

MEASURES OF SELF-REPORTED WELL-BEING: THEIR
AFFECTIVE, COGNITIVE, AND OTHER COMPONENTS*

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ABSTRACT. This investigation begins from the hypothesis that social indicators of perceived well-being – e.g., people's assessment of their own life quality – will, like other attitudes, reflect two basic types of influences: affect and cognition. In addition, the indicators were expected to include two other components: unique variance (mainly random measurement error) and correlated measurement error. These ideas are investigated using a structural modeling approach applied to 23 assessments of life-as-a-whole from a national survey of Americans ($N = 1072$) and/or a survey of urban residents in England ($N = 932$). In both sets of data, models that included affective and cognitive factors fit significantly better than more restricted models. Furthermore, as expected, measures of (a) 'happiness', 'fun', and 'enjoyment' tended to be relatively more loaded with affect than were measures of (b) 'satisfaction', 'success', and 'meeting needs'; and (c) measures designed to tap both affect and cognition tended to fall between the first two groups. In addition, the results suggest that measures employing relatively many scale points and direct assessments yield more valid indicators of people's evaluations of life-as-a-whole than do measures based on three-point scales or on explicit comparisons with other times or groups. These results contribute to basic knowledge about the nature of life quality assessments, help to explain some previously puzzling relationships with demographic factors such as age and education, and may be useful to designers of future studies of perceived well-being.

1. INTRODUCTION

Previous research on the nature of attitudes suggests that they include at least two fundamental components: *cognition* and *affect*. In figurative language, cognition refers to the rational, 'from-the-head', aspects of a person's response, while affect refers to the emotional, 'from-the-heart' (or 'from-the-gut') components.

Measures of perceived ('subjective') well-being – one type of social indicator – are fundamentally measures of attitudes, and hence can be expected to reflect cognitive and affective elements. Furthermore, different measures of perceived well-being can be expected to include different combinations of cognition and affect. In fact, this may explain why different measures of well-being sometimes show distinct patterns of relationships to other variables.

This article reports a series of explorations into the affective and cognitive

components of some of the more widely used measures of perceived well-being. It is shown that the expected differences among the measures do indeed appear and that these differences replicate in independent social indicator surveys conducted in the United States and Great Britain.

From the standpoint of basic science, the research reported here represents an attempt to understand some of the fundamental types of influences that determine the responses people give when asked about their well-being. From a more applied perspective, this report may offer guidance to future investigators who face practical problems of selecting or constructing measures for use in studies of self-reported life quality.

In Sections 2 and 3 we briefly review the intellectual heritage out of which the present study arises — some recent studies on perception of well-being, and some of the relevant past research pertaining to the nature of attitudes, respectively. Section 4 describes the 23 measures of global well-being that will be the focus of attention here, the two major data sources that have been analysed, and the structural-equation methodology that has been employed. The statistical results, and certain checks on those results, are presented in Section 5. Section 6 summarizes the results and describes some needed further research.

2. CONNECTIONS TO SOME PREVIOUS RESEARCH ON PERCEIVED WELL-BEING

The past decade has witnessed an expanding worldwide interest in the compilation of various types of social indicators. Some of the work has taken the form of conducting sample surveys of national, regional or metropolitan populations to assess perceptions of well-being — i.e., of people's direct first-hand evaluations of the quality of their lives, both in general and with respect to numerous specific life concerns (for example, job, family, neighborhood, public services, sense of fairness, safety, and many more). Among the major recent quality-of-life surveys are those described by Allardt (1973) in Scandinavia, Andrews and Withey (1976) and Campbell, Converse, and Rodgers (1976) in USA, Abrams (1973) and Hall (1976) in England, and Blishen and Atkinson (1978) in Canada. Earlier surveys by Cantril (1966) in 13 countries and by Bradburn (1969) in USA should also be mentioned.

These surveys, and many others with similar objectives, have used a variety

of different questions to elicit people's attitudes about their lives. A common way to obtain feelings at the most global level has been to ask the simple question, "How do you feel about your life as a whole?" and then to provide a set of answer categories that range from 'Delighted' to 'Terrible', or from 'Completely satisfied' to 'Completely dissatisfied', or from 'The best I could expect to have' to 'The worst I could expect to have'. There are numerous alternatives, however, and sometimes respondents have been asked about happiness ('How happy are you?'), about positive affect ('During the past few weeks did you ever feel on top of the world?'), about negative affect ('During the past few weeks did you ever feel depressed or very unhappy?'), about the frequency of worrying, about current mood, and many more. This list is not exhaustive, but serves to illustrate some of the approaches that have been tried. (For a list of more than 60 different measures of global well-being, a proposed typology for classifying these measures, and information on how most of the measures related to each other in one set of American data, see Andrews and Withey, 1976, Chapter 3.)

In the most general terms, it can be said that most of the different measures of perceived global well-being have shown broadly similar patterns of relationships to other variables. For example, richer people have expressed more positive sentiments than poorer people; blacks — at least in the United States — have rated their life quality lower than have whites; and most of the global measures that have been submitted to multivariate analysis have been reasonably predictable by additive combinations of evaluations of more specific life concerns.

Although the most basic patterns are broadly similar, closer examination reveals subtle but potentially important differences among the measures. There is no reason to assume that (1) all measures tap people's underlying feelings with the same sensitivity, or (2) that all measures tap the same set of underlying feelings. In fact, past research in psychometrics would lead one to expect that some answer formats would provide more precise measures than other formats, and that different question wordings (e.g., asking about 'happiness' versus 'satisfaction') would result in measures with different orientations. Indeed, the published work on social indicators includes some hints that these kinds of differences do in fact occur. For example, Campbell, Converse, and Rodgers (1976) report that feelings of happiness tended to be lower among older people, but that feelings of satisfaction tended to be higher. A partial replication is reported by Andrews and Withey (1976): They

also found that happiness declined with age (but satisfaction showed no clear upward trend). In another example Smith (1978) reports that measures of happiness and affect show seasonal variations over the year but that measures of satisfaction remain constant.

The fact that different measures show somewhat different patterns of relationships raises the fundamental question, Why? It would seem reasonable to suppose that the measures are tapping different components of people's attitudes about their own well-being. Given that self-reports of well-being are reports about attitudes, and the well-established usefulness of analysing attitudes in terms of their affective and cognitive components, it seems reasonable to expect that these differences in the measures might be attributable to their comprising different combinations of affect and cognition. McKennell (1978) and McKennell and Andrews (1980) have presented extended theoretical discussions and some empirical data in support of this view.

3. CONNECTIONS TO SOME PREVIOUS RESEARCH ON THE NATURE OF ATTITUDES

Interest in the nature of attitudes has a long history in social psychology. After reviewing 16 previous definitions of *attitude*, Allport defined it as follows in 1935: "It is a mental and neural state of readiness to respond, organized through experience exerting a directive and/or dynamic influence on behavior." Forty years later, in another extensive review of the attitude literature, Fishbein and Ajzen (1975) defined *attitude* as: "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object." It seems obvious that people's responses to questions about perceived well-being in quality-of-life surveys meet the above definitions and hence that knowledge about the nature of attitudes may have something to contribute to our understanding of self-reports of well-being.

The idea that mental states may include various conceptually distinct components has been around for thousands of years. According to McGuire (1968), philosophers have concluded that there are basically three perspectives from which the human condition can be viewed: *knowing*, *feeling*, and *acting*, and he cites both Hindu and classical Greek sources as proposing that attitudes include cognitive, affective, and conative (i.e., behavioral) components. A basically similar trilogy of components has been investigated

by social psychologists for the past several decades. Ostrom (1969), for example, describes the situation as follows:

At the most global level, attitudes can be characterized as an evaluation of the attitude objective on a pro to con continuum. This generalized evaluation can be analyzed into three components: affective, behavioral, and cognitive.

The [affective] component includes... favorable to unfavorable feelings... [expressions of] like or dislike, feelings, and emotional and physiological reactions. Perhaps the phrase 'gut reaction' best conveys the spirit of this component.

The [behavioral] component includes... supportive to hostile actions... [reflecting] personal action tendencies,... past actions, future intentions, and predicted behavior in hypothetical situations.

The cognitive component includes... desirable to undesirable qualities... [reflecting] values and attributes assigned to the attitude object,... beliefs about the object, characteristics of the object, and relationships of the object with other objects (including self). Evaluative phrases which are not on the emotional continuum should also be included. (Ostrom, 1969, p. 16)

While the conceptual distinctions between the cognitive, affective, and behavioral aspects of attitudes seem reasonably clear, the statistical relationships among these components are of some debate. One could argue – as do Insko and Schopler (1967) for example – that a 'triadic consistency' should generally prevail among the three components. The investigation reported by Ostrom (1969) did indeed find high overlaps among the three components. Alternatively, one could *define* the components to be statistically independent of one another – arguing, for example, that cognitive components are those aspects which are different from (i.e., statistically unrelated to) affective components. For reasons of convenience, and because of the nature of the data that are available to us, we adopt this latter strategy, but we also show that the degree of presumed overlap between affect and cognition actually has little effect on the general conclusions that will be drawn about the nature of self-reports of well-being.

Although investigators of attitudes sometimes also consider a behavioral component as part of an attitude (and sometimes *intentions* are further distinguished from actual behavior), behavior will not be considered in the present report. The assessments of perceived well-being that are examined below are evaluations of life quality that have no direct behavioral referents, and hence a behavioral component seems of little relevance. This is not to say, however, that the measures of well-being are expected to be statistically independent from either actual behavior or behavior intentions: on the contrary, such links probably do exist, but seem not to be constituent parts of the particular survey measures that have been widely used to date. (Exploration of these links should be on the agenda for further research.)

4. DATA SOURCES, MEASURES, AND ESTIMATION METHODOLOGY

4.1 *Data sources*

The data analysed in this report come from two separate surveys.

One survey was designed to be representative of American adults and was based on a probability sample of all American citizens aged 18 and over (and married persons under 18) living in households in the continental United States (except households on military reservations). These data were collected under the direction of Andrews and Withey in November 1972 from 1072 respondents as part of a larger face-to-face personal interview study (see Andrews and Withey, 1976, Appendix B, for further details on sampling design, response rates, etc.). Data were collected by trained interviewers of the University of Michigan's Survey Research Center.

The second survey was of British adults. It was conducted in March 1975 under the direction of Abrams and Hall and was based on a representative sample of people aged 16 and over living in British metropolitan areas. The number of respondents to this survey was 932. Other analyses of these British data have been reported by Abrams (1976) and by Hall (1976).

4.2 *Measures of global well-being*

Although plans for the present analyses had not been formulated at the time the surveys were originally designed, the desirability of including a wide range of different measures of global well-being was clear. Thus it happens that the range of measures now at our disposal, while not ideal, is nevertheless rather well suited to our needs.

The analyses reported below focus on 23 different measures of global well-being. Of these, 10 were assessed in the American survey and 16 in the British survey (there are three measures that are identical in both surveys).¹ Exhibit 1 presents the exact wording of each question and response scale, a short code name for each measure, and the source(s) of the data. The heterogeneous character of these various ways of assessing people's feelings about their life-as-a-whole is immediately evident.

The order of presentation within Exhibit 1 is in accord with our initial expectations about the relative sensitivity of the measures to affective and cognitive elements. The measures can be divided into four groups:

EXHIBIT 1
Measures of global Well-being

Variable's group and name	Description	Suvey ^a
<i>Group A</i>		
Life 1	"How do you feel about your life as a whole?" Answered on scale with seven main categories: 'Delighted,' 'Pleased', 'Mostly satisfied', 'Mixed (about equally satisfied and dissatisfied)', 'Mostly dissatisfied', 'Unhappy', 'Terrible'; plus several off-scale categories – 'Neutral', and 'I never thought about it' – which were excluded in analysis.	A
Life 2	Same as Life 1 but asked later in the interview.	A
<i>Group B</i>		
Sat 11-pt	"All things considered, how satisfied or dissatisfied are you with your life as a whole these days?" Eleven point response scale (numbered 0–10) labelled at the ends with: 'Dissatisfied' and 'Satisfied'.	B
Sat 7-pt	"How satisfied are you with your life as a whole these days?" Seven point response scale, labelled at the ends with: 'Completely satisfied' and 'Completely dissatisfied'.	A
Sat 3-pt	"In general, how satisfying do you find the way you're spending your life these days? Would you call it completely satisfying, pretty satisfying, or not very satisfying?"	A
Make sat	"...how you feel about your present life": Seven point response scale labelled at the ends with 'Makes me completely dissatisfied' and 'Makes me completely satisfied'.	B
Doing well	"When you think of the things you want from life now, would you say you were doing very well, fairly well, or not too well?"	B
Successful	"...how you feel about your present life": Seven point response scale labelled at the ends with 'Unsuccessful' and 'Successful'.	B
Meets needs	"... how you feel about your present life": Seven point response scale labelled at the ends with 'Does not meet my needs in any way' and 'Meets my needs in every way'.	B
Bet th des	"...how you feel about your present life": Seven point response scale labelled at the ends with 'Is very much worse than I deserve' and 'Is very much better than I deserve'.	B
<i>Group C</i>		
Affect pos	Bradburn's Positive Affect Scale: the number of five positive events experienced. "During the past few weeks did you ever feel ...particularly excited or interested in something? ...proud because someone complimented you on something you had done? ...pleased about having accomplished something? ...on top of the world? ...that things were going your way?"	A, B

Exhibit 1 (continued)

Affect neg	Bradburn's Negative Affect Scale: the number of five negative events experienced. "During the past few weeks did you ever feel ...so restless that you couldn't sit long in a chair? ...very lonely or remote from other people? ...bored? ... depressed or very unhappy? ...upset because someone criticized you?"	A, B
Happy 7-pt	"...how you feel about your present life": Seven point response scale labelled at the ends with 'Unhappy' and 'Happy'.	B
Happy 3-pt	"Taking all things together, how would you say things are these days – would you say you're very happy, pretty happy, or not too happy these days?"	A, B
Make happy	"...how you feel about your present life": Seven point response scale labelled at the ends with 'Makes me extremely unhappy' and 'Makes me extremely happy'.	B
Happy D–T	"How do you feel about how happy you are?" (Same delighted-terrible response scale as Life 1)	A
Fun	"...how you feel about your present life": Seven point response scale labelled at the ends with 'Full of fun' and 'No fun at all'.	B
Enjoyable	"...how you feel about your present life": Seven point response scale labelled at the ends with 'Enjoyable' and 'Miserable'.	B
<i>Group D</i>		
Change 11-pt	"Think of how your life is going now. How much would you like to change your life as it is now?" Eleven point response scale (numbered 0–10) labelled at the ends with 'Not at all' and 'A very great deal'.	B
Change 3-pt	"Considering how your life is going, would you like to continue much the same way, change some parts of it, or change many parts of it?"	A
Bet future	"...how you feel about your present life": Seven point response scale labelled at the ends with 'Will get very much worse in the future' and 'Will get very much better in the future'.	B
Worry	"In general, how much would you say you worry these days?" Same response scale as Change 11-pt.	B
Thermometer	"Where would you put your life as a whole these days on the feeling thermometer?" Vertical scale running from "100° – very warm or favorable feeling' to '0° – very cold or unfavorable feeling' with intermediate numbers and labels at 85°, 70°, 60°, 50°, 40°, 30°, and 15° (see Andrews & Withey, 1976, p. 367, for full wording of intermediate labels).	A

^a Key to surveys: A = American data (Andrews & Withey, 1976)
B = British data (Abrams, 1976; Hall, 1976)

A. The first two measures, Life 1 and Life 2, were specifically designed to tap *both* affective and cognitive elements.

B. The second group consists of measures that were expected to be primarily sensitive to cognitive elements. The first four measures in Group B, all of which assess *satisfaction*, were expected to be more sensitive to cognitive than affective elements because of the notion that the concept of satisfaction requires some kind of comparison – either explicit or implicit – between a level of achievement and some standard (e.g., what one expects or aspires to) and hence involves the kind of judgmental thinking and knowledge that is the hallmark of cognition. The remaining four measures in Group B, although not phrased in terms of satisfaction, were also expected to be sensitive primarily to cognitive aspects because each of these items involves a comparison with certain implied or explicit criteria.

C. The third group consists of eight measures that were expected to be primarily affective in orientation. The first two of these measures – Bradburn's scales of Positive affect and Negative affect – were expected to come as close as any of these measures to representing 'pure' affect. These two scales, each consisting of five separate items, have been taken directly from Bradburn (1969). (His finding – surprising when it first emerged – that these measures were uncorrelated with each other replicated in both of the present surveys. The product-moment correlations between these two scales were 0.01 and 0.00 in the American and British data, respectively.) Next there follow four items in Group C that ask about *happiness*. The first three of these happiness items have simple answer scales that were expected to give the measure a heavily affective cast; the fourth happiness measure, which was answered on a more complex scale that includes ideas of satisfaction as well as affect, was expected to come closer to being 'balanced' with respect to affect and cognition than the other three, but still to be primarily affective. The final two measures in this group – those asking about fun and enjoyableness – were also expected to be predominantly sensitive to affective components.

D. The fourth group includes five items that clearly tap attitudes about global well-being, but for which we had no clear expectations regarding their relative sensitivity to affective and cognitive components. Included here are two measures that ask about desired changes in the future, another than asks about expected changes in the future, one that asks about worries, and a very general item about life-as-a-whole answered on a response scale (the feeling thermometer – widely used for assessing attitudes toward political candidates) which provided few clues regarding the likely affective-cognitive balance in the answers.

4.3 *Estimation methods*

General approach. To estimate the sensitivity of global measures of well-being to their presumed underlying affective and cognitive elements requires that these components be disentangled from each other, and from certain other components that will shortly be described. The new technology of structural equation modelling with unmeasured variables offers a powerful means for accomplishing this.

What one knows, on the basis of the observed data, is how the various measures relate to one another. Using this information jointly with a causal model – i.e., with some specific ideas about factors that might have influenced the measures and hence affected their covariation – one can seek a mutually consistent set of influence estimates that will account for the entire set of observed covariations. While one can never ‘prove’ – in an ultimate sense – that a particular causal model is correct, various pieces of evidence will determine the degree of confidence one may have in the model. Among the criteria are (1) the extent to which the model incorporates current thinking about relevant sources of influence, (2) the degree to which the model succeeds in accounting for the observed patterns in the data, and (3) the reasonableness of the parameter estimates produced by the model, considering other things already known or suspected about the measures.

The models used in the present analyses presume that there are four types of influences that may be present, in varying degrees, in measures of global well-being. These four are: (1) affective reactions a person has to his or her life-as-a-whole; (2) cognitive reactions to life-as-a-whole; (3) reactions that have nothing to do with life-as-a-whole but which influence two or more of the well-being measures because of the way they were assessed (i.e., ‘correlated errors’, or ‘methods effects’); and (4) everything else that might influence a single measure but which has nothing to do with a person’s reactions to global well-being (i.e., ‘uncorrelated errors’).

Exhibit 2 presents the model that was applied to the American data. A generally similar model was applied to the British data and will be discussed later.

Parameter estimates for this and all other models were computed by

LISREL III, a computer program that estimates linear structural equation systems by maximum likelihood methods (Joreskog and Sorbom, 1976).

The basic model. The model portrayed in Exhibit 2 is a straightforward implementation of the causal hypotheses sketched previously. Within the rectangles on the left and right of Exhibit 2 are the actual measures being

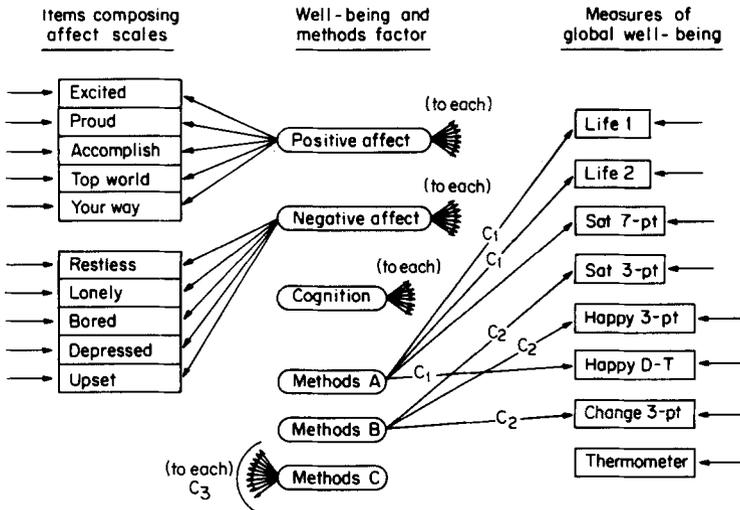


EXHIBIT 2

The structural model that was applied to American data.

analysed. The first block of five rectangles on the left contains the items that constitute Bradburn's Positive affect scale, and the second block of five contains the items of the Negative affect scale (see Exhibit 1). On the right are eight measures of global well-being. It is the interrelationships among these 18 items that this model seeks to explain. The model assumes that the relationships vary because the measures are differentially sensitive to some of the same underlying sources of influence.

The arrows going to each rectangle symbolize inputs from particular

sources of influence. Although not shown in Exhibit 2, each arrow carries a number (a 'parameter estimate') which indicates *how much* influence enters along that path.

The three ovals in the upper center of Exhibit 2 represent the affective and cognitive reactions which we presume people have to their life-as-a-whole. Note that the affective reactions have been separated into positive and negative components (in accord with Bradburn's findings mentioned above). The absence of any direct connections among these three ovals indicates that they will be treated as three statistically independent influences. (The effects of allowing certain departures from independence among these factors was the topic of some subsidiary investigations that are discussed later.)

The three ovals in the lower portion of the exhibit represent three types of methods effects. Because some people use a particular response scale in one way – for personal or stylistic reasons that have nothing to do with their feelings of well-being – while others use that scale in another way, there is likely to be a spurious component to relationships between measures that use the same or similar response scales. By explicitly incorporating method effect factors in the model, one can separate out these spurious relationships from the more fundamental links to affect and cognition that are of primary interest. Method factor A links to the three items that use the 7-point Delighted-terrible response scale, and also to the 7-point satisfaction measure that used a somewhat similar scale. (As indicated by the c_1 's in the exhibit, the magnitude of Methods effect A was *constrained* to be equal for each of the measures using the Delighted-terrible scale, but was allowed to be of different magnitude for the 7-point satisfaction measure.) Method factor B links to the three measures that have similar three-category response scales; the c_2 's in the exhibit indicate that this method effect was constrained to be equal for each of these measures. Finally, Method factor C links to each of the 10 affect items, all of which were answered in a simple yes-no format; the c_3 in the exhibit indicates that all of these method effects were constrained to be equal.

In addition to the inputs from affect, cognition, and shared methods effects, each measure is presumed to include certain random (i.e., uncorrelated) errors. The short arrows entering each rectangle from the perimeter of the exhibit represent the influences of these random errors. (Because

the Thermometer measure uses a response scale different from that of any other measure in this analysis, any effect attributable to that scale will be included in the uncorrelated error component of this measure.)

The substantive meaning of the unmeasured causal variables. A reasonable concern, when one examines a model such as that portrayed in Exhibit 2, is with the 'meaning' of the unmeasured variables indicated by the ovals. What leads one to believe that they operate in accord with the labels that have been placed on them? The answer lies in how the ovals are linked, or *not* linked, to each other and to the observed measures, and in how these linkages have been controlled (e.g., by constraining them to be equal) (Burt, 1976).

In the case of the factor labelled Positive affect, this factor was expected to act like pure positive affect because it is the *only* factor that can uniquely explain the covariation among the items of Bradburn's Positive affect scale, covariation which — as noted previously — was presumed to result from these items' common sensitivity to positive affect. (Note that the Methods factor C, because all its links are constrained to be equal, can represent only something that all five positive affect items and all five negative affect items have in common and to the same degree, and hence this factor will not pick up positive affect.)

Parallel comments explain why the Negative affect factor was expected to come reasonably close to representing pure negative affect.

Unfortunately, none of the available measures seemed even close to being an indicator of pure cognition. Accordingly, the cognitive factor has been defined through a process of residualization. The cognitive factor is what the global well-being measures share that is *not* affect (either positive or negative) and that is *not* attributable to common method effects. This approach to defining a cognition factor, despite its being indirect, seems well supported by both theory and analytic results. As noted in Section 3 of this paper, there is substantial evidence that some kind of cognitive mental process seems to be one of the underlying factors that influence attitudes. And, as we have shown elsewhere (McKinnell and Andrews, 1980), a cognitive factor residualized as here: (1) does make a useful contribution to explaining the pattern of covariations among global measures of well-being; (2) yields highly consistent

factor loadings across a substantial variety of causal models; and (3) shows replicable cross-national results.

While the ability to estimate the parameters of structural equations incorporating unmeasured variables, as required by the model portrayed in Exhibit 2, represents a very important and quite recent technological development, it must be recognized that the values obtained are only *estimates* of what may go on in the real world. We believe the model appropriately incorporates past and current theorizing about the nature of attitudes and about likely sources of errors in observed measures, and, furthermore, the model does indeed explain the relationships among the measures rather well and on the basis of reasonable parameter estimates (as will be detailed in Section 5). Nevertheless, there is no direct way to 'prove' that results from applying this model are precisely correct. What seems important at this point is to observe that nothing to date has suggested a fundamental flaw in the model or its application, and that although the numerical values of some of the parameter estimates will vary according to certain assumptions made in specifying the model, the overall pattern of results, and hence the general conclusions to be derived from them, seem not to be heavily dependent on these assumptions.

5. RESULTS

This section begins by presenting the results from the analysis of measures in the American data. Then follows a description of results from the British data. Finally a series of subsidiary analyses designed to check the sensitivity of the conclusions to various assumptions made in the main analyses are presented.

5.1 *Measures in the American data*

Exhibit 3 presents the results of applying the model portrayed in Exhibit 2 to the well-being measures included in the American survey. Before turning to its 12 columns of information, however, it is important to report that the model performed quite satisfactorily in accounting for the variances and covariances among the measures.² There were a total of 171 such variance or covariance statistics to be 'explained', and the average predicted value of

each was within ± 0.04 of the observed value and in no case was a prediction off by as much as 0.19.

In Exhibit 3, columns 3–9 indicate the sensitivity of the well-being measures to various components of attitudes about life-as-a-whole, columns 10 and 11 indicate sensitivity to other influences (correlated and random measurement errors), and column 12 is a total. Note that the figures under ‘Other’ components are subdivided into two types of components: Correlated measurement error variance attributable to a measure’s sharing common response scales (shown in column 10), and unique variance (shown in column 11), most of which is probably random measurement error, but some of which might be a measure’s valid reflection of attitudes that have nothing to do with feelings about life-as-a-whole. Note, also, that the figures for the totals in column 12 all come close to 100%, as one would expect. (The small discrepancies from 100% are primarily attributable to the model’s not being able to account precisely for all the variance of each measure while simultaneously having to account for all the other variances and covariances.)

The results shown in Exhibit 3 are generally in accord with our expectations, sketched earlier, about the composition of these global measures. However, there is one substantial surprise, and a few other results may call for adjustments in our expectations.

As noted in the initial discussion of the measures, the Group A measures — Life 1 and Life 2 — were expected to reflect substantial amounts of both affect and cognition. The affect-cognition ratios presented in column 7 show that the two types of components come close to being balanced in these measures. In the case of Life 1, the ratio of 0.8 is based on estimates that 26% of the variance reflects affective components and 33% reflects cognitive components (see columns 5 and 6). Furthermore, the affective component is itself evenly divided between positive and negative affect — 13% of the measure’s variance being attributable to each, as is shown in columns 1 and 2. For Life 2, the affect-cognition ratio is nearly the same, at 0.7, as it is for Life 1, and none of the variance component estimates differ in a statistically significant way from those for Life 1.³ For an indication of the extent to which the Life 1 and Life 2 measures are sensitive to feelings about life-as-a-whole, one may refer to column 8 of the exhibit, where it is shown that approximately 60% of the variance of these measures (59% and 61%, respectively) is estimated to tap either affect or cognition (column 8 is the

EXHIBIT 3
Estimated variance components for measures of global well-being in American data

Group	Measure	'True' variance					Total L-A-W		Other variance		Total
		Affect		Cogni- tion	A : C ratio	%	coef	Common methods	Unique		
		Pos.	Neg.							Sum	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
A	Life 1	13%	13%	26%	33%	0.8	59%	0.77	10%	31%	100%
	Life 2	15%	11%	26%	35%	0.7	61%	0.78	10%	26%	97%
B	Sat 7-pt	10%	14%	24%	32%	0.8	56%	0.75	3%	39%	98%
	Sat 3-pt	8%	15%	23%	19%	1.2	42%	0.65	5%	51%	98%
C	Happy 3-pt	19%	14%	33%	15%	2.2	48%	0.69	5%	45%	98%
	Happy D-T	18%	12%	30%	29%	1.0	59%	0.77	10%	29%	98%
D	Change 3-pt	2%	17%	19%	12%	1.6	31%	0.56	5%	64%	100%
	Thermometer	8%	6%	14%	26%	0.5	40%	0.63	0%	60%	100%

sum of columns 5 and 6). Since some readers will be accustomed to 'validity coefficients' as these are reported in the psychometric literature, column 9 reports the measure's estimated sensitivity to aspects of life-as-a-whole in this form — 0.77 and 0.78 for Life 1 and Life 2, respectively. (Column 9 is simply the square root of column 8.) Finally, the model indicates that about 10% of each measure's variance is attributable to common methods effects, and that another 25–31% is attributable to other unique sources (mainly random measurement error).

Thus the first part of Exhibit 3 contains no surprises, and in fact this characterization of the Life measures, while considerably more detailed than those available previously, is in excellent accord with previous analyses of these same data and with validity estimates for these measures when they were included in other data (e.g., Andrews and Withey, 1976, Chapter 6).

The surprises in Exhibit 3 come with respect to the Group B measures — the 7-point and 3-point satisfaction measures. It was expected that including the term 'satisfaction' in the question would make these measures somewhat more cognitive in orientation than the Life measures. That this seems not to be the case, however, can be seen by the affect-cognition ratios in column 7. The 7-point satisfaction measure has a ratio of 0.8, very similar to the Life measures, and the 3-point satisfaction measure has a ratio of 1.2, and hence is somewhat *more* affectively oriented than the Life measures. In fact, the 7-point satisfaction measure differs in only minor respects from the Life measures; it seems slightly less sensitive to both affect and cognition, and the balance of positive and negative affect tilts slightly toward negative affect.⁴

The 3-point satisfaction measure, besides having a surprisingly affective cast, seems notably less valid as an indicator of attitudes about life-as-a-whole (e.g., note columns 8 and 9). While the relatively affective cast of this measure was not expected, its lower overall sensitivity to attitudes about life-as-a-whole is just what one would expect on the basis of this measure's having only three response categories. There is substantial evidence that small numbers of answer categories (2–4) tend to reflect less true variance than larger numbers (5 or more) — see, for example, Cochran, 1968; Connor, 1972; Ramsay, 1973. The results in Exhibit 3 are consistent with this: Three of the four lowest validity coefficients (in column 9) are for measures using 3-point response scales.

The two happiness measures, Group C in Exhibit 3, are, as expected, relatively more affectively oriented than the Life measures (note their affect-

cognition ratios of 2.2 and 1.0). Furthermore, again as expected, the Happy D-T measure is compositionally closer to the Life measures (which use the same D-T scale) than the 3-point happiness measure. The balance of positive and negative affect in both of these happiness measures (which is in favor of positive affect) is just opposite to that in the two satisfaction measures (where negative affect predominates). Finally, one may note that while the 3-point happiness measure has a high affect-cognition ratio, this ratio is high not because the measure is especially sensitive to affective components, but because it is especially *insensitive* to cognitive components; unfortunately, the overall validity of this measure is only modest.⁵

The two measures in Group D – 3-point change and feelings about life-as-a-whole measured on the Thermometer scale – were ones about which we had no clear expectations regarding sensitivity to affect and cognition. In these data the affect-cognition ratios show the change measure to be weighted in favor of affect (and this is mainly *negative* affect – see columns 1 and 2), and the Thermometer measure to be weighted in favor of cognition. However, of all the measures in Exhibit 3, these two seem least sensitive to feelings about life-as-a-whole (note their low validities, in columns 8 and 9, and the large amounts of unique variance, in column 11).

Before describing some of the subsidiary analyses done to check the stability of these findings, or considering the implications these results have for people with practical concerns about measuring well-being, we present the results from the British survey, since in many ways they replicate and extend the pattern of the present findings.

5.2 *Measures in the British data*

The model that was applied to the British data was highly similar to that used for the American data and shown in Exhibit 2. There were only two modifications: (1) instead of including all 10 individual components of Bradburn's scales of Positive and Negative affect, the scales themselves were substituted,⁶ and (2) because the measures used response scales that differed from the American survey, the methods factors had to be altered.⁷

The model applied to the British measures came even closer to reproducing their observed variances and covariances than did the model applied to the American data. The average (absolute) discrepancy between the observed and estimated values was only ± 0.02 , and the highest discrepancy among all 136 was less than 0.12. As may be seen in column 12 of Exhibit 4, the model

came reasonably close to accounting for 100% of the total variance of each measure.

Exhibit 4 presents the main statistical results for the British data and is laid out parallel with Exhibit 3. The British data included no measures in Group A, so the exhibit begins with the Group B measures – those that were expected to be relatively more sensitive to cognitive components than the measures included in Group C. A glance at the affect-cognition ratios in Exhibit 4 will confirm that this is indeed the case for most of the measures: The Group B measures tend to have lower ratios than the Group C measures. In fact, out of 30 comparisons between measures in Group B and C, only two comparisons run counter to the expected direction, and for neither of these is the discrepancy substantial.

Several of the Group C measures – Enjoyable, Fun, and Happy 7-point – appear very heavily loaded with affective components, as does one of the Group D measures. For these measures the affect-cognition ratios range from 4.0 up to 13.5. For example, Exhibit 4 estimates the Enjoyable measure as consisting of 27% affective variance, approximately evenly split between positive and negative affect, and only 2% cognitive variance, for an affect-cognition ratio of 13.5. The Worry measure also has a ratio at about the same level, but here nearly all of the affect is negative affect, a characteristic that seems intuitively reasonable. The Fun measure, in contrast, is estimated to be twice as sensitive to positive affect as to negative affect and (like Enjoyable and Worry) very little influenced by cognitive components. None of these measures with relatively heavy emphasis on affective components, however, shows more than mediocre validity (see columns 8 and 9 of Exhibit 4).

While the broad patterns evident in Exhibit 4 tend to be in accord with our initial expectations, and to replicate the major patterns in the American data, there are some interesting discrepancies between the U.S. and British results.

One can note, for example, that measures that ask about happiness in the British data tend to tilt in favor of negative affect, while the American data showed happiness items tending toward positive affect. (On the other hand, the satisfaction items tilt toward negative affect in both the British and American data sets). One can also observe that Change 11-point, a British measure, seems primarily sensitive to cognitive components, while the 3-point change measure, which occurs in the American data, was more sensitive to affective influences. One can also observe that the estimated validities (columns

EXHIBIT 4
Estimated variance components for measures of global well-being in British data

Group	Measure	"True" variance					Total L-A-W		Other variance		Total
		Affect		Cogni- tion	A : C ratio	%	coef	Common methods	Unique		
		Pos.	Neg.							Sum	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Sat 11-pt	11%	24%	35%	20%	1.8	55%	0.74	1%	45%	101%
	Make sat	13%	18%	31%	25%	1.2	56%	0.75	10%	35%	101%
	Doing well	8%	9%	17%	20%	0.9	37%	0.61	4%	60%	101%
	Successful	12%	14%	26%	16%	1.6	42%	0.65	10%	50%	102%
	Meets needs	9%	18%	27%	23%	1.2	50%	0.71	10%	42%	102%
	Bet than des	8%	7%	15%	8%	1.9	23%	0.48	10%	70%	103%
	Happy 7-pt	10%	30%	40%	10%	4.0	50%	0.71	10%	40%	100%
	Happy 3-pt	12%	20%	32%	15%	2.1	47%	0.69	4%	49%	100%
	Make happy	12%	20%	32%	19%	1.7	51%	0.71	10%	37%	98%
	Fun	20%	10%	30%	3%	10.0	33%	0.57	10%	57%	100%
	Enjoyable	12%	15%	27%	2%	13.5	29%	0.54	10%	62%	101%
	Change 11-pt	1%	7%	8%	14%	0.6	22%	0.47	1%	77%	100%
	Bet future	11%	0%	11%	5%	2.2	16%	0.40	10%	76%	102%
	Worry	2%	24%	26%	2%	13.0	28%	0.53	1%	72%	101%

8 and 9) for measures in the American data tend to come out somewhat higher than in the British data. Whether these differences reflect true cultural differences, or result from different methodological contexts in which the data were collected and analysed, or both, cannot be immediately determined.

One difference between the British and American results that is immediately obvious, but which may be an artifact of assumptions made in specifying the model, is the fact that most measures that can be matched between the two surveys seem more sensitive to affective components in the British data. Note, for example, that the Group B measures in the American data have affect-cognition ratios of about 1.0, but that in the British data the ratios for measures in this group run from 0.9 up to 1.9. While this could reflect a cultural difference, we know from the experimentation described in note 7 that the size of the affect-cognition ratios is heavily dependent on assumptions made in specifying the model (but that these assumptions do not greatly influence the *rank order* of the ratios which are the primary focus of our attention).

5.3 *Further analyses*

In addition to the two main analyses just described, a number of additional analyses were performed to check the stability of the results under alternative assumptions and to see whether certain demographic variables would relate in expected ways to the factors of affect and cognition. One set of subsidiary analyses that checked the sensitivity of the British results to alternative assumptions about the validity of the affect scales has already been described in note 7 and needs only to be referenced here. Several other analyses, however, also merit attention.

Age and education related to affect and cognition. One of the empirical observations that suggested one consider separate factors that might underlie well-being measures was the finding that happiness and satisfaction showed different relationships to the age of respondents. (Happiness declined with age, satisfaction did not.) By adding age (and also education) to the model shown in Exhibit 2, we could examine the relationships of these variables to the unmeasured factors of affect and cognition that we presumed underlay the measures of global well-being.⁸ The results for age were very much as

expected: Age related negatively to both the positive and negative affect factors (-0.25 and -0.22 , respectively), and positively to the cognition factor ($+0.08$). Education showed a different pattern: It related positively to positive affect ($+0.28$), and negatively to the negative affect and cognition factors (-0.07 and -0.12 , respectively). Thus this analysis provided confirmation that the affect and cognition factors as operationalized in the model would relate differently to outside variables, and with patterns that seemed reasonable in the light of previous evidence. Since it was the differing patterns of relationships between well-being measures and age that had stimulated our initial interest in distinguishing affective and cognitive factors, being able to demonstrate that these factors as implemented in our model would indeed relate differently to outside variables was of considerable importance.

The relationship between positive affect and negative affect. One of the assumptions built into the model in Exhibit 2 is that the positive affect factor is statistically independent from the negative affect factor. While this assumption is in accord with Bradburn's findings that the two affect scales were statistically independent from each other and showed different patterns of relationships with other variables, the conclusion about the independence of positive and negative affect has been questioned by other investigators (Cherlin and Reeder, 1975; Brenner, 1975).

The implications of correlated error in the affect items for the observed zero correlation has not been considered in the literature. For example, it is entirely possible that the true underlying correlation between positive and negative affect could be negative but that measures tapping these affects could yield an observed correlation of zero because correlated errors would essentially cancel out the 'true' negative relationship, particularly after this had been attenuated by the effects of random error. This is a topic that needs further investigation.

In fact, tests with our model show that a good fit to the data could be achieved assuming *any* relationship ranging from 0 to -1.0 between the affect factors simply by allowing compensating changes in the impacts of Methods factor C. Thus it was important to see whether the basic conclusions described earlier regarding the order of the measures with respect to their relative sensitivity to affect and cognition would change if the positive and negative affect factors were allowed to be related to one another.

Accordingly two further models were run in which the affect factors were related to one another -0.50 and -0.88 . The affect-cognition ratios continued to order the measures in essentially the same way as in Exhibit 3 (where the relationship between the affect factors was fixed at zero).⁹ Hence our major conclusions are not dependent on the assumption of independence between the affect factors. Furthermore, not only does the order of the measures on the affect-cognition ratio stay about the same, but so also do the values of the ratios themselves. For example, the Life 1 measure has an affect-cognition ratio of 0.8 under the assumption of independence between affect factors (as shown in Exhibit 3) and 0.9 when we assume the affect factors correlate -0.88 .

The relationship between the affect factors and the cognition factor. Another assumption incorporated in the model in Exhibit 2 is that cognition is appropriately defined as being statistically independent of affect. While such a definition for cognition has an appealing elegance and simplicity to it, one could imagine counter-arguments that would suggest that relationships might occur between cognition and the two affect factors. Are the results presented earlier sensitive to what one assumes about these relationships? Although we have not actually run versions of the basic model that incorporate this change, other modelling work we have performed is instructive on this point. In the basic model (Exhibit 2), cognition is essentially a correlated residual: Cognition is what well-being measures have in common that is not affect and not shared methods effects. If cognition were allowed to be related to the affect factors, the cognitive factor would no longer be a pure residual but would also provide an alternative linkage between measures of well-being and the items in the affect scales. The effect would be that the measures would be estimated to be relatively more sensitive to cognitive components and less sensitive to affective components. Although the affect-cognition ratios would tend to decrease, there is no reason to expect that the relative positions of the measures according to these ratios would change. In short, the basic pattern of results reported previously would remain stable.

6. SUMMARY AND CONCLUSIONS

Beginning from the observations that measures of perceived well-being are attitudes, and that prior research suggests that attitudes include affective

and cognitive components, we have analysed a substantial set of evaluations of life-as-a-whole (23 measures in all) to try to determine the extent to which each reflects affective, cognitive, and other components.

We find that the measures do indeed differ in a number of interesting ways that are of potential importance both theoretically and practically. Most of these differences are in close accord with what a careful consideration of the content and form of the item and its response scale would lead one to expect. Furthermore, the patterns of differences are basically similar in two representative but independent sets of data – one collected in the United States, the other collected in Great Britain.

For most of the measures examined, the total variance has been apportioned among five different components by using a structural modelling approach. These components are: positive affect, negative affect, cognition, common methods effect (mainly correlated error), and unique effects (mainly random error). Except for the fact that together these components should account for 100% of a measure's variance, each of these components is free to vary in any amount, and the resulting range of possible 'mixtures' could be – and in fact was found to be – substantial.

The estimated composition of each measure, i.e., the extent to which each measure reflects each of the five components, has been fully described above, and here only three of the main trends will be summarized.

1. If one considers the *ratio of affective to cognitive components*, one finds that some measures are much more affectively oriented than others. This finding, replicated in both the British and American data, is one of the basic justifications for distinguishing these components. Doing so represents a conceptual and statistical refinement over a common past practice of considering that all global measures are simply reflections (perhaps to differing degrees) of a single underlying factor, feelings about life-as-a-whole. Measures that ask about happiness, fun, and enjoyableness (in addition to Bradburn's scales of positive and negative affect) fall in the group for which relatively high affect-cognition ratios were observed. On the other hand, items that employ the term 'satisfaction' and/or that involve comparisons with implicit or explicit criteria tend to have lower affect-cognition ratios.

2. One can also consider the *ratio of the two types of affect* – i.e., whether the measure tilts toward positive or negative affect, or is reasonably balanced between the two. The data suggest that satisfaction measures tend to tap more negative than positive affect and that in the United States (but

not in Great Britain) the reverse is true for happiness measures. In the British data, an item that asked about fun was much more sensitive to positive than negative affect, whereas an item that asked about worries was heavily loaded with negative affect.

3. Still another way measures can be compared is with regard to the *ratio of their estimated true variance to total variance* – i.e., the percentage of their total variance that is estimated to tap feelings about life-as-a-whole rather than reflecting common methods effects or unique sources, most of which would probably be random errors. In one sense, this is an examination of the internal validity of the measures. There was a rather consistent tendency for measures employing 3-point response scales to show lower validities than measures with scales having more response categories. It also appears that explicitly comparative measures, i.e., ones that involve comparisons over time or with other groups, are markedly less valid as reflectors of absolute evaluations of life-as-a-whole than are measures that call for a direct assessment.

Given that different measures are differentially sensitive to positive affect, negative affect, cognition, and other (mainly error) factors, as this analysis and others reported by McKennell (1978) and McKennell and Andrews (1980) have shown, it seems important that designers, analysers, and users of surveys that assess perceived well-being should be sensitive to some of the issues involved. If one wants to assess absolute evaluations of perceived well-being, then one should seek measures that do this well; these will be the measures with relatively high validity coefficients. However, one faces further decisions regarding the desired mixture of affects and cognition: mainly cognition, mainly positive affect, mainly negative affect, or some balance among the three. Unfortunately, the issues do not stop with making these choices, because the current portfolio of available measures is far from complete and the ideal measure for a particular purpose may not exist.

While we believe that a useful start has been made toward furthering knowledge about the nature and characteristics of well-being measures, there is much further research and development that needs to be undertaken. The list of activities would include at least the following: (1) The present paper deals exclusively with well-being measures at the global level, i.e., ones that assess life-as-a-whole. Theoretical considerations we have laid out elsewhere (McKennell and Andrews, 1980) strongly suggest that the separate influences of affect and cognition also need to be explored at the level of

evaluations of specific life concerns ('domains'). So far as we know, no appropriate data for doing this now exist, but they could be developed. (2) As just noted above, even at the global level the portfolio of available measures is far from complete. Work needs to be done to develop valid measures that would have more purely cognitive orientations. (3) We believe that the question of what negative relationship, if any, exists between positive and negative affect needs investigation. As reported above, some initial analyses show that the surprising (but replicable) zero relationship between measures of these factors could be attributable to correlated methods effects. Further work on affect that makes due allowance for random and correlated errors in measurement and that examines how the affect *factors* relate to a variety of outside variables would be useful. (4) Finally, we feel that much additional work needs to be undertaken regarding the differential relationships of affect and cognition to a wide variety of outside variables: respondents' behaviors — past, current, and future, respondents' demographic characteristics, and respondents' social settings as assessed by 'objective' social indicators. As noted previously, hints of such differential relationships led to the present investigation, and we have reported above that our modelling analyses were responsive to such differences, but this topic has only been opened. This fourth undertaking seems a particularly promising approach both for suggesting how people come to evaluate their lives as they do (a basic *causal* question for research on social indicators) and for suggesting some of the implications of people's evaluations (a basic *effects* question).

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NOTES

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¹ In this counting Bradburn's scales of positive and negative affect are treated as single measures. Each of these scales is based on five items (as shown in Exhibit 1), and in the

analysis of the American data these individual items, rather than the composite scales, were used.

² As is common practice in analyses of this type, all variables were standardized prior to being analysed – i.e., transformed to have means of zero and variances of 1.0. This transformation has no effect at all on the main substantive results presented here but makes many of the parameter estimates more immediately interpretable.

³ The LISREL program computes standard errors for the model's parameter values, and none of the parameters involving Life 1 and Life 2 differ by even as much as one standard error.

⁴ These comparisons between the Satisfaction and Life measures, as well as other comparisons to be discussed later, raise issues of the statistical significance of the observed differences. While theory as well as statistical significance needs to be considered in interpreting a set of results (Morrison and Henkel, 1970), we have performed about forty tests on selected differences shown in Exhibits 3 and 4 using a test described by McNemar (1972, p. 140). (This test compares two relationships computed for the same set of respondents and is relevant because the measurement model parameters used to derive Exhibits 3 and 4 may be thought of as factor loadings or correlation coefficients.) The overall pattern of results from these significance tests is clear: Given the sizes of our samples, most differences in Exhibits 3 and 4 of 8 percentage points or more meet conventional criteria for statistical significance ($p < 0.05$), and most differences of 5 to 7 percentage points are at the margin of statistical significance ($0.05 < p < 0.1$).

⁵ In addition to the Group C measures shown in Exhibit 3, the analysis included the 10 items that compose Bradburn's scales of positive and negative affect. Although these items are not the primary focus of this report, in order that all estimates from the model may be available, we here report the estimated variance components for these 10 measures. The percent of variance attributable to positive affect in the first five items (ordered as shown in Exhibit 2) was: 12%, 27%, 43%, 22%, and 34%; the percent of variance attributable to negative affect in the second five items was: 19%, 37%, 31%, 51%, and 11%; the percent of variance attributable to a common methods effect in all 10 items was 2%; and the percent of variance estimated to be unique in each item was: 86%, 70%, 55%, 76%, 64%, 78%, 61%, 67%, 47%, and 86%. Although Bradburn's positive and negative affect scales *Themselves* were not included in the analysis of the American data, by knowing the relationships between those scales and other global measures, and the estimated variance composition of the global measures (reported in Exhibit 3), we can estimate that both the Positive affect and Negative affect scales have validities of approximately 0.87 (i.e., that approximately 76% of each scale's variance represents the intended affect factor and that approximately 24% is error).

⁶ The use of single multi-item affect scales to define the affect factors rather than five separate items required an a priori estimation of the validity of these scales. After examining the American data, where our results suggested the multi-item affect scales would each have had validity of about 0.87 (see note 6), and after finding somewhat lower relationships among the individual affect items in the British data, an estimated validity of 0.80 was used. Several alternative validity values (0.87, 0.70, 0.50) were also tried, and it was determined that while the assumed validities of the affect scales have a substantial effect on the estimated affect-cognition ratio for the measures (column 7 in Exhibit 4), and for the statistics on which this ratio depends (columns 3–6), the *rank order* of the measures with respect to this ratio tends not to change markedly. (Land and Felson (1978) discuss the rationale behind this kind of exploration of the sensitivity of results to assumptions made when specifying the model.)

⁷ Three separate types of response scales are represented among the 14 measures of global well-being in the British data and shown in Exhibit 4. These are: 3-point scales (Doing well and Happy 3-point), 11-point scales (Sat 11-pt, Change 11-pt, and Worry), and 7-point scales (all 9 remaining measures). As in the model shown in Exhibit 2, a

separate methods factor was defined for each type of response scale and linked to all measures that employed that scale. All the links from any one methods factor were constrained to have equal parameter estimates. (In order for this equality constraint to work as intended, it was necessary that all measures be scored in the same direction, i.e., numerically higher scores had to imply more positive evaluations, and since four of the measures –Enjoyable, Fun, Worry, and Change 11-pt – had been presented to respondents in the opposite direction, their scores were reversed.)

⁸ Incorporation of age and education into the model shown in Exhibit 2 was accomplished by adding age and education to the list of observed measures, by adding an age factor and an education factor to the set of unmeasured variables, by fixing the linkage of each of these two factors with its respective indicator at 1.0, and by estimating all the linkages involving these two new factors and the previous three substantive factors, positive affect, negative affect, and cognition. As the analysis was actually run, all previous free and constrained parameters were re-estimated, but most changed very little from what has already been reported in Exhibit 3.

⁹ In the most extreme case (assuming a -0.88 relationship between the affect factors), the order of the measures on the affect-cognition ratio was: Thermometer, Life 1, Sat 7-pt, Life 2, Happy D-T, Sat 3-pt, Change, and Happy 3-pt. This sequence has a rank order correlation of $+0.9$ with the order shown in Exhibit 3.

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