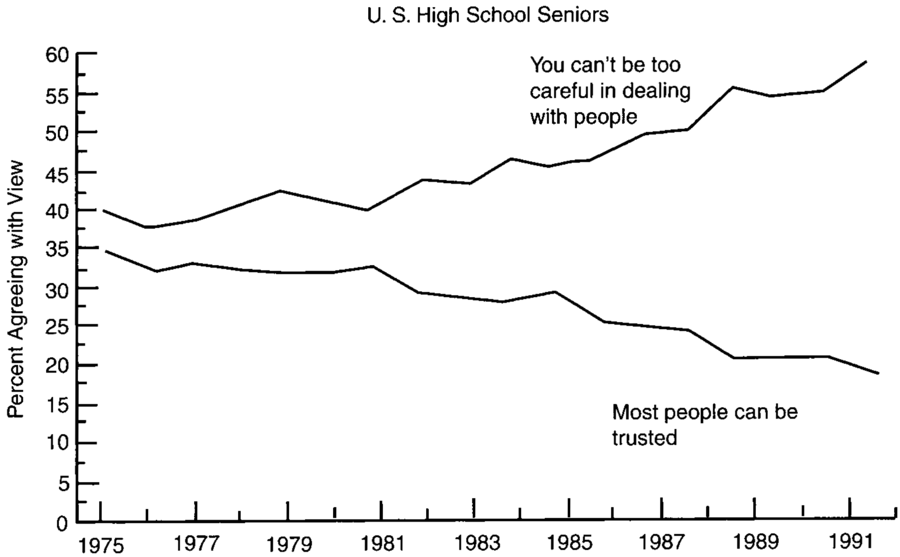
Source: Data from 31,901 participants in the General Social Survey, National Opinion Research Center, 1972 to 1994.

FIGURE 19.2 Marital Status and Rate of Depression



Source: Robins and Regier 1991, 72.

FIGURE 19.3 Declining Trust



Source: University of Michigan's annual *Monitoring the Future Survey* of U.S. high school seniors, as reported by Bronfenbrenner et al., 1996, 2. Reprinted with permission of the Free Press, a division of Simon & Schuster, Inc.

FIGURE 20.1 A Two-Dimensional View of Well-Being

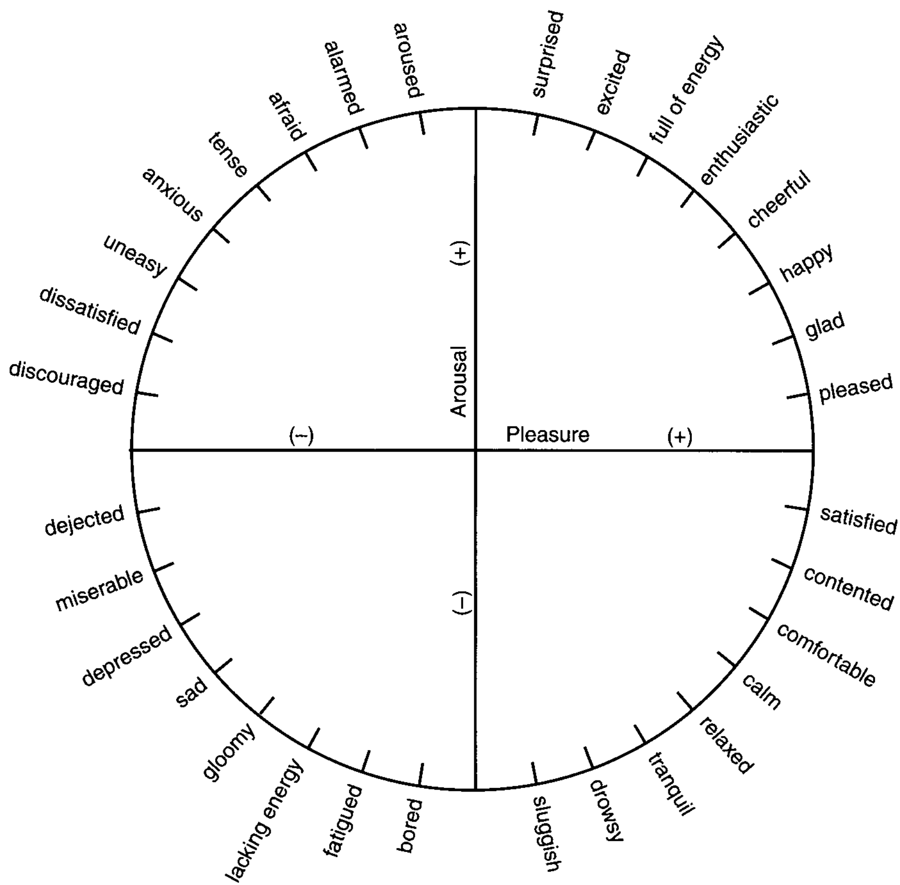


FIGURE 20.2 Three Axes for the Measurement of Well-Being

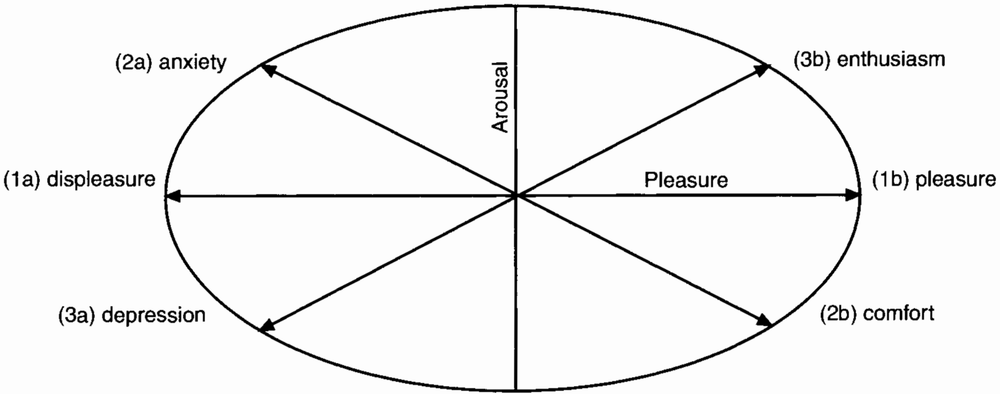


FIGURE 20.3 A Model of Employee Well-Being and Its Determinants

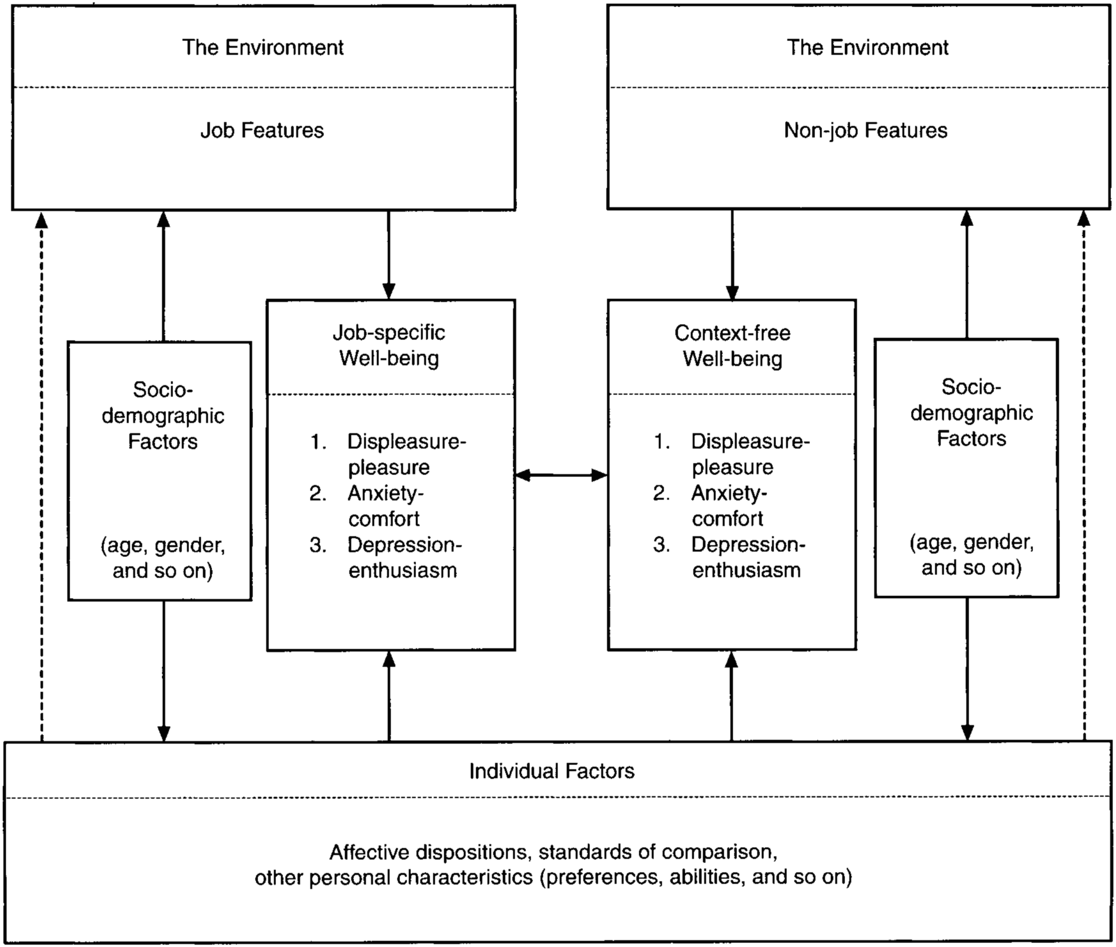


FIGURE 21.1 A Value Function of Income

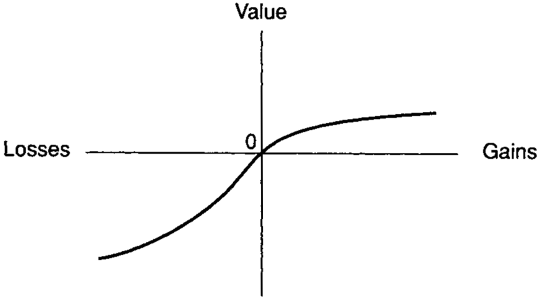


FIGURE 21.2 The Welfare Function of Income

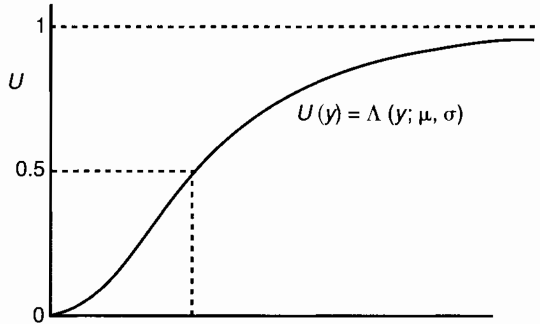


FIGURE 21.3 Welfare Function of Income with Different μ_A μ_B (σ Constant)

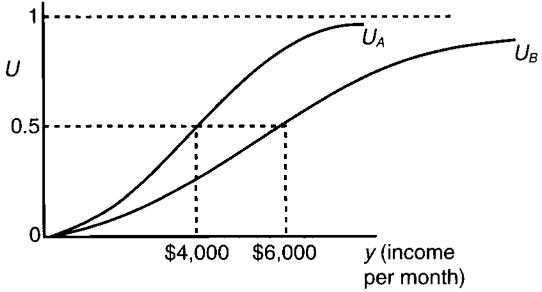
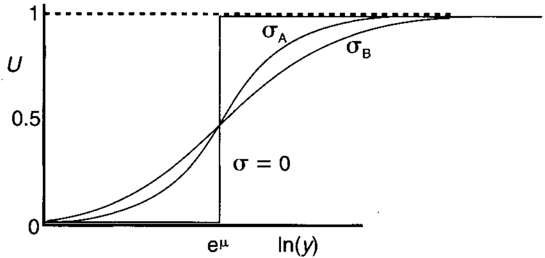


FIGURE 21.4 Welfare Function of Income with Different σ_A σ_B (μ Constant)



The phenomenon of a shifting welfare function arising from a partial adaptation of income norms

FIGURE 21.5 The Welfare Gain on Income Increase

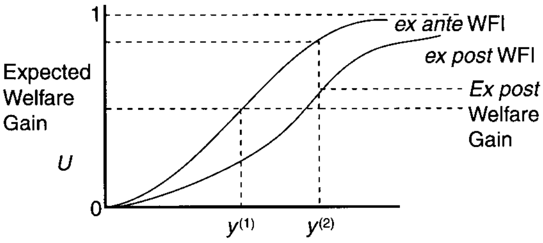


FIGURE 21.6 The Social Standard Welfare Function

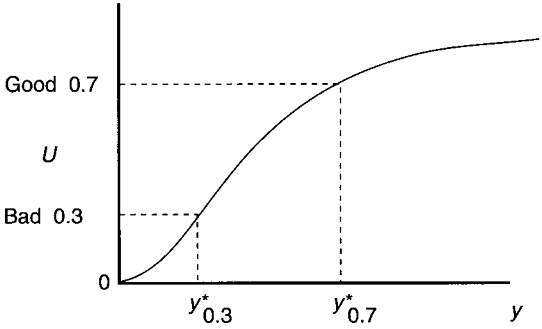


FIGURE 21.7 Time-Discounting Density Functions for Various Ages

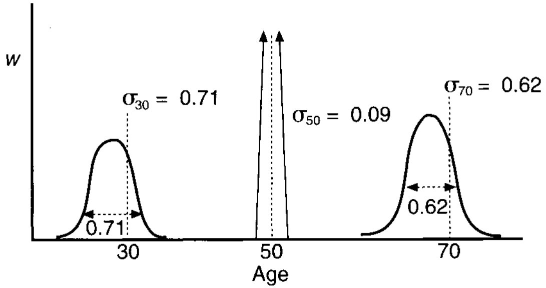


TABLE 21.1 Translation into Numbers and Line Segments

Numbers	*Empirical Mean*	*Standard Deviation*	*Theoretical Prediction*
Very bad	$\bar{v}_1 = 0.0892$	0.0927	0.1
Bad	$\bar{v}_2 = 0.2013$	0.1234	0.3
Not bad, not good	$\bar{v}_3 = 0.4719$	0.1117	0.5
Good	$\bar{v}_4 = 0.6682$	0.1169	0.7
Very good	$\bar{v}_5 = 0.8655$	0.0941	0.9
Line segments			
Very bad	$\bar{w}_1 = 0.0734$	0.0556	0.1
Bad	$\bar{w}_2 = 0.1799$	0.0934	0.3
Not good, not bad	$\bar{w}_3 = 0.4008$	0.1056	0.5
Good	$\bar{w}_4 = 0.5980$	0.1158	0.7
Very Good	$\bar{w}_5 = 0.8230$	0.1195	0.9

Source: van Praag (1991).

TABLE 21.2 Estimates of Welfare Parameters for Nine Countries

	β_1	β_2	N	R^2
Belgium	0.097	0.433	1272	0.695
Denmark	0.075	0.631	1972	0.829
France	0.059	0.505	2052	0.676
West Germany	0.112	0.583	1574	0.693
Great Britain	0.115	0.364	1183	0.575
Ireland	0.169	0.455	1733	0.636
Italy	0.156	0.381	1911	0.510
The Netherlands	0.100	0.537	1933	0.664
Russia (1995)	0.250	0.501	1444	0.501

Source: van Praag, Hagenaars, and Van Weeren (1982).

TABLE 21.3 Values of μ_τ, σ_τ, w_P, w_O, w_F

Age	μ_τ	σ_τ	w_P	w_O	w_F
20	−1.32	1.44	0.72	0.18	0.10
30	−0.32	0.71	0.40	0.48	0.12
40	0.27	0.26	0.00	0.81	0.19
50	0.45	0.09	0.00	0.70	0.30
60	0.22	0.21	0.00	0.91	0.09
70	−0.43	0.62	0.46	0.48	0.07

TABLE 21.4 Regression Equations for the Age Standards ($N = 538$)

	Constant	*Age*	*Education*	*Family Size*	*Gender*	R^2
Young	1.414	0.319	0.180	0.069	0.027	0.091
	(0.270)*	(0.043)	(0.067)	(0.026)	(0.030)	
Somewhat young	2.329	0.266	0.045	0.056	0.019	0.135
	(0.183)	(0.029)	(0.045)	(0.018)	(0.020)	
Middle-aged	3.160	0.177	0.014	0.016	0.048	0.163
	(0.115)	(0.018)	(0.028)	(0.011)	(0.013)	
Somewhat old	3.740	0.117	0.018	0.003	0.047	0.132
	(0.095)	(0.015)	(0.023)	(0.009)	(0.011)	
Old	4.243	0.058	0.067	0.003	0.048	0.071
	(0.099)	(0.016)	(0.025)	(0.010)	(0.011)	

Source: van Praag, Dubnoff, and Van der Sar (1988).
*Standard deviations in parentheses.

TABLE 21.5 General Age Standards

	General Standards	
	Male Respondents	*Female Respondents*
Young	17.69	18.41
Somewhat young	30.16	30.95
Middle-aged	49.54	52.50
Somewhat old	65.73	69.31
Old	75.06	78.91

Source: van Praag, Dubnoff, and Van der Sar (1988).

TABLE 21.6 Estimation Results of w and μ

	w	μ
Health	0.08	−0.00
	(11.43)	(−1.11)
Partner	0.04	−0.01
	(3.62)	(−1.13)
Job	0.07	−0.01
	(9.57)	(−1.67)
Sleep	0.07	0.00
	(8.90)	(0.55)
Alcohol/drugs	0.04	−0.01
	(4.27)	(−1.22)
Family	0.07	−0.01
	(7.92)	(−2.61)
Sexuality	0.03	0.00
	(3.50)	(0.86)
Parents	0.05	−0.01
	(6.53)	(−2.16)
Neighborhood	0.08	0.00
	(13.61)	(0.26)
Religion	0.02	−0.01
	(4.00)	(−3.54)
$\ln y$	0.12	0.55
	(5.13)	(41.49)
$\ln fs$	−0.81	−0.34
	(−3.60)	(−2.66)
$\ln y \ln fs$	0.09	0.03
	(4.13)	(2.44)
$\ln^2 fs$	−0.06	0.03
	(−3.36)	(2.49)
$\ln age$	−2.14	1.10
	(−5.88)	(5.27)
$\ln^2 age$	0.30	−0.14
	(4.13)	(−4.82)
Dummy-job	−0.10	0.01
	(−5.07)	(−0.57)
Constant	3.10	2.24
	(4.72)	(5.93)
R^2	0.24	0.61

Source: van Praag and Plug (1995).

TABLE 21.7 The Optimum Family Size for Specific Income Levels

fs = 1	*fs* = 2	*fs* = 3	*fs* = 4	*fs* = 5	*fs* = 6
8,103	20,418	35,060	51,451	69,280	88,346

Note: Family income is measured in Dutch guilders (NLG2 is about $1.00).

TABLE 21.8 Money Value of Nonmonetary Child Benefits

	One Breadwinner			
*Income**	*First Child*	*Second Child*	*Third Child*	*Fourth Child*
20,000	−262	−838	−1,005	−1,039
30,000	1,114	−236	−748	−959
40,000	2,911	651	−279	−713
50,000	5,023	1,749	348	−341
60,000	7,383	3,018	1,100	130

	Two Breadwinners			
Income	*First Child*	*Second Child*	*Third Child*	*Fourth Child*
20,000	−726	−1,153	−1,240	−1,223
30,000	419	−708	−1,100	−1,236
40,000	1,983	22	−747	−1,082
50,000	3,871	964	−237	−802
60,000	5,990	2,074	399	−423

Source: van Praag and Plug (1995)
*Family income is measured in Dutch guilders (NLG2 is about $1.00).

FIGURE 22.1 National Income and Mean Subjective Well-Being

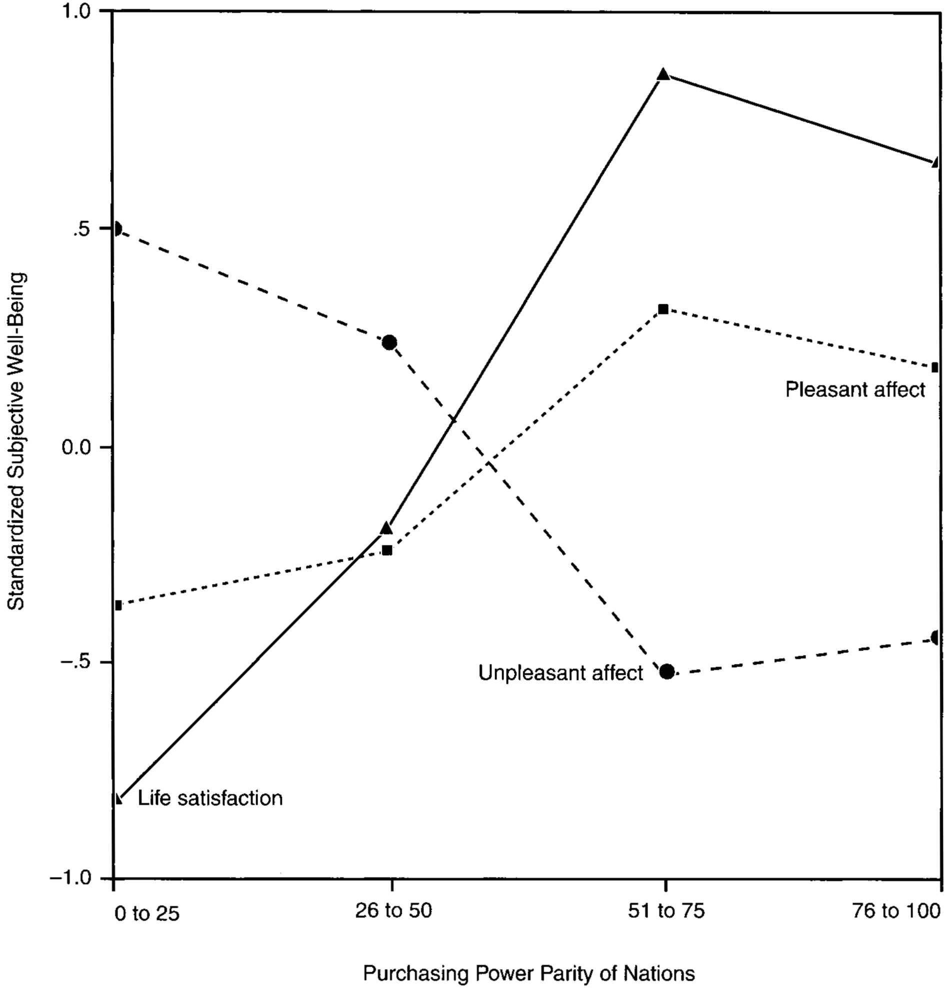


TABLE 22.1 Subjective Well-Being Values of Nation

Nation	*Life Satisfaction*	*Hedonic Balance*	*Positive Affect*	*Negative Affect*
Bulgaria	5.03	.91	1.93	1.01
Russia	5.37	.29	1.69	1.41
Belarus	5.52	.77	2.12	1.35
Latvia	5.70	.92	2.00	1.08
Romania	5.88	.71	2.34	1.63
Estonia	6.00	.76	2.05	1.28
Lithuania	6.01	.60	1.86	1.26
Hungary	6.03	.85	1.96	1.11
India	6.21	.33	1.41	1.09
South Africa	6.22	1.15	2.59	1.44
Slovenia	6.29	1.53	2.33	.80
Czech Republic	6.30	.76	1.84	1.08
Nigeria	6.40	1.56	2.92	1.36
Turkey	6.41	.59	3.09	2.50
Japan	6.53	.39	1.12	.72
Poland	6.64	1.24	2.45	1.21
South Korea	6.69			
East Germany	6.72	1.25	3.05	1.80
France	6.76	1.33	2.34	1.01
China	7.05	1.26	2.34	1.08
Portugal	7.10	1.33	2.27	.94
Spain	7.13	.70	1.59	.89
West Germany	7.22	1.43	3.23	1.79
Italy	7.24	1.21	2.04	.84
Argentina	7.25	1.26	2.45	1.19
Brazil	7.39	1.18	2.85	1.68
Mexico	7.41	1.38	2.68	1.30
Britain	7.48	1.64	2.89	1.25
Chile	7.55	1.03	2.78	1.75
Belgium	7.67	1.54	2.46	.93
Finland	7.68	1.18	2.33	1.15
Norway	7.68	1.59	2.54	.95
United States	7.71	2.21	3.49	1.27
Austria	7.74	1.77	2.90	1.13
Netherlands	7.84	1.81	2.91	1.10
Ireland	7.87	1.99	2.89	.90
Canada	7.88	2.31	3.47	1.15
Sweden	7.97	2.90	3.63	.73
Iceland	8.02	2.50	3.29	.78
Denmark	8.16	1.90	2.83	.93
Switzerland	8.39	1.14	1.39	.24

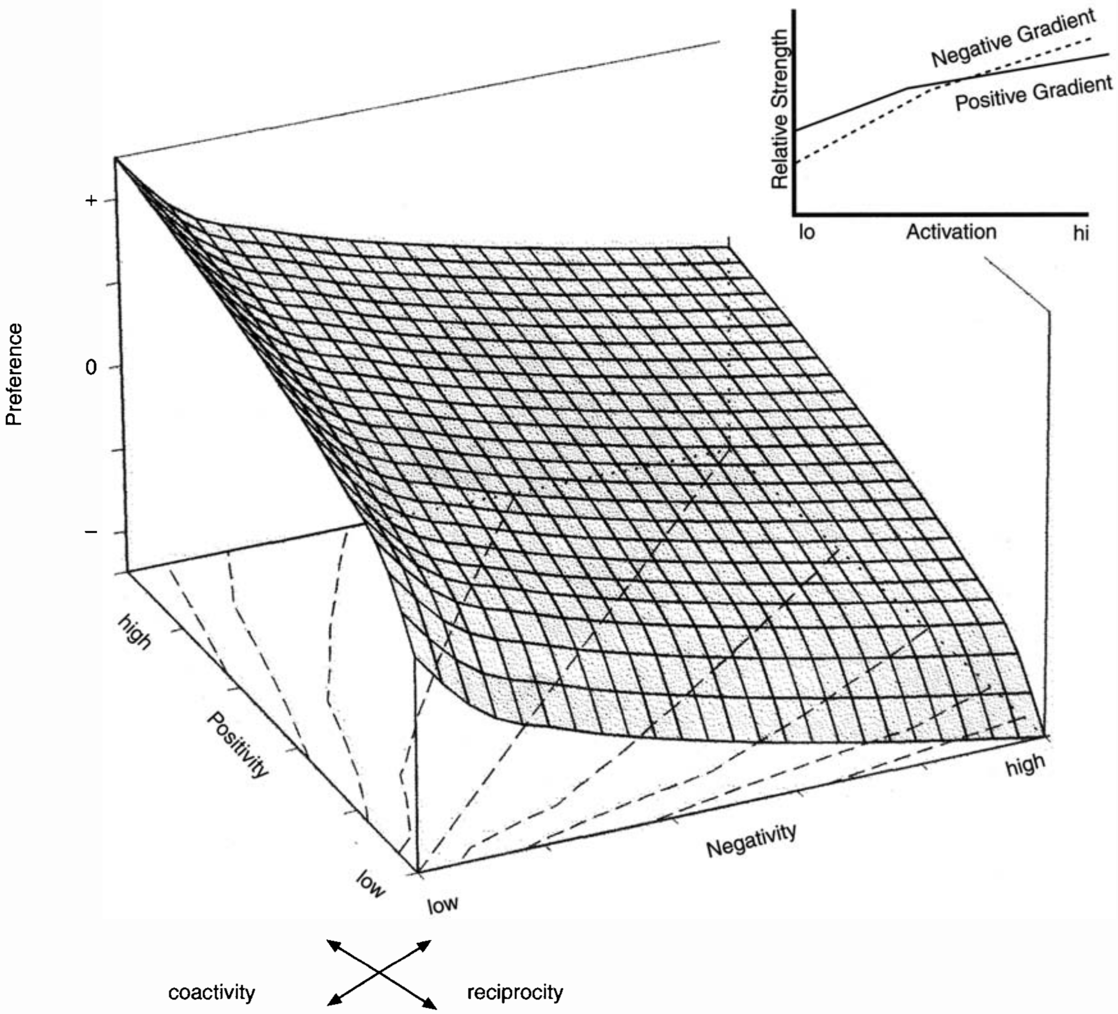
Source: World Values Study Group (1994).
Note: Values are weighted to achieve probability samples of nations, and respondents with apparent data errors were dropped before analyses.

TABLE 22.2 Norms for the Experience of Subjective Well-Being

Nation	*Life Satisfaction*	*Pleasant Affect*	*Unpleasant Affect*
China	4.00	4.47	4.00
Tanzania	4.43	5.07	3.83
Bahrain	4.74	5.66	3.87
Nepal	4.78	5.06	3.81
Zimbabwe	4.80	5.76	3.33
Thailand	4.92	5.44	3.13
Korea	4.98	5.91	4.10
Hong Kong	5.07	4.99	3.23
Ghana	5.11	5.14	2.88
Nigeria	5.11	5.50	3.06
Japan	5.14	6.10	4.11
India	5.15	5.37	3.38
Guam	5.28	5.04	3.71
Turkey	5.29	6.03	4.04
Indonesia	5.33	5.94	4.24
Pakistan	5.49	5.68	3.34
Lithuania	5.54	5.66	3.04
Argentina	5.55	6.10	2.95
Estonia	5.59	5.91	3.15
South Africa	5.69	5.91	3.37
Singapore	5.72	5.83	3.48
Slovenia	5.76	6.22	3.92
Peru	5.77	5.96	2.83
United States	5.77	6.15	3.52
Greece	5.80	6.38	3.15
Germany	5.81	6.06	3.88
Brazil	5.82	5.93	2.60
Denmark	5.82	6.06	4.17
Taiwan	5.83	5.60	3.65
Italy	5.89	5.98	3.38
Portugal	5.91	6.10	2.75
Austria	5.92	5.91	3.76
Finland	5.93	6.20	4.01
Hugary	5.97	6.21	4.32
Netherlands	6.00	5.97	3.67
Puerto Rico	6.12	6.24	2.30
Norway	6.12	6.11	3.18
Egypt	6.14	5.26	2.84
Spain	6.20	5.96	2.94
Colombia	6.20	6.30	2.52
Australia	6.23	6.25	3.71

Source: International College Student Data (1995).
Notes: Life satisfaction is the mean response for the ideal level of the five items of the Satisfaction with Life Scale (7-point scale). Affect values range from 1 (extremely inappropriate) to 4 (neutral) to 7 (extremely appropriate).

FIGURE 24.1 The Bivariate Evaluative Plane and Its Associated Preference Surface



Source: Adapted from Cacioppo and Berntson (1994). Copyright 1994 by the American Psychological Association.
Notes: The surface represents the behavioral disposition of an individual toward (+) or away from (−) the target stimulus. Preference is expressed in relative units. The point on the surface overlying the left axis intersection represents the maximally positive disposition evoked by the target stimulus, and the point on the surface overlying the right axis intersection represents the maximally negative disposition toward the target stimulus. The inset superimposes the strength of the activation of positive and negative motivational forces as a function of movements along the coactivity diagonal. Note that the predictions depicted in this inset mirror those for approach-avoidance conflict in Miller's theory of conflict (see Miller 1959, figure 5).

FIGURE 25.1 Classical Fear Conditioning

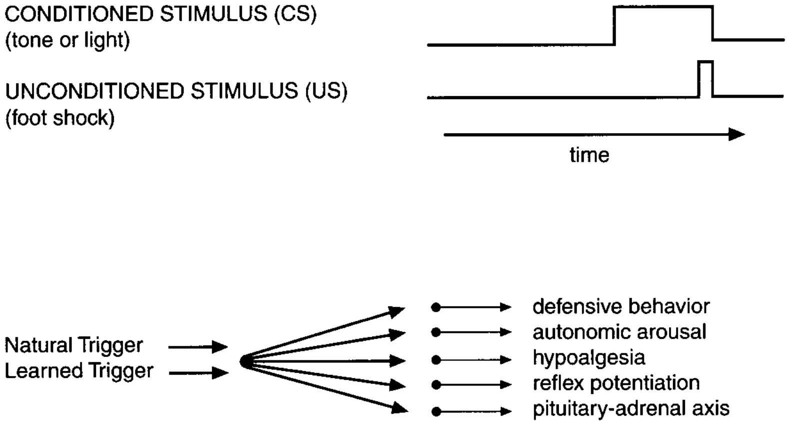


FIGURE 25.2 Dual Pathways to the Amygdala in Fear Conditioning

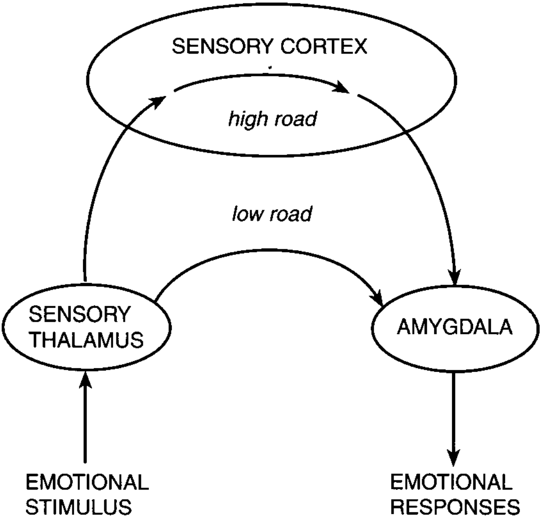


FIGURE 25.3 The Amygdala: The Hub in a Wheel of Fear

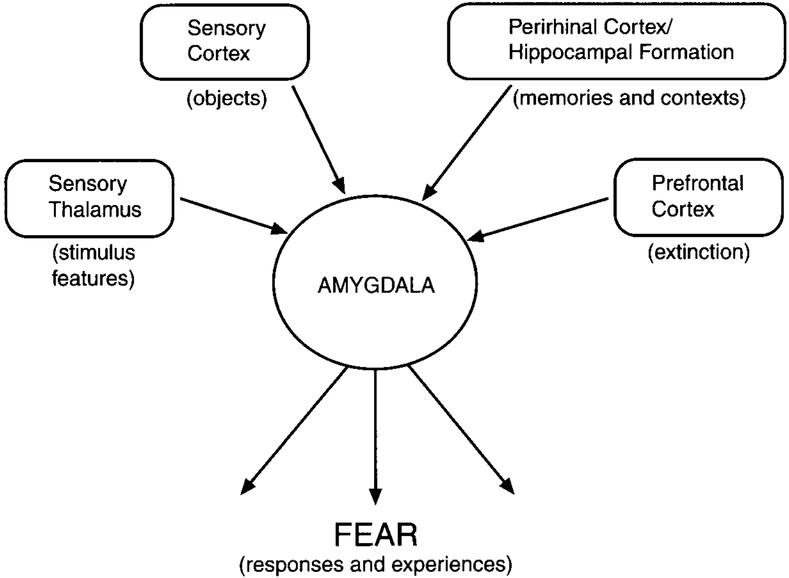


FIGURE 25.4 Emotional Action Versus Reaction

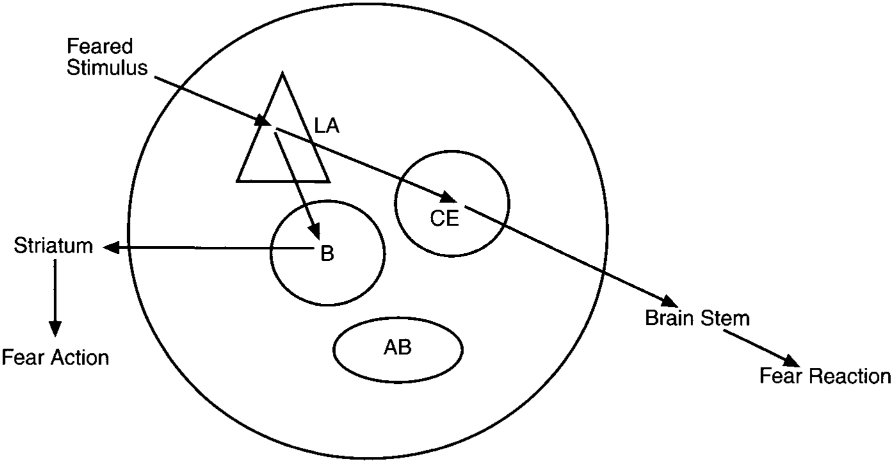


FIGURE 25.5 How Feelings Come About

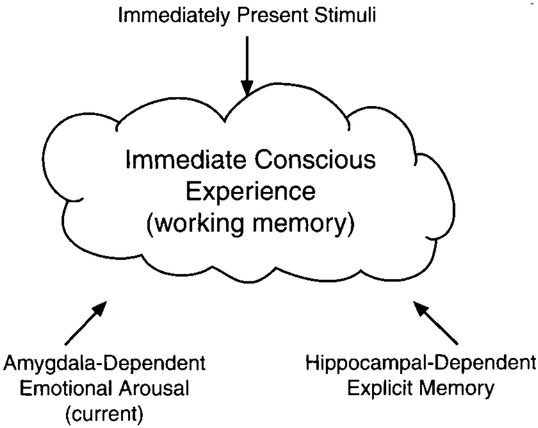
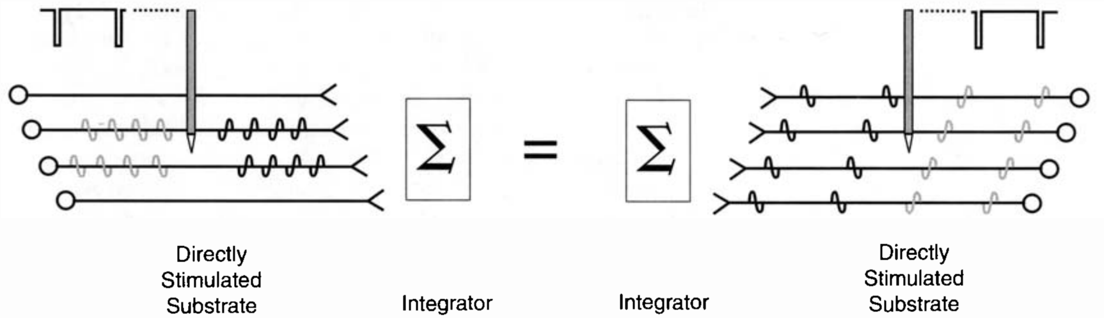
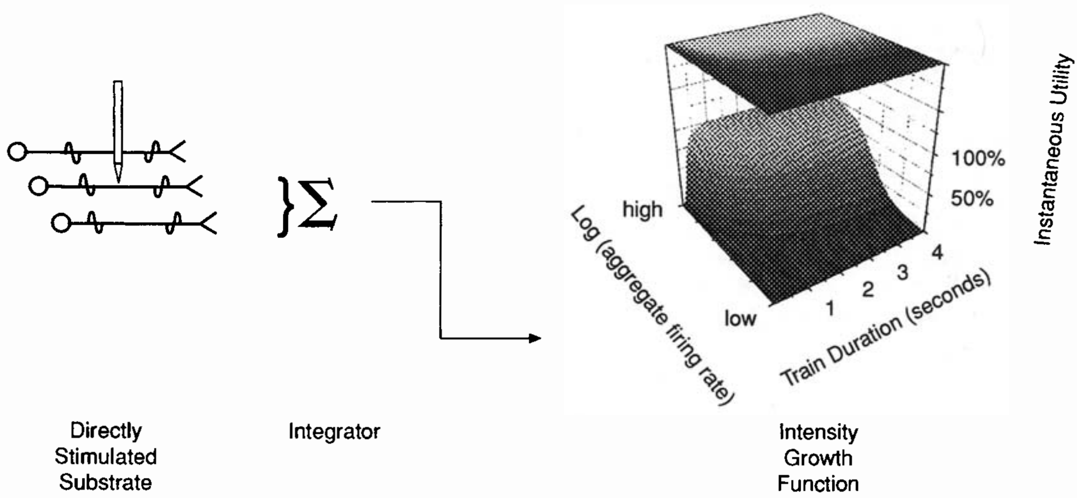


FIGURE 26.1 The Counter Model of Spatio-Temporal Integration in the Neural Circuitry Subserving Brain Stimulation Reward



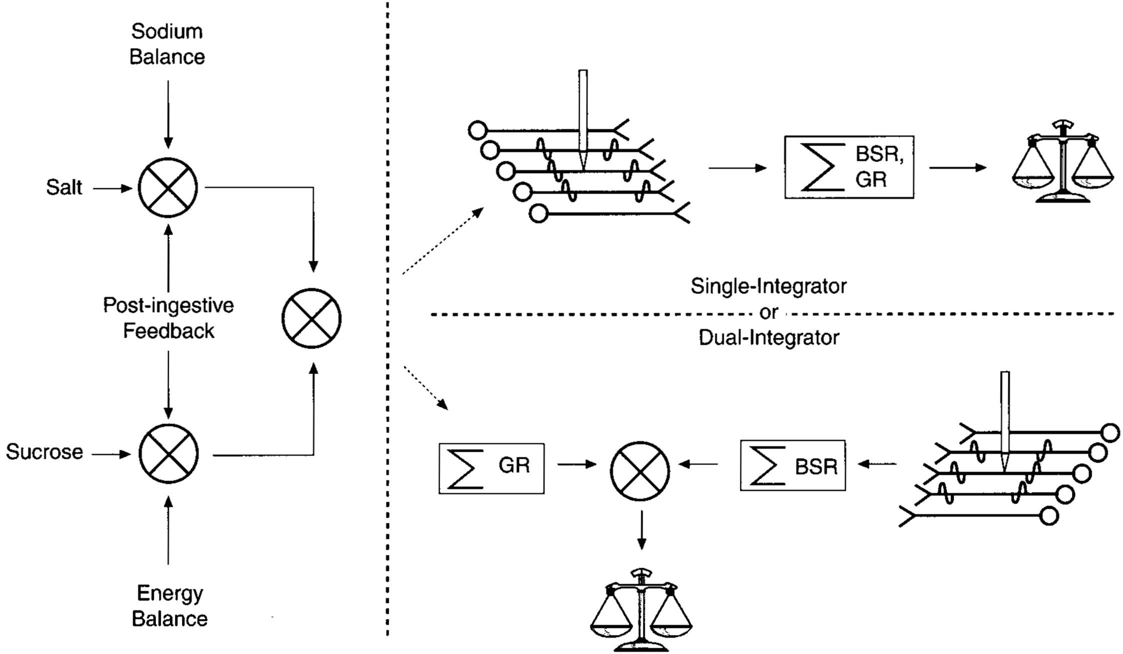
Notes: Action potentials elicited in the directly activated neurons responsible for BSR impinge on a neural circuit that integrates their effects over time and space. The output of this integrator is determined by the aggregate rate of firing during a fixed time window. Thus, firing two neurons four times each produces the same output as firing four neurons twice each. (In addition to triggering action potentials that propagate to the synaptic terminals, the stimulation also triggers action potentials that propagate "backward" toward the cell body. These "antidromic" action potentials, shown in gray, have no behavioral effect unless they invade another axonal branch.)

FIGURE 26.2 BSR: Computing Instantaneous Utility



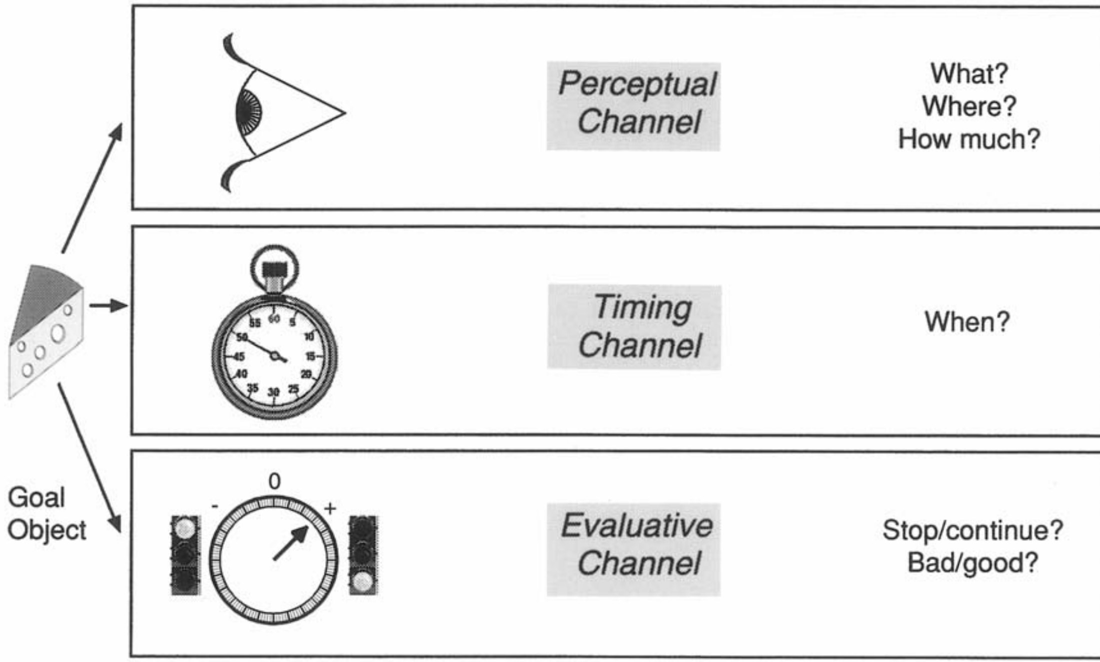
Notes: This figure shows the growth of instantaneous utility as a function of stimulation strength and duration. The stronger the stimulation, the higher the aggregate rate of firing in the directly stimulated neurons responsible for the rewarding effect. Three relationships are depicted by the three-dimensional graph. With aggregate firing rate held constant, instantaneous utility climbs as the duration of the input is prolonged, eventually leveling off. This leveling-off is responsible for the "duration neglect" that has been reported in BSR experiments (Gallistel 1978; Mark and Gallistel 1993; Shizgal and Matthews 1977). With duration held constant, instantaneous utility climbs steeply as the aggregate firing rate is increased and then levels off. A logistic growth function has been used to simulate this effect. The third relationship is depicted in the projected contour map. The outlines of successive horizontal sections through the three-dimensional structure have been projected onto this plane. Each contour line gives the combinations of aggregate firing rate and train duration that raise instantaneous utility to a given "altitude." The contour lines follow the hyperbolic form first described by Gallistel (1978). Changing the altitude at which the cross-section is taken shifts the curve along the axis representing the logarithm of the firing rate but does not change the curvature. Plotting the growth of instantaneous utility as a function of both aggregate firing rate and train duration illustrates an important consequence of the parallelism of the contour lines: the rate at which instantaneous utility grows with train duration increases as a function of aggregate firing rate. At high aggregate firing rates, instantaneous utility approaches asymptote very quickly; at low firing rates, much more time is required for instantaneous utility to level off. Results consistent with this relationship have been reported by Mason and Milner (1986).

FIGURE 26.3 Two Schemes for Combining the Rewarding Effects of LH Stimulation and Gustatory Stimuli



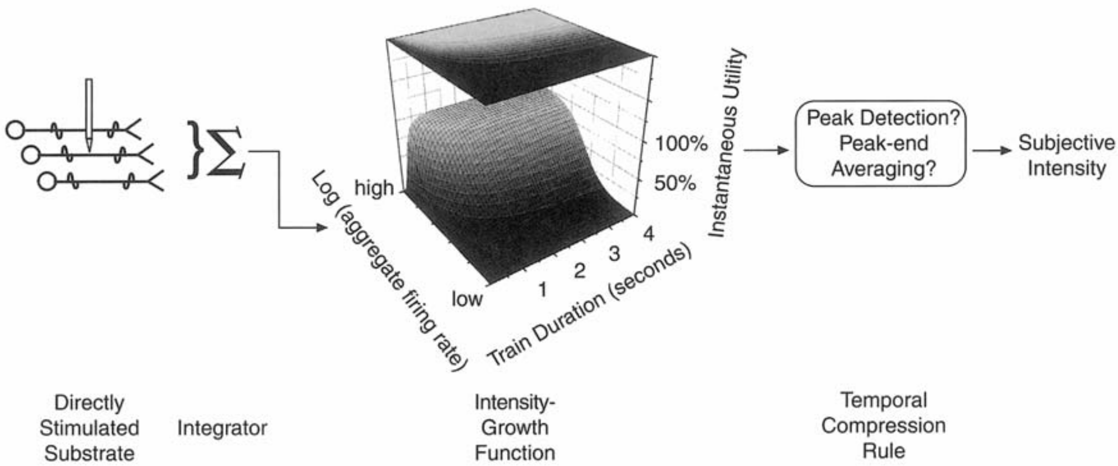
Notes: On the basis of experiments by Conover and his colleagues (Conover and Shizgal 1994b; Conover et al. 1994), signals that give rise to gustatory reward are weighted by physiological feedback prior to their combination with the signals that give rise to BSR. In the upper right panel, the two rewards are combined by passing the gustatory reward through the population of neurons from which the stimulating electrode samples. Thus, the postsynaptic effects of the gustatory and electrical rewards are integrated by a common circuit. In the lower panel, the gustatory and electrical reward signals are integrated separately before they are combined and relayed to the choice mechanism (adapted from Shizgal and Conover [1996]). Reprinted with the permission of Cambridge University Press.

FIGURE 26.4 The Parallel Channels That Process Information About Goal Objects in Real Time



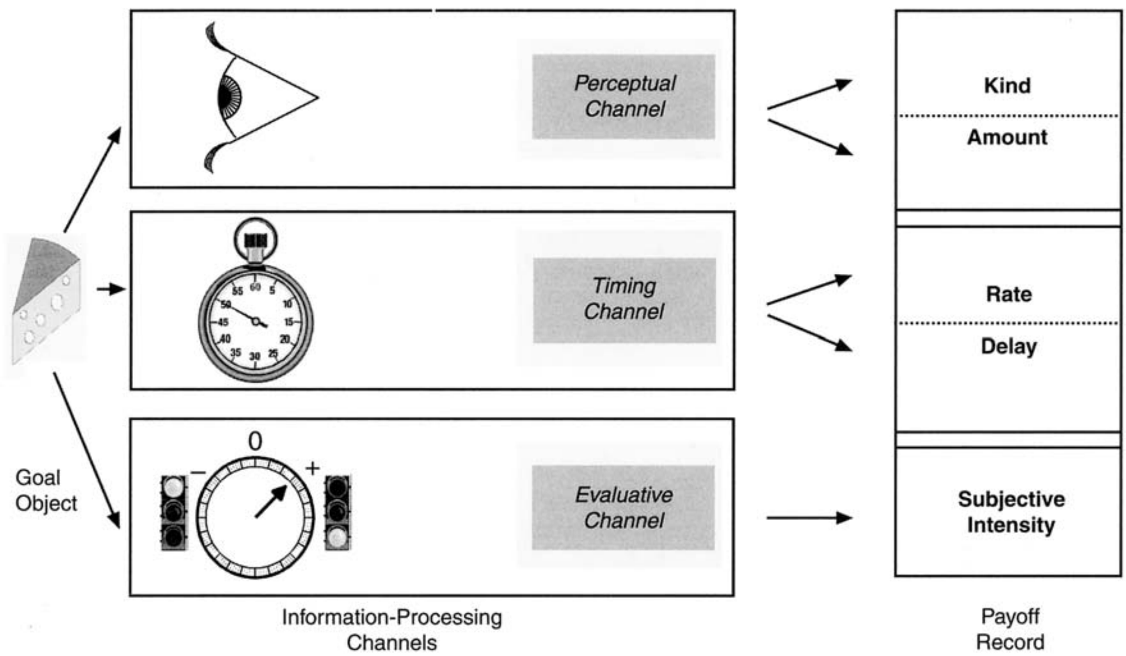
Notes: The perceptual channel returns the identity, location, and amount of the goal object, whereas a stopwatch-like channel marks the time when the goal object was encountered. The evaluative channel steers ongoing behavior so as to maintain or terminate contact with the goal object. Given sufficient allocation of attention and working memory, the output of the evaluative channel may be manifested in hedonic experience as pleasure or suffering.

FIGURE 26.5 BSR: Computing Subjective Intensity



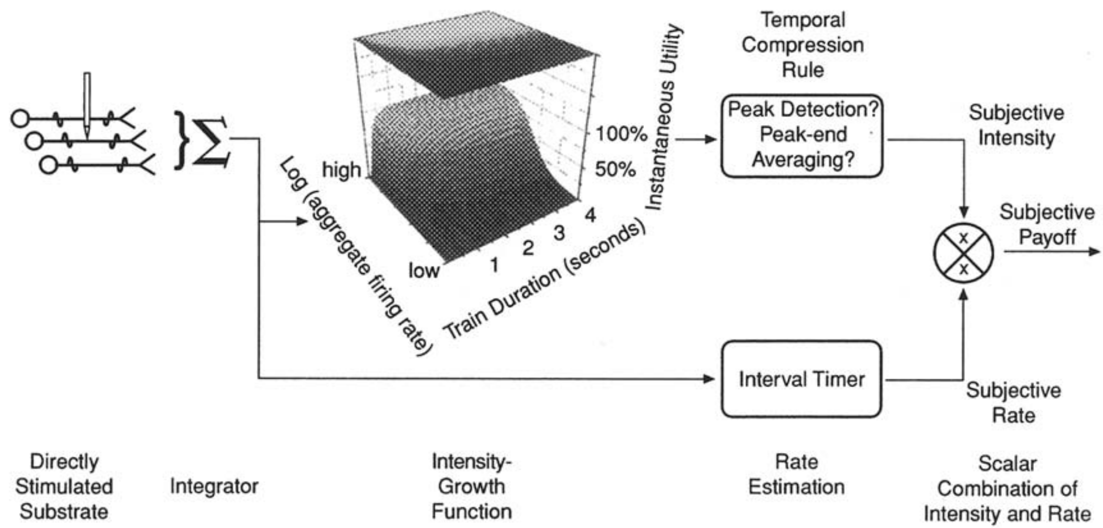
Notes: Shown here is "representation by exemplar" (Schreiber and Kahneman 1997) in computing the subjective intensity of BSR. The quantity recorded in memory (the subjective intensity) is derived from exemplar values of instantaneous utility, such as the peak (Gallistel 1978; Gallistel et al. 1981) or the peak and end (Kahneman et al. 1993; Redelmeier and Kahneman 1996). These exemplar values are independent of the temporal integral of instantaneous utility. Thus, subjects working for BSR manifest duration neglect: once instantaneous utility has reached the plateau of the plotted surface, further increases in duration fail to increase the remembered subjective intensity.

FIGURE 26.6 Recording the Output of the Parallel Information-Processing Channels

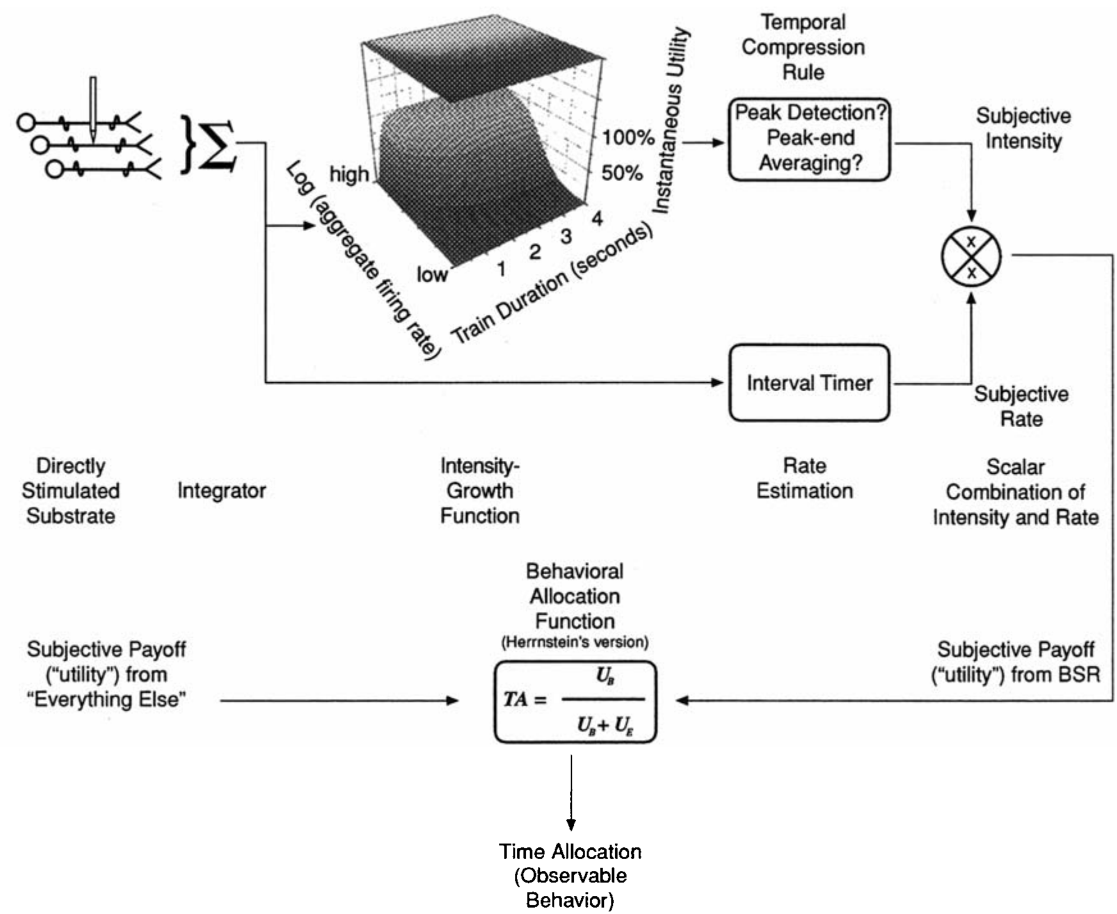


Notes: Stored information from all three channels contributes to payoff. Information derived from the perceptual channel indicates kind ("Is the goal object a source of food, water, or salt?") as well as amount. Estimates of the encounter rate and the delay between a successful response and delivery of a reinforcer are derived from the output of the stopwatch timer. The evaluative channel contributes an estimate of subjective intensity (see figure 26.4) to the payoff record.

FIGURE 26.7 BSR: Computing Subjective Payoff



Notes: The left-hand portion of the figure, reproduced from figures 26.1 and 26.2, shows how the instantaneous utility of the rewarding stimulation is derived from the aggregate firing rate in the directly stimulated stage of the underlying neural circuit. Via the principle of representation by exemplar, instantaneous utility is transformed into the subjective intensity of the payoff, one of the dimensions of the stored record of subjective payoff. Two possible rules for carrying out this transformation are shown: peak-end averaging and peak detection. A second dimension of the stored record, the subjective rate of payoff, is provided by an interval timer. On the basis of research on operant matching, the combinatorial operation for combining these two dimensions is shown as multiplication.



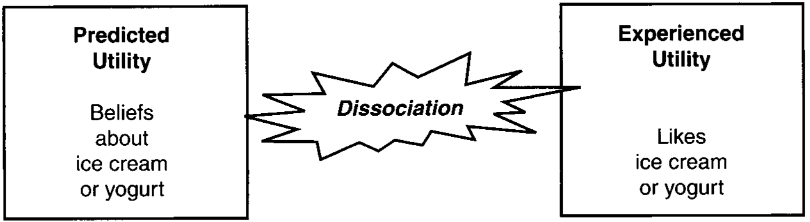
Notes: According to Herrnstein's (1970) treatment of operant performance for a single experimenter-controlled reinforcer, the payoff obtained by working for the experimenter-controlled reinforcer is compared to the payoff from competing activities such as grooming, exploring, and resting ("everything else"). The allocation of behavior to the experimenter-controlled reinforcer is determined by the payoff it provides as a proportion of the sum of all payoffs available in the test environment. This view of behavioral allocation runs into difficulty when the subject works for an essential natural reinforcer unavailable outside the test environment or when the subject chooses between two natural reinforcers of different kinds. However, neither of these restrictions apply in the case of BSR.

FIGURE 27.1 Reward Value

Expected/ Remembered Utility	**Decision Utility**	**Instant Experienced Utility**
Beliefs about value	Wants	Likes

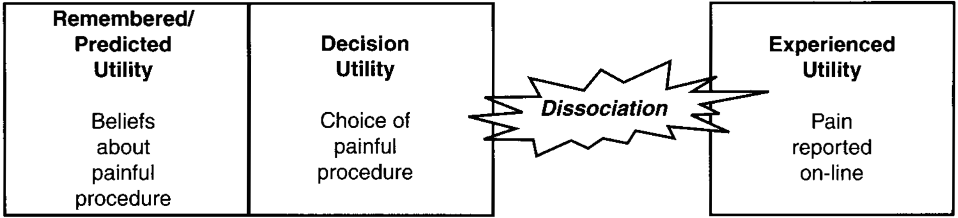
Notes: Three types of utility, corresponding to beliefs about value, wants based on value, and the hedonic value of actual experience. For a given outcome, these three types of utility might be expected to covary together for a rational individual who had experienced the outcome.

FIGURE 27.2 Dissociated Reward Value



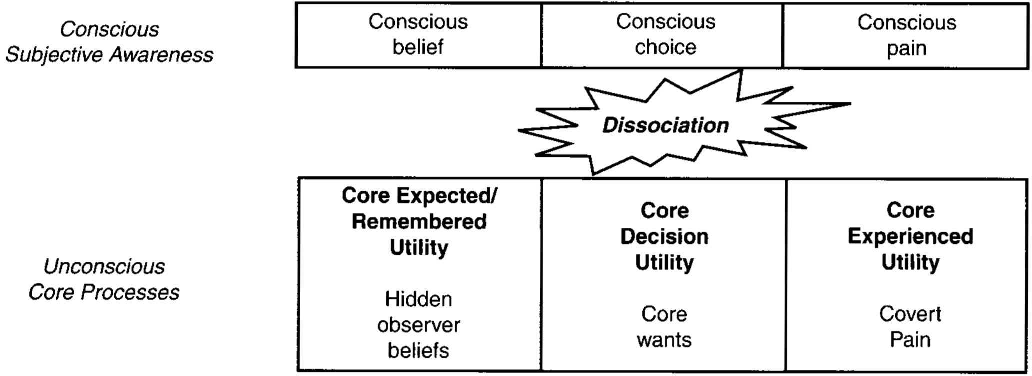
Notes: Dissociation of predicted utility (beliefs about future emotion) from actual subsequent utility (liking ratings for ice cream or yogurt; based on Kahneman and Snell [1992]).

FIGURE 27.3 Dissociated Pain



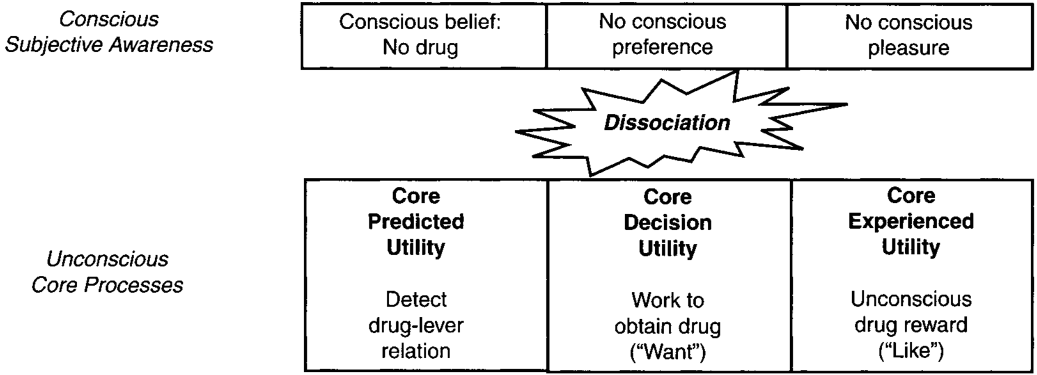
Notes: Dissociation of choice and belief about a painful experience from the actual experience itself, due to the distortion of memory for pain (based on Kahneman et al. 1993). Alliesthesia (change in food palatability as a function of satiety and repetition) provides a similar dissociation for pleasure (based on Mook and Votaw 1992).

FIGURE 27.4 Painful Event in Hypnosis



Notes: Hypnotic dissociation of conscious awareness of pain from underlying core processes of the emotion for all types of utility. Hypnotic analgesia reduces the subjective awareness of pain as an experienced event, and therefore decisions and beliefs based on subjective pain. But underlying processes of pain, detected by hidden observer measures, persist. (Description of hypnotic analgesia based on Hilgard [1986]).

FIGURE 27.5 Unconscious Drug Reward

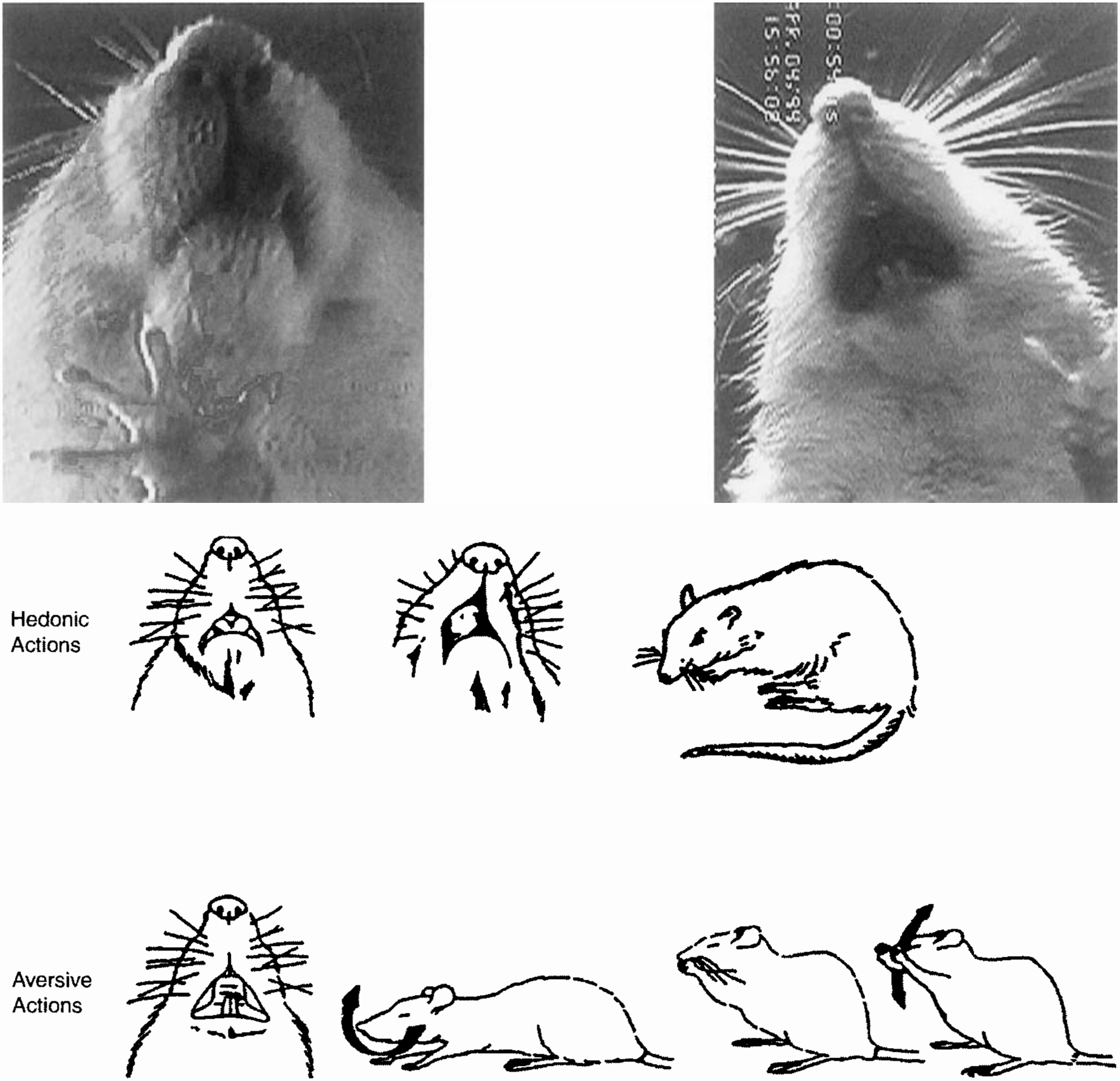


Notes: Dissociation of conscious drug-related emotion from the underlying unconscious core processes of "liking" and "wanting," based on the descriptions of Fischman and Foltin (1992) and Lamb et al. (1991). The dissociation of awareness from core processes applies to all three types of utility and is revealed in the behavior of addicts seeking a "below threshold" dose of cocaine or morphine. Although they may not be subjectively aware of the drug, they may nonetheless show behavioral evidence that they "like" it, "want" it, and act on their belief of how to get it.

FIGURE 27.6 Facial Display of Hedonic Impact

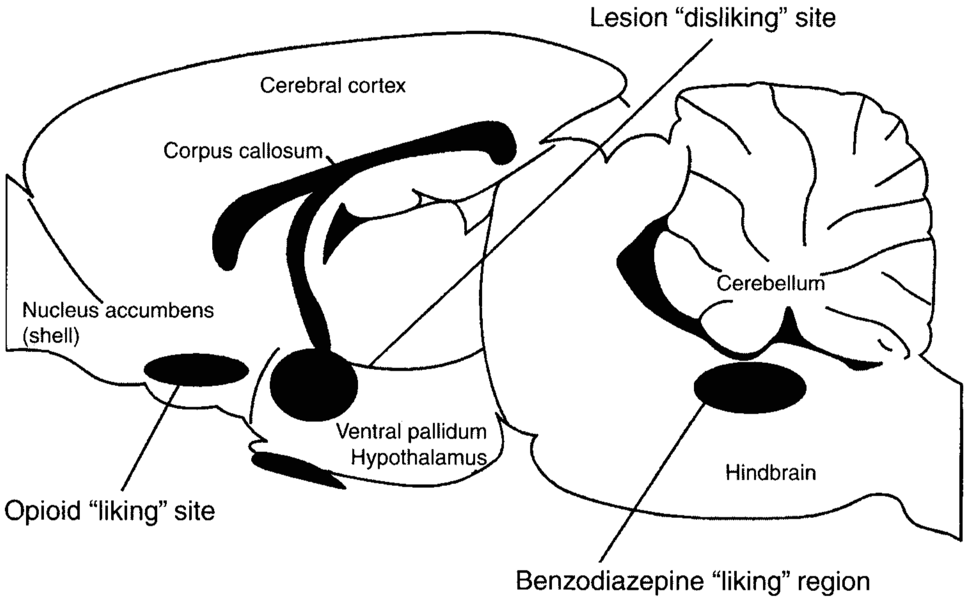
Notes: Affective expressions of a three-week infant to a sweet taste (left) and to an intensely salty taste. Observations collected by Harris, Booth, and Berridge; photo from Berridge (1996) following Steiner (1973).

FIGURE 27.7 Animal Display of Hedonic Impact



Notes: Affective expressions of rats to sweet and bitter tastes. Hedonic "liking" patterns include tongue protrusion to a sweet taste (left photograph), lateral tongue protrusion, and paw lick (drawing). Aversive "disliking" patterns include gape (right photograph), headshake, face wash, and forelimb flail (drawing). Drawing after Grill and Norgren (1978a).

FIGURE 27.8 Brain Substrates of Food "Liking"



Notes: Brain substrates of food "liking." These include the ventral pallidum site, where damage produces "disliking" or aversion even for sweet tastes; the shell of the nucleus accumbens site, where opioid stimulation by morphine enhances food "liking," and the brain-stem region, where benzodiazepine/GABA stimulation also enhances food liking. Each manipulation of "liking" changes food "wanting" secondarily. See Berridge (1996) for review. Brain atlas based on Paxinos and Watson (1996).

FIGURE 27.9 Conceptual Dissociation of Decision Utility from Experienced Utility by Manipulation of Dopamine Brain Systems

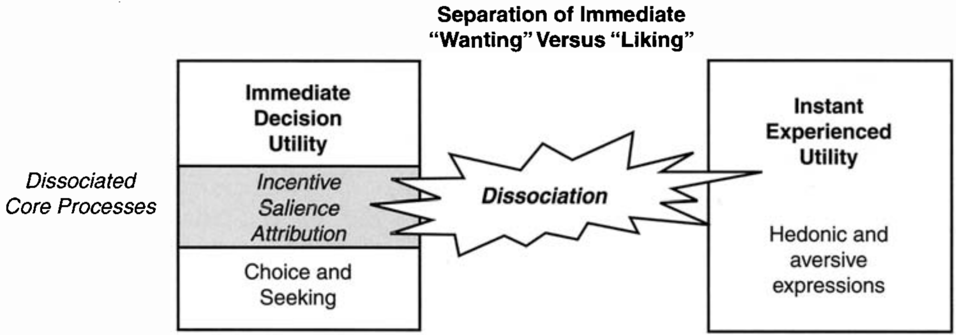
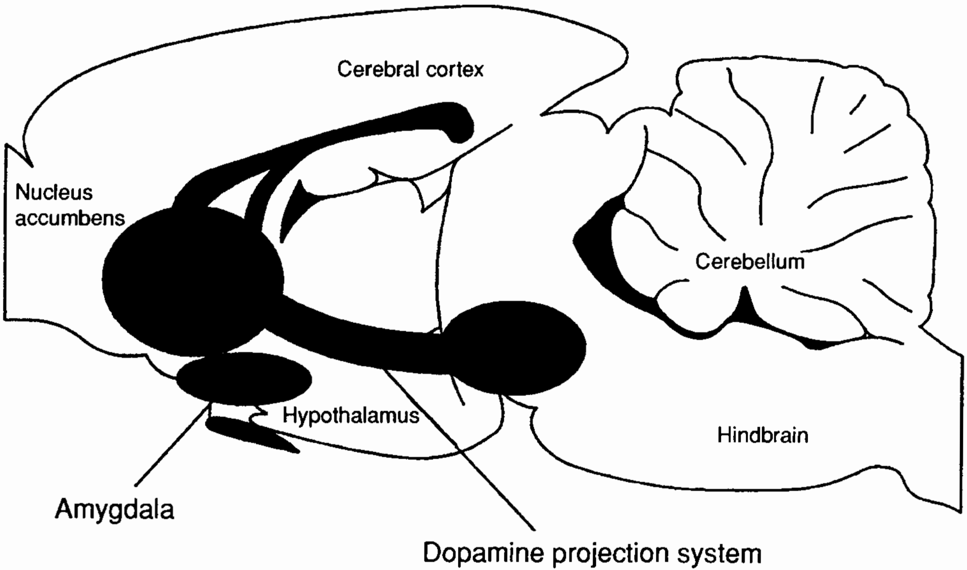
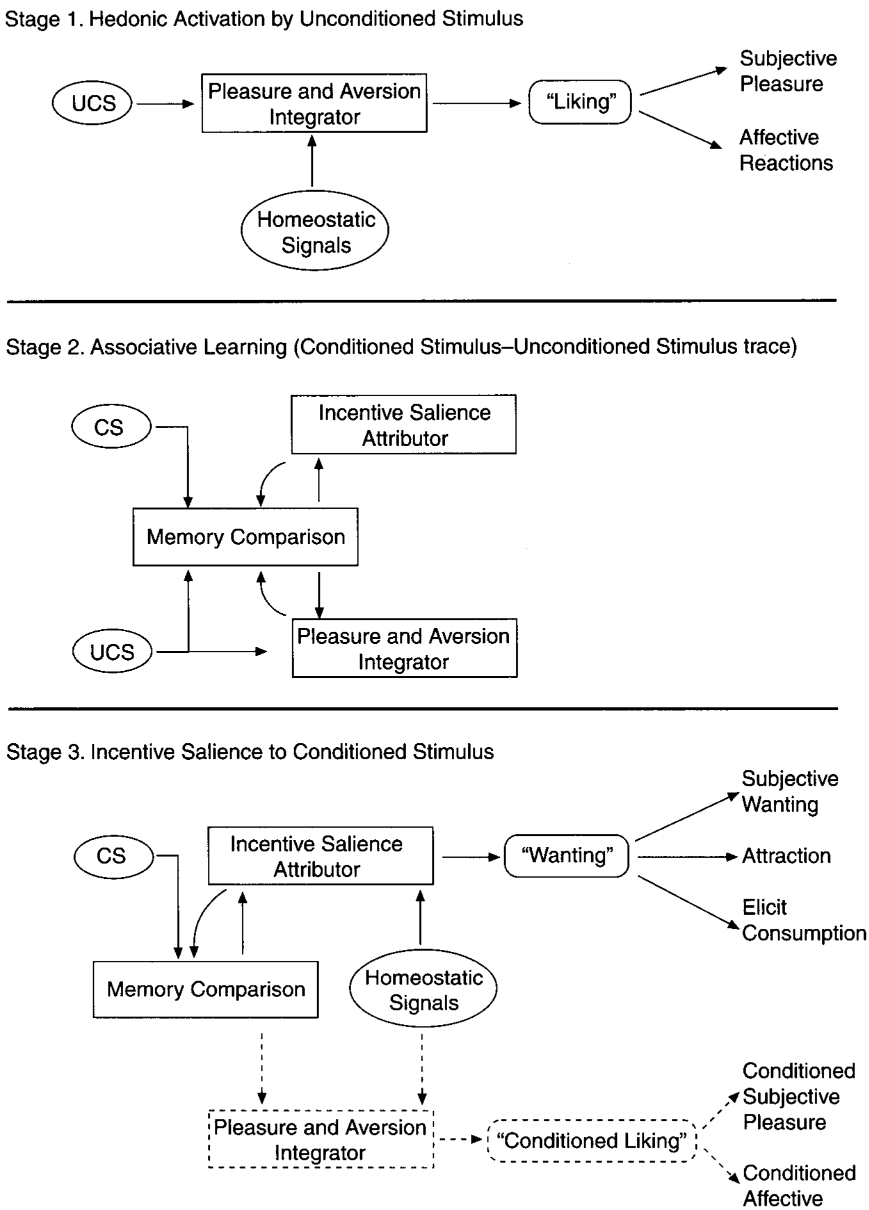


FIGURE 27.10 Brain Substrates of "Wanting"



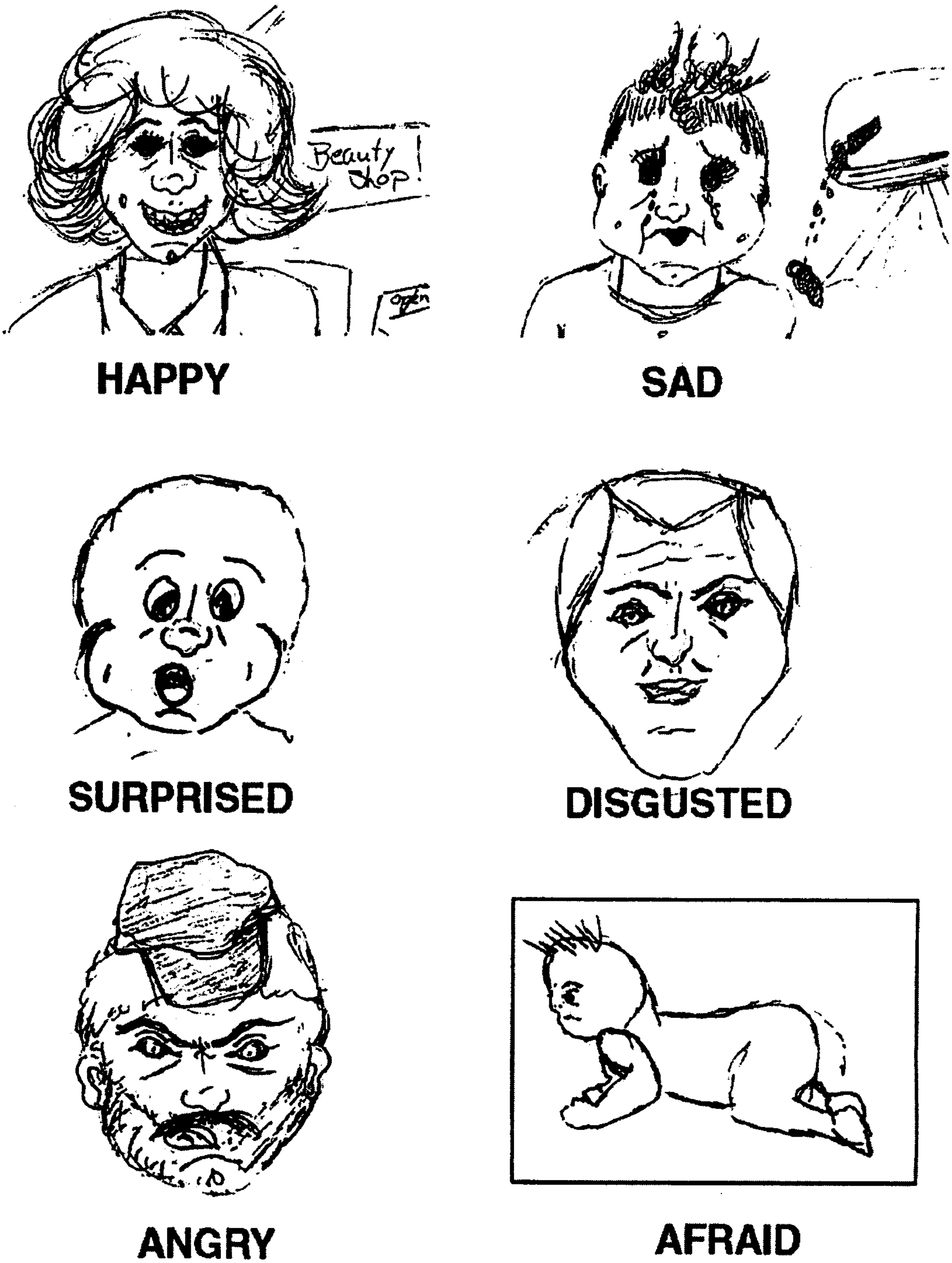
Notes: Sites include the ascending dopamine projection from midbrain to nucleus accumbens, where stimulation induces "wanting" without "liking," and where lesions eliminate decision utility without impairing experienced utility or predicted utility, and the amygdala nuclei, where lesions disrupt the elicitation of fear or reward by particular stimuli (see Berridge 1996).

FIGURE 27.11 Three Stages of Normal Reward—Incentive Salience Model



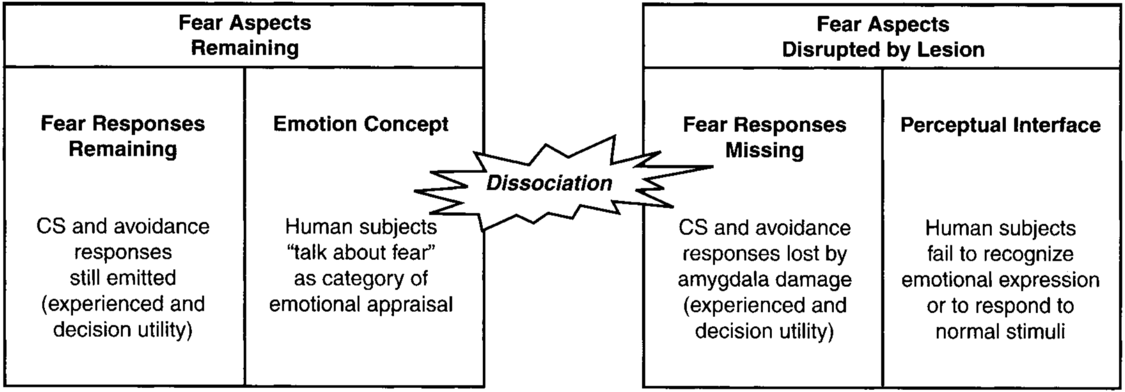
Notes: (1) Hedonic pleasure ("liking") acts as the normal trigger for reward. Hedonic neural systems activate the associative and incentive salience steps. "Liking" by itself is free-floating and not sufficient to motivate goal-directed behavior. (2) Associative learning systems are needed to correlate the representation of external objects and events (conditioned stimuli) with hedonic activation. Associative neural systems are separate from those of "liking" and "wanting." (3) Incentive salience is subsequently attributed to conditioned stimuli or their representations by dopamine-related systems, making these stimuli attractive and "wanted." The attributed stimulus acts as an incentive to elicit action and direct motivated behavior.

Figure 27.12 Depiction of Emotion After Amygdala Damage



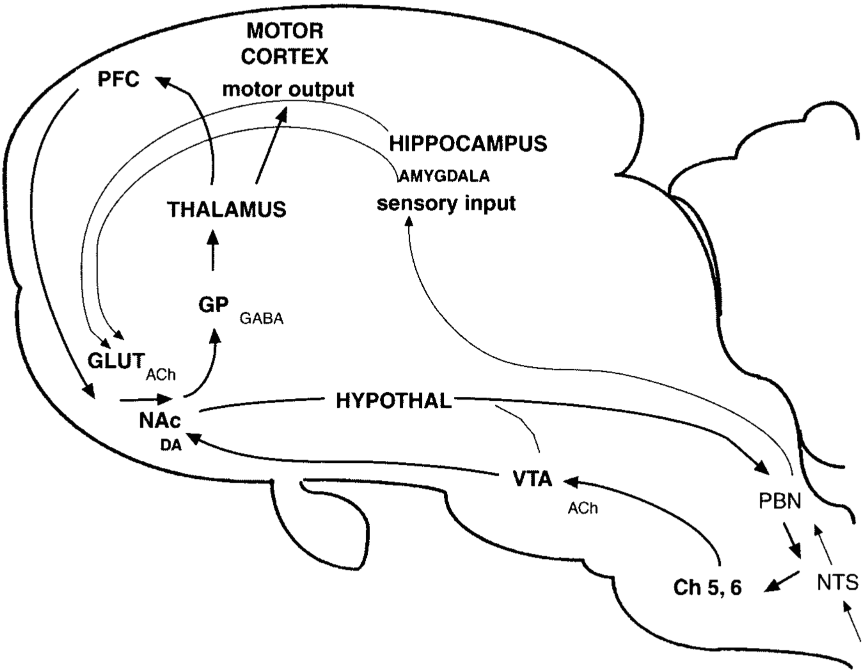
Source: Reproduced with permission from Adolphs, Tranel, Damasio, and Damasio (1995, 5888).
Notes: Emotional expressions drawn by a woman who had bilateral amygdala lesions due to disease. Note that all emotions are fairly well depicted except for "afraid."

FIGURE 27.13 Dissociation of Fear by Amygdala Damage



Notes: Dissociation of fear by amygdala damage. Many fearful behavioral and autonomic responses of animals are disrupted, but others persist (as may be true for positive emotional responses too). Similarly, humans fail to recognize fearful stimuli or expressions after damage, but can still talk coherently about fear as an emotional category.

FIGURE 28.1 A Schematic Side View of the Brain



Notes: Starting in the lower right corner of the figure, taste and other chemosensory signals from the hypothalamus, tongue, and gut enter brain stem nuclei (in the nucleus tractus solitarius(NTS) and parabrachial nucleus (PBN). Brain stem output projects indirectly to the taste sensory cortex and prefrontal cortex (PFC). In the amygdala and hippocampus, taste information is combined with other sense modalities (sights, sounds, locations, and codes for safe nutrition versus toxic foods). The arrows from the hippocampus (for example, place memory), amygdala (for example, emotion memory), and prefrontal cortex (for example, complex choice memory) represent highly processed sensory information that goes to the nucleus accumbens (NAc). The NAc is a sensory-motor interface in the loop, drawn in bold lines from PFC to NAc and back to the PFC with commands branching off to the motor cortex. The acetylcholine(ACh) neurons in the NAc may act as gates between sensory signals and motor action outputs. These "gates" are modulated by dopamine (DA), along with norepinephrine, serotonin, and opioid peptides (not shown, but discussed in the text). The medial and lateral hypothalamus help control the NAc via the loops shown (hypothalamus to the NAc). By this route, feeding signals control the DA/ACh balance in the NAc to reinforce or inhibit "voluntary" instrumental behavior. A more detailed version of this figure is given in a recent review (Leibowitz and Hoebel 1998). GLUT refers to the neurotransmitter glutamate for sensory inputs to the NAc. GABA is the neurotransmitter for NAc outputs.