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Indicators of environmental quality and life-satisfaction: a subjective approach.

Author(s) of paper/
Auteur(s) du texte

John F. Hall
A. James Ring

Social Science Research Council
Survey Unit,
Regent House, Fifth Floor,
89 Kingsway, London WC2B 6RH

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"Indicators of Environmental Quality and Life-Satisfaction - a Subjective Approach"

John Hall and James Ring, Survey Unit, Social Science Research Council, London, UK.

ABSTRACT

The SSRC Survey Unit has an internal programme of survey research to develop a set of subjective indicators of social well-being for use in conjunction with "hard" measures to monitor social change and evaluate social performance. It is envisaged that, when finalized, these indicators will form a series over time. We do not propose to repeat or discuss here the reasoning and procedures which led to the content and format of our current work. These are more than adequately described elsewhere.

This paper summarizes the work to date on defining "quality of life" and operationalizing and measuring some of the basic indicators, and presents preliminary results from surveys carried out in Autumn and Winter 1973/4. Two basic measures of well-being were used; first, a ladder-scale ranging from "completely satisfied" to "completely dissatisfied" with various aspects of life and with life as a whole; second, a semantic differential scale assessing "my present life" on a number of more affective dimensions. The general conceptual approach has been to examine "life-domains", but with an emphasis in the present surveys on public policy at the expense of the more personal and aesthetic domains. Within certain key domains a number of sub-domains have been identified. Satisfaction ratings were obtained for both domains and sub-domains, and importance ratings were obtained at both levels. Where possible, objective information on relevant "hard" indicators was also collected.

The main aim of this paper is to examine two domains directly relevant to Environment" (ie. "The house you live in" and "This local district as a place to live") with a view to determining what contribution each makes to a sense of well-being. At the same time comparison is made of the relative contribution to well-being and to satisfaction with house and district of both subjective and objective measures. Of particular interest is the analysis of survey data on Sunderland collected under contract to the Dept. of the Environment using the same questionnaire as in a national study. Both surveys were conducted over the same time period. In addition to survey data, the analysis includes statistics for political wards provided to us by the Sunderland Planning Programme Dept., some of which are derived from the 1971 Census. The official statistics used as indicators are those available at the time of writing and are not necessarily the best for a "quality of life" approach. A variety of multivariate statistical analyses are employed to test the properties of the measures used and the validity of some simple models of life-satisfaction.

Prologue

Each year, on their birthdays,untold hundreds of British citizens receive from "Marie Simone" a printed circular wishing them "Many Happy Returns of the Day" and offering to send, for £1, "..your personal three-year star-plan: 10,000 words of daily predictions and your very own Lucky Yukon Gold-Miner's Spade." Problems covered are proclaimed in large block capital letters: "INSECURITY! LUCK! HAPPINESS! LOVE! MONEY! WEALTH! MARRIAGE! HEALTH!"

Tom Harrisson, founder of Mass Observation, once wrote, "You cannot, yet, take a census of love in Liverpool, or random sample the effect that fear of the future has on the total pattern of contemporary life in Leeds." For several years now a number of researchers on both sides of the Atlantic have been trying to do precisely that. Bradburn in Chicago, Campbell and Converse in Michigan, Allardt in Helsinki and Abrams and Hall in London have severally and jointly been working towards the definition and measurement of "quality of life" as experienced by individual human beings rather than as indexed by some cash value such as G.N.P. The work has had a distinctly psychological flavour, at times openly Maslovian, venturing into such realms as music, love, fresh air and sunshine, being with or near nature. The London work has tended more towards social policy areas, since, although we are aware that the non-policy areas are the better determinants of a sense of well-being, it is the policy areas which allow of intervention to correct glaring inequalities and injustices.

We picked a fascinating time to do a "quality of life" survey. The Arab-Israeli war had already broken out before fieldwork started; then England were knocked out of the World Cup, Princess Anne was married, the miners went on strike, the oil-crisis worsened, bringing about the three-day week, the whole followed by a General Election. Also during fieldwork, Sunderland, the giant-killers of the Second Division, who had won the 1973/4 F.A. Cup knocking out the mighty First Division Leeds United, were knocked out of the 1974/5 competition. Tragically, two young schoolgirls had been found murdered in one of the Sunderland wards. If it is true that external events influence affect and well-being, and if we have even remotely valid and reliable measures, then surely even the crudest of them should prove sensitive to such traumatic experiences?

Fieldwork had already been booked for the national study and the questionnaire was being finalised for the printers, when the Survey Unit was asked by the Dept. of the Environment to conduct surveys in two towns as part of a four-area experiment in recreation co-ordination. To cater for this, we simply inserted two extra pages on leisure behaviour and replicated the entire survey in Sunderland and Stoke-on-Trent simultaneously with the national survey..Most of the fieldwork for the national survey was completed by mid-December 1973, but interviewing in Stoke and Sunderland continued well into February 1974 (and into the crisis period!) but not, unfortunately, through the election..We had very much hoped to double up on the national sample and continue interviewing as the crisis grew and the election approached, a unique opportunity to test the sensitivity of our

measures to changes in national economic and political circumstances, but ironically the crisis itself caused a reduction in available funding and in the event we had to drop the idea.

Academic background to present study

In his review of Campbell and Converse (1970) which, together with Bradburn (1969) was heavily drawn on in Unit's initial design work, McKennell(1971) hypothesized three simple models to explain life-satisfaction,* assuming that it was possible to obtain a valid and reliable measure of such a notion. The simplest (Model (a)) states that overall life-satisfaction is a weighted sum of satisfactions with different aspects of life, which we term "domains", and that, in turn, these domain-satisfactions are weighted sums of specific satisfiers and dis-satisfiers. The second model introduces the concepts of negative and positive affect as identified by Bradburn, stating that some domains will contribute to life-satisfaction more through positive than through negative affect, or vice versa. The same will apply to the contribution to domain satisfactions of their component sub-domains. The third model (Model (c)) allows for the possibility that all self-reported satisfactions, whether at global, domain or sub-domain level, are determined by some underlying social psychological syndrome or short term mood state. All three models should be seen in the context of background or stratification variables. More complex models would introduce Maslovian hierarchies of both subjective and objective measures, but we shall not be able to examine these in time for the I.S.A. conference. Since the present study is concerned primarily with social policy domains, we did not set out specifically to measure affect or personality, and so our measures of these are, to say the least, indirect. We shall therefore confine ourselves in this paper to examination of the statistical properties of our key measures of well-being, and to testing Model (a) above.

At the global level, we shall use two different dependent variables: the single overall rating of satifaction with "your life as a whole these days" and the unweighted sum of the fifteen-item self-completed semantic differential scale assessing "My present life". At the domain level, and since this paper's sole raison d'être is this session of the Social Ecology group, we shall use as dependent variables the satisfaction ratings with "your (house/flat)" and with "this local district as a place to live". At both levels the independent variables will include "hard" and "soft" measures. The methods used are simple and multiple regression and an extended version of MCA specially adapted by James Ring to take account of order restrictions. (See Appendix D) The models are tested on data from the whole sample, using domain-satisfactions to predict overall life-satisfaction, and sub-domain satisfactions to predict domain satisfactions. The residuals are then analysed using AID on "hard" measures in a search for meaningful population sub-groups, and the models are then re-applied to the emergent sub-groups.

(* See fig 1)

Instruments

The basic tool used for obtaining satisfaction ratings was a vertical numbered scale adapted from the work of Cantril. For the two pilot surveys it was in the form of an open-ended ladder with the words "COMPLETELY SATISFIED" above and "COMPLETELY DISSATISFIED" below. The first pilot used eleven points numbered 0-10 and the second pilot seven points numbered 1-7. This latter was to enable comparison with a survey in the USA by ISR, many questions in which were common with the UK conurbation study. For the main study the scale was changed back to eleven points numbered 0-10, but the format chosen, after consultation with Dr. Belson of LSE, was that of boxed numbers linked by a single line like rectangular beads on a thread. In the later survey the same scales, with suitable wording changes, were used to obtain different kinds of ratings in answer to the questions "How much is there...? "To what extent ....?" and "Whereabouts would you say .... is now?" or ".... deserves to be?" (See fig 2) However, the only variables to be used in this paper will be satisfaction ratings.

On inspection it is immediately apparent that most of the satisfaction ratings are heavily skewed towards the upper pole denoting high satisfaction. The exceptions are in those domains which are more remote from the individual respondent, or in which respondents have little direct control and, therefore, responsibility. This is not necessarily an artefact of the scales used, since the skews are reversed, but not so heavily, when the lower part of the scale denotes a desirable condition (eg. "In general, how much would you say you worry these days?") All the satisfaction scales also display a pronounced trough at point 9, and, peaks at 5,8 and 10 and, occasionally, when the distribution shifts towards 'dissatisfied', at 2. (See fig. 3)

Apart from the four pairs of items tapping a dimension of "constraint" the eleven affective pairs of items in the semantic differential scale are also heavily skewed towards the positive poles, but the crude sum of items, denoted as 'SDSCORE', is almost normally distributed.

Even though there is no social or psychological theory which requires that life-satisfaction should be normally distributed, other researchers are attempting with some success to spread out the hump of high satisfaction ratings by the use of a greater number of compound or superlative verbal descriptions at the positive pole. We ourselves have transformed the raw life-satisfaction ratings to approximate a normal distribution* and applied the same transformation to the domain satisfaction ratings. The gain in explanatory power is negligible.

(* See fig 9)

Life-domains

The research programme started with a review of available empirical literature, notably Campbell and Converse (1970), Bradburn (1969), Robinson (1970).and McKennell (1970). This reading was supplemented by a number of free-ranging interviews with members of the public, and a handful of sociologist-colleagues, all of which were tape-recorded. A number of teenage-pupils in a London secondary-school were asked to write essays on the subject of "Happiness" Content analysis of the interview transcripts (expletives deleted) and of the essays produced a huge pool of possible 'Quality of Life' dimensions to be measured. These were reduced to a usable list of 'Life-domains' which would be common to most people and for which they could reasonably be asked to give satisfaction ratings. We are not convinced that any of the lists we have produced, whether used in the field or not, is exhaustive of the underlying dimensions of psychological well-being or is ideally suited to the survey research approach.

Domains crucial to a psychological or sociological approach, (Family life, Friendships, Religion) were used in the pilot surveys, but were dropped from the main study; domains we are aware of, but have yet to use in the U.K., (Role-performance, Appreciation of Beauty, Communion with Nature, Sex-life) have been covered by research elsewhere (Ann Arbor, Helsinki); domains which have yet to be operationalized, but evident from the content analysis of all the earlier work, (Need for life to appear integrated rather than fragmented, need for novelty, variety and freedom from constraints of clockwatching, social mores and obligations to others) will provide work for the future. Other kinds of variables are also relevant (Personality syndromes, Psychiatric malfunctions, Stereotypes, Stress) but again indicators either exist already or are being developed elsewhere (Ann Arbor, NORC, Edinburgh) Hopefully, when we have isolated and refined a reliable and valid measure of individual subjective well-being - a very promising possibility is the semantic differential scale assessing "my present life" - we will attain convergence of measures of all the above dimensions in the same study.

Another problem apart from that of which domains to include, has been that of psychological measurement. Debate centred on distinguishing between cognition and affect in measures of well-being, and consequently on the vocabulary to be used in questions. Should we ask whether people are happy, or contented, or satisfied? Andrews and Withey (1974) got round the problem by including 'happy' and 'satisfied' on the same verbal rating scale and got results very similar to our own. McKennell (1973) reports an exhaustive and detailed examination of the questions common to the ISR survey in the USA and our own second pilot survey.

He concludes that the global measures using 'satisfied' are a mixture of cognitive and affective components, but that when 'satisfying' is included in the semantic differential it is almost entirely affective. In the 1973 surveys we used 'satisfied-dissatisfied' as the dimension for global domain ratings, but for overall life ratings, in addition to 'satisfied-dissatisfied' and the semantic differential, we have used questions on progress towards "getting what you want out of life", on the amount of "choice and control over the way life has turned out for you", the extent of wishes to change one's present and past life, and finally on how happy people feel. The wording we finally selected for the obtaining of overall satisfaction ratings on the 0-10 scale in the domains was "All things considered, how satisfied or dissatisfied are you overall with (Domain)" The domains for which this wording was used, in the order they appeared in the questionnaire, was as follows:

+*A Your (house/flat)
+*B This local district as a place to live
C (NAME OF TOWN) as a place to live
*D The level of freedom and democracy in Britain today
+*E Your job
+*F The way you spend your leisure time
*G Your standard of living
+ H Your general financial situation
+*I Your present state of health
*J The education you (had/are having)

(See tables 3-5 for results. Items marked + were used in the first pilot survey : those marked * were used in the second pilot)

Each of these overall satisfaction questions was preceded by a request for relevant classification material, and for ratings of satisfaction or evaluation of particular aspects or components of the domain. At the end of the interview, after the overall life-satisfaction and other global ratings had been obtained, respondents were shown a list of domains covered and asked to indicate first, which three were the most important to them personally in determining how satisfied or dissatisfied they were with their lives, and second, which three were the least important. (This list did not include (TOWN) and included "Your income" in place of financial situation.) They were also asked to indicate the single most, and single least, important domains. This allows the domain satisfaction ratings to be weighted by the importance ratings if desired, although Campbell (1973) claimed that the effect of this on the analysis of the USA data was negligible.

Global measures

In all our measures of well-being, women consistently report themselves as happier, doing better, more satisfied with life, less prone to worry, less willing to change their present lives, than do men. Older people have higher ratings on some measures and lower ratings on others. Whilst the higher social classes appear to be more successful at avoiding the worst off end of our scales, they are not necessarily more numerous at the better off end: in fact, people living on state benefits are more numerous than all other groups at both ends of the life satisfaction scale.

However, socio-economic grade does have a consistent relationship with three of the measures, in that middle class people are much more likely to appear in the 'good' categories, and less likely to appear in the 'bad' categories, than are working-class people. (See table 1)

Semantic differential

The ISR study of "Quality of Life" in the United States included an eight-itemm semantic differential scale assessing the respondent's present life. We included these eight items together with two additional items in our second pilot survey. The unweighted sum of scores on these items was used as a dependent variable and seemed so promising that we repeated the scale with modifications in our main study. O'Muircheartaigh and Whelan (1972) had shown that there was a single general factor accounting for a very large proportion of the variance in the scale, and a smaller factor loading on items "Tied down - Free" and "Easy - Hard". Since this second dimension of "constraint" or "struggle" is of equal interest to "affect" in policy research, we included additional items aimed at tapping it. The main problem was that there are plenty of strong and evocative words and phrases to express distressful and rotten conditions of life, but that their opposites are not in common use outside the clergy and drug-freaks. We searched long and hard for opposites of "Trapped" and "In a rut", and eventually decided on 15 items as follows:

*Boring	-	Interesting
*Enjoyable	-	Miserable
*Tied down	-	Free
*Rewarding	-	Disappointing
Rough	-	Smooth
*Full	-	Empty
*Discouraging	-	Hopeful
*Easy	-	Hard
Frustrating	-	Fulfilling
Full of fun	-	No fun at all
Controlled by others	-	Under my control
Full of possibilities	-	In a rut
Unsuccessful	-	Successful
*Brings out the best in me	-	Doesn't give me much chance
*Unhappy	-	Happy

(* included in Second Pilot)

The same general factor was extracted with heavy loadings on the 11 affective items. The other four items load on a second factor, but extraction of more factors will probably split both sets of items. (See fig. 4 for the factor plot) We have used the unweighted sum of all 15 items in our analysis for this paper, but we include for information a summary of the sub-scale scores in table 2a. The difference in scores is often 10 or more points between social groups, but can reach 30 or more when people are grouped by their answers to the happiness questions. The two sub-scale scores appear to run in opposite directions for age group. This phenomenon warrants further investigation. (See table 2a)

Environmental satisfaction

In addition to the global measures of satisfaction with house and district, and immediately preceding each, we obtained satisfaction ratings with a number of aspects of each, some particular, some more generalized. The aspects chosen for study were mostly derived from the open ended responses to questions in the pilot studies, but we also deliberately chose items to represent the various need-levels outlined by Maslow, even if these may not have been present in earlier responses. Respondents were thus encouraged to think of their housing and their immediate local environment in wider terms than might have been the case.

Housing

The items eventually used in the list for housing satisfaction were as follows:

- A The kitchen
- B The number of rooms you have
- C Keeping it warm in winter
- D Keeping it clean & tidy
- E Facilities for baths or showers
- F Freedom from noise
- G Freedom from damp & condensation
- H The view from your windows
- I Privacy from neighbours
- J The cost of (rent/mortage) rates, repairs, etc.

(See table 6 for results)

The list was rotated in its presentation, half of the respondents starting with the last item and working upwards. Half the questionnaires were printed on white, and half on coloured paper. If the respondent's polling number on the electoral register was even the white questionnaire was used, if odd, then a coloured questionnaire. Relevant show cards were also printed on coloured paper in the reverse order to that on the printed questionnaire, but in the same order as presented to each respondent.

Respondents were then shown a list of the items for which they had given satisfaction ratings and asked to indicate which three were the most important to them personally in determining how satisfied or dissatisfied they were with their housing.

The average house-satisfaction rating for the whole sample was 7.8 with 28% indicating complete satisfaction. There was no difference between the sexes, but satisfaction increased with age and also with socio-economic grade of head of household, (See Tables 4 and 5) with the exception of grade E who are mostly (female) old-age-pensioners.

Turning to specific aspects of the dwelling, the highest satisfaction ratings were given to number of rooms (8.3) and to facilities for baths (8.1) and ease of keeping clean and tidy (8.1); the lowest ratings were given to costliness (6.6) kitchen (6.7) and view from windows (6.6). The items seem to cluster into meaningful groups including internal amenities, comfort, external amenities, but costliness appears to be tapping a separate dimension. Two major factors were extracted accounting for 39% and 10% of the variance before rotation, and it would appear that the overall house satisfaction rating is closely related to the first factor (See Fig 6 and Table 6) The two items loading heavily on the second factor, view and privacy, are of interest, since, as we shall see, they are both related to district satisfaction. In the multivariate analysis "view from your windows" displaces some of the items in the district list. (See tables 12 and 13)

Some internal evidence of validity is given by the enormous differences in satisfaction with particular aspects of their housing of those for whom the relevant objective condition differs. In houses where there is no fixed bath or shower, satisfaction with facilities for baths or showers falls to 1.5 for the UK and 1.3 for Sunderland as against 8.5 and 8.8 in houses with baths, whether shared or not. In houses without inside flush w.c.'s the figures are 3.3, 2.9 as against 8.5 and 8.8 (See Table 7).

In addition to the subjective satisfaction ratings for the various aspects of housing, we have hard-data relating to the dwelling itself. These data together with multivariate analysis offer some validation of the subjective measures and also of the final global rating as an overall measure of housing satisfaction. The hard measures show expected association with both the overall satisfaction with dwelling and also, where obtained, satisfaction with the relevant aspect. Those who do not have, or have to share, a bath, toilet or kitchen, are much less satisfied with their dwelling than those who have exclusive use. Sharing a toilet or kitchen, or not having a separate kitchen, is associated with particularly low levels of dwelling satisfaction. Those who have a garden, garage or central heating are more satisfied than those who have not. The more (bed)rooms people have, the more satisfied they are. Owner-occupiers are more satisfied than council tenants who in turn are more satisfied than private tenants. In the UK sample occupants of detached houses score higher than those in semi-detached, who in turn score higher than those in terraced houses, and these latter are more satisfied than people who live in flats or maisonettes. (See Table 8). However in the Sunderland sample it does not appear to make much difference whether people live in detached, semi-detached or terraced houses, but all of these are more satisfied than people who live in flats or maisonettes.

Local district

The list of items relating to local district was chosen in same way as the list for housing satisfaction. An advantage is that some of these items were used in the second pilot study and in the main survey and so we have some confirmation of structure of the domain satisfaction involved. For Pilot II the list of items was not rotated, and was preceded by a question on strength of attachment (on a 1-7 scale) to the local district as a place to live. For the main study the list was rotated on the same principles as that for housing. Whilst much has been made in some studies, usually with reference to housing estates, of the importance of general appearance in determining satisfaction with environment, we were aware from previous work that the largest component in this would probably be social rather than aesthetic, and consequently included items to tap this dimension. Even key landmarks are probably more likely to be perceived, referenced and evaluated in terms of social rather than physical experience. The items included in the 1973 surveys were as follows:

A The state of the roads and footpaths
*B Bus and train services
*C Shops
*D Freedom from noise
E Places of entertainment - cinemas, pubs and clubs
F Freedom from crime
*G Schools
*H Parks and similar open spaces
*I Traffic in the streets
*J The general appearance of the district
K Personal safety on the streets at night
*L Being near your family and relatives
M Being near your friends
*N Clean air, free of fumes and dirt
*O The sort of people who live round here

(Items marked * were used in the second pilot survey in 1971)
(See table 9 for results)

Multivariate analysis of the second pilot data revealed a clustering into prima-facie Maslow-type groups. O'Muircheartaigh and Whelan (1972) report that, in spite of being entered into the analysis with a large number of other variables, the items in the district list cluster with each other without exception. Within the larger district cluster, three separate clusters appear which can be tentatively labelled as I: Generalized social II: Public Amenity & Services III: Pollution. We have not yet repeated the clustering analysis on the 1973 data, but examination of the zero-order correlations indicates much the same basic structure. (See fig 8)

When the whole list of sub-domain satisfactions together with overall district satisfaction was factored, three major factors emerged accounting for 37%, 10% and 8% of the common variance before rotation. After rotation overall satisfaction with district loaded heavily on the first factor (0.72) as did general appearance (0.77) and personal safety (0.71). Four other items loaded 0.6 or higher (See table 9) The three items with heaviest loadings on the second factor were shops (0.65) entertainments (0.54) and buses and trains (0.54) closely followed by parks (0.47) and schools (0.44) The third factor has only two items with substantial loadings, proximity to friends (0.73) and to family (0.59). (See fig. 7)

The highest correlations between district satisfaction and item-satisfaction were for "sort of people" (0.68) and "general appearance" (0.67); the lowest were "being near your family" and "shops" (0.29) and "buses and trains" (0.23). The highest satisfaction ratings were for "sort of people" (7.6) and "schools" (7.5) and the lowest for entertainments (5.6) and traffic (5.5). Again there was no difference in mean satisfaction between men and women, but there were differences between age and social class groups. However more women than men say they are completely satisfied with their local districts at all age and class levels. (See table 5).

Perceptions and realities of environmental quality

All the world over, buried in battered boxes, consigned to cluttered cupboards, or deep in darkened drawers, lie half-forgotten files stored for superannuation by once bright-eyed youth, each grand title proclaiming some cherished research idea, fancy and fact in various mixture, condemned to Sisyphean shuttle between repository and 'pending' tray: dried seeds await the germinating rain and ripening sun: the latent made manifest.

Such a dream, sparing of effort, bountiful in harvest, is to ensure that all survey interviews are coded by small-geographical location so that psychological and subjective measures can be mapped in space and treated just like other data. Perhaps in some future Utopia we may standardize to 100-metre grid locations, but more practicable goals can be set by using the voting wards of local authorities.

An advantage of this is that in those areas where government and local authorities collect and publish statistics at ward level, every survey is immediately open to enrichment by the addition of known data about the locality in which it took place. Moreover, it also enriches the stock of data on wards themselves which can then become units of analysis. Implications for social policy formulation and monitoring are enormous. Localized social indicators have already been submitted to regression analysis to determine the rate-equalization for the Greater London Boroughs. We therefore seized with alacrity the opportunity of designing into the Sunderland survey, with the enthusiastic cooperation of the Sunderland Programme Planning Department, the collection of census and other statistics available at ward-level. For the 1973 national study we have no hard data as yet on the districts in which the interviews took place. The only possible exception is the total length of residence by respondents in the districts they now live in, and this shows the expected (strong) positive relationship with overall district satisfaction. It is only when we turn to the Sunderland study that we enter the Aladdin's cave of hard local district data against which to check the survey data. Whilst there is a problem that wards tend to be quite large in area and that we have no smaller sub-divisions for which data are available, it is encouraging that, even at this crude level of precision, the relationships which emerge between hard measures and subjective survey responses, though unsurprising, are quite striking. (See table 10)

Hard measures which are consistently correlated with satisfaction ratings are: proportion of households in owner-occupation, proportion of households with access to a car, % of population aged 0-14, % population aged 60 or over. One subjective measure in the district domain, satisfaction with "parks and similar open spaces", seems to be correlated with practically all the hard measures. At the time of writing, the 1971 Census data on social class is not available, nor do we have data on acreage of green space, mature trees, residential densities, age of dwellings, rateable value of dwellings, levels of noise and air-pollution, or traffic-flows. If and when such data become available, we doubt if any relationships will emerge which will necessitate rewriting our party political manifestoes.

Sunderland

The city of Sunderland, with a population in 1971 of around 220,000 lies on the north-east coast of England. An ancient port, its major growth occurred in the second half of the 19th century and was associated overwhelmingly with shipbuilding in yards along the River Wear and coal-mining on the East Durham Coalfield. These two industries still form the backbone of the city's employment although great efforts have been made over the last half century to diversify into other industries as the 'classical' coal-steel-ships economy of the north east went into decline.

In settlement terms, Sunderland has historically consisted of an old urban core on the south bank of the Wear, added to by peripheral growth and the incorporation into the municipality of outlying villages, suburbs and rural areas. This process reached its climax in 1974, when further boundary extension occurred to bring the population up to 300,000 when the whole city became a Metropolitan Borough of the new Tyne-Wear County.

Sunderland is characterised by large areas of poor-quality housing and by deficient infrastructure. It is however, famous for its depth of fierce local feeling, passionate attachment to the local professional soccer teams and enthusiasm for drinking, playing in brass bands, growing vegetables and breeding racing pigeons. The working-class culture of shipyard and coalmines is still very pervasive.

The total list of indicators supplied to us by the Sunderland Programme Planning Dept. is given in Appendix C . Table 10 shows the mean satisfaction scores with 'local district' and 'town' of those living in wards characterised by high and low levels of selected indicators. The groupings were chosen to yield approximately equal numbers in categories except where there was a very long gap in the intervals in which case the gap was chosen as a break point.

The largest differences in district-satisfaction means are between wards where the population aged 0-4 is less than 8% (7.0) and those where it is 8% or more (8.5) and between wards where the proportion of households with access to a car is 30% or less (7.1) and those where it is 41% or higher (8.5). The smallest differences are registered between wards with differing proportions of single person households and differing average household sizes. We must beware of reading too much into these figures since the geographical area included in the wards will coincide only crudely with the areas perceived as being "this local district".

Evaluation of models

The first model tested on the national data was a stepwise multiple regression model using the unrecoded data. This model explained just under half of the variance for the overall sample. However, an examination of the domain and overall satisfaction frequency distributions shows that they are all highly skewed (see table 3).

Since regression models perform best when the variables are normal, a second model was tried in which all the scales were transformed so that the overall life-satisfaction scale resembled a grouped normal distribution. A standardized normal distribution was taken and partitioned into eleven ranges according to the overall life satisfaction frequencies. The mean of each partition was then taken as the recoded score, and the transformations applied to all satisfaction scores. (See fig. 9)

Although the regression coefficient was only marginally improved, the correlations were all also slightly higher and the first variables to enter the equation explained the variance more than for model (a). The order in which the variables entered the equation was also different. Although most variables entered in the same order, some were transposed (finance with health, leisure with education), but the partials at equivalent levels were close enough to reject any assumption of qualitative differences between the models.

Overall life-satisfaction

We compared the simplest model (model a) with a multiple regression model using overall life satisfaction as the dependent variable and two independent sets of predictors - the ten domain satisfaction items and the fifteen semantic differential items. Four variations of the model were applied. Owing to the inclusion of job-satisfaction in the predictors, two of the models are based on fewer cases. However the results are not significantly affected when job-satisfaction is excluded. A substantial amount of explained variance had clearly been lost from both sets of predictors.

In spite of the loss in explained variance due to using semantic differential score as the predictor, it is still small enough to justify using it as a component in a more general model of life satisfaction. This would eliminate the necessity of including all fifteen semantic differential items in such a model.

		Explained variance (%)	Number of cases	Number of predictors	Loss of explained variance (%)
1	Multiple regression of overall life satisfaction with the domain satisfaction items.	48.3	501	10	-
1a	As 1, but excluding job-satisfaction	45.3	872	9	-
2	Simple regression of overall life satisfaction with the sum of domain satisfactions	40.7	501	10	16
2a	As 2, but excluding job satisfaction	38.3	872	9	16
3	Multiple regression of overall life satisfaction with the semantic differential items.	46.3	933	15	-
4	Simple regression of overall life satisfaction with the sum of semantic differential items.	41.9	933	15	9

Closer examination of the stepwise output of the multiple regression models shows first, that the single item "general financial situation" is a better predictor than the simplest model which includes ten items, and second, the three items, finance, leisure and standard of living, account for 92% of the explained variance. Similarly, the first three semantic differential items, enjoyable, miserable, unsuccessful - successful, unhappy, happy, account for 92% of the explained variance.

To summarise, the proportion of variance common to all, or most, of each set of predictors is large enough to warrant using only the sum of the first three items as a model, instead of the sum of all items. It is interesting to note that, on comparison of the two multiple regression models (1 and 3), the semantic differential items explain as much variation in overall life satisfaction as do the domain satisfaction items.

Environmental determinants of life-satisfaction

Having examined the regression models using the domain satisfactions as predictors, we then defined three environmental domains (house, district, town) and compared the models including all domains with models using only the environmental domains and models using all domains except the environmental ones. These models were run on data from both the national and the Sunderland surveys, on samples including and excluding job satisfaction as a predictor. In all, twelve multiple regression analyses were carried out and these are summarised in table 11.

The proportion of variance in overall life satisfaction explained by each model (i.e. the multiple R^2) is never more than 50%. The ratios between the three model types remain consistent for each of the four samples, although the Sunderland sample including job satisfaction has noticeable reductions in explained variances (for all domains this is 32% compared to 45% and 49%) In all four samples the beta-weights for the three environmental items are substantially reduced when the other domains are included as predictors, but the beta-weights for the non-environmental domains are only marginally reduced when the environmental domains are included. This tends to support the hypothesis that the non-environmental domains explain most of the variation in overall life satisfaction by themselves, whereas the environmental items only explain this variation through the intervention of other domains. The multiple regression co-efficients give further support to this, since in all the samples the variance explained by the other domains is only marginally less than that for all domains, but the variance explained by the environmental domains alone is only one third of this.

We also calculated the proportion of variance in overall life satisfaction explained by environment domains after controlling for the effect of the other domains, and vice-versa. These figures (see table 11) clearly demonstrate the almost negligible direct effect of environment on life satisfaction. Moreover, we see that the proportion of variance explained by the other domains independently of environmental domains varies from 74% to 83%, again demonstrating that environmental domain/satisfactions are not really significant predictors for overall life satisfaction.

This independence of the environmental domains is shown graphically in the plot of the two main factors after rotation for maximum variance (see fig 4) Satisfaction with house, local district and town load heavily on the second factor and are clearly separate from the other domains: satisfaction with life as a whole is most heavily loaded on the first factor and is located furthest away from the three environmental domains.

Models of environmental satisfaction

Marans and Rodgers (1972) report analysis of the USA data in which they tested MCA on three types of predictor of neighborhood satisfaction. They show that it is the subjective assessments of neighborhood which are the best predictors and that person variables and locality variables do not have much effect when they are included. We therefore set out to repeat their analysis on our data from Sunderland using the Census data for the local wards and with the advantage that all the data was from a single city. We first reduced an initial list of over 30 predictors by preliminary analysis to select the best ones using MCA and regression. Since some of the predictors are ordinal and since

MCA assumes nominal categories, James Ring wrote an extended version (EMCA) to take account of ordered predictors (see Appendix D) and this was used to select the district items for the model. There is little difference in the beta-weights or in the proportion of explained variance between the multiple regression and the extended MCA, and the addition of the two house items does not make any difference to the regression. (See table 12) MCA was used on a selection of person variables and those with beta-weights of .10 or greater were included in the MCA model of the full set of predictors. Census variables were chosen on the basis of prima-facie relation to district satisfaction. The full model included eight satisfaction ratings, seven Census variables and five person variables, with district satisfaction as the dependent variable. The MCA model was run seven times in all so that the three sets of predictors could be used separately and in all three pairings and finally all three together. The full results are given in table 13.

Again, as with the Marans and Rodgers findings, the subjective assessments of district account for vastly more variation in district satisfaction than do Census or person variables. The multiple R^2 for the district items is .60 on their own, and rising insignificantly to .61 with the addition of either Census or person items, and to .62 with all three together. Census and person items on their own each have .12 and together they have .20 . The highest beta-weights are for "sort of people" and for "general appearance" (.38 and .30) followed by "view from your windows" (.18) % of households with access to a car (.16) and "freedom from crime" (.15). We appreciate that the more generally worded phrases are the best predictors, but it does look as though policy makers will have to take account of subjective assessments of environment as perceived by those who live in it, since it is likely that even the "best" environments they devise may not meet with the approval of the people, especially if they perceive the other inhabitants as unsatisfactory.

Epilogue

It will be evident to the reader that this paper has been assembled in something of a hurry.(It has even been typed on two different type-writers by two different people) This is an occupational hazard in survey research, when papers are often promised before the data is even in from the field, usually by someone other than the eventual authors. We could have given a simple descriptive account of the work being done at the Survey Unit on subjective social indicators, but we tried to stick to the "Environment" specified in the session title and to something like a decent accounting for variation in our dependent variables. We would be grateful for any feedback on the environmental or indeed any other aspect of the work.

Appendix A Tables

Table 1 Summary of global measures of well-being (UK:Urban:1973)

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	N
All	17	19	13	24	17	13	11	18	6	42	9	25	14	966
Sex:														
Men	15	16	12	18	18	12	10	15	5	37	8	20	14	442
Women	18	22	14	23	16	14	11	21	6	47	9	30	12	544
Age:														
17-29	19	15	11	22	12	12	9	18	5	42	10	22	9	241
30-44	15	15	15	12	19	12	13	20	5	45	6	20	9	230
45-59	17	19	14	19	17	13	10	16	6	41	9	25	13	231
60 or over	15	27	13	29	21	29	11	18	6	41	10	34	20	263
Class of HH or C.E														
AB	11	22	4	23	36	5	3	34	tr	60	10	27	15	146
C1	11	13	9	20	21	11	8	18	7	40	5	23	10	205
C2	16	23	10	22	15	14	7	16	4	45	12	28	13	294
D	21	15	19	17	8	16	15	13	6	33	7	23	13	232
E	30	32	32	24	10	19	31	12	15	33	9	25	18	88
Tenure:														
Owned	14	25	7	27	23	8		22		48	11	32	16	202
Mortgaged	9	18	8	22	21	12		22		52	7	22	12	287
Council rent	25	18	22	17	10	16		13		34	9	24	10	325
Other	17	13	12	18	16	14		16		36	11	21	14	152
Dwelling type:														
Detached	9	25	6	23	30	7		27		52	10	27	15	145
Semi-detached	16	21	12	22	16	12		20		45	9	26	13	326
Terraced	19	15	16	17	15	18		12		37	8	23	12	258
Flat/M'sette	22	14	18	22	13	11		16		36	8	22	11	103

Key to columns: (a) % not satisfied with life now (0-5)
(b) % completely satisfied with life now (10)
(c) % scoring low on semantic differential (15-59)
(d) % scoring high on semantic differential (95-105)
(e) % scoring low on anomy scale (6-14)
(f) % scoring high on anomy scale (21-30)
(g) % not doing too well
(h) % doing very well
(i) % feeling not too happy
(j) % feeling very happy
(k) % with a very great deal of choice and control over life (10)
(l) % not wishing to change present life at all (0)
(m) % not at all worried (0)

[NB: For clarity and simplicity, in this and all subsequent tables, all coefficients have been given to 2 significant figures and decimal points omitted]

Table 7 Summary of semantic differential scale (Andrews:1973)

		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
53	Boring-Interesting	12	20	5.2	1.5	46	73	-24	71	25	06
54	Enjoyable-Miserable	9	26	5.4	1.4	48	73	-22	69	26	04
55	Tied down-Free	23	29	4.9	1.9	29	54	-14	21	50	-02
56	Rewarding-Disappointing	15	22	5.1	1.5	48	72	-27	69	26	07
57	Rough-Smooth	13	16	5.0	1.5	50	68	-25	27	74	12
58	Full-Empty	10	33	5.5	1.5	42	67	-24	73	12	03
59	Discouraging-Hopeful	9	26	5.3	1.4	38	66	-21	37	29	**
60	Easy-Hard	30	13	4.4	1.7	38	51	-22	12	64	10
61	Frustrating-Fulfilling	22	15	4.7	1.6	48	73	-28	34	44	06
62	Full of fun-No fun at all	13	12	4.9	1.4	44	69	-20	66	24	05
63	Controlled by others-Under my control	19	25	5.0	1.7	33	50	-15	20	45	00
64	Full of possibilities-In a rut	18	17	4.8	1.6	37	70	-21	64	23	-07
65	Unsuccessful-Successful	11	14	5.0	1.4	50	74	-25	59	43	09
66	Brings out the best in me-Doesn't give me much chance	17	13	4.8	1.6	47	73	-24	68	28	07
67	Unhappy-Happy	4	45	5.9	1.3	58	75	-22	61	44	23

Key to columns: (a) % not so good (0-3)
(b) % extremely good (7)
(c) Mean rating scoring low=1 and high =7
(d) Standard deviations of (c)
(e) Correlation with overall life satisfaction
(f) Correlation with sum of items in scale (SUMSD.E)
(g) Correlation with sum of items in anomy scale
(h) Rotated factor loadings: factor 1 (Varimax)
(i) Rotated factor loadings: factor 2
(j) Beta-weights regressing overall life-satisfaction on semantic differential items

Table 2a Semantic differential: Mean sub-scale scores

Affect = sum of eleven affective items: range 7-77
Constraint = sum of other four items: range 7-28

	SUNDERLAND			UK		
	Affect	Constraint	N	Affect	Constraint	N
All	56	19	770	57	19	966
Age group:						
17-29	56	18	154	58	18	241
30-44	58	19	188	57	18	230
45-59	55	19	210	56	19	231
60 or over	55	21	217	56	22	263
Sex:						
Male	57	19	338	57	19	442
Female	55	19	432	57	19	524
Social class of HR or CWE						
AB	63	21	50	61	20	146
C1	59	19	126	58	19	205
C2	56	19	293	58	19	294
D	55	19	194	55	19	232
E	51	18	97	49	20	88
Tenure:						
Owned outright	57	21	100	59	22	202
Mortgaged	60	20	142	60	18	287
Rented from council	54	19	437	54	18	325
Other	56	19	91	56	19	152
Global measures:						
Very happy	62	21	317	63	21	407
Fairly happy	53	18	413	54	18	504
Not too happy	39	14	40	36	14	40
Doing very well	64	21	117	64	22	173
Doing fairly well	57	20	522	57	19	690
Not doing too well	44	16	131	42	15	103
Completely satisfied (10)	64	22	157	66	22	181
(9)	63	21	79	63	21	128
(8)	58	20	187	59	20	235
(7)	55	19	131	55	18	159
(6)	51	17	74	50	17	74
Exactly halfway (5)	47	16	99	48	16	121
Dissatisfied (0-4)	38	15	43	33	11	35

Table 3 Summary of domain satisfaction ratings (UK:Urban:1973)

Distributions:

Scale point / Domain	0 %	1 %	2 %	3 %	4 %	5 %	6 %	7 %	8 %	9 %	10 %	N
HOUSE	2	tr	1	2	2	11	5	10	25	15	28	961
DISTRICT	3	1	2	2	3	9	7	12	20	14	28	960
TOWN	1	1	2	2	3	9	8	10	22	11	32	966
DEMOCRACY	1	tr	1	2	4	23	12	14	25	8	9	950
JOB	tr	tr	tr	1	tr	7	4	13	22	20	32	500
LEISURE	1	tr	1	2	3	14	9	14	22	12	22	912
ST.of LIVING	1	tr	1	2	3	12	9	16	26	12	19	966
FINANCIAL SIT.	2	1	3	4	5	17	13	15	17	11	12	916
STATE OF HEALTH	2	1	2	2	3	13	4	9	19	15	31	950
EDUCATION	2	1	3	2	5	19	12	14	20	8	14	946
OVERALL LIFE NOW	tr	tr	1	2	1	13	8	17	25	14	19	933

Other summary information:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
HOUSE	7	28	7.8	2.2	35	29	-19	28	58	05	-04	3	9
DISTRICT	11	28	7.5	2.5	27	24	-22	12	81	-06	03	1	24
TOWN	8	32	7.6	2.3	31	23	-16	22	57	08	-01	not asked	
DEMOCRACY	9	9	6.7	2.0	22	18	-27	23	23	07	04	3	14
JOB	2	32	8.3	1.8	46	38	-13	49	22	18	20	13	6
LEISURE	7	22	7.5	2.1	41	42	-22	50	27	05	18	2	21
ST. OF LIVING	7	19	7.4	2.0	56	46	-28	67	34	32	16	12	tr
FINANCIAL SIT.	15	12	6.6	2.4	51	44	-29	62	24	15	14	10	2
STATE OF HEALTH	10	31	7.7	2.4	35	36	-12	39	05	16	15	48	1
EDUCATION	13	14	6.7	2.3	34	29	-21	41	14	08	07	1	26
OVERALL LIFE NOW	4	19	7.6	1.9	--	65	-29	75	22	--	--	--	--

Key to columns: (a) % dissatisfied (0-4)
(b) % Completely dissatisfied (0)
(c) Mean satisfaction rating
(d) Standard deviation of (c)
(e) Correlation with overall life satisfaction
(f) Correlation with semantic differential score
(g) Correlation with anomy score
(h) Rotated factor loading: factor 1 (Varimax)
(i) Rotated factor loading: factor 2 (Varimax)
(j) Beta-weights regressing life against domains (listwise deletion)
(k) Beta-weights regressing SDSCORE against domains.
(l) % giving as most important for life-satisfaction
(m) % giving as least important for life-satisfaction

tr = trace (ie. 0.05 or less)

Table 4 Mean Overall Satisfaction with main domains and with life as a whole (1973:UK)

Domain	All	Sex		Age				Grade				
		Men	Women	18-29	30-44	45-59	60 & Over	AB	C1	C2	D	E
Job (N=587)	8.3	8.0	8.6	7.9	8.3	8.5	8.7	8.4	8.2	8.4	8.1	-
House/flat	7.8	7.8	7.8	7.3	7.7	7.8	8.3	8.4	7.9	7.6	7.5	8.0
Town	7.8	7.7	7.8	7.2	7.5	8.0	8.3	7.8	7.4	7.7	8.0	8.3
Health	7.7	7.8	7.6	8.6	7.9	7.1	7.2	8.0	7.8	8.1	7.3	6.5
Local District	7.5	7.5	7.5	6.8	7.5	7.5	8.3	8.1	7.3	7.5	7.2	8.1
Leisure	7.5	7.5	7.5	6.9	7.0	7.5	8.3	7.4	7.4	7.6	7.3	7.8
Standard of living	7.4	7.4	7.5	7.1	7.2	7.4	8.0	8.1	7.5	7.5	7.0	7.1
Education	6.7	6.4	7.0	7.0	6.2	6.3	7.2	7.4	6.7	6.7	6.3	6.9
Freedom & Democracy	6.7	7.0	6.5	6.4	6.5	6.9	7.1	6.9	6.7	6.7	6.7	6.5
Financial situation	6.6	6.6	6.6	6.1	6.3	6.9	7.1	7.1	6.7	6.8	6.2	6.2
Life as a whole												
Five years back	7.0	7.0	7.1	6.4	6.6	7.3	7.7	7.2	6.9	7.1	6.8	7.3
Now	7.6	7.5	7.7	7.5	7.5	7.5	7.9	7.9	7.5	7.7	7.4	7.3
Five years ahead	8.0	7.9	8.1	8.3	8.1	7.8	7.7	8.2	8.1	8.1	7.8	7.5
Entitlement now	8.7	8.7	8.7	8.8	8.8	8.5	8.6	8.7	8.7	8.8	8.6	8.6
N =	966	442	524	241	231	231	263	147	205	296	231	87
SDSCORE	76	76	76	77	74	76	78	80	77	77	74	69

Table 6 Summary of satisfaction with housing (UK:Urban:1973)

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Kitchen	20	27	6.7	3.0	47	59	19	14	17
No. of rooms	8	52	8.3	2.4	41	40	25	15	12
Keep warm	18	32	7.1	2.9	46	61	25	08	16
Keep clean	6	41	8.1	2.2	42	54	25	09	5
Baths/showers	11	51	8.1	2.9	47	56	20	15	8
Free from noise	19	32	7.0	3.1	38	26	48	08	6
Free from damp	15	33	7.3	2.9	49	53	35	14	5
View from windows	19	28	6.7	3.1	46	29	58	15	4
Privacy	10	40	7.9	2.6	41	18	68	07	8
Cost	19	25	6.6	3.0	34	24	29	14	19
OVERALL HOUSE	7	28	7.8	2.2	--	63	46	--	--

Key to columns:

(a) % dissatisfied (0-4)

(b) % completely satisfied (10)

(c) Mean satisfaction ratings

(d) Standard deviation of (c)

(e) Correlation with overall house satisfaction

(f) Rotated factor loadings: factor 1 (Varimax)

(g) Rotated factor loadings: factor 2

(h) Beta-weights regressing house on house items.

(i) % giving as most important for house satisfaction.

Table 7 Satisfaction with amenity by availability

Satisfaction with:	Availability	Sunderland $\bar{x}$	Sunderland N	U.K. $\bar{x}$	U.K. N
Kitchen	Shared	4.8	4	5.2	19
	Not shared	6.8	763	6.7	942
No. of rooms	1 bedroom	7.0	70	8.0	76
	2 bedrooms	7.9	284	8.0	242
	3 bedrooms	8.7	554	8.5	538
	4 or more	9.1	51	9.0	103
Keeping it warm in winter	Central heating	7.3	325	8.5	397
	No central heating	5.2	445	6.1	564
Facilities for baths or showers	No fixed bath	1.3	55	1.9	67
	Fixed bath	8.0	711	8.5	894
" " "	No inside W.C.	2.9	69	3.3	93
	Inside W.C.	8.0	700	8.3	868

Table 8 JFH 12.7.74

Mean overall satisfaction with house by housing conditions.

		Sunderland		UK	
Basic amenity		Mean	N	Mean	N
Bath or shower	None or shared	5.5	58	6.3	93
	Exclusive	7.8	699	8.0	867
Inside W.C.	None or shared	6.2	76	6.6	113
	Exclusive	7.8	684	7.9	845
Separate kitchen	None or shared	4.2	14	7.2	39
	Exclusive	7.7	744	7.8	917
Garden	No	7.0	194	6.8	148
	Yes	7.9	566	8.0	811
Garage	No	7.4	562	7.4	589
	Yes	8.2	198	8.4	366
Number of bedrooms	One	7.0	70	8.0	76
	Two	7.4	284	7.6	242
	Three	7.9	354	7.8	538
	Four or more	8.2	50	7.9	103
Central heating	Yes	8.1	321	8.4	397
	No	7.3	440	7.4	564
Tenure	Owned-outright	8.8	99	8.7	201
	Mortgaged	8.2	141	8.2	286
	Council rent	7.4	433	7.2	323
	Other	6.5	88	7.1	151
Dwelling type	Detached	7.7	11	8.7	144
	Semi-detached	7.9	355	8.1	376
	Terraced	7.8	287	7.4	276
	Flat/Maisonette	6.4	108	7.0	162

Table 7 Summary of satisfaction with local district (UK:Urban:1975)

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
State of roads	24	14	6.2	2.9	36	43	28	-04	04	4
Bus & train sevices	24	18	6.2	3.0	23	15	54	03	-01	8
Shops	14	27	7.2	2.7	29	06	65	17	09	11
Freedom from noise	19	21	6.8	2.8	52	62	18	16	10	5
Entertainments	34	18	5.6	3.2	31	19	54	16	03	3
Freedom from crime	19	20	6.7	2.7	49	59	24	09	07	5
Schools	9	27	7.5	2.4	33	28	44	19	-05	7
Parks & open spaces	16	30	7.2	2.8	33	31	47	12	-04	5
Traffic in the streets	36	9	5.5	2.9	40	61	14	03	-03	3
General appearance	22	18	6.5	2.8	67	77	19	10	32	11
Personal safety	17	18	6.8	2.7	54	71	15	10	07	3
Being near family	18	29	6.9	3.1	29	12	18	59	04	11
Being near friends	12	28	7.3	2.6	35	17	15	73	04	4
Clean air	19	23	6.9	2.8	56	64	16	21	13	9
Sort of people	9	31	7.6	2.4	68	60	17	36	30	12
OVERALL DISTRICT	11	28	7.5	2.5	--	72	23	30	--	--

Key to columns:

(a) % dissatisfied (0-4)

(b) % completely satisfied (10)

(c) Mean satisfaction ratings

(d) Standard deviation of (c)

(e) Correlation with overall district satisfaction

(f) Rotated factor loadings: factor 1 (Varimax)

(g) Rotated factor loadings: factor 2

(h) Rotated factor loadings: factor 3

(i) Beta-weights regressing district on district items

(j) % giving as most important for satisfaction with district

able 10

Sunderland Survey: Mean ratings of satisfaction with "local district" and with (Sunderland/Hetton/Houghton/Washington) as a place to live" by various census and other 'hard' measures relating to wards in which respondents live.

Ward indicator			Satisfaction with: Local district	Town	Life as a whole	N
Population	1. % aged 0-4	Less than 8%	8.5	8.7	7.6	205
		8% or more	7.0	8.4	7.2	346
	2. Children aged 0-4 per 1000 women aged 15-14	Less than 420	8.3	8.5	7.6	244
		420 or more	7.0	8.5	7.0	307
	3. % aged 0-14	Less than 25%	8.1	8.6	7.5	353
		25% or more	7.3	8.5	7.4	395
	4. % aged 60 or over	Less than 19%	7.2	8.5	7.5	371
		19% or more	8.2	8.6	7.4	377
	5. % single person households	Less than 17%	7.6	8.5	7.5	349
		17% oe more	7.9	8.5	7.4	399
	6. % households with 6 or more persons	Less than 7%	8.1	8.6	7.6	373
		7 % or more	7.3	8.5	7.3	375
	7. Average size of household	Less than 2.9	7.9	8.5	7.4	297
		2.9 or more	7.6	8.5	7.5	451
	8. % households at more than 1½ persons per room	Less than 3%	8.1	8.7	7.8	451
		3% or more	7.1	8.3	7.0	297
Tenure	9. % households in owner-occupation	Less than 26%	7.3	8.5	7.2	324
		26% or more	8.0	8.6	7.7	424
	10. % households renting from local council	Less than 30%	8.1	8.5	7.6	254
		30% to 59%	7.8	8.6	7.5	164
		60% to 79%	7.8	8.5	7.4	186
		80% or more	6.8	8.3	7.1	144
Amenity	11. % households with exclusive use of basic amenities	Less than 76%	7.4	8.5	7.0	242
		76% - 90%	8.3	8.4	8.0	245
		91% or more	7.5	8.6	7.5	261
	12. % households with access to car	0 - 30%	7.1	8.3	7.1	346
		31 - 40%	8.1	8.7	7.5	227
		41% or more	8.5	8.7	8.2	175
	13. No of buses per day to city centre	Less than 600	7.2	8.4	7.4	250
		600 or more	7.9	8.6	7.2	301

Table 11 Multiple regression of life-satisfaction on domain satisfactions

		NATIONAL						SUNDERLAND					
		incl. job			excl. job			incl. job			excl. job		
		(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Number of cases		501			801			323			634		
	HOUSE	23		05	27		11	19		11	30		11
	DISTRICT	-01		-06	02		-06	14		--	12		01
	TOWN	25		08	23		14	10		07	08		05
Beta=	DEMOCRACY		08	07		04	03		-03	-05		05	03
weights	LEISURE		06	05		11	09		11	08		21	18
for	ST. OF LIV.		33	32		32	27		24	22		22	18
domains	FINANCE		16	15		21	20		20	20		28	27
(%)	HEALTH		16	16		18	18		13	13		14	14
	EDUCATION		09	08		11	10		05	05		09	08
	JOB		19	18					14	12			
Multiple R^2 (%)		15	48	49	18	44	47	12	31	32	17	44	45
% variance explained by environment after controlling for other domains			02			05			01			02	
% variance explained by other domains after controlling for environment			40			35			23			34	
% of variance explained by other domains which is independent of environment domains			83			80			74			77	

Table 12 Selection of variables for MCA model of district satisfaction

SUNDERLAND

DISTRICT with district list

Model	Ordered MCA	Multiple R	Multiple R
Number of cases	701	701	701
State of roads	-02	01	01
Bus & Train services	--	-03	-03
Shops	05	05	05
Freedom from noise*	10	10	07
Entertainments	06	05	04
Freedom from crime*	10	09	09
Schools	02	-03	-03
Parks & open spaces	06	06	04
Traffic in streets	03	-01	01
General appearance*	24	27	27
Safety at night	04	02	--
Being near family*	08	06	05
Being near friends*	08	08	08
Clean air	09	06	04
Sort of people*	35	34	33
(View from windows)*			09
(Privacy from neighb.)*			06
% variance explained	62	58	59

DISTRICT with person variables using MCA model (N = 692)

Predictor	Beta-weight
Sex	08
Age group*	26
Working status*	15
Terminal education age	02
Tenure of dwelling*	17
Type of dwelling*	11
Marital status	08
Residence as % of age*	10
Social class of HH	05
Adjusted multiple R^2	11
% variance explained	15

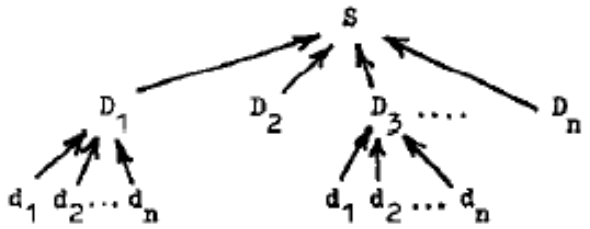
The best predictors from each set (those marked *) were included in the final model together with census variables selected as having prima-facie relation to district satisfaction (see table 10)

Table 13 Satisfaction with district using all permutations of predictor sets with MCA (Sunderland)

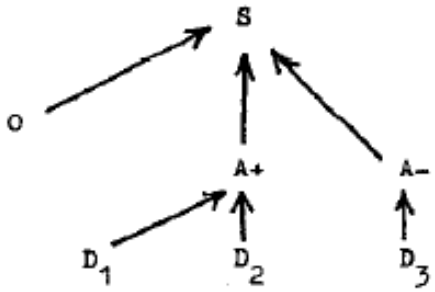
Predictor:	No. of categories	Est. simple r	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Environment: No. of cases			733	748	704	733	689	704	689
View from windows	10	43	14			15	17		18
Privacy from neighbours	10	43	09			09	07		07
Freedom from noise	10	47	12			11	10		10
Freedom from crime	10	45	14			13	15		15
General appearance	10	61	29			30	29		30
Being near family	10	31	11			12	13		14
Being near friends	10	38	12			12	11		12
Sort of people	10	42	37			35	40		38
Census:									
% aged 0-14	3	24		38		14		33	11
% aged 60 or over	3	19		05		06		12	07
% h'holds with 6 or more persons	2	23		05		09		05	07
% H'holds in owner-occupation	3	17		08		11		05	13
% with excl. use all amenities	3	16		15		06		12	07
% at more than 1 person per room	3	26		14		09		09	08
% h'holds with access to a car	3	26		22		13		20	16
Person:									
Age group	4	24			28		10	25	11
Working status	4	11			09		09	08	11
Tenure of dwelling	4	18			17		05	08	05
Type of dwelling	4	21			19		03	16	04
Residence as % of age	11	08			10		08	09	08
Adjusted multiple R^2			60	12	12	61	61	20	62
% variance explained			64	14	14	66	67	24	68

Appendix B Figures

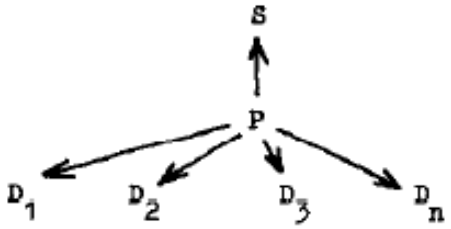
Fig. 1 Models of life satisfaction. McKennell (1971)



Model (a)



Model (b)



Model (c)

S = Life-satisfaction/Well-Being

D = Domain satisfaction

d = Sub-domain satisfaction

A = Affect

P = Personality

O = Other components of S

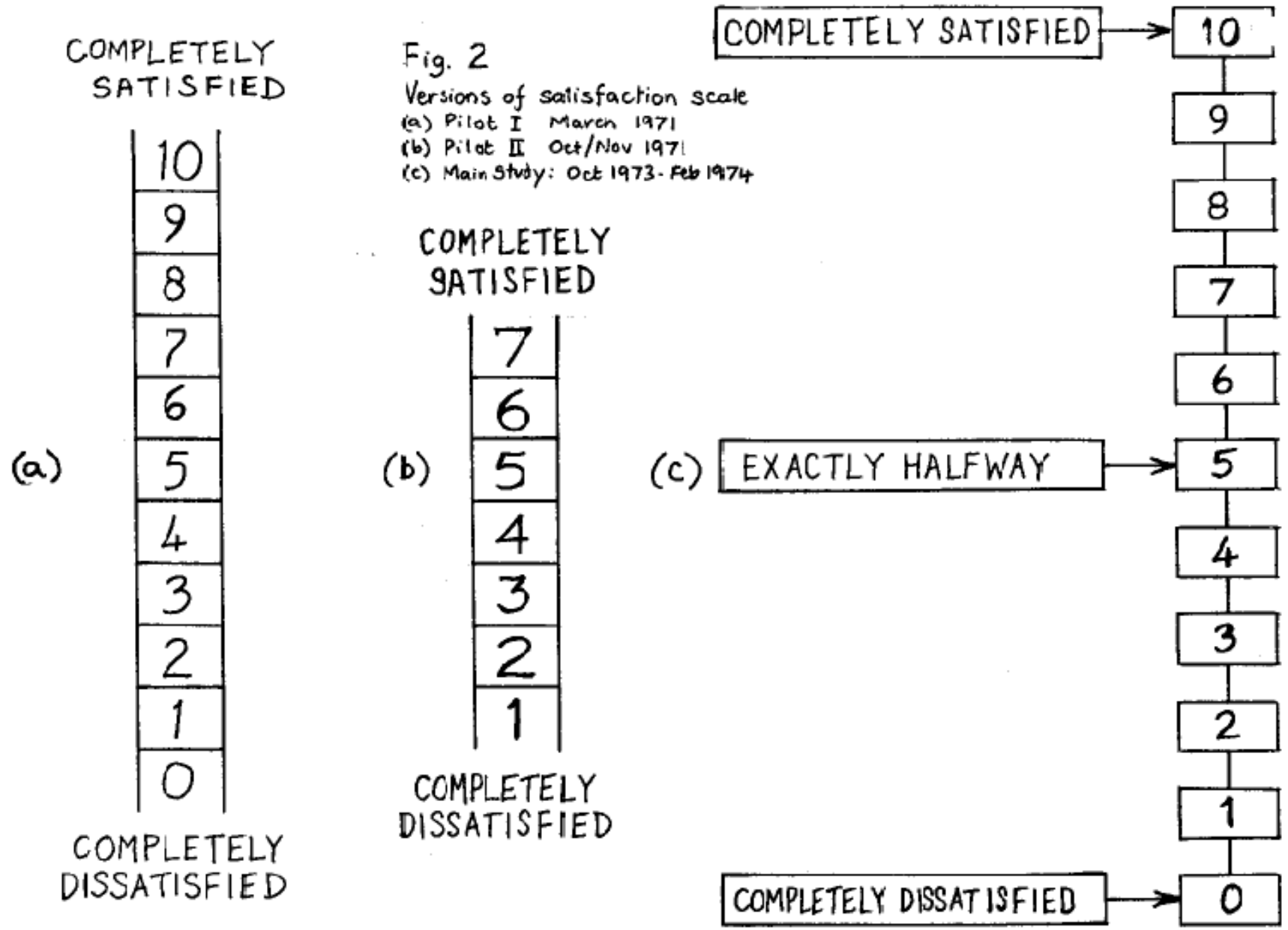
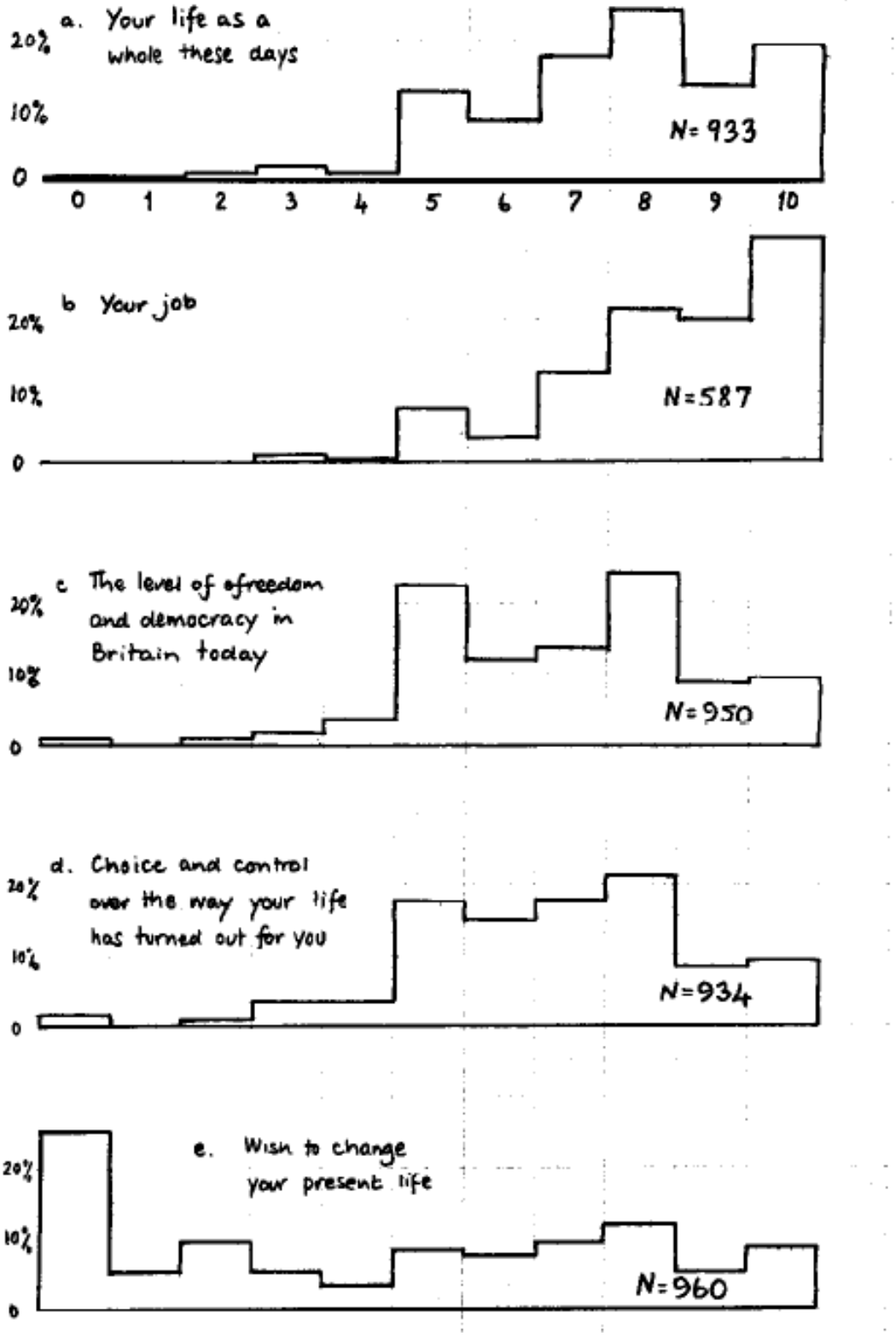


Fig. 2
Versions of satisfaction scale
(a) Pilot I March 1971
(b) Pilot II Oct/Nov 1971
(c) Main Study: Oct 1973 - Feb 1974

FIG 3 DISTRIBUTION OF SHOW CARD RESPONSES (UK: 1973)

a, b, c 0 = COMPLETELY DISSATISFIED 10 = COMPLETELY SATISFIED

d, e 0 = NONE : NOT AT ALL 10 = A VERY GREAT DEAL



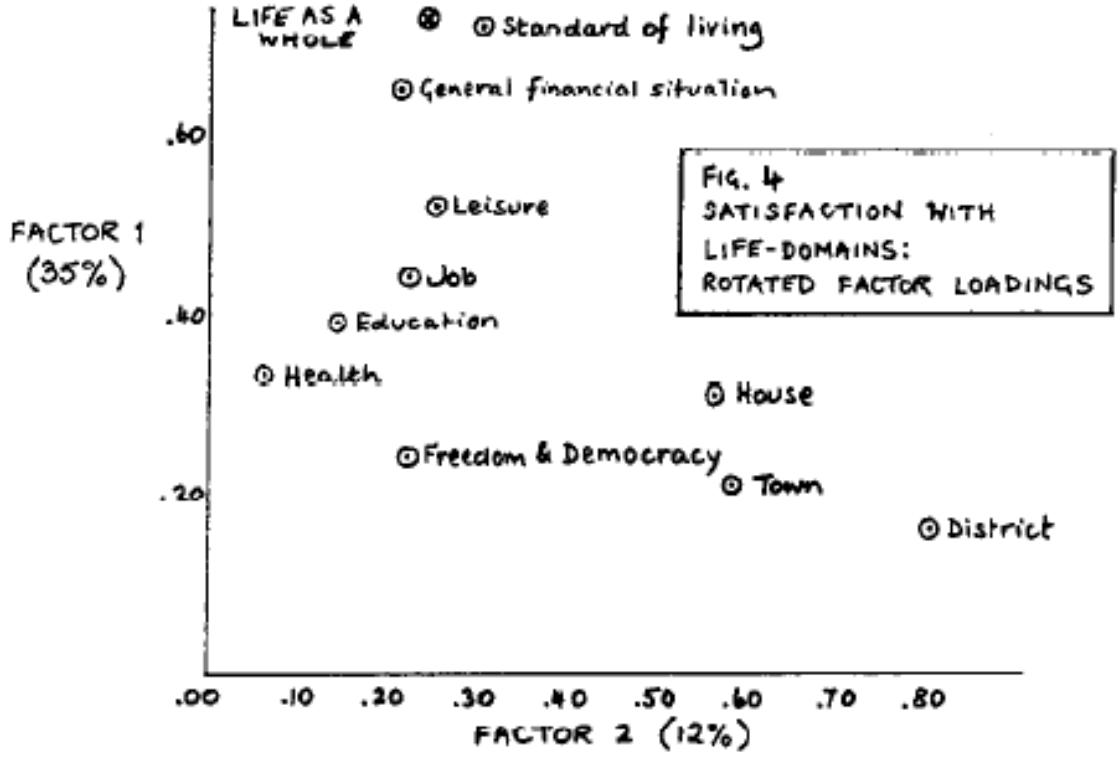


FIG. 4
SATISFACTION WITH LIFE-DOMAINS: ROTATED FACTOR LOADINGS

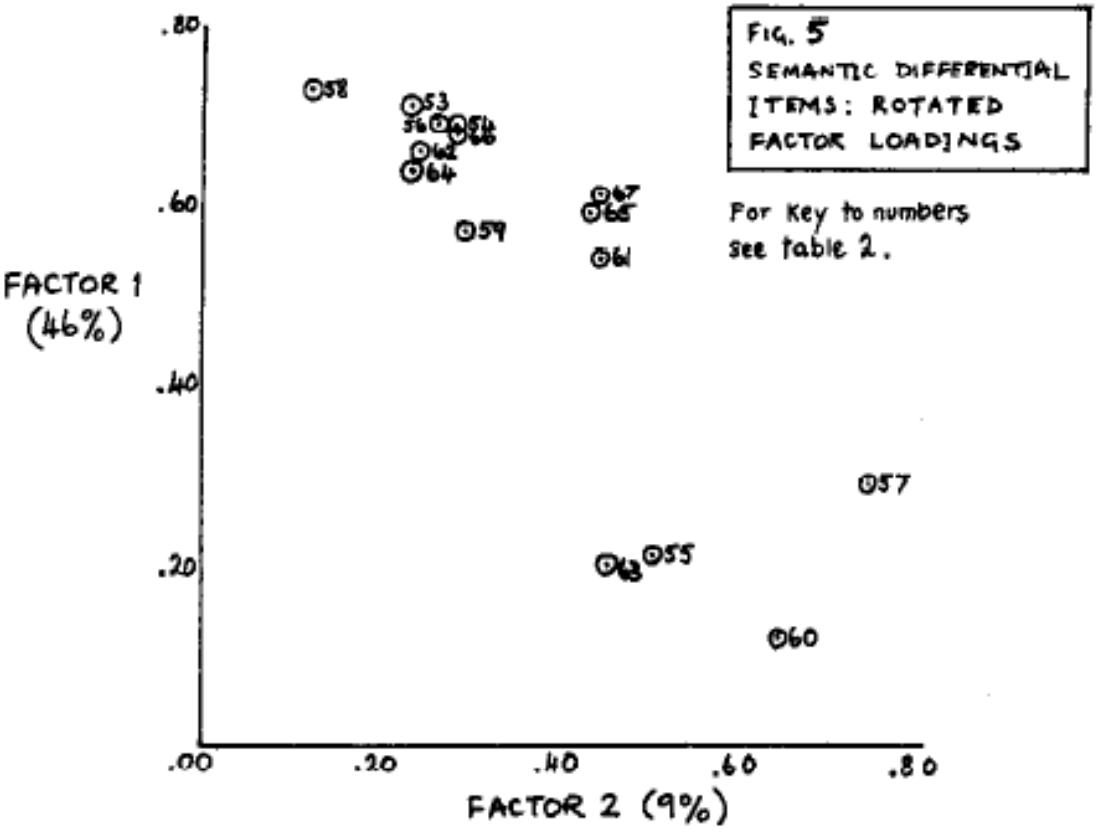


FIG. 5
SEMANTIC DIFFERENTIAL ITEMS: ROTATED FACTOR LOADINGS

For Key to numbers see table 2.

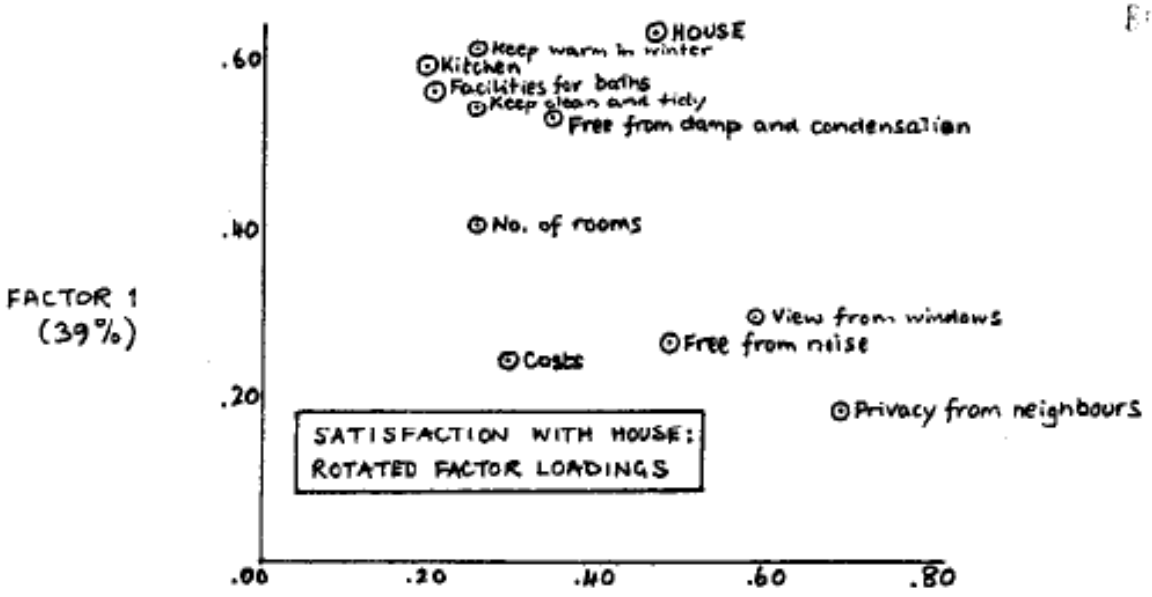

HOUSE
Keep warm in winter
Kitchen
Facilities for baths
Keep clean and tidy
Free from damp and condensation
No. of rooms
View from windows
Free from noise
Costs
Privacy from neighbours
SATISFACTION WITH HOUSE:
ROTATED FACTOR LOADINGS
.60
.40
.20
.00
.20
.40
.60
.80
FACTOR 1
(39%)
FACTOR 2 (10%)

FIG 6.

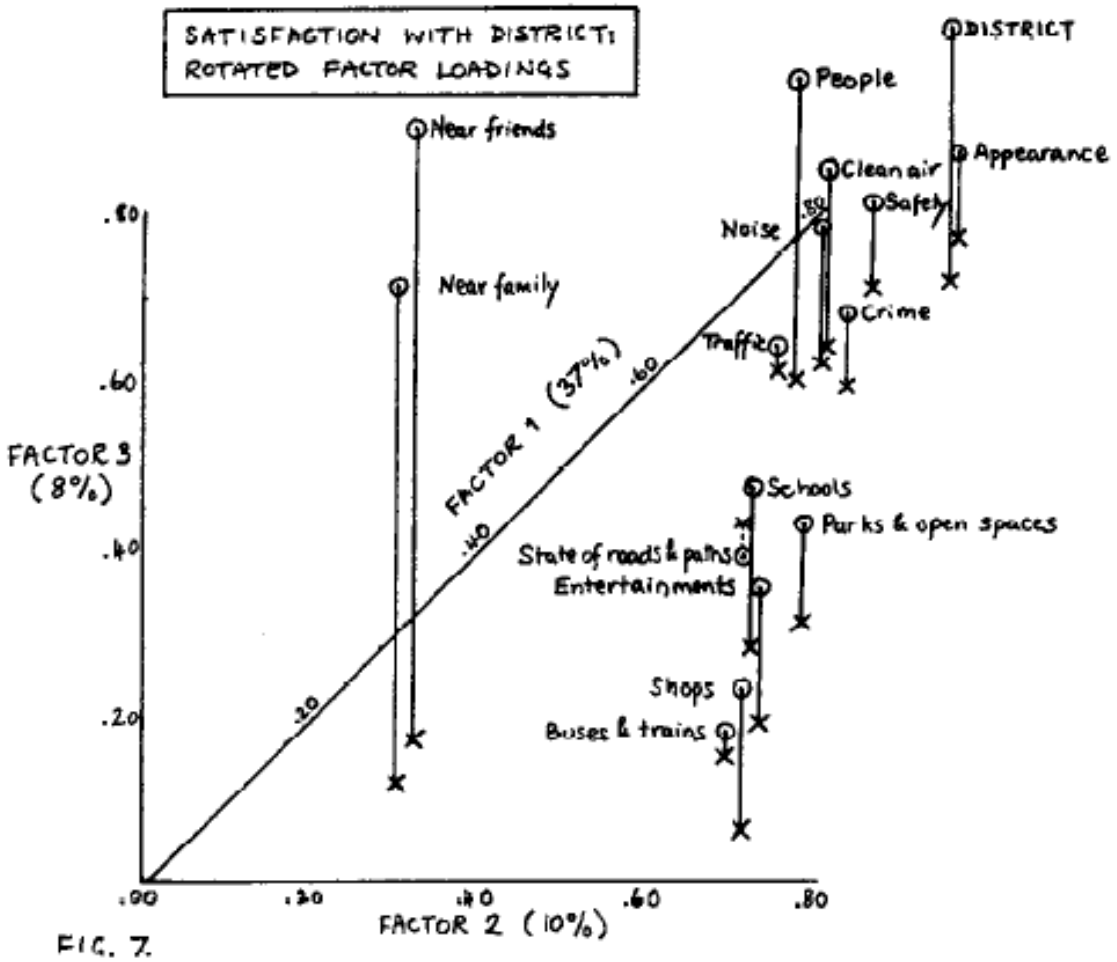

SATISFACTION WITH DISTRICT:
ROTATED FACTOR LOADINGS
DISTRICT
People
Near friends
Clean air
Appearance
Safety
Noise
Near family
Crime
Traffic
FACTOR 1 (37%)
Schools
Parks & open spaces
State of roads & paths
Entertainments
Shops
Buses & trains
.80
.60
.40
.20
.00
.20
.40
.60
.80
FACTOR 3
(8%)
FACTOR 2 (10%)

FIG. 7.

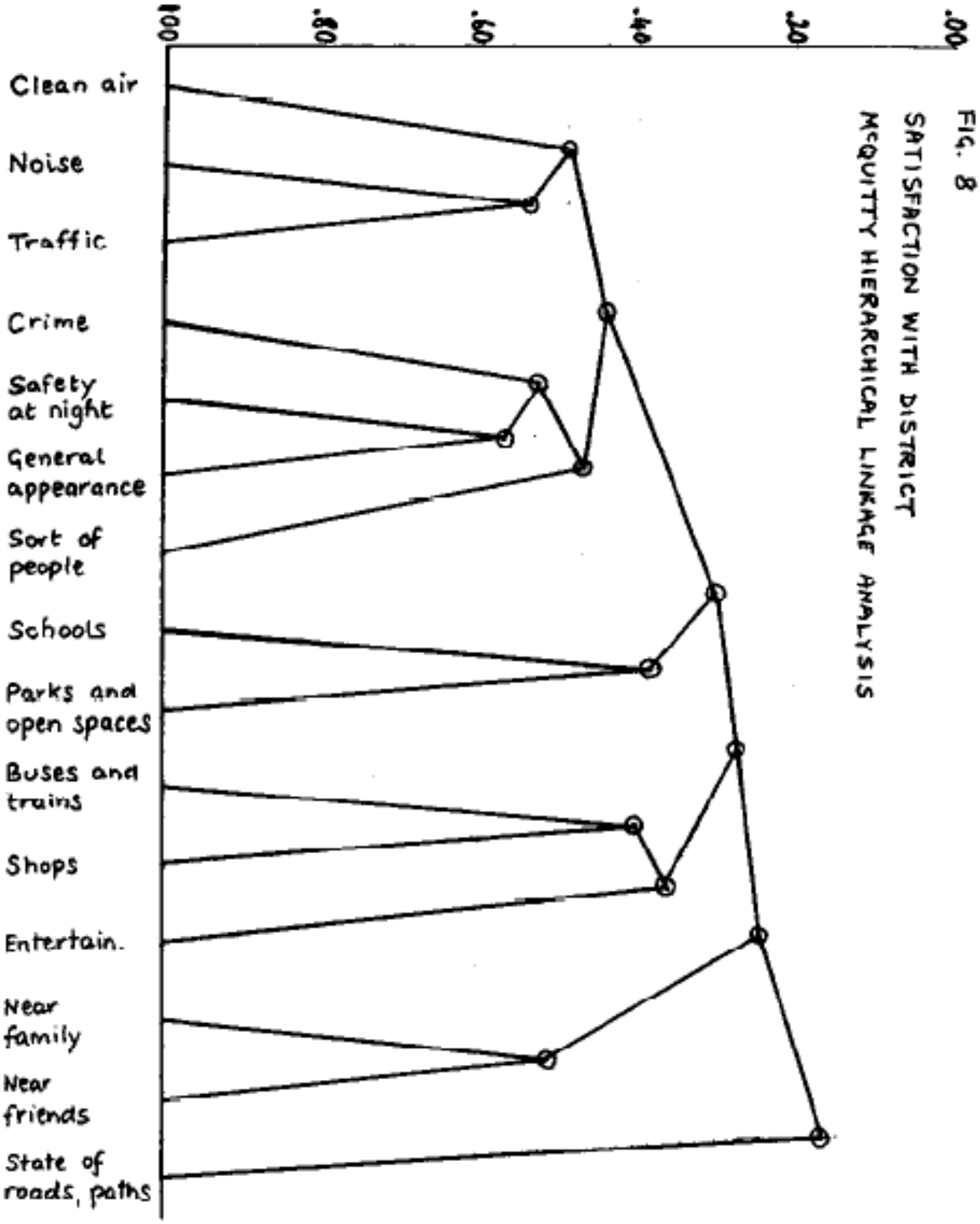
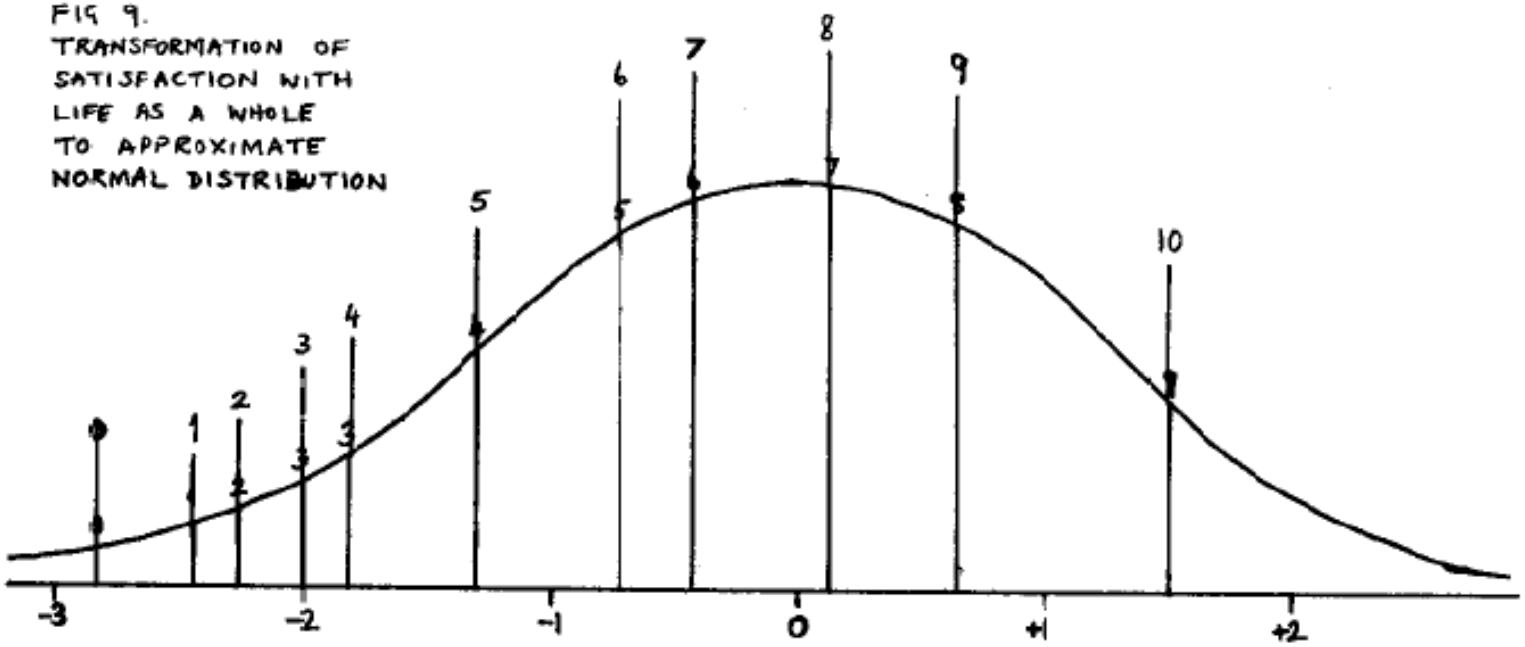


FIG. 8
SATISFACTION WITH DISTRICT
McQUITTY HIERARCHICAL LINKAGE ANALYSIS

FIG 9.
TRANSFORMATION OF SATISFACTION WITH LIFE AS A WHOLE TO APPROXIMATE NORMAL DISTRIBUTION



Scale point	0	1	2	3	4	5	6	7	8	9	10
Recode	-2·85	-2·47	-2.28	-2.01	-1·84	-1·30	-0·82	-0·44	+0·11	+0·64	+1·42

Appendix C Census and other data available for Sunderland wards

Total population
% aged 0-14 years
% aged 60 or over
Total households
Average size of household
% single-person households
% households with one child
% households with two or more children
% households with six or more persons
% men aged 15 or over economically active
% women aged 15 or over economically active
% married women economically active
% households with children aged 0 -14
Total dwellings
Total electorate
% poll in April 1973 elections
Average occupancy rate of dwelling
Total households in owner-occupation
% households in owner-occupations
Total households in council property
% households in council property
Total households in unfurnished private rented property
% households in unfurnished private rented property
Total households in furnished private rented property
% households in furnished private rented property
Total shared dwellings
% households with exclusive use of all amenities
% households living at more than $1\frac{1}{2}$ persons per room
% households living at between 1 and $1\frac{1}{2}$ persons per room
Total households with one car
Total households with two or more cars
% households with access to a car
Average number of cars per head
% aged 15 - 29 years
Total public houses
Total licensed restaurants
Total licensed clubs
Total Post Offices
Total Post Boxes
Total telephone kiosks
Total chemists shops
Total dentists
Total police stations
Total playgroups
Total doctors
Total grass sports pitches (school)
Total clinics
Total voluntary associations
Total youth organizations
Total population aged 18-20
% disabled aged 18 or over
Index of children's play deprivation
Total local shops
Total floor-space in local shops (1000 ft^2)
% Labour vote (May 1973)
% poll (May 1973)
Total children aged 0-14 years
Total children aged 5-14 years
Total children aged 0-4 years
Total women aged 15-44 years
Total children aged 0-4 per 1000 women aged 15-44
% aged 0-4 years
Total buses per day to city-centre

APPENDIX D

The Extension of Multiple Classification to Include Ordered Predictors

Summary

Multiple Classification Analysis is a widely used technique for determining the relationship between a continuous or quasi-continuous (eg. interval scale) variable and a number of nominal or categorical predictor variables. The distinguishing feature of MCA is that it in no way depends on any ordering of the categories. This is often most advantageous when the analysis involves such predictors as occupation, region, marital status, etc. In fact, a subsidiary use for MCA has been proposed in which the adjusted deviations for each category of each predictor can be used to define a linear scale for the predictor, which can be interpreted as that scale, which, together with the other predictors, best explains the variation in the dependent variable.

However, we often need to introduce discrete predictors which have inherent ordering, such as preference ratings or ladder scales. The application of MCA to a model involving such predictors does not necessarily force the adjusted deviations to show a monotonic relationship between the dependent variable and each predictor. MCA could be used to show that a strong monotonic relationship does exist, but in practice most social surveys fail to produce such an ideal result.

The problem that is dealt with here is primarily that of devising an extension to MCA to allow for this monotonic relationship of the predictors on the dependent variable. The standard version of the MCA model is summarized and the method of solution is indicated. The extra constraints necessary for the ordered version of MCA are then examined and the criteria for its solution are identified.

Notation

Basic Elements

Let N be the size of the sample,

P be the number of predictors,

C_i be the number of categories for the i-th predictor,

Y_k be the value of the dependent variable Y of the k-th response,

d_{ijk} be the dummy variable for the j-th category of the i-th predictor for the k-th observation, such that:

$d_{ijk} = 1$ if this category has been selected
$= 0$ otherwise,

a_{ij} be the adjusted deviation (or coefficient) for the j-th category of the i-th predictor,

W_k be the weight applied to the k-th response,

e_k be the residual error for the k-th response.

Derived variables

Define $W = \sum_{k=1}^{N} W_k$. the weighted number of responses in the sample;

$\overline{Y} = \sum_{k=1}^{N} W_k Y_k / W$, the weighted average of the dependent variable,

$W_{ij} = \sum_{k=1}^{N} W_k d_{ijk}$, the weighted number of responses for which the i-th predictor falls in the j-th category;

$\overline{Y}_{ij} = \sum_{k=1}^{N} W_k d_{ijk} Y_k / W_{ij}$, the weighted average of the dependent variable when the i-th predictor falls in the j-th category;

$W_{ijlm} = \sum_{k=1}^{N} W_k d_{ijk} d_{lmk}$, the weighted number of responses for which the i-th predictor falls in the j-th category and the l-th predictor falls in the m-th category.

The MCA Model

The basic Multiple Classification Analysis model defines a linear relationships between the dependent variable Y and the adjusted deviations a_{ij} for each predictor:

$$(1) \qquad Y_k = K + \sum_{i=1}^{p} \sum_{j=1}^{c_i} a_{ij} d_{ijk} + e_k$$

Here K is a constant, which depends on the restrictions on the coefficients a_{ij}. The solution to this model is defined only up to an arbitrary additive constant for each predictor. That is:

if K and a_{ij} provide a solution to the model

then $K' = K + \sum_{i=1}^{p} K_i$ and $a'_{ij} = a_{ij} - K_i$ also provides a solution,

Where K_i are arbitrarily chosen constants. Thus, in order to obtain a unique solution we must restrict the values of a_{ij} by a set of constraining equations. The equations that have been used in standard MCA models[1] are the zero mean constraints:

$$(2) \qquad K = \bar{Y}, \qquad \sum_{k=1}^{N} \sum_{j=1}^{c_i} W_k a_{ij} d_{ijk} = 0.$$

The least-squares minimization procedure is used to obtain the solution:

$$\text{Minimize} \quad \sum_{k=1}^{N} W_k e^2_k \quad \text{subject to the constraints (2)}$$

This technique minimizes the weighted sum-of-squares of the residual error term, and is equivalent to the minimization of the unexplained variation in the dependent variable Y.

Using the derived variables previously defined, the mathematical problem reduces to the following formula:

$$(3) \qquad \text{Minimize} \quad \sum_{i=1}^{p} \sum_{j=1}^{c_i} \sum_{l=1}^{p} \sum_{m=1}^{c_l} W_{ijlm} a_{ij} a_{lm} - 2 \sum_{i=1}^{p} \sum_{j=1}^{c_i} W_{ij} a_{ij} \times (\bar{Y}_{ij} - \bar{Y})$$

$$\text{subject to} \quad \sum_{j=1}^{c_i} W_{ij} a_{ij} = 0.$$

This problem has a unique solution, and can be shown to be the solution to the set of normal equations:

$$(4) \qquad \sum_{l=1}^{p} \sum_{j=1}^{c_l} W_{ijlm} a_{lm} = W_{ij} (\bar{Y}_{ij} - \bar{Y})$$

Iterative solutions to these equations are well-known and have been implemented in the computer program MCA, which is widely available both as a single program and in the OSIRIS package.

Interpretation of the MCA model

The MCA model has been interpreted in terms of similar statistical problems. For example Sonquist et al. [2] have shown its relationship to multiple analysis of variance and to dummy variable regression. In the analysis of variance model we consider a P-way analysis of variance with $C_1 x C_2 x \ldots\ldots x C_p$ individual cells, and with a variable number of observations in each cell. The coefficients a_{ij} are then the 'fitted constants' of the ANOVA model.

For multiple regression with dummy variables, one of the dummy variables for each predictor becomes redundant, and is generally omitted from the model. The dummy variable multiple regression coeffieients b_{ij} are thus related to the MCA coefficients by an additive constant Q_i for each predictor:

$$a_{ij} = b_{ij} + Q_i \quad \text{where} \quad Q_i = - \sum_{j=1}^{C_i} W_{ij} b_{ij} / W$$

A further interpretation of MCA is a rescaling program. The scaled predictor variables are defined by:

$$X_{ik} = \sum_{j=1}^{C_i} a_{ij} d_{ijk}.$$

The MCA model (with zero mean constraints) may then be rewritten:

$$(5) \qquad Y_k = \bar{Y} + \sum_{i=1}^{P} X_{ik} + e_k \qquad \text{where} \qquad \sum_{k=1}^{N} X_{ik} = 0.$$

This is then a regression model of Y_k against X_{ik} where the beta coefficients are all unity. Thus by constructing a scale for each predictor using the coefficients a_{ij} we produce derived predictor variables which are scaled in such a way as to minimize the variation in Y. The correlation matrix for Y and the X_i's may be derived directly from the coefficients a_{ij} and the weights W_{ijlm}.

MCA with ordered predictors

A problem which frequently occurs in survey analysis concerns the fitting of ordered categorical predictors to a dependent variable. For example we may wish to examine the composition of an overall altitude scale in terms of component scales, where the scales cannot be assumed to be isomorphic with respect to each other.

The difficulty arises when we demand that the adjusted deviations preserve a monotonic relationship between each predictor and the dependent variable. That is, for example, a higher predictor value must produce a more positive effect on the estimate of the dependent variable. Hence in our MCA model we must demand that the coefficients a_{ij} be monotonic with the category j.

$$(6) \qquad k > j \Rightarrow a_{ik} \geqslant a_{ij}$$

Thus we must examine an MCA model as defined in (5) above but with the additional set of constraints defined by (6).

The problem may be solved by first considering the differences between adjacent coefficients:

Let $\quad Z_{i1} = a_{i1}$

$$Z_{ij} = a_{ij} - a_{i(j-1)} \quad \text{for } j \neq 1$$

After some algebraic manipulation, we can rewrite the minimization problem

$$(7) \quad \text{Minimize} \quad \sum_{i=1}^{p} \sum_{k=1}^{c_i} \sum_{l=1}^{p} \sum_{n=1}^{c_l} \left[\sum_{j \geq k}^{c_i} \sum_{m=n}^{c_l} W_{ijlm} \right] Z_{ik} Z_{ln} - 2 \sum_{i=1}^{p} \sum_{k=1}^{c_i} \left[\sum_{j \geq k}^{c_i} W_{ij} (\bar{Y}_{ij} - \bar{Y}) \right] Z_{ik}$$

$$\text{subject to} \quad \sum_{k=1}^{c_i} \left[\sum_{j \geq k}^{c_i} W_{ij} \right] Z_{ik} = 0 \text{ and } Z_{ik} \geqslant 0 \text{ for } k \neq 1.$$

This problem is now in the form of a standard quadratic programming model. In general it has a unique solution, and a computer program has been developed to solve the ordered problem. This consists of an additional subroutine to the MCA program.

Solving the Ordering Problem

The solution to the minimization problem (7) is given uniquely by the following formula:

$$(8) \qquad V_{ik} = \sum_{l=1}^{P} \sum_{n=1}^{C_l} \left[\sum_{j=k}^{C_i} \sum_{m=n}^{C_l} W_{ijlm} \right] Z_{ln} - \sum_{j=k}^{C_i} W_{ij}(\bar{Y}_{ij} - \bar{\bar{Y}})$$

$$V_{ik} \geq 0 \text{ for } k \neq 1, V_{ik} = 0 \text{ for } k = 1,$$

$$Z_{ik} \geq 0 \quad \text{for } k \neq 1 \quad \text{and either } V_{ik} = 0 \text{ or } Z_{ik} = 0.$$

Where the zero mean constraint again appears as a property of the solution equation, when we take the case for $k = 1$. This formula can be made more practical by substituting for the Z_{i1} into the rest of the set of equations:

$$(9) \qquad V_{ik} = \sum_{l=1}^{P} \sum_{n=2}^{C_l} \left[\sum_{j=k}^{C_i} \sum_{m=n}^{C_l} W_{ijlm} - W_{ij} W_{1m} / W \right] Z_{ln}$$

$$- \sum_{j=k}^{C_i} W_{ij} (\bar{Y}_{ij} - \bar{\bar{Y}}) \geq 0 \quad \text{for } k \neq 1,$$

$$Z_{ik} \geq 0 \quad \text{for } k \neq 1 \quad \text{and either } V_{ik} = 0 \text{ or } Z_{ik} = 0.$$

This requires a new iterative technique for its solution, derived from the methods of linear programming. In general this method, the simplex method, provides an exact solution, and singularities (ie. linear dependence of predictors categories) can be detected without difficulty. However the number of iterations is often as much as ten or twenty times that taken by the normal equations method, although the computation required at each iteration is somewhat reduced. In addition, free or nominal predictors can be accomodated by forcing the V_{ik} to zero and releasing the constraints on the Z_{ik}, and negatively related predictors can be introduced by reversing the inequalities.

The simplex method of solution distinguishes between basic categories, where the equality $V_{ik} = 0$ holds, and non-basic categories, where the equality $Z_{ik} = 0$ holds. The initial solution starts by making all categories non-basic, and then each subsequent iteration introduces a new category into the basis, until the conditions in equation (9) are met.

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