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A STATISTICAL ANALYSIS OF WEIGHTS IN COMPOSITE QOL INDICES

Editor's Note: In a recent article published in Sociological Methods and Research, Michael Hagerty and Ken Land study the statistical foundations of how to construct composite or summary indices (e.g., Quality of Life indices) for a social unit (e.g., cities, states, nations) that will be endorsed by a majority of its citizens. Since this problem is of central importance to the Social Indicators/ Quality-of-Life/ISQOLS communities, we present an abbreviated version of the article here. For full details, mathematical proofs and citations/references to other publications, readers are referred to the SM&R article:

The Problem

The past decade has seen increased interest among social scientists in the construction of summary or composite indices of social well-being, or as they have come to be termed, "Quality-of-Life" (QOL) indices. This work coincides with a general interest in the subject among individuals, policy makers, and political leaders, who view such indices as possible yardsticks for measuring their successes or lack thereof.

Hagerty, Michael R. and Kenneth C. Land 2007 "Constructing Summary Indices of Quality of Life: A Model for the Effect of Heterogeneous Importance Weights," Sociological Methods and Research, 35(May):455-496.

There is, however, little agreement among sociologists and other social scientists on methods for aggregating social indicators to create a QOL index that is useful for public discourse on social well-being and policy issues relevant thereto. Some researchers even argue that no summary index should ever be computed. They cite two important barriers to QOL indices. The first is that the concept of QOL is too general to be useful. Critics point to the problem that QOL is a composite indicator whose components (e.g., crime rate, GDP/capita, environmental damage) are not highly correlated, nor are their causes identical. Hence traditional factor analysis would recommend that these components be treated as separate factors. While these diverse components probably should not be combined into a single first-order factor, it is possible that QOL could be considered a higher-order factor (a factor analysis of first-order factors). Moreover, a QOL index can be useful in considering how people make emigration decisions ("Is the QOL of one state higher than my current residence?"), and in how people make political decisions ("Am I better off today than 4 years ago?"). These decisions require individuals to integrate many *objective* indicators into a single *subjective* evaluation of whether they should move, or whether they should agitate against the incumbent. QOL research has shown that people in many nations are able to form reliable judgments of their subjective QOL (often measured by national surveys as overall satisfaction or happiness with life as a whole) as a function of objective indicators such as personal income, political freedom, degree of physical health, marital status, race, inequality, and other variables. In spite of the cognitive difficulties in combining these various objective indicators, people appear to do so reliably and to use their judgments in important social decisions.

Finally, a QOL index can be very useful to policy makers, who need to know the relative contribution of each social indicator (e.g., unemployment, crime rate, divorce) on citizens' perceived well-being, so that they can target interventions and budgeting to each indicator area. For example, economists have recently shown that the national unemployment rate is more important to overall QOL than the national inflation rate. Therefore, we address issues raised by the stream of research that considers QOL to be a measurable and useful concept.

A second fundamental reason for questioning the usefulness of QOL is that individuals, policy makers, and researchers themselves disagree on the relative importance weights that each social indicator should have in a summary QOL index. Without agreement on the importance of each social indicator, chances for agreement on the overall QOL index would seem slim. Social science research can reduce disagreement substantially by establishing the effects of various objective variables on citizens' QOL (measured by questions on life satisfaction or happiness). But such research can never completely eliminate heterogeneity in subjective weights, because each individual deviates somewhat from the average effect (this is the rationale underlying random-effects

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models). For example, people will always differ on how much they value additional income, due to individual differences such as how materialistic their values are. Hence the common call for "doing more research" is not likely to eliminate all heterogeneity from individuals' judgments of QOL. Instead it is useful to pose the question "*How much* heterogeneity is possible in a society wherein a majority of members still can agree on a single QOL index? Some minimal level of agreement is necessary in every society to pursue shared goals.

A formal analysis has not previously been done on how heterogeneity affects chances for agreeing on a social index. The Hagerty-Land paper fills this gap and proves results that are not predicted by intuition. In particular, the present paper (1) specifies a model for how individuals disagree with each other on QOL judgments, (2) predicts how much disagreement results from various types of QOL indices and various distributions of weights, and (3) recommends QOL weights that maximize agreement among individuals.

We hasten to note that much research on social well-being can be conducted without any overall composite or summary index of QOL – by examining individual components of quality of life (e.g., public health, education, income, etc.). It is more parsimonious to avoid assuming any higher-level construct when interest is restricted to one component of QOL, or when all lower-level components agree. But when lower-level components of QOL *disagree* in sign, the inevitable question arises, "What is the *net effect* of these conflicting social indicators on individuals' QOL?" This query sometimes is posed more brutally by individuals and politicians with the question, "Are we better off than x years ago?" To answer this type of question, people must transform the many objective indicators (such as unemployment, political freedom, and crime rate) into a subjective judgment of overall QOL. Psychologists term this process the psychophysical transformation. The Hagerty-Land paper models this transformation using previous work in QOL and examines implications for societal agreement. If some level of societal agreement exists, then it will be easier to create political agreement on which QOL indicators to target for budgeting and intervention. Moreover, publicly available QOL indices could provide powerful shorthand descriptions for overall trends in QOL, much as the Dow-Jones Industrial Average is a powerful public index of the performance of more than 5,000 stocks in the U.S.

The Model

We now specify a model for assessing the degree of agreement between two QOL indices when importance weights for component indicators differ among individuals. Define **X** as a matrix with K columns and N rows. The columns record the scores from K social indicators (e.g., Gross Domestic Product per capita, Gini coefficient of income inequality, divorce rate, etc.) on each of the N social units (e.g., cities, states, nations). Define $\mathbf{W}_i$ as the weighting (column) vector of individual i, measuring how important each social indicator is to that person. Then i's QOL judgment of social unit n is the sum of the K social indicators, weighted by person i's *importance weights for each indicator k* or, for short, *importances*:

$$Q_{in} = \sum_{K} w_{ik}\, x_{kn}, \qquad w_{ik} > 0, \text{ for n = 1,…, N social units} \qquad (1)$$

Though this model may appear restricted to linearity, it can also incorporate non-linear effects by adding a new variable that is some function of the old indicator (e.g., log (GDP/capita)). The general additive model has been successful at approximating many more complex functions, and some research has found that people use an additive model in direct tests of how people judge others' quality of life.

We constrain each weight to be a non-negative number (that is, only positive or zero weights are allowed). Hence we assume that any indicators that are negatively related to QOL (e.g., infant mortality) are reversed in sign to allow positive importance weights. This assumption that everyone has positive weights is probably not controversial for social indicators such as GDP/capita and infant mortality, where everyone prefers more money and better health, given that all else is held constant. But it may be controversial for indicators such as divorce rate, where some people may view higher divorce rate as reflecting more freedom for women, but others view it as a decline in support for children. In such a situation, one could add indicators for the omitted variables (women's freedom, support for children) to assure that weights are positive for all individuals.

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Note that multiplying all weights by a constant c simply expands the QOL index by the factor c and does not change the ordering of the social units being rated. Therefore, without loss of generality, we divide each person i's weights by Sw_{ik} so that all k weights sum to one for each i.

Finally, the linear model in Eq. 1 should not be confused with the simple utilitarian model of Bentham, where utilities of *individuals* are summed to get social welfare, ignoring inequality among individuals. In contrast, Eq. 1 allows some of the indicators to be measures of the overall stratification of income or wealth (positional information), as well as measures of individuals' freedom (called non-utility information by Sen). Hence the model in Eq. 1 offers great flexibility in modeling individuals' evaluations of QOL.

As noted previously, QOL indices may be used either in cross-sectional or over-time comparisons. The goal in cross-sectional comparisons is to evaluate a social unit relative to other social units. This may, for example, allow people to decide in *which* nation they should live (e.g., the International Living Index) or which nation is in more need of development assistance (e.g., Richard Estes' Index of Social Progress). In the case of over-time comparisons, QOL indices rate multiple time periods in the *same* social unit (time-series), to decide whether QOL has increased or decreased over time in that entity. The goals in the time-series case are to provide information for informing individuals about QOL changes over time, to fuel a public policy debate, and to decide whether policies are successfully improving QOL within a given country (though of course, many uncontrolled variables will also influence QOL). It is desirable to find a measure of agreement that will be useful in both of these cases.

For this purpose, we propose to use the familiar Pearson correlation coefficient to measure levels of agreement between the QOL judgments of individuals i and j, denoted by A_{ij}. The correlation coefficient has a number of desirable properties for measuring agreement. It has finite limits between –1 (complete disagreement) and 1 (complete agreement), and its statistical properties are well researched. It already has been widely used as a measure of inter-rater agreement, and as a measure of similarity between persons in cluster analyses. Another attractive property of the Pearson correlation coefficient is that certain values represent important levels of agreement among people. The first is naturally $A_{ij} = 1$, where perfect agreement occurs between the QOL indices of i and j. The second is $A_{ij} = .7$, which is the common cutoff among researchers for assessing agreement between raters. Agreement between raters is not expected to be perfect, but the .7 cutoff implies that about 50% of the variance in one rater should be predictable from the other ($r^2 > .5$). The third noteworthy level of A_{ij} is zero, because this is the point above which the QOL index of individual i agrees *in direction* with that of j. To see this, take the limiting example of QOL evaluations of year t and year t+1. Then $A_{ij} > 0$ implies that the raters agree on whether the nation's QOL has *increased or decreased during that time*. This is a fundamental question that often helps define similar political parties, social classes, and interest groups. In the next section, we use the Pearson correlation coefficient to calculate the agreement between any two individuals whose importance weights differ among social indicators.

The use of the Pearson coefficient to measure agreement between individuals' importance weights is appropriate even in the case that the weights are measured by the conventional 1 to 3 (or 5) rating scales of sample surveys – as long as one seeks only to draw conclusions about the measurements (i.e., the 1-to-3 (or5) ratings) themselves. For example, if we want to test the hypothesis that the mean importance weights of two component indicators are equal, then we need not be further concerned about measurement models. If, however, we want to draw conclusions about the underlying latent dimension of importance of the component indicators to the individuals surveyed, then we either must use a measurement procedure for the importance weights (such as conjoint measurement) that gives interval-scale properties to the measured importance weights or use a measurement model such as a Rasch model that relates the measured weight scores to the latent dimension in a possibly nonlinear way and thus produces non-equal-intervals among the measured weights. To date, there are no studies of the relative importance of component indicators of QOL composite scores that use anything other than the standard rating scales of sample surveys. Accordingly, the model and analyses we present can be regarded as pertaining to the properties of these weights viewed as measurements themselves and as approximations to the individuals' underlying latent dimension of importance of the component indicators that may not take into account possible nonlinear relationships to the underlying dimension.

Agreement Between QOL Indices When Importance Weights Differ

The weighted sum in Eq. 1 is more compactly designated in matrix notation as:

$$\mathbf{Q_i} = \mathbf{X}\mathbf{W_i}, \qquad (2)$$

where $\mathbf{Q_i}$ is a N x 1 column vector of summary (or composite) index values (or scores) of individual i for each of the n = 1, …, N social units, $\mathbf{X}$ is a N x K matrix of values of the K social indicators for each of the N social units, and $\mathbf{W_i}$ is a K x 1 column vector of weights of person i for the K social indicators in $\mathbf{X}$. We assume, without loss of generality, that each social indicator in $\mathbf{X}$ has already been standardized, so that the mean of each column of $\mathbf{X}$ is zero and standard deviation is one. The resulting composite scores $\mathbf{Q_i}$ will also have a zero mean, since the original indicators had zero means. But in general the composite scores will *not* have standard deviation of one. Our goal then is to find the *correlation A_{ij} between the QOL indices of individuals i and j, with different weight vectors*, $\mathbf{W_i}$ and $\mathbf{W_j}$.

By definition of the correlation coefficient,

$$A_{ij} = 1/(N\text{-}1)\ S_i\ \mathbf{Q_i^T}\,\mathbf{Q_j}\ S_j, \qquad (3)$$

where N is the number of social units rated, S_i is the inverse of the standard deviation of the QOL index for person i (used to standardize the scores $\mathbf{Q_i}$), and $\mathbf{Q_i^T}$ denotes the matrix transpose of $\mathbf{Q_i}$. The term $1/(N\text{-}1)\,\mathbf{Q_i^T}\mathbf{Q_j}$ is the covariance of the QOL indices, which after standardization is the correlation coefficient between $\mathbf{Q_i}$ and $\mathbf{Q_j}$.

Analysis of the Model

We now state several propositions that summarize properties of this model for measuring agreement between QOL indices for different individuals.

Proposition 1: The correlation A_{ij} between any two individuals' QOL indices is a function not only of the two individuals' weights, but also is moderated by the correlations among the social indicators $\boldsymbol{R_x}$.

In fact, even when two persons' weights are diametrically opposed, A_{ij} can be surprisingly high because $\mathbf{R_x}$ acts as a lower limit on agreement.

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Proposition 2: When all correlations among the K social indicators $\mathbf{R}_x$ are positive, then all individuals will agree on the direction of the QOL index ($A_{ij} > 0$), regardless of the distribution of weights.

This result is useful in applications, because many QOL indices have social indicators that are all positively correlated.

Proposition 3: The maximum agreement A_{ij} is 1 and occurs when $\mathbf{W}_i = \mathbf{W}_j$, (when the individuals' weights agree). The minimum value of A_{ij} for two social indicators (K = 2) is r, and occurs when $\mathbf{W}_i$ is orthogonal to $\mathbf{W}_j$, (i.e., $\mathbf{W}_i = [1,0]^T$ and $\mathbf{W}_j = [0,1]^T$ so that each individual places all their weight on different indicators). When K > 2, the upper bound on the minimum is r_{min}, the minimum correlation between the social indicators.

Proposition 3 confirms the common intuition that agreement is maximized when people have the *same* weights on social indicators, and agreement is minimized when people have *opposing* (orthogonal) weights on social indicators. But intuition does not reveal the magnitude of the minimum $A_{ij} = r_{min}$. Note that the minimum correlation is *not zero*, but may be higher or lower, depending on r_{min}.

The next proposition considers not just the minimum and maximum for A_{ij}, but the entire area where agreement is positive ($A_{ij} > 0$).

Proposition 4: When some correlations among social indicators $\mathbf{R}_x$ are negative, then some persons in the group may disagree on the direction of the QOL index ($A_{ij} < 0$). But the area where people agree appears to rise quickly toward 100% as r_{min} rises toward zero. Specifically for the case of two social indicators (K = 2), even when r is extremely negative (r = -.9), over one half of the area (59.8%) results in agreement on the direction of the QOL index.

We now consider whether researchers can construct a QOL index that will maximize agreement among individuals. Let **Z** be any vector of weights that is a linear function of individuals' weights $\mathbf{W}_1, \mathbf{W}_2, \mathbf{W}_3, \ldots$. Then we prove (in the Appendix) that the choice of **Z** that maximizes agreement over all individuals is simply the mean weight vector across individuals, $\underline{\mathbf{W}}$.

*Proposition 5: There is **a unique weighting** for any QOL index that maximizes the agreement A with the index over all individuals i in the population. This unique weighting for the QOL index is $\underline{\mathbf{W}}$, or the average weights (calculated over all individuals in the population).*

Proposition 5 is helpful only if the distribution of weights is already known, as from a survey. If individuals' importances are not known, then what weights should be used to create the QOL index in order to reduce the risk of disagreement most? This question is answered in the next proposition.

*Proposition 6: When individuals' weights are not known, then the unique weights **Z** that minimizes maximum possible disagreement over all possible distributions—the **minimax estimator**—is equal weighting: $\mathbf{W}_E = [1/K, 1/K, 1/K, \ldots]^T$.*

Applications to QOL Indices

These six propositions specify some intriguing and not intuitively obvious properties of the model (Eq. 1 or 2). In the Hagerty and Land (2007) paper, we gave extensive examples of their application. We briefly summarize a few of these here.

Example 1: Human Development Index 2001. The Human Development Index (HDI) is an example of a QOL index that can be used to make cross-sectional comparisons among social units – in this case, nations. (Recent versions also report time-series trends over 25 years, so it can now be used for time-series analyses as well.) The HDI is published annually by the United Nations Human Development Program. It is calculated from three social indicators: log (Gross Domestic Product) in Purchasing Power Parity, life expectancy in years, and education (a weighted average of literacy rate and school enrollment rate). These three indicators are first transformed so that their ranges are equal and then are averaged (with equal weights) to derive the HDI index. A HDI score is calculated for each nation for which data on these three indicators are available. Nations then are arrayed from the most to the least developed with respect to these indicators of human development. The annual United Nations Human Development Program reports do not justify why the indicators are weighted equally. How much would the HDI change if the weights change? Do individuals (or members of any social group) hold equal weights for those indicators? Do individuals hold such diverse weights that no index can capture the views of the group? Unless we know the answer to this, computing a summary index seems premature.

To begin the analysis, we first compute the correlations among the individual social indicators R_{xx}. We computed these from the published data for the HDI 2001 for 162 nations, as shown in Table 1(a). The correlations are all significantly different from zero and are quite high. These high correlations are consistent with previous findings on cross-sectional social indicators at the nation-level. The consequence is that any resulting QOL index formed from these social indicators also would have high agreement among individuals.

To see this, we can use Proposition 3, which states that the minimum agreement will be r_{min} in Table 3a, or +.77. Thus, we have the surprising conclusion that even people with diametrically opposed weights would have QOL indices that have correlation $r_{ij} = +.77$. The intuitive reason for this is that the underlying social indicators are near substitutes for each other. *Hence even people who disagree on the ethically appropriate weights can still agree on their QOL indices for the specific countries and time periods in question.* The correlation of +.77 is within the common findings for test-retest reliability of a single measure. Hence, for the HDI, even worst-case weights will yield indices that are equivalent for most purposes.

Table 1. Correlations among social indicators from (a) the HDI 2001 and (b) the HDI and Gini Coefficient.

(a)

	(1)	(2)	(3)
(1)log(GDP/capita)	1		
(2)Life Expectancy	.82	1	
(3)Education	.77	.79	1

(b)

	(1)	(2)	(3)	(4)
(1)log(GDP/capita)	1			
(2)Life Expectancy	.85	1		
(3)Education	.80	.82	1	
(4)1-Gini Index	.40	.40	.30	1

Proposition 3 gives the minimum of A_{ij} for the HDI 2001. But it is important to find the entire distribution of agreement among all pairs of individuals, to gauge overall agreement in the population. To estimate the distribution, Proposition 1 states that we must know not only the correlations among social indicators R_x, but also the distribution of individuals' weights. We therefore

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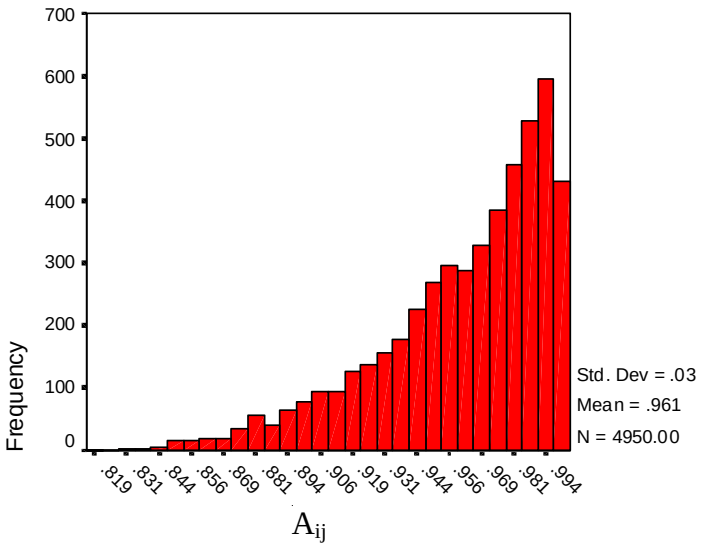
examine several benchmark distributions of weights. We first examine a uniform distribution. In a later section we examine actual distributions of importance weights that are drawn from surveys.

To specify a first reasonable benchmark for distribution of weights in the population, we assume a uniform distribution, simulating 100 draws from a population whose importance weights are uniformly distributed along the unit interval [0,1]. We used standard sampling methods to create random draws from this multivariate distribution known as the Dirichlet distribution. The resulting distribution of A_{ij} over all 4950 possible pairs of the 100 individuals is shown in Figure 1. As predicted by Proposition 3, all correlations are positive, despite the fact that some individuals had diametrically opposed weights. As predicted by Proposition 3, the minimum A_{ij} in the simulation is .82, above the theoretical minimum of .77. In fact, the distribution itself is more positive than predicted by the propositions, because it is skewed toward the maximum of one. Despite the intuition that the distribution of correlations among pairs of individuals on a QOL index composed from uniformly distributed weights might itself be uniform, the actual distribution is heavily skewed toward the maximum of one. This is good news for agreement among individuals. The average correlation A_{ij} in Fig. 1 among people was +.97, with standard deviation of .028. Over 93% of all possible pairs had correlations above +.90. This is far higher than many would expect, when weights are distributed uniformly.

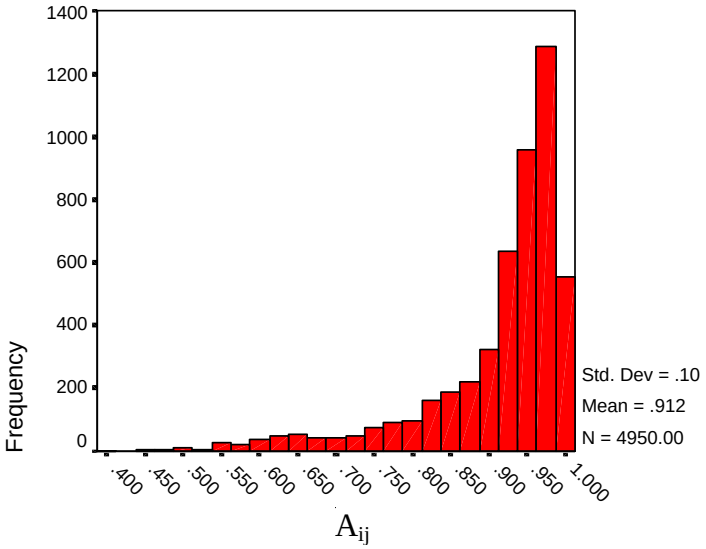
Figure 1. Histogram of A_{ij} over all 4950 possible pairs of 100 simulated individuals with weights generated from a uniform distribution for social indicators: log(GDP/capita), life expectancy, and education in Example 1.



Example 2: GDP per capita and Income Equality. One of the reasons that weights don't matter in the HDI 2001 is that the underlying social indicators are highly correlated (e.g., the correlation between GDP per capita and health was .82). This is reasonable because all of the social indicators collected are meant to be measures of human development. When multiple measures of the same underlying construct are used, then we would expect them to have high correlations with each other. A more challenging example is the relationship between income equality and GDP per capita. These concepts are clearly different, and theorists have argued whether the direction of the relationship is positive or negative. The United Nations *Human Development Report* (2001) reports, in a supplementary table, income equality measures for 111 nations – the largest number ever reported in a single source. We extracted the most common measure of inequality, the Gini coefficient of income distribution. Since the Gini coefficient varies from 0 (no inequality) to 1 (maximum inequality), we reversed its direction by using the transformation (1-Gini). Hence all importance weights remain in the positive quadrant. The correlations between Equality (1-Gini) and the three HDI indicators over the 111 nations are shown in Table 3(b).

Note first that the intercorrelations among the three HDI indicators for the 111 nations (Table 3(b)) are quite similar to the ones computed over all 162 nations (Table 3(a)), and all correlations in the table are significantly different from zero. Note also that the simple correlation between GDP/capita and income equality is +.4. This figure is lower than those in the HDI, but is significantly greater than zero, and is consistent with multivariate results. How do different weightings affect a QOL index that includes not only HDI but also Equality?

Figure 2. Histogram of A_{ij} over all 4950 possible pairs of 100 simulated individuals with weights generated from a uniform distribution for social indicators: log(GDP/capita), life expectancy, education, and (1-Gini).



As in Example 1, a benchmark distribution of 100 random individuals with uniformly distributed weights was generated. The resulting distribution of A_{ij} of all 4950 possible pairs of the 100 individuals is shown in Figure 2. Again, as predicted by Proposition 2, all correlations are positive, despite the fact that some individuals had diametrically opposed weights. As predicted by Proposition 3, the minimum A_{ij} in the simulation is .40, equal to the theoretical minimum of .40. Again, the distribution itself is more positive than predicted by the propositions, because it is skewed toward the maximum of one. The average correlation A_{ij} in Fig. 2 among people is +.91, with standard deviation of .01. Over 94% of all possible pairs had correlations above +.70 (the usual criterion for assessing good inter-rater reliability).

Example 3: The Index of Social Health. The Index of Social Health (ISH) was developed by Marc Miringoff and associates. Using the United States as the social unit to be indexed, the ISH is based on

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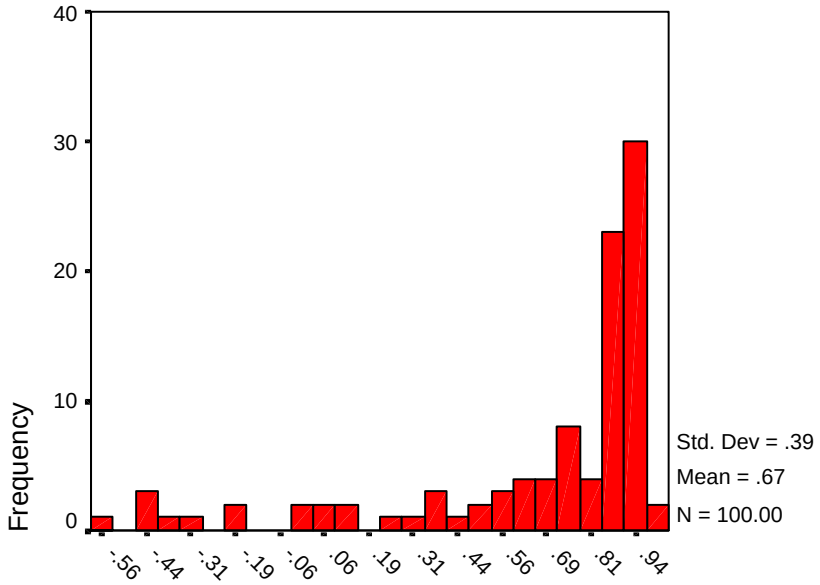
16 social indicators tracked annually from 1970 to the most recent year available: average weekly earnings, life expectancy at age 65, gap between rich and poor, violent crime rate, infant mortality, child abuse, children in poverty, teenage suicide, drug abuse, high-school dropout rate, teenage births, unemployment, health insurance coverage, poverty among those over 65, alcohol-related traffic fatalities, and housing affordability. Rates for these indicators for any specific year are indexed as percentages of their values for the year in which they had their "best practice" or best performance value. They are then averaged with equal weights to obtain the value of the ISH for a specific year.

To our knowledge, the correlations among these indicators have not been published. Using the raw data from Miringoff's research, the Hagerty-Land (2007) article computed the correlations for the 16 indicators. Contrary to the previous cross-sectional examples, many large negative correlations were found. For example, average weekly earnings is correlated at -.921 with life expectancy at age 65. (while life expectancy increased over time, weekly earnings of hourly workers declined). These large negative correlations provide the conditions for conflicting policy recommendations and for very low agreement among individuals on the resulting QOL index.

Proposition 3 predicts that the lowest agreement among pairs of individuals will be r_{miin} for these correlations or -.94. How much agreement would actually result from this QOL index with a population whose weights were uniformly distributed? Using the technique in Example 1 to generate individuals with uniformly distributed weights, we find levels of agreement that are surprisingly high. Average A_{ij} is +.40, with a standard deviation of .45, but again the distribution is strongly skewed toward one, with fully 80% of the 4095 paired comparisons resulting in $A_{ij} > 0$, and 34% of paired comparisons with $A_{ij} > .7$.

Proposition 6 predicts that the equal-weighting QOL should generate maximum agreement among uniformly distributed individuals. The distribution of agreement between the equal-weight QOL index and the 100 simulated individuals is shown in Figure 3. The mean $A_{E,i}$ is +.67 with standard deviation of .39. What was not predicted was the skew toward one, resulting in 67% (a supermajority) of individuals with $A_{E,i} > .7$, and 89% with $A_{E,i} > 0$.

Figure 3. Distribution of $A_{E,i}$ agreement between the equal-weight QOL index and the 100 simulated Individuals for the 16 social indicators of the Index of Social Health.



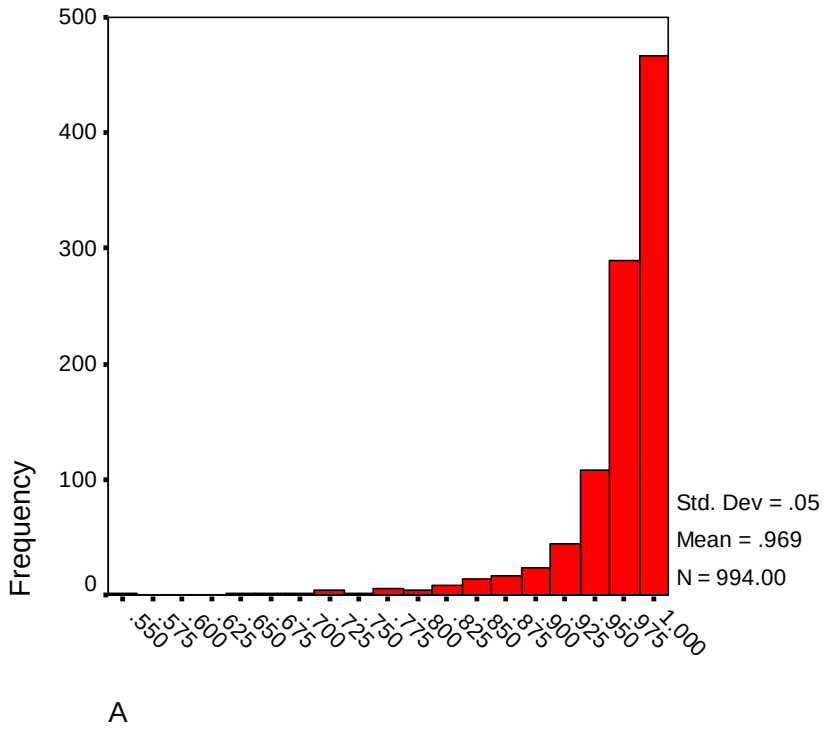
Example 4: Importance Weights from Sample Surveys. What happens when one uses real sample survey data on importance weights. The Hagerty-Land (2007) article studied this using two surveys of importance weights, both of which included international samples, though only U.S. responses were used in order to examine agreement in a single country in a single language. The first is the World Values Survey (WVS) which asks respondents in 50 countries to rate the importance of: family, friends, leisure time, politics, work, and religion. The second is a 2005 online survey the The Economist Intelligence Unit (EIU) of current readers of *The Economist* magazine was conducted, with 3160 readers from 147 countries providing complete responses. Respondents were asked to rate the importance of 10 social indicators on a 5-point scale, where 5 denoted "Very important" and 1 denoted "Unimportant." This second survey has the disadvantage of not being a probability sample of voters in a nation, but has the advantage of measuring more social indicators on a finer scale. The 10 importances measured were: material well-being, your health, family relations, job security, job satisfaction, social and community activities, security situation in your country, degree of political and civil liberty in your society, and degree of social equality in your society.

Hagerty and Land (2007) found that the mean importance for "your health" is highest, followed by family relations, political and civil liberty, job satisfaction, job security, security situation. Inspection showed that all six distributions were single-peaked and not bi-modal. They computed intercorrelations of responses to the 10 importance for the U.S. sample of 994 and found that the average correlation between importances was rather low at +.20, but the largest negative correlation was even smaller at -.07 (between social equality and material well-being). The only other remarkable correlations were a cluster among political and civil liberty, gender equality, and social equality, all of which were positive.

The 16 social indicators of the ISH from Example 3 were reevaluated using the surveyed importances from 500 randomly selected EIU respondents. Agreement rates were much higher using actual weights from the EIU compared to using uniformly distributed weights. The mean agreement A_{ij} among the 124,750 pairs was +.93, with standard deviation of .09. Over 80% of all possible pairs had correlations above +.90. And again, mean agreement $A_{E,i}$ between the 994 respondents and the equal weighting index was higher yet, at +.97. Figure 4 shows the distribution of agreement for the 994 respondents with the equal weighting index. In summary, both surveys predict that a supermajority of citizens in the U.S. would endorse a QOL index with these 16 social indicators

(Continued on next page.)

Figure 4. Distribution of $A_{E,i}$ agreement between the equal-weight QOL index and the 994 actual U.S. respondents of the EIU survey for the 16 social indicators of the Index of Social Health.



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Discussion

Of the many QOL indices that have been proposed to date, none have explicitly considered whether individuals would agree with their choice of indicators and weights. The Hagerty-Land (2007) paper proposes a simple model for predicting the extent of individuals' agreement on QOL judgments with other individuals, and investigates whether it is possible to create a QOL index from real social indicators that will be endorsed by a majority of individuals.

In every case examined, using both real surveys of individuals' importance weights as well as a more general uniform distribution, it was possible to create a QOL index that a majority of individuals endorse (i.e., they agree at least with the direction of the QOL index). Specifically:

1. When correlations among social indicators are all positive (as in all cross-sectional data sets considered here), then agreement will be high regardless of the variation in weights. This highlights the paradoxical result that people may argue in theory about whose weights are more ethically appropriate, but in practice their conflicting weights will yield substantial agreement on the overall QOL index. This result is well known in regression analysis, but has not been observed in the context of social indicators.

2. When some correlations among social indicators are negative (as in time-series data sets where trends diverge for some indicators), intuition suggests that chances for agreement are slim. However, our results are the first to show that disagreement is much rarer than expected, and occurs only when the distribution of individuals' weights are (1) bimodal, and (2) negatively correlated (that is, when individuals' weights are diametrically opposed). These conditions did not occur in the surveys of real importance weights, nor in the more general uniform distributions, with the result that agreement on the QOL indices was much higher than expected from simple intuition or from previous work. The reason that the uniform distribution generates such high agreement is because it is *not* bimodal. It contains a broad "middle segment" in the center whose weights are near enough to each other to generate agreement at the average W. The surveys of real weights are very strongly unimodal, and so generate even higher agreement. However, highly polarized and emotional issues such as abortion are more likely to show bimodal weight distributions, generating insufficient agreement for a majority to endorse.

3. Researchers can increase the level of agreement for a QOL index by weighting the components appropriately. Agreement is maximized by using the average weights from a survey of individuals' importances. Alternatively, if no surveys exist, equal-weighting of indicators is the minimax estimator that minimizes disagreement even among diametrically opposed individuals. Note that in current practice, many QOL indices already use equal-weighting of indicators, though their authors admit that they do not know whether this weighting is correct. The current results can now place current practice on a sound theoretical footing, and show how it is possible to further increase agreement through surveys.

(Continued on next page.)

Implications for QOL Indices

The Hagerty-Land results predict high agreement among QOL indices that are constructed according to the assumptions in Eq. 2. These assumptions are: (1) all individuals place positive weights on each attribute, and (2) all individuals use general additive models to judge QOL. With respect to the first assumption, many existing QOL indices already conform. For example, everyone prefers more longevity, higher income, and more education (all other things being equal) in the Human Development Index and hence the positivity requirement is met. Another conforming survey is the World Values Survey (WVS) which allows only non-negative weights.

However, there are indices that fail the positive weights assumption. For example, *Money* magazine's index of Best Places to Live in the United States includes an indicator "average price of a 3-bedroom home". Some people (homeowners) would place a high positive weight on this, but others (homebuyers) would place a high negative weight, violating Eq. 2. In fact, this is an example of a zero-sum negotiation game where every gain for a buyer is a loss for the seller, and joint gains are always zero regardless of the price. *Money* magazine probably included this indicator because their readers are primarily home buyers, but this indicator is not suitable for a QOL index because (1) QOL does not change with this indicator since the joint sum is always zero, and (2) sharp disagreement would result because Eq. 2 is violated. Negotiation researchers recommend instead including indicators that allow positive joint gains to enhance the framing of shared interests. Much research has shown that this increases the likelihood of agreement and increases joint gains in negotiations. Applying these principles to the *Money* magazine example, a simple "laddering" procedure ("what deeper goals are you trying to achieve with lower housing prices/ higher housing prices?") could replace the single zero-sum attribute (price) with two shared goals: lower cost per square foot of new construction, and higher personal income. Both of these new indicators would conform to our assumptions and would result in higher likelihood of agreement.

This example points out that not all social indicators are appropriate in QOL indices, and inclusion should be contingent on each indicator's (1) reliability, (2) perceived importance by citizens, and (3) likelihood of agreement on the resulting QOL index, as derived here. Another important example of indicators to exclude from QOL indices are tax policy, because conservatives place a negative weight on average tax burden, and liberals tend to place a positive weight. Tax policy is better viewed as a means to an end, and a successful QOL index would again apply laddering to include the end-state variables (e.g., better health care, education, pollution control, and economic growth. These examples show that a QOL index would not remove the need for policy analysis and political discussion, but it would focus policy analysis and politics by forcing proponents to estimate each policy's results on the QOL index.

The second assumption from Eq. 2 is that individuals use a simple additive model to form judgments about QOL. While this model has been confirmed in studies of how individuals evaluate well-being and related subjects, it needs more empirical research. In particular, substitutability or complementarity may exist between social indicators that would require modeling *interactions* among indicators. For example, an individual with higher average income may consider life expectancy more important than an individual with very low income (as life becomes more "worth living," longer life may be more valuable). Such complementarity could be added to Eq. 2 by constructing an interaction term, though its importance weight would be more difficult to measure in surveys. Empirical tests for these interactions could be done by surveying individuals and determining their preferences for hypothetical "bundles" of social indicators for their social unit. To our knowledge, no such studies have been done for representative samples of any social units. Such work would be invaluable for constructing a QOL index that correctly mirrors the preferences of the social unit.

The methods we outline here also allow deeper analysis of the more than 20 QOL indices that have been proposed. None of them agrees perfectly with each other, and some disagree even in direction with others. Our analysis in Eq. 6 now allows researchers to "decompose" the sources of disagreement into those due to selection of different (though correlated) indicators (R_x), those due to use of different weights to construct the indicator W_z , and those due to different importance weights in the target population W_i.

These conclusions must be viewed with caution for several reasons. First, we made use of existing surveys of individuals' weights that were not specifically designed to measure weights for the QOL indexes reviewed here. Most importantly, the weights in Eq. 2 must be correct to a ratio scale (because the zero point is meaningful), whereas the Likert scales in existing surveys are often considered correct only to an interval scale. However, studies of choices in surveys have shown that a particular anchoring ("not at all important" = 0) in Likert scales appears to assign the appropriate response to the zero point, and validation studies of Eq. 2 in choice surveys show that this type of scale predicts preferences quite successfully. Another limitation of existing surveys is that they contain only a few general importance weights (family, work, etc.) measured on a scale with only four points. However, the finer gradations available with a 10-point scale are unlikely to change our results. Hagerty and Land (2007) show that agreement is most likely when: (1) weight distributions are all unimodal rather than uniform or bimodal, (2) correlations are mild and positive, and (3) few people use the zero point of the scale. All three of these conditions are true in the surveys we examined, and it seems unlikely that an expanded rating scale or a different zero point would change these properties.

~Michael R. Hagerty and Kenneth C. Land

2007 ISQOLS Conference Abbreviated Program (Preliminary)

Thursday, December 6, 2007							
7:30 am – 7:30 pm: Conf. Registration							
8:30 am - 5:00 pm: QOL of the Disabled (roundtable)							
6:30-pm – 7:30 pm: Cocktail reception							
7:30 – 8:30 pm: Welcome address and Plenary Session: Alex Michalos: "Impact of Arts-Related Activities on the Perceived Quality of Life"							
8:30 – 10:00 pm: ISQOLS Executive Committee Meeting (Light Snack)							
Friday, December 7, 2007							
7:30 am – 7:30 pm: Conf. Registration							
7:30-8:30 am: Coffee (next to the registration desk)							
7:00 am – 8:30 am: ARQOL Editorial Review Meeting (Continental Breakfast)							
8:30am – 10:00 am: Plenary session: Roy Brown, Robert Schalock, Ann Turnball, & Ivan Brown: "Quality of Life and People with Intellectual & Developmental Disabilities"							
10:00 am – 10:30 am: Coffee break							
10:30 am – 12:00 pm:	QOL in Latin America I	QOL of the Poor	Financial Well-Being	Health Well-Being	International Well-Being Index I	QOL/ Economics I	QOL of the Disabled I
12:00 pm – 1:30 pm Lunch (on own)							
1:30 pm – 3:00 pm	QOL in Latin America II	QOL of Migrants/Refugees	Family Well-Being	QOL/Psych & Healthcare I	International Well-Being Index II	QOL/ Economics II	QOL of the Disabled II
3:00pm – 3:30 pm Coffee break							
3:30 pm – 5:00 pm	QOL in Latin America III	QOL of Children I	Housing/Neighborhood Well-Being	QOL/Psych & Healthcare II	International Well-Being Index III	QOL/Economics III	QOL of the Disabled III
5:00pm – 5:30 pm Coffee break							
5:30 pm – 7:00 pm	QOL in Artic Circle I	QOL of Children II	Community Well-Being I	QOL/Psych & Healthcare III	International Well-Being Index IV	QOL/Political Science/ Sociology I	QOL of the Disabled IV
7:30 pm – 10 pm: Awards dinner banquet							
Saturday, December 8, 2007							
7:30 am – 7:30 pm: Conf. Registration							
7:30-8:30 am: Coffee (next to the registration desk)							
7:00 am – 8:30 pm: ISQOLS Board of Directors Meeting (Continental Breakfast)							
8:30am – 10:00 am: 8:30am – 10:00 am: Plenary session: Enrico Gionannini: "Measuring the Progress of Societies: Towards a Global Effort"							
10:00 am – 10:30 am: Coffee break							
10:30 am – 12:00 pm:	QOL in Artic Circle II	QOL of Children III	Community Well-Being II	Pharmacology and QOL I	Psychometrics & Quant. Methods I	QOL/ Political Science/Sociology II	QOL of the Disabled V
12:00 pm – 1:30 pm Lunch (on own)							
1:30 pm – 3:00 pm	QOL in Artic Circle III	QOL of Children IV	Community Indicators Research--Certification: (workshop)	Pharmacology and QOL II	Psychometrics & Quant. Methods II	QOL & Public Policy	Ph.D. Student Workshop I
3:00pm – 3:30 pm Coffee break							
3:30 pm – 5:00 pm	QOL in Europe I	QOL of the Elderly I	Employment and Work Well-being I	QOL Therapy/Coaching: (workshop)	Psychometrics & Quant. Methods III	QOL/Ethics/Business Admin	Ph.D. Student Workshop II
5:00 pm – 5:30 pm Coffee break							
5:30 pm – 7:00 pm	QOL in Asia	QOL of the Elderly II	Employment and Work Well-being II	QOL/Personality/Social Psychology I	Qualitative Methods I	QOL/ Marketing I	Social & Environmental Well-Being
Sunday, December 9, 2007							
7:30 am – 12:00 pm: Conf. Registration							
7:30-8:30 am: Coffee (next to the registration desk)							
7:00 am – 8:30 pm: : ISQOLS Board of Directors Meeting (Continental Breakfast)							
8:30am – 10:00 am: Plenary session: Ronald Paul Hill: "Rawlian Ethics, the Human Development Index, and the Poor"							
10:00 am – 10:30 am: Coffee break							
10:30 am – 12:00 pm:	QOL in Europe II	QOL of Women	Employment and Work Well-being III	QOL/Personality/Social Psychology II	Qualitative Methods II	QOL/ Marketing II	QOL/Travel & Tourism
12:00 pm – 1:30 pm Lunch (on own)							
1:30 pm – 3:00 pm	QOL in Europe III	QOL in Africa	Employment and Work Well-being IV	Spiritual Well-Being	Qualitative Methods III	QOL/Recreation & Leisure	QOL/ Education
END OF CONFERENCE							

Call For Papers

Applied Research in Quality of Life

The Official Journal of the International Society for Quality-of-Life Studies

The aim of this journal is to publish conceptual, methodological and empirical papers dealing with quality-of-life studies in the applied areas of the natural and social sciences. As the official journal of ISQOLS, it is designed to attract papers that have some direct implications for or impact on practical applications of research on the quality-of-life. We welcome papers crafted from inter-disciplinary, inter-professional and international perspectives. This research should guide decision making in a variety of professions, industries, nonprofit, and government sectors such as healthcare, travel and tourism, marketing, corporate management, community planning, social work, public administration, human resource management, among others. The goal is to help decision makers apply performance measures and outcome assessment techniques based on concepts such as well-being, human satisfaction, human development, happiness, wellness and quality of life. The Editorial Review Board is divided into specific sections indicating the broad scope of practice covered by the journal, and the section editors are distinguished scholars from many countries across the globe.

Authors interested in submitting manuscripts for publication should consult the website http://ariq.edmgr.com. Manuscripts should be directed to the relevant Section Editor of the Editorial Review Board. If an appropriate Section Editor can not be identified, direct the manuscript to the current Editor in Chief, Michalos.

THE INTERNATIONAL SOCIETY FOR QUALITY-OF-LIFE STUDIES: HEADQUARTERS AND WWW HOMEPAGE

The International Society for Quality-of-Life Studies (ISQOLS) was formed in the mid-1990s. The objectives of ISQOLS are: 1) to stimulate interdisciplinary research in quality-of-life (QOL) studies within the managerial (policy), behavioral, social, medical, and environmental sciences; 2) to provide an organization which all academic, business, nonprofit, and government researchers who are interested in QOL studies can coordinate their efforts to advance the knowledge base and to create positive social change; and 3) to encourage closer cooperation among scholars engaged in QOL research to develop better theory, methods, measures, and intervention programs.

The year 2006 membership fees are US$75 for regular members and $50 for students or retired persons. Prof. M. JOSEPH SIRGY (Virginia Tech and State University) is Executive Director of ISQOLS. Anyone interested in knowing more about ISQOLS should contact Prof. Sirgy at the central office.

The ISQOLS central office recently moved to new physical and virtual locations. Please note the new addresses:

International Society for Quality-of-Life Studies (ISQOLS)
1800 Kraft Drive, Suite 111
Blacksburg, Virginia 24060-6370, USA

Office tel: (540) 231-5110; fax: (540) 961-4162

E-mail: isqols@vt.edu
Website: www.isqols.org

Message from ISQOLS President

Dear Colleagues,

By the time you read this message, our next ISQOLS conference in San Diego will be just around the corner.

This year, ISQOLS 2007 represents not only our regular meeting held every 18 month; it also doubles as an important regional meeting for all our members in the Americas. San Diego is located on the border between north and south so we are expecting colleagues from as far north as the Arctic Circle, from Canada and the United States, and from Mexico right down to Argentina. To date, we have no members in the Antarctic to report on the well-being of the penguins which is a concern for us all in a globalised world. But in the year of the polar bear, global warming is sure to creep into discussions of the many domains under review at the conference. And our colleagues in the Americas will need a global audience which is reason enough for the rest of us to come to San Diego.

The programme for ISQOLS conferences has traditionally been divided into streams devoted to our core business of refining our tools of measurement, QOL by domain and sectors of society, and regional QOL issues. This year's conference theme picks up the first theme of measurement. By the time we are in conference, our new journal, *Applied Research in Quality of Life*, will be ready to celebrate its first birthday. The title of our very own journal and this year's conference theme remind us that the rationale for perfecting our indicators is that they will be more useful for practical interventions and for evaluating whether policy is indeed having a positive impact on people's lives and our future on this planet.

Our conference chairs have put together an exciting programme for us. If you have not already submitted a paper or session proposal for the programme, it is not too late to come to the conference. Your participation which will enrich discussion following presentations will be most welcome. Plenty of time has been reserved to give feedback and to air your views during coffee breaks with colleagues.

Last year during an informal lunchtime session at ISQOLS2006 convened by Past-President Wolfgang Glatzer and one of our Vice-Presidents, Anna Lau, we heard that ISQOLS conferences are appreciated for many reasons. One of the main benefits, we learnt, is that our members come from many parts of the world and represent diverse scientific disciplines and research interests. So in the short space of a few days in conference, we're given a wonderful opportunity to broaden our horizons and step out of our narrow specialised cocoons. We can learn about perspectives we've never heard of or considered before that might contribute to a new angle on our own research or even lead to a new joint research partnership with a colleague from the other side of the globe. In the past years our members have embarked on many fruitful team projects following on our ISQOLS conferences.

Our colleagues Joe Sirgy and his conference co-chairs, Mariano Rojas, Alex Michalos, and Don Rahtz have spent much time and thought in preparing this conference for us. We hope you will come to the party in San Diego! We really look forward to seeing there.

~ Valerie Møller, President (2007-08)

The Marriott San Diego Mission Valley is hosting the ISQOLS conference
To qualify for ISQOLS special reduced room rate, reservations for the Marriott Hotel must be made using the following registration code: isqisqa.

SINET WORLD WIDE WEB HOMEPAGE

SINET has a homepage entry on the World Wide Web. It is located on the homepage of the Department of Sociology at Duke University and thus can be accessed by clicking on Department Publications on the address of that page, namely, http://www.soc.duke.edu or by typing in the full address http://www.soc.duke.edu/resources/sinet. The homepage for *SINET* contains a description of the Contents of the Current Issue as well as of Previous Issues. In addition, it has Subscription Information, Editorial Information, Issue-Related Links, and a link to the homepage of ISQOLS, the International Society for Quality-of-Life Studies. The Issue-Related Links button has links to World Wide Web locations of data for the construction, study, and analysis of social and quality-of-life indicators that have been identified in previous issues of *SINET*. When you are surfing the Web, surf on in to our homepage.

SINET

Social Indicators Network News

Subscription Information

As a service to the world-wide social indicators community, SINET is issued quarterly (February, May, August, November). Subscribers and network participants are invited to report news of their social indicator activity, research, policy development, etc., to the Editor for publication. Deadlines are the 20th of the month prior to each issue.

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SINET

Social Indicators Network News

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