Intra-generational mobility and social distance: Work history analysis and occupational structure

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Short Abstract

The frequency of intra-generational job transitions is considered as an indicator of social interaction. As such, occupational units may be scaled in terms of their distributions of more and less likely transitions. The derived scales share many similarities with those based upon alternative indicators of social interaction, and appear to be an informative representation of the order of social stratification within the UK. (Additionally, the model of interaction at the level of analysis of the **occupational** unit, can be compared with the model at the level of analysis of broader social class categorisations, allowing for evaluation of how well the imposed class boundaries illustrate the wider order of intra-generational occupational associations).

Our end product is a scaling of occupational units which reflects patterns of intra-generational mobility. Aside from the general use of these scores as an occupational index, we also consider how they lend themselves to analysis of the life course career structures of individuals. In this format it is possible to describe individuals' career sequences through the derived scale scores, and a possible summarising measure, namely fitting a regression line of best fit to those sequences, is considered.

Medium Abstract

In this paper, we discuss a secondary use for occupational life history data. We argue that the statistical modelling of occupational moves within individuals' life courses can be used to reveal patterns in the relative social distance between different occupational titles, under the simple assumption that occupations between which moves are more common are 'closer' to each other than those between which mores are rare. As in the 'CAMSIS' project, in which patterns in the binary combinations of husbands' and wives' jobs are modelled for a similar purpose, in this application we use as our base units the binary combinations between each set of two contiguous jobs within individuals' reported job sequences (specifically, our unit of analysis is the crosstabulation of occupational titles by employment status records). Such data is amenable to formulations from Goodman's class of association models, and we find that the estimation of row and column scores (Goodman's 'RC2' models) generates metric values which can be associated with the occupational units.

These metric values, therefore, represent detectable patterns of which job transitions tend to be more and less common within individuals' life courses. In fact our data resources – in this discussion limited to British retrospective and panel surveys – allow for the construction of alternative transition units of contiguous, or otherwise related, job moves, with or without duration weightings, and with the possible incorporation of information on other relevant sociological factors such as the gender and ethnicity of the occupation holders.

We find that in most circumstances, a low dimensional hierarchy appears to be an adequate model for the patterns of occupational associations revealed in intra-generational data. The primary dimension to this hierarchy, we suggest, can be described as one of 'generalised advantage', or social stratification, sharing many features with those patterns revealed by other models for the frequency of social interaction between occupations, such as the CAMSIS modelling of marital partnerships, and other research into occupational patterns between friends or in inter-generational associations. In an additional twist however, the location of occupations through intra-generational associations incorporates selected features which are not shared by other models of social distance, but which can readily be explained by the longitudinal substantive context, most noticeably in the relatively 'low' scores assigned to occupations from what can be characterised as 'declining' industries or sectors. Subsequently, the metric scores which define the primary dimension of association can be proposed in themselves as an informative scoring of occupational locations.

Another attraction of our approach is that the imposition of varying constraints to the association models used to derive occupational scores, facilitates the comparison between the derived occupational scores and alternative externally proposed occupational scales or schema. Thus in this paper we discuss the derivation and features of an intra-generational occupational hierarchy, and compare its values with those of alternative sociological conceptualisations of occupational locations.

Our end product, then, is a scaling of occupational units which reflects patterns of intra-generational mobility. Aside from the general use of these scores as an

occupational index, we also consider how they lend themselves to subsequent analysis of the life course career structures of individuals. In this format it is possible to describe individuals' career sequences through the derived scale scores, and a possible summarising measure, namely fitting a regression line of best fit to those sequences, is considered.

Introduction

According to Weber, a social class comprises 'the totality of those class situations within which individual and generational mobility is easy and typical' (Weber 1978:302). Such an apparently simple assertion, though, begs a number of questions. Setting aside, for the moment, the not-inconsiderable technical problems, there is first, the issue of whether the social classes identified in these alternative ways – individual (*intra*-) and (*inter*-)generational mobility – would be the same. Secondly, though, and more basically, there is the question of whether we could identify *classes*, as such, at all. Weber, and many subsequent writers (e.g. Scott 1996), see the structure as one in which occupations tend to cluster together into groupings, within which mobility is relatively common and between which it is relatively rare. The logical extreme of this view would be to see the groupings as internally homogeneous, marked by no detectable pattern to internal movements, and clearly bounded by what could be identified as mobility barriers. A more relaxed view would allow for some internal differentiation and a degree of fuzziness in the boundaries.

However, this relaxed view could be followed to the other logical extreme, which is of a continuous hierarchy of occupations. At any point in this hierarchy, movement to adjacent occupations would be relatively easy and common, but movement to occupations further up or down the hierarchy would be progressively more difficult and rarer. There would, however, be no points that could be identified as distinct barriers.

A number of early studies claim to derive, through an empirical examination of inter-generational mobility patterns, succinct social class schema aligned with Weber's conception of categorical mobility boundaries. These categories are believed to be both externally clustered and internally homogeneous (eg Blau & Duncan 1967, Breiger 1981, Erikson & Goldthorpe 1992, Goldthorpe 1980, Hauser 1978, Hout 1984), though they do not necessarily concur between studies. Erikson and Goldthorpe (1992) and Snipp (1985) extend those investigations to data on intra-generational mobility patterns; Snipp (1985), in comparison with Hout (1984), argues for the approximate equivalence of schema identified through inter- or intra-generational patterns. However, most of these investigations cannot truly be regarded as neutral assessments of category formation, as they are typically derived through the examination of a slightly larger, but still small, number of occupational units (the classical example are the 17 units analysed in American research), and / or with the adoption of strong theoretical presuppositions (see esp Goldthorpe 1980). These premises are likely to bias subsequent results in favour of the initial categorical or theoretical structures – aptly illustrated when an alternative analysis of barriers in intra-generational mobility in the US, using different base unit categories, concludes that a different occupational structure, reflecting industrial segmentation, also summarises distinct, internally homogeneous mobility regimes (Tolbert 1982).

The justification for the starting point of aggregated categories is regarded by many writers as pragmatic, as Snipp (1985:479) writes : "*Seventeen categories are sufficiently detailed to represent a variety of occupational types but are not so numerous as to be unmanageable*". However, it is our contention that, in fact, many

more categories do not prove unmanageable at all, see also Rytina (2000b). Furthermore, we argue that when a much finer level of detail is considered (we typically deal with several hundred base occupational units), it is not at all clear that the conception of a small number of distinct mobility-bounded groupings will find support. On the contrary, the other logical extreme alluded to above, of a continuous gradation in mobility patterns, seems more appropriate (again cf Rytina 2000b's conclusions for patterns of inter-generational mobility).

Integration with the CAMSIS approach

Literature produced through, or closely related to, the CAMSIS project, has repeatedly demonstrated that a continuous occupational grading schema is a more appropriate conceptualisation of social stratification differences (Prandy 1990, Prandy 1998, Stewart et al 1980). In particular, the contention of the CAMSIS project is that patterns of *social interaction* between occupational title holders offer a reliable, and theoretically consistent, method of deriving such occupational scores, namely through the statistical analysis of structures to those patterns of associations (Prandy 2000). In previous research occupational combinations for cohabiting couples or friendship groupings have been used as indicators of social interaction patterns. First, the development of the Cambridge Scale (Prandy 1990, Stewart et al 1980), used primarily the frequency of friendship associations. More recently, work has concentrated upon the series of national CAMSIS measures, using the frequency of occupational associations between spouses (Prandy 2000, Prandy et al 2002). Equally however, from such a perspective, the patterns of both inter- and intra-generational mobility exhibited by occupational incumbents can be regarded as evidence of which occupations have stronger and weaker social associations between each other. Thus from such data, information can be derived about the nature of the structure that underlies those patterns of association. Already, in closely related work, Rytina (1992, 2000a, 2000b) has used the frequency of inter-generational mobility transitions to scale occupational units in terms of their more and less likely inter-generational transitions.

The evidence so far from these studies strongly suggests that in all three cases – friendship, marriage, and inter-generational mobility – the underlying structure of social association between occupations is much more like a continuous hierarchy than a division into distinct social class groupings (see also Prandy 1998, Rytina 2000b). Furthermore, it looks very much as if the underlying structure is essentially the same in all cases (Prandy & Lambert forthcoming, Rytina 2000b). The case of intra-generational mobility is, therefore, a particularly interesting one. If the analysis of the job transitions of individuals as reported in retrospective work history surveys suggests a structuring into classes, then it would be the exceptional case. If not, and a hierarchical structure is revealed, is it necessarily going to be the same structure as in the other cases? Job changes within a working life are likely to be much more constrained than changes between generations or the choice of a friend or spouse, so either of these possibilities is open. Of great interest would be to test whether the same flaws which we suggest lie with support for certain occupational schema which have been based primarily upon patterns of inter-generational mobility (Prandy 1998, Rytina 2000b), cf (Erikson & Goldthorpe 1992, Goldthorpe 1980), will apply to the same schema's engagement with evidence on intra-generational mobility (as eg Erikson & Goldthorpe 1992, Halpin & Chan 1998).

Analysis of Individual Career Trajectories

There is another, closely related reason for being particularly interested in the nature of the structure revealed by an analysis of intra-generational mobility. Although the collection of work history data is becoming more commonplace, the development of methods for dealing with their analysis has not kept pace. In the approach to be adopted here, job transitions at the individual level and the structure of relations between occupations are complementary, two sides of the same coin. So, if we can identify the nature of the structure, through an analysis of individual transitions, then it becomes possible to represent a sequence of individual transitions in terms of movement (or lack of it) through the structure. As we hope to show, this would allow for a simpler and more readily comprehensible means of describing individual work histories.

It can be suggested that two methods of career analysis currently dominate sociological research. The first employs variations of event history analyses for modelling the chances of individuals making certain occupational transitions over time (eg Blossfeld & Drobnic 2001). In the second, methods are applied to summarise the aggregate career trends of individuals, such as techniques of sequence analysis (Agresti et al 2000, Halpin & Chan 1998), or more overt arithmetic functions of past experiences (Becker 1964, Gershuny 2000, Miller 1998, Taris & Feu 1999). However, both fields have employed relatively simple representations of occupational differentiation in their analysis, such as low numbered occupational class or industrial sector categorisations (indeed, many analyses distinguish no finer level of detail than whether an individual is employed or not). By contrast, the prospect of analysing career sequences through the CAMSIS approach, first by constructing detailed indicators of occupational differentiation which reflect career developments, then by utilising that differentiation in the modelling of individual career profiles, offers an appealing advance on previous techniques.

Data sources[1]

Our analysis makes use of two UK datasets that have information on job transitions at the level of occupational unit group and employment status. The first is the Family and Working Lives Survey (FWLS) (Rohwer 1996), which contains retrospective life-history information for nearly 11,000 adults, plus truncated life-history information for nearly 6,000 of their partners (left-truncated at the start of the partnership). It is a nationally representative stratified random sample which includes a substantial 'booster' sample of members of ethnic minority respondents (Research Services Ltd. 1995).

The second version of the British Household Panel Study (BHPS) combined life history dataset (Halpin 2000), contains alternative life history records. First, selective work life histories for approximately 16,000 respondents who have ever been interviewed in the BHPS are collated in one record[2]. For respondents who were interviewed in the second or third waves of the BHPS panel, these life-histories usually extend to their first post-school activity; for other respondents these histories are left-truncated from their first panel interview; for all respondents records are also left and right truncated according to any patterns of intermittent panel membership.

Because there is a substantial degree of comparability in the nature of the data collection and preparation exercises used for the FWLS retrospective, and BHPS collated retrospective-and-panel, life history datasets, we combine the records of each to generate a larger data resource which forms the basis for the results presented here.

Table 1 : General features of the dataset
(BHPS and FWLS transition records combined)

Number of respondents (males)	9675
Number of job-to-job transitions	40256
Number of non-diagonal transitions	28746
Transitions not modelled as 'pseudo-diagonals'	39190
Soc-by-status categories	407

Table 1 shows the general features of the dataset used. The basic units of analysis – the categories modelled as origin and destination occupations – are what we call 'soc-

[1] All data used was supplied by The Data Archive, University of Essex.

[2] An unfortunate feature of this dataset is a restricted indicator of employment status (self-employed v's full-time employed v's part-time employed v's non-employed categories), and the presentation of only some of the derived occupational classifications available from the CASOC (Elias et al 1993) coding scheme used. In this analysis, an approximation of a more detailed employment status classification was used, obtained by reconstructing the 36 categories of the Hope-Goldthorpe unit groups from a measure of the Hope-Goldthorpe scale (Goldthorpe & Hope 1974), in combination with employment status information inherent to the 1992 version of the Goldthorpe class schema (Erikson & Goldthorpe 1992).

by-status' categories, namely the combination of occupational title using the 1991 Standard Occupational Classification (SOC) (Office of Population Censuses and Surveys 1991) and a five-fold indicator of employment status based upon that used by Elias et al (1993). However, sparsely represented soc-by-status categories have been combined with others, in such a way as to maintain their SOC minor or major group value and the original employment status value[3]. For our dataset, this generates a total of 407 soc-by-status categories.

In addition, but not prepared and analysed at this stage, the BHPS panel data collections offer the possibility of additional, and much more comprehensive, job transitions information in combination with supplementary data covering a wide variety of individual level variables (whereas the FWLS and BHPS records have relatively sparse detail on the nature of job transitions and the individuals who experience them). This could be obtained by examining the precise between wave life history files which are collected and updated during each BHPS panel interview, but which are used relatively sparingly in the construction of the combined life-history file. The use of such data could allow for the assessment of occupational transitions in the context of many other putatively correlated factors, such as demographic and educational backgrounds, and the political and cultural attitudes and behaviours of individuals.

Returning to table 1, there is a question of what should be taken as constituting a job transition. Taking a transition to be a move in employment situation would include many cases of individuals moving into or out of paid employment. Since our primary concern is with occupation, transitions of this kind are of no interest[4]. However, if the analysis is restricted to direct moves from one occupation to another, then those cases where a spell of labour market inactivity or unemployment intervenes would be lost. Since this would considerably restrict the number of transitions available for analysis, we decided to ignore such spells, and to treat these cases as if there had been a direct move from one job to another. (In our terminology, we analysed all consecutive occupational moves, regardless of whether they were 'contiguous', ie adjacent in time, or 'non-contiguous', ie interspersed by a non-employment spell).

Alternative possibilities, not considered below, would be to include categories of non-employment in our analysis of occupational unit transitions. One simple realisation would be to include 'unemployed' as a single occupational category, or perhaps making a brief distinction between 'short-term' and 'long-term' unemployment categories. Equally, as has been experimented with in other CAMSIS scale estimations, it may prove convenient to work with categories of 'unemployed' and 'out of the labour market' which are cross-classified by the highest educational level of the relevant respondent, whilst other life-course employment status categories

[3] In this instance an automated recoding procedure was used which checked the number of transitions representing an original soc-by-status unit, and then reclassified the unit if that number was considered to be too low. This and other methods are described more generally in the CAMSIS project webpages, http://www.cf.ac.uk/socsi/CAMSIS/ (correct at 1.4.02).

[4] By contrast, the most common forms of life history analysis conducted in previous research focus on such employment status transitions but *not* upon differences in terms of social stratification (see esp. Blossfeld & Drobnic 2001, Elliott et al 2001).

(such as ‘full time education’, ‘maternity leave’, ‘illness/disability’) may also be used to further distinguish the nature of the non-employment spell. It is possible that these alternative treatments would carry implications for the derived occupational scales, as well as generating substantive conclusions on the nature of the non-employment spells involved.

Nevertheless, the analysis below, which is for males only, is based only on ‘consecutive’ job transitions (as defined above). There is, in fact, no strong substantive reason for dealing only with consecutive jobs and associating one ‘origin’ job with the next ‘destination’ job. We are considering sets of jobs that are linked by the fact that they have been held by the same individual and there is no necessary reason for regarding the order in which the jobs are held as relevant[5]. So we could regard every job, except the last, as an origin job and every other subsequent job as a destination. Indeed, we could also ignore the time asymmetry of a progression from origin to destination jobs and deal with all the possible combinations of every job situation reported by an individual and all their other job situations.

These techniques would have the advantage of considerably increasing the number of cases available for analysis. However a complication with them is the possibility that some of the job transition cases in each design are related to, and even defined by, each other within any given individuals’ record. In addition, in both extended data formulations (but particularly the latter), these designs would impose a substantively unappealing equivalence of influence between consecutive and non-consecutive, and forward and backward in time, job transitions.

We could note however that even our restricted focus on consecutive job transitions may be subject to a dangerous complexity, namely that multiple records from the same individuals are analysed, and that greater influence is effectively given to individuals who report more transitions than to those who report more stable careers. To account for the former, it may be of value to specify accounts of hierarchical structuring in these records, namely the ‘nesting’ of transitions within individuals (cf Agresti et al 2000). To account for the latter issue, as mentioned above, we may consider applying some form of duration weighting to the records.

Another conceptualisation of intra-generational occupational mobility analyses has been the use of various methods related to ‘sequence analysis’ techniques, in order to describe patterns in the total career sequences of individuals (eg Abbott & Tsay 2000, Chan 1995, Halpin & Chan 1998, Han & Moen 2001, Taris & Bok 1994, Taris & Feu 1999, Van der Heijden et al 1997). This requires slightly different data resources (including as much information as possible on the *completed* career sequences of individuals). At present, existing analyses have restricted themselves to very limited categorical conceptualisations of occupational unit differences – eg the Goldthorpe class schema (Halpin & Chan 1998), and an assessment of whether occupations were considered by respondents to be from “a higher level, same level, or lower level job compared to the previous job” (Taris & Feu 1999:162-3). A full incorporation of occupational unit detail, moreover, may prove practically impossible in combination

[5] Although, see below, it may not be desirable that consecutive and non-consecutive transitions have exactly the same influence in the final model.

with the multiple permutations of unit sequences[6], although again this introduces an issue which we may wish to return to.

Although again not considered further, an interesting aside in our discussion of the data available for analysis concerns the possibility of attaching other relevant information to each transition considered. Information on the time at which the transition occurred (or perhaps the midpoint of the time between non-contiguous consecutive occupational transitions) may possibly be incorporated, as could 'external' covariates associated with the individual exhibiting the given transition, such as indicators of their social characteristics. Lastly, simple characterisations of the transition itself could conceivably be considered : for instance Taris and Feij (1999:159) mention the substantive interest in classifying whether a career transition was regarded by the respondent as 'voluntary' or 'involuntary'. We should bear in mind, however, that the complexities of retrospective data resources significantly hinder the ability to obtain reliable information on such additional relevant factors, whilst the incorporation of any of these possibilities could dramatically increase the complexity of the data structures considered for the model of association.

Lastly, an attractive feature of the datasets described above in table 1 is their relative simplicity, insofar as relatively few variables are required per record. One implication of this is their likely comparability with other data resources from both within Britain and from elsewhere. In the UK, several other major resources – for instance the SCELI datasets and the Oxford Mobility Study of 1972 – are likely to contain readily accessed equivalent occupational career data, whilst we may also anticipate finding similar information from other as yet unidentified sources. Outwith Britain, panel datasets with interests in labour force histories are well established in several countries (see especially the PSID (eg Maume 1999) and GSOEP (eg Scherer 2001a)), whilst efforts in improving cross-national comparability of such resources, notably for longitudinal and panel data at the CEPS institute (Centre for Population Poverty and Public Policy Studies 2002), increase their immediate accessibility. Thus, whilst the analysis below is restricted to the BHPS and FWLS resources, it is likely that future work will incorporate comparisons both with different UK resources, and between Britain and other national resources (cf Mayer 2000, Mayer et al 1989, Scherer 2001b).

[6] We would effectively be trying to analyse occupational units in an n-fold cross-tabulation, where n is the maximum number of transitions in a life-course. A simplifying model, however, may involve the specification of hierarchical relations between transitions in a binary cross-classification, as mentioned above.

Methods

The statistical methods used to construct the intra-generational occupational association models are the same as in the CAMSIS project (Prandy & Jones 2000, Prandy & Lambert 2002). Whereas in the latter case the binary interactions examined are those involving the occupations of husbands and wives in a sample of couples, here they are the occupations of the origin and destination job in the employment transitions reported in a sample of individual's work histories.

In the first instance, the binary interactions are investigated through methods of correspondence analysis (CA) (Greenacre 1984). Here, the cross-tabulation of origin and destination occupations is described in terms of its deviation from the expected distribution under independence. This deviation can be partitioned into a number of segments, within each of which all of the relevant pattern of non-independence may be entirely explained by a particular dimension of occupational unit scores. To fully explain all of the deviations from independence, as many dimensions as occupational units may be needed. However, in most situations studied hitherto, we find that an underlying structure to the deviations from independence is revealed, whereby a single largest dimension of occupational scores emerges[7], which reflects a general pattern of distance in social interaction throughout the whole population. In turn, this dimension is related to broader patterns of social stratification (Prandy 2000).

Preliminary correspondence analyses are particularly useful because they are easily carried out using standard statistical packages and provide a quick exploratory tool for investigating the patterns of association between occupational units. In particular, in this investigation, CA is used to quickly identify any particular combinations of occupational unit groups that have, as explained later, a disproportionate influence on the scoring of relevant dimensions (what are subsequently referred to as 'pseudo-diagonals').

However, a much more flexible method of obtaining comparable occupational scores can be found in variations of Goodman's class of RC-II association models (Clogg 1982, Goodman 1979). These proceed by extending loglinear models for the expected frequency of a cell in a binary cross-classification to include the additional multiplicative effect of one or more dimensions of estimated row and column category scores. The major advantages in this instance are that the modelling framework allows for the comparison of alternative models through goodness-of-fit statistics, and for the specification of a number of constraints in the way that row and column category scores are allowed to influence the expected cell count. The latter amount to the comparison of nested models for the testing of alternative occupational unit categories (Rytina 2000a).

We use the program lEM (Vermunt 1997a) to fit a basic RC-II model allowing for the specification of row and column category scores in a single dimension, as shown in equation (1). In addition. lEM allows us to set a number of constraints and variations to that model, which, with some complexity, can be expressed through extensions in

[7] In fact, in most practical analyses the largest dimensions in the first model are found to be specifically associated with (diagonal) non-independence in a small number of influential occupational units. As these are not usually substantively interesting, such "problem occupations" are explicitly controlled for, in this analysis by excluding the particular cells' cases from the correspondence analysis solution.

the equation shown as (2), in this case following the style and terminology of Rytina (2000a).

$$\hat{m}_{ij} = \hat{a}_i \hat{b}_j \exp(\hat{\tau}[\hat{x}_i \hat{y}_j]) \quad (1)$$

$$\hat{m}_{ij} = \hat{a}_i \hat{b}_j \hat{L}_{k(i,j)} \sum_{1}^{M1} \exp(\phi^m X^m{}_i Y^m{}_j) \sum_{1}^{M2} \exp(\hat{\varsigma}^m [\hat{\theta}^m{}_i \hat{\theta}^m{}_j]) \sum_{1}^{M3} \exp(\hat{\tau}^m [\hat{x}^m{}_i \hat{y}^m{}_j]) \underline{G}(\boldsymbol{\kappa}_{(i,j)}) \quad (2)$$

First, in the simpler model (1), we see that the predicted cell count $\hat{m}_{ij}$ is specified as a function of the main estimated log-linear (frequency) parameters $\hat{a}_i \hat{b}_j$ (for the row and column categories a and b), plus the influence of specific scores for each row and column category in a single ordered dimension, $\hat{x}_i \hat{y}_j$. Here, the row category scores $\hat{x}_i$ refer to the estimated scores for each starting category of occupational title-by-employment-status value, and the column category scores $\hat{y}_j$ the estimated scores for the ending category of the same title-by-employment-status units. We also note that these scores influence the final cell prediction through an estimated parameter, $\hat{\tau}$, which generates the association statistic for a given dimension.

The main extensions shown in (2) include the possible estimation of the row and column scores $\hat{x}^m{}_i \hat{y}^m{}_j$ over multiple dimensions *m*; the option of using pre-specified row and column scores as predictor factors, in one or more dimensions, as indicated by the $\sum_m \exp(\phi^m X^m{}_i Y^m{}_j)$ term; the possibility of imposing an equality constraint upon the estimated row and column scores (Goodman 1979), as indicated by the $\sum_{1}^{M2} \exp(\hat{\varsigma}^m [\hat{\theta}^m{}_i \hat{\theta}^m{}_j])$ symbol; the option of modelling 'levels' $\hat{L}_{k(i,j)}$ to the data, namely partitions of cells where all cells within a given set are subject to the same multiplicative effect; and finally the possibility of estimating parameters to specific cells as applied through the function $\underline{G}(\boldsymbol{\kappa}_{(i,j)})$. In the various CAMSIS project applications of RC models, as included in this example, the main extensions from (2) that we consider are the specification of parameter effects for particular cells as (ie accounting for 'pseudo-diagonals'), and the specification of multiple dimensions of estimated scores which are usually constrained within predefined levels. NOTE : I'M STILL NOT 100% SURE ABOUT ALL OF THIS.

Preliminary correspondence analysis and scale characteristics

CA actually provides two solutions (one for row points, the other for column points) which, although intimately connected, are distinct. In the present case, origin and destination occupations are drawn from the same structure, so we would not expect any major differences between the two solutions. (There might, possibly, be effects resulting from the fact that, in many, though certainly not all, cases, the destination job is a move 'upwards'.) This is, in fact, what we find : using the 1999 BHPS wave, the correlation between the CA derived scores for starting and ending jobs was 0.991 for a sample of 3800 employed men, and 0.989 for a sample of 7300 employed adults.

For both origin and destination soc-by-status units, the first dimension of the CA model for the binary association between origin and destination jobs reveals a largely coherent order of estimated scores, at least in terms of our prior expectations about social distance and social stratification. This is illustrated in Table 2, which shows selected occupations as they are located on the scale derived on the origin occupations. (These results are obtained after removing the contribution of a small number of 'pseudo-diagonal' cells; these cells are subsequently modelled with 'factorial designs' (Vermunt 1997b) in the RC-II models below.)

Table 2 : Top, middle and bottom ranking soc-by-status titles
(CA model, origin occupations, 1990 SOC*10 + employment status categorisation)

Top 10 titles	Middle 10 titles	Bottom 10 titles
2504 Mangr Chartered and certified accountants	9407 Empye Postal workers, mail sorters	5003 semp0 Bricklayers, masons
2144 Mangr Software engineers	8607 Empye Inspectors, viewers and testers (metal and electrical)	5007 Empye Bricklayers, masons
2204 Mangr Medical practitioners	5994 Mangr Other craft and related occupations n.e.c.	8117 Empye Preparatory fibre processors
2147 Empye Software engineers	8994 Mangr Other plant and machine operatives n.e.c.	5707 Empye Carpenters and joiners
2507 Empye Chartered and certified accountants	5177 Empye Precision instrument makers and repairers	8127 Empye Spinners, doublers, twisters
1207 Empye Treasurers and company financial managers	6607 Empye Hairdressers, barbers	8197 Empye Other textiles operatives
3206 Supvr Computer analyst/programmers	9507 Empye Hospital porters	5717 Empye Cabinet makers
1204 Mangr Treasurers and company financial managers	5073 semp0 Painters and decorators	5027 Empye Plasterers
2297 Empyee Other Medical Professional	5227 Empye Electrical engineers (not professional)	5703 semp0 Carpenters and joiners
2607 Empye Architects	9992 S emp All others in miscellaneous occupations n.e.c.	5357 Empye Steel erectors

Employment status categories :
S emp : Self employed with employees; Semp0 : Self-employed with no employees; Mangr : Manager; Supvr : Supervisor; Empye : Employee;

A more precise indication of the nature of these dimensions is their relationship to the CAMSIS scales based upon patterns of social interaction. For a sample of 3800 employed males in the 9th wave of the BHPS (1999), there is a high correlation between both origin (0.862) and destination (0.860) scale scores and Cambridge Scale occupational values (the 1990 revised version of the Cambridge Scale based upon friendship patterns, Prandy 1990, which is supplied with the original BHPS data). Equally, when the latest CAMSIS project occupational scale scores for the British 1990 SOC's are compared (Prandy & Lambert 2002, now based solely upon marriage patterns), we see a similarly high correlation with the job transitions starting and ending scales, 0.890 between the CAMSIS social interaction scores and the origin job transitions based scores, and 0.885 between the CAMSIS social interaction and the destination based scores. Correspondingly, for a sample of 3500 employed women from the same BHPS wave, we see that the starting-job-based estimated scores

correlate by 0.856 and 0.855 with the Cambridge Scale and CAMSIS measures respectively, and the ending-job-based estimates, by 0.845 and 0.841 respectively[8].

Although, as the correlations suggest, the general ranking of occupations in the scales derived by job-transitions and by social interaction patterns is similar, there are three noticeable differences.

First, in the order derived from employment transitions, some of the soc-by-status categories clustered towards the 'lower' end of the scale are not those we would necessarily anticipate as being the most socially disadvantaged. Specifically, there are a number of craft and skilled manual jobs, for instance Carpenters and Cabinet makers towards the bottom of the scale. More generally, we observe that both skilled and unskilled jobs in declining industries (for instance mining) are particularly likely to be placed at the bottom of the CAMSIS job-transitions based model, in a way not seen so starkly for the social interaction based jobs, and despite traditionally relatively favourable levels of unionism and pay. A tentative suggestion at this stage is that occupations from more traditionalistic and / or demographically declining trades, are ranked towards the 'disadvantaged' location of the job-transitions based CAMSIS scalings. On the one hand, this could reflect the genuine social disadvantage of these positions; on the other, we may wish to try controlling for these factors, possibly by incorporating external information on the status of occupations as from declining or expanding industries, then constraining a subsidiary dimension to describe the nature of these trends.

Secondly, in many versions of the CAMSIS model using marital associations, the occupations at the top of the scale can be characterised as those of the, for want of a better word, "intelligentsia" (for example university lecturers, legal professionals, authors and creative artists). Although these occupations also rank high in the model based upon job transitions, a slightly different characterisation of the top occupations seems to apply, whereby the top jobs are more noticeably 'careerist', and often credentialised within the profession (typical examples being accountants, IT professionals, and also, more generally, occupations with a managerial element). We should of course note that many of both these types of jobs are noted to have particularly high levels of career stability – ie individuals start in the occupational unit early in their career, and do not generally move between other occupations, cf Stewart et al (1980) – for which reason the occupations may not have been well represented in our datasets by their typical incumbents. Moreover, our distinction between both types of advantaged jobs is ambiguous at this stage; in particular our analysis may benefit from incorporating information on formal educational qualifications, both at the stages of scale constructions, and in subsequent assessments of the properties of the derived scales. Nevertheless, the tone of this second observation is certainly substantively plausible : a particularly important differentiating element in a jobs-transitions based hierarchy could be related to progression through careers within a strict band (careerist, professionalised occupations), as opposed to the more general

[8] Note also that these values are likely to be conservative estimates of the degree of correlation between transition-based and social interaction based scores. This is because the derivation of the early transition-based scores presented here involved a number of shortcuts in the coding and aggregation of occupational categories, and the distribution of score values to the BHPS's own occupational categories, which a more thorough analysis would avoid.

educational associations carried with the influence of being ‘intelligentsia’ in marital associations.

Other evidence on the nature of differences between the (job-transitons based and social interaction based) scale structures can be identified by systematically examining the relative scores. As an example, table 3 below lists those occupations which have the largest difference in their relative position on the two types of scale. The table is constructed by using the job-transitions scale values as a single regression predictor of the CAMSIS (marriage based) scale values (four times over to cover the four data permutations, job-transitions for start v’s end jobs, crossed by CAMSIS scores for men or for women). Then, those occupations with the largest positive and negative residuals between observed and predicted values (in any of the four models), are identified as the most extreme mismatches. In the example of table 3, we list all those occupational units where the standardised prediction residual was greater than 2 or less than –2 standardised units. This list does not completely accord with the first and second points raised above, which were made through an interpretative review of the scale scores. However it does show which occupational units we may be most ‘concerned’ about in our claim that the two alternative scale derivations produce essentially the same structure.

In fact, because the job-transition derived scale scores shown were produced through a relatively hurried implementation, we would also suspect that some of the larger mismatches shown in table 3 are likely to be due more to patterns of pseudo-diagonality which have not yet been taken account of, rather than substantive differences between the scales. As an aside, a more substantively attractive examination would involve reviewing the distribution of such residuals over a prespecified range of occupational units – for instance, the first claim above may be supported if almost all occupations which could be classified as involving ‘craft’ skill, exhibited positive rather than negative residual values.

Table 3 : Occupational base units with largest gap between job-transition, CA, derived scores, and marriage pattern derived CAMSIS scale scores
(Index = GB 1990 SOC*10 + employment status indicator)

Job transition model suggests less advantage / more disadvantage than marriage model	Job transition model suggests more advantage / less disadvantage than marriage model
1504 Mang Officers in UK armed forces	2144 Mang Software engineers
1534 Mang Fire service officers (station officer and above)	2304 Mang University and polytechnic teaching professionals
1602 Semp+ Farm owners and managers, horticulturalists	2314 Mang Higher and further education teaching professional
1742 Semp+ Restaurant and catering managers	2934 Mang Social workers, probation officers
1792 Semp+ Managers and proprietors in service industries n.e.c.	3206 Supvr Computer analyst/programmers
1996 Supvr Other managers and administrators n.e.c.	3497 Empye Other health associate professionals n.e.c.
2207 Empye Medical practitioners	5317 Empye Moulders, core makers, die casters
2503 Semp0 Chartered and certified accountants	5507 Empye Weavers
2927 Empye Clergy	5977 Empye Face trained coalmining workers, shotfirers
3324 Mang Ship and hovercraft officers	8597 Empye Other assemblers/lineworkers n.e.c.
3326 Supvr Ship and hovercraft officers	9107 Empye Coal mine labourers
3327 Empye Ship and hovercraft officers	9117 Empye Labourers in foundries
3803 Semp0 Authors, writers, journalists	9337 Empye Refuse and salvage collectors
3813 Semp0 Artists, commercial artists, graphic designers	
3853 Semp0 Musicians	
3877 Empye Professional athletes, sports officials	
5403 Semp0 Motor mechanics, auto engineers (inc. road patrol	
5607 Empye Originators, compositors and print preparers	
5703 Semp0 Carpenters and joiners	
5947 Empye Gardeners, groundsmen	
5992 Semp+ Other craft and related occups n.e.c.	
5994 Mang Other craft and related occups n.e.c.	
6116 Supvr Fire service officers (leading fire officer and b	
6992 Semp+ Other personal and protective service occupations	
6993 Semp0 Other personal and protective service occupations	
8992 Semp+ Other plant and machine operatives n.e.c.	
9993 Semp0 All other miscellaneous occups n.e.c.	
9994 Mang All others miscellaneous occups n.e.c.	

Lastly, the CA models also anticipate a less appealing feature of the use of job-transitions as an indicator of social distance. The percentage of inertia explained by the first dimension is relatively low (around 2-3% in the models reported upon, and moreover is only marginally larger than the percentage explained by the second and further dimensions. (By contrast a typical value in a correspondence analysis from the CAMSIS project using marital associations would show a percentage of inertia for the first dimension in the region of 10%?, typically more than double that of the second

dimension). This suggests that there may be multiple important dimensions to the order of social distance revealed by patterns of employment transitions. Inspection of the second and subsidiary dimension scores suggest they are not predominantly related in nature to the first dimension scores (and instead have few obvious substantive interpretations). However, further assessment of the other influential subsidiary dimensions may reveal evidence of association – one simple analysis may involve regressing scores from several dimensions onto a prediction of the CAMSIS marital association-based scores, extending the example described above.

To some extent this dimensional multiplicity may be a function of the large number of diagonal job transitions, that is, moves where the origin and destination job categories are the same. In such cases, 'important' dimensions in the CA explanation become simply those that separate certain occupations with high numbers of diagonal transitions from all others. The fact that there are many diagonal transitions is to be expected[9], but such cases are largely irrelevant to the kind of analysis that we are conducting. The fact that a particular job is close to, indeed identical with, itself is trivially true (in a way which is not necessarily the case in the alternative CAMSIS analysis of marital occupational associations); new information about the distances between jobs can only come from the frequency of movements between them. (A possible exception to this might be those job-to-same-job transitions that sandwich a spell out of employment, but we have not separately identified those.) However, when a correspondence analysis for only the non-diagonal soc-by-status transitions is run, whilst the percentage of inertia explained by the first dimension does increase (for the example used here, from 1.8% to 3.3%), it does not do so overwhelmingly, and there remains evidence of influential further dimensions[10].

[9] A diagonal move would be recorded as a consecutive transition if, either, there was a change in employment circumstances which was not recorded as an occupational unit change, or there was an intervening spell of non-employment which we do not record in our current data constructions.
[10] One interesting alternative explanation of multidimensionality is the suggestion that career progression is often ambiguous in its implications for material and lifestyle well-being. For instance Taris and Feij (1999) suggest that one factor involved in 'positive' occupational moves (ie moves seen as desirable in terms of social advantage), is a concomitant increase in work stress and hence lower well-being. It may be suggested that the transition based derived occupational order is conflated by a well-bing structure.

Final soc-by-status model

As described above, an alternative derivation of a CAMSIS scale involves the implementation of 'RC-II' association models for the cross-classification of starting and ending occupational units. These produce scores for the first dimension which are closely related to those of the CA solution, but have the additional attraction of allowing us to experiment with constraints on the values of the occupational unit scores, and report the comparison of alternative models in terms of aggregate fit statistics. Table 4 illustrates statistics for 3 such alternative models.

Table 4 : Comparison of three RC-II models for the scaling of SOC-by-status categories

Model	Log-like	Df and Npar	BIC 1	BIC 2
1.1 One dimension, origin and destination scores unequal	-416468	163992 1656	-1604057	850495
2.4 Two dimensions, origin and destination scores unequal, but dim 2 scores equal within employment status	-414325	163987 1661	-1608290	846261
3.1 One dimension, origin and destination scores equal	-417150	164802 846	-1611282	843269
			N=	40256

The patterns of scores given in the first dimension to both origin and destination soc-by-status categories in the various RC-II models, are very similar to those from the preliminary CA model, for instance illustrated in table 2. However, the flexibility of the RC-II modelling framework allows us to try alternative specifications. Table 4 illustrates the comparison of an unconstrained single dimensional model with one in which row and column scores are constrained to be equal, (1.1 cf 3.1), and another in which an additional dimension is introduced (2.4), where in the second dimension, scores of the same employment status category must have the same estimated score. Summary goodness-of-fit statistics for these variations are shown. The more negative BIC 1 and 2 values (Bayesian Information Criteria based upon likelihood ratio and log-likelihood respectively, cf Hagenaars 1990, Vermunt 1997b), suggest that the 'best' model is 3.1, with model 2.4 intermediate. Thus model 3.1 is more parsimonious in terms of the number of parameters and degrees of freedom used, but it is also noticeable that it has a higher log-likelihood value than the other models (ie, it actually explains *less* of the job-transitions associations, though it does so more efficiently). Model 2.4 by contrast explains the most variation of the three models, and is also more statistically 'efficient' than its close equivalent, model 1.1, without the subsidiary dimension. For this reason we favour model 2.4 of the 3 forms tried (comparable judgements are made in the CAMSIS models used for marital association patterns, cf Prandy & Lambert 2002). In particular, from this evaluation, whilst the BIC statistics suggest the model where origin and destination scores are constrained to be equal has a greater efficiency, we still prefer the model where the scores are allowed to differ, because a greater explanation is still added, whilst, we also suggest, the latter formulation has greater substantive appeal.

The 'nesting' of categorical schema

The other issue that can be explored using RC-II modelling is the one of whether occupations are structured (through their patterns of intra-generational mobility) as a near-continuous hierarchy, or as a set of discrete, categorical groupings, including classes. This can be done by nesting the occupational titles of the soc-by-status categorisation within each of the other categorisations. We briefly examined such schema from the 11 categories of the 1992 version of the Goldthorpe class schema (Erikson & Goldthorpe 1992)[11], the 36 categories of the Hope-Goldthorpe occupational unit groups (Goldthorpe & Hope 1974), the 5 categories of employment status discussed above, and the nine major groups of the 1991 SOC classifications (cf McKnight & Elias 1997). If any of these categorisations is adequate, in goodness-of-fit terms, for explaining the pattern of cell frequencies, then it would be the case that all the occupations within any category could be represented by a single parameter: the extra level of detail provided by the soc-by-status category would be unnecessary.

By imposing designs on the log-linear parameters and on the row and column scores in this way, we can replicate the models above for the categorical schemes. Table 5 below summarises the results of 5 models, first the model RC 1.1 for all 407 soc-by-status values, then models where both category scores and category log-linear parameters are constrained to be equal.

Table 5 : Comparison RC-II models showing categorical class schema as nested versions of the general soc-by-status model

Model (One dimension, origin and destination scores unequal)	Log-like	Df and Npar	BIC 1	BIC 2
1.1 407 soc-by-status values	-416468	163992 1656	-1604057	850495
1.2 11 Goldthorpe classes	-466551	165607 41	-1521016	933536
1.3 36 Hope-Goldthorpe unit groups	-459862	165511 137	-1533375	921177
1.4 5 Employment status categories	-477507	165631 17	-1499358	955194
1.5 9 Major group categories	-466959	165615 33	-1520283	934268
			N=	40256

It is, perhaps, unsurprising that the model without any categorisation constraints (i.e. with the full 407 soc-by-status categories) explains the most variation, but the degree of superiority in this respect strongly suggests that the difference is significant. In

[11] There may be errors in the derived one-to-one correspondence of soc-by-status units with the Goldthorpe categories used. In the initial analysis, this correspondence was achieved by assigning soc-by-status values to their modal Goldthorpe class or Hope-Goldthorpe unit group as revealed through CASOC classifications to the Goldthorpe schema in the BHPS and FWLS samples.

fact, both BIC statistics suggest that the trade-off in lost degrees of freedom is worthwhile. The fact that the next best model is that using the 36 Hope-Goldthorpe categories, and in fact that the models with greater statistical efficiency are, in order, those with successively more numbers of categories, is a further indication that the full texture of the order of social distance as revealed by job transitions is best captured with a greater number of categories. There is thus a strong justification for preferring the larger number of detailed soc-by-status units.

The models above consider the map of social interaction in one dimension only, though we have already seen evidence to suggest that variation in job transitions could be associated with more than one factor. Such possibilities could, in turn, influence our conclusions concerning the value of alternative categorical schema – it may be, for instance, that after accounting for a separate dimension of employment status differences, the relative attraction of the extensive soc-by-status schema is ameliorated in comparison to a broader categorisation. However, preliminary findings, not shown, suggest this is still not the case, and that the more detailed schema retain their attractions regardless of subsidiary dimensional structures. (We tried testing this issue by constructing models where a 'free' dimension was added to a dimension which had been constrained in its dimension scores, though not in its log-linear parameters, around the categorical schema. We found the model with two unconstrained dimensions to be most efficient, followed by the model with one unconstrained dimension plus one SOC major group dimensions, then finally by the models with one unconstrained dimension and one dimension constrained around status groups, the Hope-Goldthorpe unit groups, and the Goldthorpe classes. However it is not entirely clear at this stage that this formulation, more readily constructed in lEM than other alternatives[12], compares like with like).

[12] In fact, whilst we can readily impose different levels of constraints on the dimension scores estimated over different dimensions, it is not clear that a method can be found which would impose different levels of constraints on the log-linear main effects between different dimensions.

Predictive validity

In the following section, we briefly consider the properties of the job-transitions derived scale scores.

Table 6 : Predictive validity of selected scales
(Using occupation of currently employed, male sample from BHPS wave 9, 1999)

	Positive Correlations		Associations (Eta-2)	
	CAMSIS (marital association)	Weekly gross pay (log)	Education (Diploma or + v's none)[13]	Voting (Tory v's any other)[14]
Job-transition based scales : (all use same 'pseudo- diagonal' definitions)				
CA Origin	0.890	0.381	0.182	0.012
CA Destination	0.885	0.383	0.184	0.010
RC1.1 Origin	0.885	0.366	0.183	0.013
RC2.4 Origin	0.858	0.333	0.177	0.009
RC3.1 Origin and Destination	0.861	0.349	0.181	0.012
Other scales :				
CAMSIS 1991	-	0.371	0.184	0.015
Cambridge	0.896	0.363	0.189	0.014
Hope-Goldthorpe	0.802	0.501	0.168	0.014
			N ~= 4000 in all cases	

The predictive validity of the measures derived from the various job-transitions models, in comparison with alternative CAMSIS derived scales (the CAMSIS 1991 marital-association-based scale and the revised Cambridge Scale), and Hope-Goldthorpe scale values (Goldthorpe & Hope 1974), is illustrated in Table 6, using data on income, education and voting from the male sample of BHPS wave 9 (1999). We illustrate patterns associated with the CA scores for both the starting and ending job scores, plus those associated with the scores derived from the three RC-II models illustrated in table 4, where the scores for models 1.1 and 2.4 refer to origin categories, and in 3.1 to the constraint of origin and destination category scores being equal. In summary, the job transition-based scales show the strong, expected relations

[13] This variable is derived by dichotomising the original BHPS variate 'iqfedhi'(see Taylor et al 2001), into those with 'diploma level or above' highest educational levels (categories 1 through 5), with those with non-missing highest levels below diploma level.

[14] This variable is derived from the original BHPS variate 'ivote' (see Taylor et al 2001). It separates those who answer the question on their current preferred party, between those who say 'conservative', between those who say any other party or view (including 'none', but excluding 'don't know').

with other indicators of social stratification. However, contrary to our expectations, the best performers are the scores derived from the CA model, though the differentiation is marginal. (The lower correlations from the RC models may be reflecting greater heterogeneity in their structuring influences. Given that we suspect that more than one dimension to social interaction as revealed by job transitions is substantial, it may be suggested that the limited dimensionality of the RC models is perhaps undesirably conflating the influence of more dimensions, in comparison to the Correspondence Analysis, whereby other dimensions are partitioned out exhaustively).

Individual careers

Finally, we can return to the issue raised earlier of how this approach to analysing work history data at the aggregate, structural level has its counterpart in looking at individual work histories. Since we have been able to establish that there is a structure of occupations, as determined by empirical patterns of frequencies of transitions between them, we are in a position to consider how each individual's set of job transitions can be represented as a path through that structure.

Given the large number of categories, and considering the methods by which the scores for the set of categories is constructed, it is perfectly reasonable to regard the scores as interval-level measures. The series of jobs held by each individual can be translated into a sequence of scores and the question of how that sequence can best be represented is equivalent to the general problem of providing summary statistics. So, for example, bearing in mind that the scores are essentially interval level, we could use the mean value to summarise someone's career. Better, though, would be to take account of the time element in the sequence and to calculate, for every individual, the best-fitting line through the sequence of points. The precise definition of this is open to debate – it is probably preferable, for example, to associate each score with the mid-point of the period for which the job is held, rather than the time of transition, and to weight each job by the time it is held. There is also the question of whether the regression line should be linear or curvilinear, but once decided it is not difficult to determine a line and a set of parameters that represent it, its intercept and slope, for example.

This technique has already been applied in a historical study of social mobility, using scores for occupations obtained in another way (Prandy & Bottero 2000). One great advantage in that case was that it was possible to substitute for the disorderly occupational information collected for each individual at varying dates and ages, estimated scores based on the regression line for two fixed ages, one early and one late in the career. The regression approach is less sensitive to problems caused by errors in the recording or coding of occupations or by occupations held at a particular time that might not be genuinely representative of the individual's usual position, and one consequence of this was that the strength of the correlation between fathers' and sons' positions was greater using these regression-estimated scores compared with scores for actual occupations held at a particular time (Prandy & Bottero 2000).

Conclusion

As elsewhere, with friendship, marriage and inter-generational mobility, the preliminary CAMSIS results for intra-generational mobility clearly indicate that a model of a hierarchical ordering of occupations better represents the actual social order, as it is empirically manifested, than does a class or other categorisation. Significantly, we see that the occupational order derived from patterns of intra-generational mobility is closely related to that derived from alternative indicators of social interaction frequencies, with a small number of reported exceptions (slight differences in the relative positioning of certain occupations, and increased evidence of important subsidiary dimensional structures for the job-transition scales). A more extensive derivation of the job-transition structures, incorporating greater attention to data construction details, model permutations, and the female labour market, and possibly with the additional inclusion of data from other countries as well as data sources, can all be expected to follow the same general pattern, with increased clarity on any specific distinguishing features.

The prospects that such a representation may improve our conceptualisation and analysis of social stratification in career structures are good. Aside from supporting a general framework for the discussion of stratification, it also allows for new methods of the analysis of careers to be readily applied.

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