Developments in the Measurement of Subjective Well-Being

Daniel Kahneman and Alan B. Krueger

For good reasons, economists have had a long-standing preference for studying peoples' revealed preferences; that is, looking at individuals' actual choices and decisions rather than their stated intentions or subjective reports of likes and dislikes. Yet people often make choices that bear a mixed relationship to their own happiness. A large literature from behavioral economics and psychology finds that people often make inconsistent choices, fail to learn from experience, exhibit reluctance to trade, base their own satisfaction on how their situation compares with the satisfaction of others and depart from the standard model of the rational economic agent in other ways. If people display bounded rationality when it comes to maximizing utility, then their choices do not necessarily reflect their "true" preferences, and an exclusive reliance on choices to infer what people desire loses some of its appeal.

Direct reports of subjective well-being may have a useful role in the measurement of consumer preferences and social welfare, *if* they can be done in a credible way. Indeed, economists have already made much use of subjective well-being data. From 2001 to 2005, more than 100 papers were written analyzing data on self-reported life satisfaction or happiness, according to a tabulation of *EconLit*, up from just four in 1991–1995. Data on subjective well-being have been used by economists to examine both macro- and micro-oriented questions. In a classic paper, Easterlin (1974) examined the relationship between economic growth and happiness. More recently, Di Tella, MacCulloch and Oswald (2001) use data on life satisfaction from the Eurobarometer to infer how people trade off inflation for unemployment, and Alesina, Glaeser and Sacerdote (2005) use the same data to study whether labor

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market regulation makes people better off. Gruber and Mullainathan (2004) examine the effect of cigarette taxes on self-reported happiness to draw inferences about the rationality of smoking using data from the General Social Surveys for the United States and Canada. Questions about subjective well-being, like the extent to which the respondent feels calm and peaceful, have also been included as outcome measures in the Moving to Opportunity for Fair Housing and Rand Health Insurance experiments (Kling, Liebman and Katz, 2005).

Yet another use of subjective well-being has been to provide an external check on economic indicators. For example, Nordhaus (1998) and Krueger and Siskind (1998) compare income growth deflated by the consumer price index to changes in the percentage of the population that reports an improvement in their financial position to assess bias in the price deflator. In discovering the potential value of subjective well-being surveys, researchers are following in the footsteps of profit-seeking companies like Gallup, which regularly conduct morale and satisfaction surveys of workers and customers for their corporate clients.

What are economists to make of this enterprise? Can well-being be measured by a subjective survey, even approximately?

In this paper, we discuss research on how individuals' responses to subjective well-being questions vary with their circumstances and other factors. We will argue that it is fruitful to distinguish among different conceptions of utility rather than presume to measure a single, unifying concept that motivates all human choices and registers all relevant feelings and experiences. While various measures of well-being are useful for some purposes, it is important to recognize that subjective well-being measures features of individuals' perceptions of their experiences, not their utility as economists typically conceive of it. Those perceptions are a more accurate gauge of actual feelings if they are reported closer to the time of, and in direct reference to, the actual experience. We conclude by proposing the U-index, a misery index of sorts, which measures the proportion of time that people spend in an unpleasant state, and has the virtue of not requiring a cardinal conception of individuals' feelings.

Measuring Subjective Experience in Principle and in the Lab

The earliest popular conceptions of utility, from Jeremy Bentham through Francis Ysidro Edgeworth and Alfred Marshall, was as a continuous hedonic flow of pleasure or pain. Kahneman has called this conception *experienced utility,* and it is also similar to what Juster, Courant and Dow (1985) call *process benefits.*[1] Edgeworth

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[1] Juster, Courant and Dow define process benefits as the "direct subjective consequences from engaging in some activities to the exclusion of others. . . . For instance, how much an individual likes or dislikes the activity 'painting one's house,' in conjunction with the amount of time one spends in painting the house, is as important determinant of well-being independent of how satisfied one feels about having a freshly painted house."

defined the happiness of an individual during a period of time as the sum of the momentary utilities over that time period; that is, the temporal integral of momentary utility.

Several methods have been used to attempt to measure the moment-to-moment flow of pleasure or pain in the laboratory. An advantage of laboratory experiments is that extraneous aspects of an experience can be controlled, and the unique effect of a stimulus on individuals' experiences can be evaluated. Participants in many experiments in psychology and in consumer research, for example, are required to undergo an experience, such as being exposed to loud noises or watching a film clip. They are asked to provide a continuous indication of the hedonic quality of their experience in real time by manipulating a lever that controls a marker on a scale, which is usually defined by extreme values such as very pleasant and very unpleasant and by a neutral value. In a similar fashion, public opinion during a political debate is sometimes assessed by means of a "dial group," in which a group of observers continually indicate their pleasure or displeasure with the candidates' views by continuously adjusting a dial. These studies yield a temporal profile of moment-to-moment subjective experience. The results of these experiments provide some insights into more standard measures of satisfaction, and lend support for the usefulness of making a distinction between *experienced utility* and *remembered utility*; that is, the way people feel about experiences in real-time and the way they remember their experiences after they are over.

The participants in experiments in which a physical stimulus is varied generally provide profiles that are similar, both in level and in shape, and that respond to the stimulus in a sensible way. For example, in an experiment described in Kahneman, Fredrickson, Schreiber and Redelmeier (1993), participant ratings of pain on a 0–14 scale increased from an average of 4.0 (after the first ten seconds) to an average of 8.4 after 60 seconds of immersing their hand in water at 14° Celsius, and the average dropped to about 6.50 over the next 30 seconds, as the temperature of the water was gradually raised to 15° C.

At the end of an experiment, individuals can be asked to evaluate their experience as a whole. Such a retrospective report can be thought of as representing the respondents' remembered utility. The evaluation of remembered utility requires the individual to remember a stream of experiences and to aggregate them in some way. Ideally, one would hope that the individual who reports his or her overall remembered utility for a period performs the task of summing momentary utilities over time that Edgeworth had in mind. This is not the case, however. Numerous studies have related individuals' retrospective evaluations of an experience to their record of real-time reports. Although retrospective evaluations are related to the real-time reports—people are generally correct in classifying a past episode as pleasant or awful—retrospective reports are also susceptible to systematic biases.

Kahneman, Fredrickson, Schreiber and Redelmeier (1993) showed that retrospective evaluations of past episodes have the dimensionality of a weighted average of moment utilities, where the weights are not equal. The critical finding was that

the duration of episodes of pain or discomfort was completely neglected in retrospective evaluations, and great weight was placed on the end of the experience and the peak or trough. Further evidence suggests that individuals' choices are affected by their remembered utility (as discussed by Kahneman and Thaler in this issue), not the profile of their experiences.

This line of research suggests that the intensity of pain and pleasure that arises during an experience can be plausibly measured in real time and that retrospective assessments are not necessarily a good measure of the sum total of individuals' actual experiences. These observations are relevant because past research on well-being has relied almost entirely on reports of life satisfaction and happiness, which are global retrospective assessments. After evaluating research on global retrospective assessments of subjective well-being, we introduce alternative measures that attempt to tap experienced utility more directly.

Surveys of Life Satisfaction and Happiness

The questions most frequently asked in research using surveys of subjective well-being elicit reports of *global* life satisfaction or happiness. In the World Values Survey, for example, respondents in 81 countries are asked, "All things considered, how satisfied are you with your life as a whole these days?" The General Social Survey (GSS) similarly asks Americans, "Taken all together, how would you say things are these days? Would you say that you are very happy, pretty happy, or not too happy?" Respondents have little trouble answering these questions. In the 1998 GSS, for example, less than 1 percent of respondents refused to provide an answer or answered "don't know"; by contrast, 17 percent of respondents refused to provide their earnings.

How should a social scientist interpret answers to questions about global life satisfaction or happiness? After all, life satisfaction is neither a direct, verifiable experience nor a known personal fact like one's address or age. It is a global retrospective judgment, which in most cases is constructed only when asked and is determined in part by the respondent's current mood and memory, and by the immediate context. In an elegant demonstration of the power of context, Schwarz (1987) invited subjects to the lab to fill out a questionnaire on life satisfaction. Before they answered the questionnaire, however, he asked them to photocopy a sheet of paper for him. A dime was placed on the copy machine for a randomly chosen half of the sample. Reported satisfaction with life was raised substantially by the discovery of the coin on the copy machine—clearly not an income effect. Other research indicates that reported life satisfaction is influenced by the current weather (higher on nicer days); although if individuals are first asked explicitly about the weather, the weather does not influence their reported life satisfaction (Schwarz and Clore, 1983). Reported satisfaction or happiness is also often strongly affected by earlier questions in a survey.

In addition to being affected by researcher initiated manipulations of context

and mood, reported life satisfaction fluctuates in natural settings over short time periods. For example, using data on a sample of 218 women in Texas who were interviewed in March 2004 and then reinterviewed two weeks later, we compute a correlation of 0.59 of life satisfaction across individuals.[2] Higher correlations are obtained if the average of a battery of life satisfaction questions is used instead of a single question. For example, using a five-item life satisfaction measure, Lucas, Diener and Suh (1996) report a test-retest correlation of 0.77 over four weeks. By contrast, reinterview studies for self-reported levels of education or earnings typically find correlations of around 0.90. The significant but lower correlation for repeat measures of life satisfaction suggests that the data may be reliable enough for many purposes, but that current mood and context cause fluctuations in people's answers from day to day.

Considerations of the effects of context, mood and duration neglect indicate certain limits on the reliability of the standard life satisfaction and happiness questions, but they are not necessarily grounds for dismissing the method altogether. The idiosyncratic effects of recent, irrelevant events are likely to average out in representative population samples. Moreover, research finds that retrospective evaluations are relevant for some subsequent choices, so measures of satisfaction may be relevant for future decisions despite their shortcomings as a measure of real-time experience. For example, job satisfaction is a strong predictor of workers' subsequent turnover (Freeman, 1978).

Evidence of the Validity of Life Satisfaction Data

The validity of subjective measures of well-being can be assessed, in part, by considering the pattern of their correlations with other characteristics of individuals and their ability to predict future outcomes. Global life satisfaction questions have been found to correlate well with a variety of relevant measures.

As a starting point, correlations have been documented between measures of life satisfaction and various objective physiological and medical criteria. In one study, subjects were exposed to a cold virus and their symptoms were closely monitored (Cohen et al., 2003). Those who had reported a higher level of life satisfaction at baseline were less likely to come down with a cold and quicker to recover if they became sick. Another study subjected individuals to a controlled wound (Kiecolt-Glaser, McGuire, Robles and Glaser, 2002) and collected baseline data on life satisfaction. The speed with which participants recovered from their wound was monitored. Subjects who were more satisfied with their lives healed more quickly.

Findings from neuroscience research also lend some support for the view that life satisfaction measures are related to individuals' emotional states. By way of

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[2] Specifically, respondents were asked, "Taking all things together, how satisfied are you with *your life as a whole* these days? Are you very satisfied, satisfied, not very satisfied, not at all satisfied?" We assigned a numeric value of 1 to 4 to their answers to compute the correlation.

background, note that there is strong clinical and experimental evidence that activity in the left prefrontal cortex of the brain is associated with the processing of approach and pleasure, whereas the corresponding area in the right hemisphere is active in the processing of avoidance and aversive stimuli. In particular, the left prefrontal cortex is more active when individuals are exposed to pleasant images or asked to think happy thoughts, while the right prefrontal cortex is more active when individuals are shown unpleasant pictures and asked to think sad thoughts. A recent study using several measures of psychological well-being reported a statistically significant correlation of 0.30 between survey reports of life satisfaction and the left-right difference in brain activation (Urry et al., 2004).

Table 1 presents a list of variables which are correlated with global reports of life satisfaction and happiness. The primary sources can be found by consulting Diener and Suh (1999), Layard (2005) and Frey and Stutzer (2002). Some visible signs of cheerfulness, such as smiling, are positively associated with self-reported happiness. Recent positive changes in circumstances, as well as demographic variables including education and income, are also positively correlated with happiness or satisfaction. Oreopoulos (2003), for example, finds that years of schooling are positively associated with satisfaction, and that this result holds up after using features of compulsory schooling laws as an instrumental variable for schooling to address the possibility of reverse causation (that is, the possibility that greater life satisfaction may cause people to complete more schooling). Variables that are associated with low life satisfaction and happiness include: *recent* negative changes of circumstances; chronic pain; and unemployment, especially if only the individual was laid off. Gender is uncorrelated with life satisfaction and happiness. The effects of age are complex—the lowest life satisfaction is apparently experienced by those who have teenagers at home, and reported satisfaction improves thereafter.

While in a cross-section of people, income has a modest correlation with life satisfaction, several studies have found that rank in the income distribution or in one's peer group is more important than the level of income (Clark and Oswald, 1996; Ferrer-i-Carbonell, 2005; Luttmer, 2005). Rayo and Becker (2005) propose a theory in which peer comparisons and adaptation to circumstances are an integral part of the "happiness function" as a result of an evolutionary process.

In any event, measures of temperament and personality typically account for much more of the variance of reported life satisfaction than do life circumstances. For example, measures of psychological depression (such as acknowledging difficulty finding the enthusiasm to get things done) are highly correlated with life satisfaction. Apparently, a person's subjective evaluation of his or her own well-being is to a significant extent a personality trait. Identical twins separated immediately after birth, for example, show the same concordance on happiness as on other traits for which a genetic basis is well established, like height (Lykken, 1996). Correlations of life satisfaction with physiological measures are intermediate in size. Correlations of life satisfaction measures with variables like active involvement in religion tend to be positive but lower.

This pattern of correlations has led Diener (1984) to conclude that the

Table 1
Correlates of High Life Satisfaction and Happiness

Smiling frequency
Smiling with the eyes ("unfakeable smile")
Ratings of one's happiness made by friends
Frequent verbal expressions of positive emotions
Sociability and extraversion
Sleep quality
Happiness of close relatives
Self-reported health
High income, and high income rank in a reference group
Active involvement in religion
Recent positive changes of circumstances (increased income, marriage)

Sources: Diener and Suh (1999), Layard (2005) and Frey and Stutzer (2002).

judgment of life satisfaction is made by combining an imperfect assessment of the balance of affect (that is, positive and negative feelings or emotions) in one's life with an assessment of how well one's life measures up to aspirations and goals. Since the components of affect and life assessment are potentially distinct, it is necessary to establish, for each correlate of life satisfaction, whether the correlation is higher for one of the constituents of the composite measure than for the other. The same question can be raised both with respect to possible causes and to possible consequences of well-being. To answer such questions, of course, it is necessary to have a separate measure of people's affect over time.

Evaluated Time Use

The most direct approach to the measurement of experienced utility would avoid effects of judgment and of memory as much as possible. Of course, outside of a laboratory setting, it is not practical to have subjects continually pull levers or turn dials to indicate their pleasure and pain. The Experience Sampling Method was developed to collect information on people's reported feelings in real time in natural settings during selected moments of the day (Csikszentmihalyi, 1990; Stone and Shiffman, 1994). Participants in experience sampling studies carry a handheld computer that prompts them several times during the course of the day (or days) to answer a set of questions immediately. Participants are shown several menus, on which they indicate their physical location, the activities in which they were engaged just before they were prompted and the people with whom they were interacting. They also report their current subjective experience by indicating the extent to which they feel the presence or absence of various feelings, such as feeling angry, happy, tired and impatient. Positive emotions are highly intercorrelated, while the correlations among negative emotions (like being angry or depressed) are also positive but lower.

Considerable evidence indicates the usefulness of these responses, both to discriminate among activities and as indicators of individual differences in overall mood and markers of health. In one recent study, 228 individuals reported their rating of happiness every 20 minutes during a workday, and measurements of cortisol, an adrenal hormone that is related to the risk of obesity, hypertension and autoimmune conditions, were taken every two hours (Steptoe, Wardle and Marmot, 2005). The subjects' average happiness ratings were significantly inversely correlated with their cortisol levels. This correlation was robust to controlling for gender, age, grade of employment, body mass and a global measure of psychological distress. The authors concluded: "The average difference in cortisol of 32.1% between the lowest and highest happiness quintiles is substantial and might contribute to health risk if it persists over months or years."

Applications of Experience Sampling have been limited, however, because it is difficult to implement in large population samples. An alternative that relies on a short recall period is the Day Reconstruction Method (DRM), which was used by Kahneman, Krueger, Schkade, Schwarz and Stone (2004). (The DRM data are available at ⟨http://www.krueger.princeton.edu/Subjective.htm⟩.) The Day Reconstruction Method combines elements of experience sampling and time diaries, and is designed specifically to facilitate accurate emotional recall. Respondents are first asked to fill out a diary summarizing episodes that occurred in the preceding day. Next they describe each episode by indicating: when the episode began and ended; what they were doing (by selecting activities from a provided list); where they were; and with whom they were interacting. To ascertain how they felt during each episode in regards to selected affective dimensions, respondents were asked to report the intensity of their feelings along nine categories on a scale from 0 ("Not at all") to 6 ("Very Much"). The affective categories were specified by descriptors, mostly adjectives, such as happy, worried and angry. The anchor, "Not at all," is a natural zero point that is likely to have a common meaning across respondents for these descriptors.
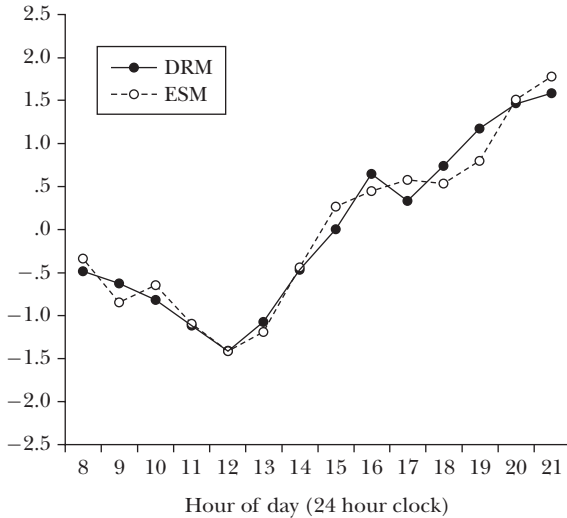
An early version of the Day Reconstruction Method was applied to a sample of 909 working women in Texas (Kahneman, Krueger, Schkade, Schwarz and Stone, 2004). One of the goals of that study was to determine whether, despite its reliance on memory, the Day Reconstruction Method reproduces results of the Experience Sampling Method. One of the tests of this proposition is shown in Figure 1, which compares hourly variation in ratings of "tired" in the Day Reconstruction Method with ratings from an independent study in which Experience Sampling was used. The results of the two studies are remarkably similar, with both showing tiredness reaching a minimum around noon.

Other features of the Texas study conformed to the basic results observed in Experience Sampling. Specifically, the incidence of negative emotions is relatively rare (for example, "angry/hostile" is rated above zero only 23 percent of the time, while the corresponding value for "happy" is 95 percent). The correlations among the emotions, particularly the positive ones, were quite high across episodes—around 0.7 for positive emotions and 0.4 for negative emotions. The available

**Tiredness Over the Day Based on Experience Sampling Method and Day
Reconstruction Method**
(points are standardized scores computed across hourly averages)


Hour of day (24 hour clock)

evidence suggests that the Day Reconstruction Method provides an efficient approximation to the results of the more demanding Experience Sampling Method.

Further analyses of the Day Reconstruction data showed that reports of tiredness were related to relevant variables in sensible ways. For example, Figure 2 shows average reported tiredness for individuals who reported that they slept less than seven hours or at least seven hours per night in the month preceding the survey based on our Day Reconstruction Method. Each group exhibits the V-shape pattern and, not surprisingly, those who slept less are more tired throughout the day. This finding suggests that respondents used the scales in a similar way—there appears to be a signal in interpersonal comparisons of reported affective experience.

Table 2 presents an analysis of evaluated time use for various activities for the Texas sample. The first column reports the proportion of the sample engaged in each activity, and the second column presents the unconditional average amount of time devoted to the activity. The third column contains *net affect*, defined as the average of the three positive categories (happy, warm, enjoying myself) less the average of the six negative ones (frustrated, depressed, hassled, angry, worried, criticized), all on a 0 to 6 scale, where 0 means not at all and 6 means very much. Net affect is a common measure of mood in the psychology literature. Here we average over each individuals' duration-weighted net affect for episodes involving the specified activity. The final column reports the U-index, which for each activity we define as the proportion of time (aggregated over respondents) in which the highest rated feeling was a negative feeling. The U-index and net affect lead to a

Figure 2

Comparison of Tiredness by Average Hours of Sleep per Night, Day Reconstruction Method

(points are hourly averages on a scale from 0 to 6)
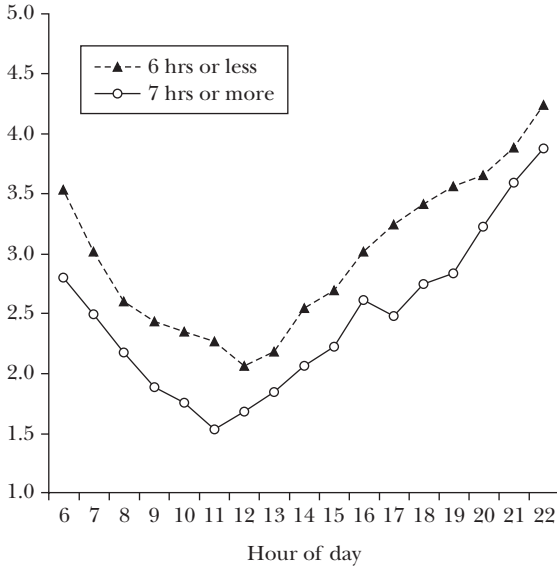
similar but not identical ranking of activities. For now, we focus on the more conventional net affect measure, and we return to the U-index later.

Overall, the results in Table 2 indicate that net affect is highest, on average, when individuals are engaged in leisure activities (such as socializing after work) and lowest when they are engaged in market work and investment or personal maintenance activities (such as housecleaning).[3] Commuting in the morning appears particularly unpleasant. Social contact during an episode is associated with high positive emotions, as emphasized by Helliwell and Putnam (2005). Interestingly, in our data the average net affect experienced during episodes of commuting rises to that of the overall average level if the commuter is accompanied by someone, indicating the influence of social contact.

The ranking of activities in Table 2 differs in some important respects from the results of satisfaction surveys that ask general questions about enjoyment of various types of activities (Juster, 1985; Robinson and Godbey, 1997). In particular, childcare and work rank much lower in our results than in these other surveys. The differences are explained by the nature of the questions in a diary and general recall survey.[4]

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[3] In the time-use literature, it is common to categorize home activities as *discretionary* or *obligatory* and to distinguish satisfaction with these activities by gender. Some home activities (like washing dishes) that are perceived as obligatory for women are considered discretionary for men. Michelson (2005) reviews this literature.

[4] This conclusion was anticipated by Robinson and Godbey (1997).

Table 2
Mean Net Affect by Activity

Activity	Percentage of sample	Time spent (hours)	Net affect	U-Index
Intimate relations	12	0.23	4.83	0.040
Socializing after work	49	1.14	4.15	0.073
Relaxing	77	2.17	3.96	0.078
Dinner	69	0.81	3.94	0.074
Lunch	67	0.57	3.91	0.078
Exercising	16	0.22	3.85	0.088
Praying/worship	23	0.45	3.78	0.105
Socializing at work	41	1.12	3.78	0.100
Watching TV	75	2.19	3.65	0.095
Phone at home	43	0.93	3.52	0.126
Napping	43	0.89	3.35	0.131
Cooking	63	1.15	3.27	0.138
Shopping	30	0.41	3.23	0.157
Computer (non-work)	29	0.51	3.22	0.165
Housework	49	1.12	2.99	0.161
Childcare	36	1.10	2.99	0.199
Evening commute	63	0.61	2.77	0.209
Working	100	6.89	2.68	0.211
Morning commute	68	0.47	2.09	0.287

Source: Kahneman, Krueger, Schkade, Schwarz and Stone (2004) and authors' calculations.
Notes: Percentage of sample is the percentage of individuals who engaged in the activity, and time spent is not conditional on engaging in the activity. If an episode involved more than one activity, it enters more than once, so total hours in a day are not constrained to sum to 24. Net affect is the average of three positive adjectives (happy, warm/friendly, enjoying myself) less the average of six negative adjectives (frustrated/annoyed, depressed/blue, hassled/pushed around, angry/hostile, worried/anxious, criticized/put down). All of the adjectives are reported on a 0 to 6 scale, ranging from 0 = "not at all" to 6 = "very much." The U-Index is the proportion of each person's time engaged in an activity in which the dominant emotion was negative, averaged over individuals. Sample consists of one day in the life of 909 employed women in Texas.

Respondents who answer abstract evaluative questions about activities are likely to be reminded that both work and childcare are desirable aspects of their life. Reports of how much they enjoy these activities will tend to be anchored on that general assessment, resulting in a favorable bias. Respondents may also feel some social pressure to tell interviewers that these domains of life are enjoyable. These biases are reduced in the Day Reconstruction Method, in which respondents describe particular episodes, without reference to more general evaluations of parts of their lives.

Having data on people's emotional experiences at various times of the day opens up many opportunities for research. People's emotional experiences while they are engaged in different activities or under different circumstances can be summarized, although research in this area has to be concerned about generalizations because individuals probably sort into different activities depending on their preferences and endowments, and because of likely declining marginal utility of time spent in various activities. We can also use the data to examine the degree to

which various adjectives are more person-related or more situation-related. Specifically, for each feeling we calculated the average variance of ratings within a subject's day (that is, across each subject's episodes), and the variance across people after aggregating over the entire day. Feelings of depression, being criticized and worried had relatively larger person components, while feelings of frustration and impatience were more features of situations.

Lastly, while net affect and reported life satisfaction are positively correlated, differences between them are worth emphasizing. Our preliminary analysis suggests that personality variables—including such factors as sleep, depression and religiosity—predict life satisfaction and net affect about equally well. Demographic factors, including ethnicity, income, education, and marital status, predict life satisfaction more strongly than they predict affect. Time use predicts net affect more than it predicts life satisfaction. These contrasts suggest that net affect provides a window on people's experience that is distinct from that captured by standard life satisfaction measures.

The Puzzle of Adaptation

One of the main puzzles of well-being research is the relatively small and short-lived effect of changes in most life circumstances on reported life satisfaction. An extreme example, which is also one of the often-cited observations in the literature, is that long-term paraplegics do not report themselves as very unhappy, nor do lottery winners report themselves as particularly happy (Brickman, Coates and Janoff-Bulman, 1978). In a more recent study using longitudinal data, Oswald and Powdthavee (2005) find that average life satisfaction drops after the onset of a moderate disability, but fully recovers to the predisability level after two years. This process is known as adaptation or habituation. For those with severe disabilities, Oswald and Powdthavee find that adaptation takes place, but is incomplete. Interestingly, Smith, Langa, Kabeto and Ubel (2005) find that the onset of a new disability causes a greater drop in life satisfaction for those in the bottom half of the wealth distribution than for those in the top half, suggesting an important buffering effect of wealth, although low-wealth individuals still recovered some of their predisability well-being.

Life events, such as marriage and bereavement, have substantial short-run effects on happiness and life satisfaction, but these effects are mainly temporary.[5] Figure 3, drawn from Clark, Diener, Georgellis and Lucas (2003), illustrates this point. The figure shows reported average life satisfaction each year for a sample of 235 women in Germany, indexed by the year in which they were married. Life satisfaction rises in the year prior to marriage and in the first year of marriage, but returns to the previous level after a short honeymoon period. The transitory effect of changes in life circumstances on reported satisfaction has been called the *hedonic*

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[5] Not everyone accepts this conclusion. Easterlin (2003), for example, has argued that people adapt to income, but not to marriage.

Average Life Satisfaction for a Sample of German Women
(by year of marriage t = 0)
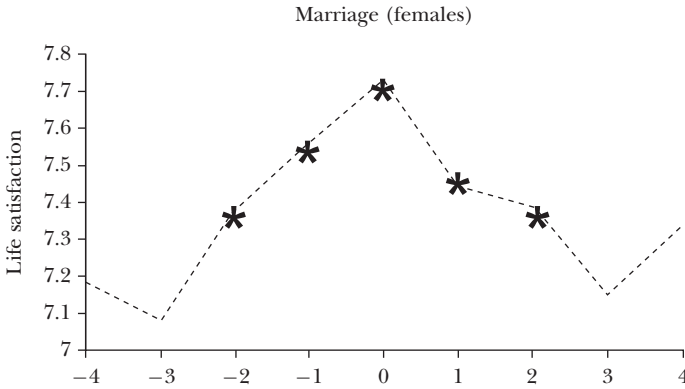
Source: Clark, Diener, Georgellis and Lucas (2003), using data from the German Socioeconomic Panel.
Note: An asterisk indicates that life satisfaction is significantly different from the baseline level.

treadmill, meaning that the effects of substantial life changes on subjective well-being are temporary.

The economic counterpart of the hedonic treadmill is that large increases in the standard of living have almost no detectable effects on life satisfaction or happiness. Easterlin (1995), for example, finds that the average self-reported happiness level did not increase in Japan between 1958 and 1987, although real income increased fivefold. Figure 4 presents related results for China, based on a sample of 15,000 individuals interviewed by the Gallup Organization. China experienced remarkably fast economic growth from 1994 to 2005, with real income per capita increasing by a factor of 2.5. This growth had substantial consequences for material well-being: ownership of color television sets rose from 40 percent of households to 82 percent, and the fraction with a telephone jumped from 10 percent to 63 percent. Yet Figure 4 indicates no increase in reported life satisfaction from 1994 to 2005; in fact, the percentage of people who say they are dissatisfied has increased, and the percentage who say they are satisfied has decreased. Studies do find that income and life satisfaction are positively correlated in a cross-section of individuals, but the correlation is only around 0.20 (for example, Easterlin, 2001). One interpretation is that aspirations rise with income. Indeed, there is survey evidence that the level of income that an individual considers to be "sufficient" is primarily determined by his or her current income (van Praag and Ferrer-i-Carbonell, 2004). Frey and Stutzer (2002) estimate that adaptation offsets about two-thirds of the benefits of any increase in income.

Some changes in circumstances have more than transitory effects: for example, the effects of unemployment and chronic pain do not seem to attenuate fully with time (Lucas, Clark, Georgellis and Diener, 2004). Nevertheless, the frequent finding

Figure 4
Life Satisfaction in China as Average Real Income Rises by 250 Percent
*Overall, how satisfied or dissatisfied are you with the way things are going in your life today?
Would you say you are very satisfied, somewhat satisfied, somewhat dissatisfied, or very
dissatisfied?*
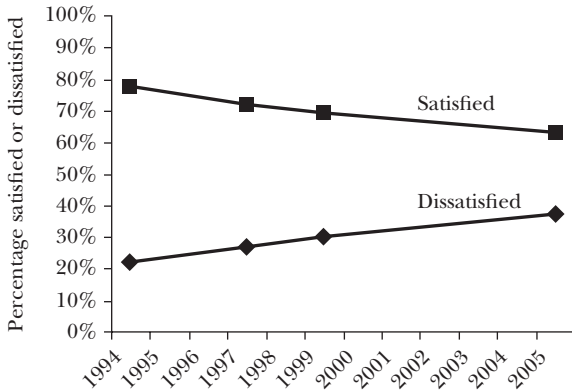
Source: Derived from Richard Burkholder, "Chinese Far Wealthier Than a Decade Ago—but Are
They Happier?" The Gallup Organization, ⟨http://sww.gallup.com/poll/content/login.aspx?ci=14548⟩.
Notes: In 1997, 1999 and 2005, respondents were given four response categories: very dissatisfied;
somewhat dissatisfied; somewhat satisfied; and very satisfied. In 1994, respondents were given a fifth
response category: "neither satisfied nor dissatisfied." The chart reports the percentage who were
satisfied or dissatisfied. Thirty-eight percent of respondents chose the neutral category in 1994; those
respondents were allocated in proportion to the number who responded that they were satisfied or
dissatisfied in that year.

of adaptation challenges both everyday intuition and economic doctrine, by sug-
gesting that in the long-run well-being is not closely related to one's circumstances
and opportunities. A possible resolution, which draws on the distinction between
affect and judgment as separate elements of well-being, is that the hedonic tread-
mill could instead be an *aspiration treadmill*. If people gradually adjust their aspira-
tions to the utility that they normally experience, an improvement of life circum-
stances would eventually lead them to *report* no higher life satisfaction than they did
before, even if they were *experiencing* higher utility than previously. In this scenario,
experienced utility could rise even while one's global evaluation of life satisfaction
remained constant.

   An empirical test of this hypothesis requires separate measurements of expe-
rienced utility and global life satisfaction. Although empirical tests of this sort are
only in their infancy, initial findings yield little support for the aspiration treadmill.

   The Kahneman, Krueger, Schkade, Schwarz and Stone (2004) study of women
in Texas also collected data on satisfaction, both with life in general and with one's
work. It therefore affords an opportunity to compare the correlates of experienced
affect with the correlates of the judgmental component of satisfaction. Measures of
net affect from the Day Reconstruction Method were positively correlated with
measures of general life satisfaction—but the correlations were often only moder-

Table 3

Correlations Between Reported Satisfaction or Daily Net Affect and Individual Characteristics

Characteristic	Life satisfaction	Net affect
Divorced (1 = Divorced; 0 = Married)	−.12	.06
Log household income	.20	.06
Education	.20	.03
Age	.12	.09
Sleep quality	.29	.30

Job feature	Job satisfaction	Net affect during work
Low-status job	−.23	−.12
Overqualified for my job	−.20	−.11
Job requires specialized education/training	.20	.10
Excellent fringe benefits	.17	.08
Constant pressure to work fast	−.19	−.28
Constant attention to avoid mistakes	−.04	−.13
Can chat with other workers while on job	.04	.11
Exposed to offensive noise	−.04	−.90

ate in size. For example, the duration-weighted measure of net affect during the entire day correlated 0.38 with life satisfaction, and the duration-weighted measure of net affect at work correlated 0.43 with satisfaction at work.

Most demographic variables and work characteristics had fairly similar correlations with the net affect and satisfaction measures, but there were significant differences, some of them worthy of note. The results shown in Table 3 are preliminary, yet suggestive. One implication from Table 3 is that experienced utility, as proxied by net affect, is more strongly related to variables that characterize the immediate context, such as time pressure at work or the opportunity to chat with coworkers, than is satisfaction. The data lend scant support for the aspiration treadmill hypothesis, however, which predicts that life circumstances have *greater* influence on net affect measured one episode at a time than on life satisfaction, because of shifts in the standards of life satisfaction. On the contrary, the data suggest that adaptation, both to income and to marital status, is more complete for the measure of affect than for life satisfaction.[6]

This conclusion is also compatible with the findings of Riis et al. (2003) in a study that applied the Experience Sampling Method to end-stage renal dialysis patients and a matched comparison group. If dialysis patients experienced lower utility but reported the same life satisfaction because they had low aspirations, we

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[6] A potentially confounding effect is that the satisfaction data are more reliable than the net affect data because net affect pertains just a single day. In our March 2004 reinterview sample, however, we found that net affect has a slightly higher correlation two weeks apart than does our life satisfaction measure.

would expect their perceived experiences throughout the day to show a lower incidence of pleasurable moments than the comparison sample. Yet the study found no significant differences in average mood throughout the day between the dialysis patients and the comparison group. Thus, measures of experienced utility or net affect also show substantial adaptation.

The invariance of reported satisfaction to material living standards and major changes in life circumstances is a reason why some economists are skeptical of the validity of measures of subjective well-being. The limited evidence that is available, however, suggests that adaptation occurs even when well-being is measured with the gold standard Experience Sampling Method. Combined with other evidence on the validity of life satisfaction measures, the widespread evidence on adaptation suggests to us that subjective well-being is not mainly a matter of income and consumption opportunities.

Many of the findings on subjective well-being may be consistent with a prominent role played by attention, or a cognitive focus on particular aspects of a situation. Attention plays a role both in the actual experience of life and in the exercise that people perform to answer questions about their global satisfaction with their lives. In this view, an essential mechanism of adaptation to circumstances such as being a paraplegic or a lottery winner is that these circumstances occupy the individual's attention for a diminishing fraction of the time as they gradually lose their novelty. A duration-weighted measurement of affect will uncover that conditions such as paraplegia or marriage are not full-time states; they are experienced part-time. The answers that an individual gives to a global retrospective question are in part determined by the aspects of life that come to mind and attract that person's attention in that context.

A shift in attention is not the only possible explanation for adaptation, however. Substitution of activities, for example, may also play a role. For instance, a sudden drop in income may cause someone to shift from regularly playing golf at a country club to strolling in a public park, with little loss in experienced utility. Measures of well-being that are connected to time use have the potential to uncover such shifts.

A Measure of Society's Well-Being: The U-Index

One of the difficulties of using data on subjective well-being is that individuals may interpret and use the response categories differently. If Jim says that he is "very satisfied" and Tim says that he is only "satisfied," is Jim really more satisfied than Tim? Maybe. But maybe Tim is the type of person who rarely uses superlatives to describe himself, either when he is jubilant or depressed, while Jim tends to extremes in his self-descriptions. To put it another way, when Tim answers a 4 about the intensity of a particular emotion, maybe that is the equivalent of a 6 for Jim.

Survey researchers try to anchor response categories to words that have a common and clear meaning across respondents, but there is no guarantee that respondents use

the scales comparably. Despite the apparent signal in subjective well-being data, one could legitimately question whether one should give a cardinal interpretation to the numeric values attached to individuals' responses about their life satisfaction or emotional states because of the potential for personal use of scales.

We propose an index, called the U-index (for "unpleasant" or "undesirable"), which overcomes this problem. The U-index measures the proportion of time an individual spends in an unpleasant state. This statistic is immediately understandable and has other desirable properties as well. Most importantly, the U-index is an ordinal measure *at the level of feelings.*

The first step in computing the U-index is to determine whether an episode is unpleasant or pleasant. There are many possible ways to classify an episode as unpleasant or pleasant. The data collected by Experienced Sampling or Day Reconstruction include descriptions of an individual's emotional state during each episode in terms of ratings on several dimensions of feelings, some of which are positive ("Happy," "Enjoying myself," "Friendly") and some of which are negative ("Depressed," "Angry," "Frustrated"). We classify an episode as unpleasant if the most intense feeling reported for that episode is a negative one—that is, if the highest rating on any of the negative affect dimensions is strictly greater than the maximum of rating of the positive affect dimensions.[7] Notice that this definition relies purely on an ordinal ranking of the feelings within each episode. It does not matter if Tim uses the 2 to 4 portion of the 0 to 6 intensity scale and Jim uses the full range. As long as they both employ the same personal interpretation of scales to report the intensity of positive and negative emotions, the determination of which emotion was strongest is unaffected (ignoring ties).[8]

From a psychological perspective, the U-index has some desirable attributes. First, the predominant emotional state for a vast majority of people during most of the time is positive, so any episode when a negative feeling is the most intense emotion is a significant occurrence. It is not necessary to have more than one salient negative emotion for an episode to be unpleasant. Second, the selection of a negative feeling as more intense than all positive ones is likely to be a mindful and deliberate choice: the maximal rating is salient, especially when it is negative, because negative feelings are relatively rare. Third, because the correlation of the intensity among various positive emotions across episodes is higher than the correlation among negative emotions, one dominant negative emotion probably colors an entire episode. For example, the correlation of happy and enjoying myself across episodes is 0.73, while the correlation between feeling criticized and feeling worried is 0.32. This pattern is not particularly

[7] Our approach is similar to a procedure proposed by Diener, Sandvik and Pavot (1991), which categorized moments as pleasant or unpleasant if the average rating of positive emotions was greater than or less than the average rating of negative emotions. Unlike the maxima, averaging ratings of feelings requires a cardinal metric. Notice also that because the correlations between negative emotions tend to be low, their procedure will categorize fewer moments as unpleasant than the definition we use.
[8] Formally, let $f(\cdot)$ be any monotonically increasing function. If P is the maximum intensity of the positive emotions and N is the maximum intensity of the negative emotions, then $f(P) > f(N)$ regardless of the monotonic transformation.

surprising, as it is commonplace for someone to feel worried but not feel criticized, yet it would be odd to feel happy but not feel enjoyment. This intuition was also clear to Leo Tolstoy, who opened *Anna Karenina* with the line, "Happy families are all alike; every unhappy family is unhappy in its own way."

Of course, the dichotomous categorization of moments or episodes as unpleasant or pleasant loses some information about the intensity of positive and negative emotions, just as a dichotomous definition of poverty misses the depths of material deprivation for those who are below the poverty line. However, we see the ordinal definition of unpleasant episodes as a significant advantage. In addition to reducing interpersonal differences in the use of scales, the question of how to scale subjective responses numerically is no longer an issue with our dichotomous measure.

Once we have categorized episodes as unpleasant or pleasant, we define the U-index as the fraction of time that is spent in an unpleasant state. The U-index can be computed for each individual (what proportion of the time is this person in an unpleasant emotional state?) and averaged over a sample of individuals. The same index can also be used to describe situations (what proportion of the time that people spend commuting is experienced as unpleasant?), as in Table 2. Notice that because the U-index is aggregated based on time, it takes on useful cardinal properties. Like the poverty rate, for example, one could compute that the U-index is X percent lower for one group than another or that it has fallen by Y percent over time. Such comparisons cannot be done for net affect data, which, at best, satisfies the requirements for an interval scale.

To illustrate the technique, we calculated the U-index for the Day Reconstruction Method sample of 909 working women from Texas. As in the calculation of net affect, positive emotions are happy, enjoying myself and warm/friendly, and negative emotions are frustrated, worried, depressed, angry, hassled and criticized. We find that the average woman spent about 17.7 percent of her time in an unpleasant state. The U-index falls slightly with household income (18.9 percent for incomes less than $35,000 and 16.6 percent for incomes of $55,000 and higher) and is unrelated to marital status. The index falls with age: those age 18–24 spent 22 percent of their time in an unpleasant state, compared with 19 percent for those age 25–44 and 15 percent for those age 45–64.

As with net affect, we find that personality traits significantly affect the percentage of time individuals spend in an unpleasant state. For example, those who score in the top third on a measure of depression spend 31 percent of their time in an unpleasant state, whereas those who score in the bottom third on the depression scale spend 13 percent of their time in an unpleasant state. (Depression is measured by the following two questions: "During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?" and "During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?") Figure 5 shows that those who report less satisfaction with their lives as a whole also spend a greater fraction of their time in an unpleasant state. Overall, the top 10 percent of people account for 38 percent of all the time spent in an unpleasant state.

Figure 5
U-Index by Global Life Satisfaction
Taking all things together, how satisfied are you with your life as a whole these days? Would you say you are very satisfied, somewhat satisfied, somewhat dissatisfied, or very dissatisfied?
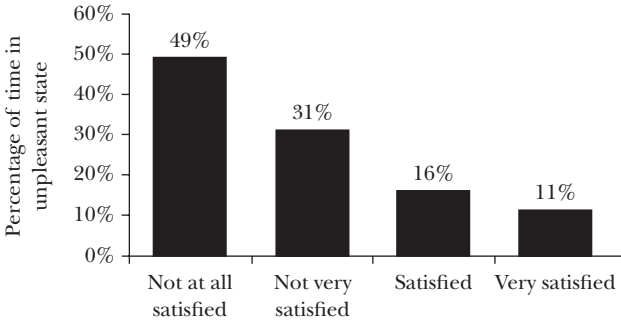

Table 2 illustrated that a ranking of activities based on the U-index is very similar to a ranking based on net affect. For example, 28 percent of the time commuting in the morning was unpleasant and 21 percent of the time working was unpleasant, while just 8 percent of the time spent socializing and 4 percent of the time during intimate relations was classified as unpleasant. The only noteworthy divergence is that praying/ worship falls a bit in the ranking of activities based on the U-index compared with net affect, because the U-index does not reflect the high positive emotions some people report during episodes of prayer and worship; all that matters for the U-index is the dominant emotion, even if the margin of dominance is small.

These findings suggest two strategies for reducing misery—or, at least, for reducing the amount of time people spend in an unpleasant emotional state. The first is to focus on mental health interventions (such as antidepression drugs or positive psychology) for the small segment of the population that spends a great deal of its time in an unpleasant state. The second is to focus on time allocation. For example, interventions that reduce the amount of time spent commuting alone (such as congestion taxes and car pool subsidies) could possibly have a beneficial effect on individuals' emotional states. Of course, the potential benefit of these interventions needs to be compared with their costs.

Our results for the U-index are only meant to be illustrative. One outstanding issue for the construction of the index involves the relevant feelings that should be included in an assessment of well-being. There is as yet no formal process of choosing an appropriate list of adjectives, and the list should vary depending on the purpose of the study. Russell's (2003) theory of core affect, in which emotions are described along two dimensions (one ranging from pleasure to displeasure, and the other ranging from highly activated to deactivated) provides a useful framework for considering descriptors to include in a study of well-being. We tried to select emotions that represent this spectrum.

Conclusion

The fact that responses to subjective well-being questions are related to individuals' health outcomes, neurological functioning and characteristics—and predict some future behavior—suggests that the data are a valid subject for study in the sense that they capture at least some features of individuals' emotional states. Measures that are collected in real time or are linked to diaries of actual events have the advantage of minimizing the filter of memory and of connecting well-being to something that matters a great deal and can be varied—how people spend their time. Time use is also amenable to traditional economic analysis.

Acceptance of self-reported measures of well-being, subject to the many caveats that subjective measurement requires, could have a profound impact on economics. First, subjective measures of well-being would enable welfare analysis in a more direct way that could be a useful complement to traditional welfare analysis. Second, currently available results suggest that those interested in maximizing society's welfare should shift their attention from an emphasis on increasing consumption opportunities to an emphasis on increasing social contacts. Third, a focus on subjective well-being could lead to a shift in emphasis from the importance of income in determining a person's well-being toward the importance of his or her rank in society. Fourth, although life satisfaction is relatively stable and displays considerable adaptation, it can be affected by changes in the allocation of time and, at least in the short run, by changes in circumstances. Layard (2005) provides a provocative discussion of how findings from research on subjective well-being could influence economic policy.

Another eventual development could be acceptance of a national well-being index, as a complement to the National Income and Product Accounts. Indeed, the Kingdom of Bhutan has proclaimed the goal of measuring Gross National Happiness, and other governments, including the United Kingdom and Australia, are committed to producing national measures of subjective well-being. A measure of Gross National Happiness would seem to us to be an overly ambitious goal in view of the present state of knowledge and limitations of subjective measurement. The U-index, or proportion of time people spend in an unpleasant emotional state, however, strikes us a promising measure of an important feature of society's well-being. Although the U-index focuses on a single characteristic of reported feelings, it is based on an ordinal measure of feelings at the episode level that reduces the impact of individual variability in the use of scales and is fundamentally connected to time allocation. For these reasons, the U-index is particularly well suited for cross-country comparisons, which may be distorted by cultural or language differences in answering standard satisfaction questions. Lastly, we suspect that many policymakers are more comfortable with the idea of minimizing a specific concept of misery than maximizing a nebulous concept of happiness.

DRM data used in this paper are available at ⟨http://www.krueger.princeton.edu/ Subjective.htm⟩.

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