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Cognitive Models for Life and Work-Related Satisfaction: Evidence From Latent Structure Analysis

by

Matsuda, Noriyuki*

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*The Institute of Socio-Economic Planning, The University of Tsukuba, Sakura-mura, Niihari-gun, Ibaraki 305, Japan.

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ABSTRACT

The present study was conducted to test latent class models for investigating the nature of the cognitive subspace specialized for the subjective assessment of quolity of life. We postulated that a) two principal dimensions of the subspace related to covert evaluation of the attained intrinsic and extrinsic rewards, b) latent states in these dimensions were to be manifested as job and income satisfaction, d) job and firm satisfaction were indicators of the same cognition, and d) life satisfaction was the summary evaluation derived from cognition in these dimensions among most Japanese men. The propositions were confirmed on the major points by the final model which let job satisfaction partially reflect cognition of the other kind as well. It was also found that there were certain classes of people whose cognitive subspace comprised additional dimension(s), though the classes were small in size. This provides evidence that both spillover and compensatory effects exist in a large population.

Key Words and Phrases; satisfaction, latent cognition, cognitive space, latent structure analysis, latent class

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1. INTRODUCTION

1.1 General Overview

Subjective evaluation of quality of life seems to involve two different kinds of cognitive space—social and personal: the former is used for evaluating one's relative social standing, while the latter is reserved for the evaluation of fulfilment concerning personal life goals. In studying the nature of the spaces, a researcher must make inferences about them on the basis of manifest indicators of the latent cognitive states, since covert evaluation in each space is not directly observable. Careful analysis of the relatioships of appropriate indicators may help find interesting properties of the spaces. This approach, however, has certain limitations in that indicators are usually imperfect in reflecting the underlying true states. Furthermore, there are possibilities that some indicators reflect more than one latent states as long as a given space is multidimensional rather than unidimensional. The extention of the latent class model by Goodman (1974a, 1974b, 1975) is particularly useful for dealing with the foregoing problems: a researcher can build a model to express the extent to which indicators represent the corresponding cognition by the conditional probabilities given a latent state or joint occurrence of them. What makes the approach even more attractive is its flexibility in applications for either exploratory and/or confirmatory purposes.

Concerning the issue of multidimensionality, Matsuda (1982a) showed that the "social" cognitive space in fact consisted of at least two basic dimensions by Goodman's latent class approach (see also Haberman, 1975, 1977). He also found that status perception was a compound indicator of cognition in these dimensions. Life being a multifacet entity, it seems natural to assume multiple dimensions in the cognitive space for the personal life evaluation as well. Overt expression of cognition in this space usually takes the form of satisfaction. The purpose of the present study is to identify basic dimensions of the personal cognitive space among Japanese men from their responses to the following satisfaction items essential to quality of life: satisfaction with job, firm (or activities in the case of the self-employed), income and life as a whole. The first two items bear on intrinsic values of work, whereas the third item relates to extrinsic rewards (Kalleberg, 1977). Few will disagree to the general belief that intrinsic values of work are not clearly differentiated in the minds of most Japanese men on account of their highly integrated concept of jobs and firms (e.g., N.H.K., 1979; Vogel, 1979). On the other hand, by the cultural norms, men's evaluation criteria for intrinsic and extrinsic, particularly monetary, rewards greatly differ. Life satisfaction is the summary evaluation in which satisfaction with respect to the other three items are subsumed. That is, two of the basic dimensions that span the personal cognitive space pertain to the evaluation of attained intrinsic and extrinsic rewards, respectively, in comparison to one's expectations. And, manifest life satisfaction is a compound indicator of the underlying cognition in the two dimensions to the extent that work has central importance in life. These propositions are to be tested in the present analysis.

The propositions presented above were formulated in hopes of providing viable alternative interpretations as to the controversial relationships between life and work-related satisfaction. It was the "spillover" and "compensatory" hypotheses suggested by Wilensky (1960) that stimulated researchers in the related fields to emprically determine their causal linkages, or, alternatively, those between satisfaction with work and nonwork activities. The hypotheses originally implied in the writing of Engels (1892) who portrayed two types of alienated workers in industrial societies: those who carry over alienation into the rest of life and those who find substitute gratification in nonwork spheres of life. However, in testing the hypotheses, researchers translated the notion of the objective condition, i.e., alienation, into that of subjective evaluation, i.e., (dis)satisfaction. Then, they directed their efforts to finding a) whether work satisfaction was positively related with nonwork or general satisfaction, or, b) whether dissatisfaction with work was compensated in nonwork activities. The accumulated evidence lends support to both spillover hypothesis (Bartlett, 1972; Iris and Kornhauser, 1965; Orpen, 1978; Rousseau, 1978) and compensatory hypothesis (London, Crandall and Seals, 1977; Tunstall, 1962). Therefore, it seems more natural to consider that both hypotheses hold in the working-age population rather than to attempt total rejection of either one in favor of the other. This is equivalent to saying that the cognitive algebra for deriving life satisfaction consists of the covert evaluation of rewards accruing from work as well as non-work activities, but different wieghts are assigned to the two sets of cognition in a large population. The results of the present analysis are expected to uphold this argument.

Before closing this section, we should refer to Keon and McDonald's (1982) work which radically opposed the popular conceptualization of job satisfaction as a subcomponent of life satisfaction. In other word, it is usually held that the former influences the latter, but not vice versa. They claimed that the improved statistical treatment of the related variables by means of three-stage least squares method enabled them to confirm their model: job and life satisfaction were mutually determined. Nonetheless, their assertions are questionable in the following respects. First, they confused the problem of joint determination with that of mutual causation. The examples they presented as possible common causes are relevant to joint determination but not to mutual causality. Moreover, the bilateral causation between job and life satisfaction poses difficulty in drawing substantive interpretations. Second, they as well as many other researchers failed to take into account the measurement and response errors likely to occur in eliciting cognition by questionnaire items. That is, what an analyst can measure are manifest indicators of the underlying true states in the sense discussed above. Andersen (1973) and Clogg (1979) were aware of this point and applied latent structure analysis to studying satisfaction with work and nonwork, respectively. (But, they were interested in single dimensions of the cognitive space.) Finally, Keon and McDonald's (1982) intension was misdirected in methodology despite their intensions. More specifically, statistical improvement should have been sought in the techniques appropriate for nonmetric variables instead of adhering to the regression family which is designed for metric data. There is no question that the measurement of satisfaction on Likert type scale is ordinal, i.e., nonmetric (Clogg, 1979). Upon consideration of the foregoing issues, we decided to apply latent structure analysis to the selected satisfaction items as explained below.

1.2 Cognitive models.

For expediency, we let A, B, C and D denote satisfaction with job, firm, income and life in general, respectively. The interrelationships among these items can be expressed by a log-linear model (see Bishop, Fienberg and Holland, 1975) under the hierarchy principle as [ABD][ACD][BC] (Matsuda, 1982b). Note that the model includes interaction terms ABD and CD in it. The two terms suggest that life satisfaction is determined jointly by A and B as well as by C. Hence, the model is compatible at the indicator level with our propositions, although more complex relationships are implied by the model. The gap in complexity between the log-linear model and the propositions should diminish by the introduction of relevant latent variable(s) reperesenting the covert evaluation. Methodologically, the objective of latent structure analysis is to explain away the relationships among variables of interest by a latent variable X; i.e.,

$$(\underline{AX})(\underline{BX})(\underline{CX})(\underline{DX}) \quad . \qquad (1)$$

We let X denote in our approach the joint occurence of the two kinds of basic cognition expained earlier.

Insert Figure 1 about here

A schematic path diagram of our prelimianry cognitive model is shown in Figure 1 in which Y and Z pertain to covert evaluation with regard to intrinsic and extrinsic rewards, respectively. A and B are the overt expressions of Y only, while C is the manifestation of Z alone. In contrast to these, D is a compound indicator, reflecting both Y and Z. If the model does not fit the data well, modifications are in order. This can be done in the following directions. First, we may partially relax the independence assumptions and put C, at certain level(s) of Z, under the influence of Y. Another way to modify the model is to allow dependence of A and/or B on Z at certain level(s) of Y. Second, if the reality is much simpler, we do not need to presume two latent variables: covert evaluation of life and work-related performance may indeed require a single dimension. Then, the four indicators are taken to reflect the same cognitive state, though the degree of representation may vary. It means that the indicators are independent from each other, given latent cognition as expressed in (1). This is known as the law of local independence after Lazarsfeld and

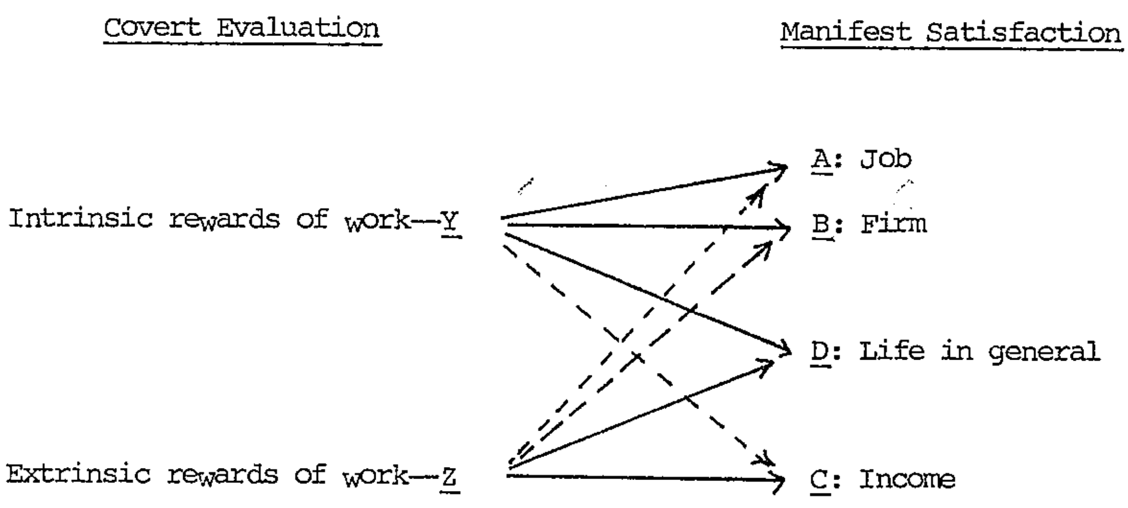

Figure 1. Cognitive Models for Life and Work-Related Satisfaction.

Note. The dotted paths are added in the modified models.

Henry (1968). As a matter of fact, the law applies to models with two (or more) latent variables as well. This is not surprising, since they are algebraically identical to single latent variable models. Inferences about multiple latent variables become possible, if there exist certain structures among the conditional probabilities given a latent class. The true structure can be ascertained by exploratory or confirmatory methods as explained in the next section.

2. Method

2.1 Data

The present study used the data of a national survey conducted in 1975 by the SSM (Social Stratification and Mobility) Committee. A full description of the sampling design is available in Ando (1978). The population for the survey covered all Japanese civilian males aged 20 to 69 from which a random sample was drawn. Stratified two-stage, systematic sampling was conducted with the national electoral districts and registered men as the primary and secondary sampling units. Stemming from the survey purposes, the total sample was devided into subsamples A and B to which different sets of questionnairs were administered. Of the two, the items under study were contained in the questionnair for Sample A which retained 2724 persons with 68.1 percent completion ratio.

2.2 Item Recoding and Case Selection

Respondents in Sample A were asked to express their levels of satisfaction with job (A), firm (B), income (C) and life in general (D). The items will be denoted in the text and tables either a) as JOB, FIRM, INCOME and LIFE, respectively, or b) by the single letter indices enclosed in the parentheses.

Responses were originally measured on a five point scale but recoded as follows:

(1) low — rather dissatisfied, dissatisfied;

(2) medium — not satisfied nor dissatisfied; and,

(3) high — rather satisfied, satisfied.

The recoding was necessary to avoid the anticipated problem in parameter estimation. Namely, cross-classification of the cases with respect to the four items will produce a large number of sparse cells, if we use the original five levels per item. Under the circumstances, parameter estimates may not be asymptoticaly efficient. We do not believe that the above recoding radically distorted the structure underlying the responses.

Cases with missing values due to non-responses were eliminated listwise from our analysis. Also deleted were students and the unemployed persons whose work-related satisfaction requires separate treatment. As a result, 2475 cases remained for the present analysis.

2.3 Latent Class Models

As mentioned earlier, the law of local independence (Lazarsfeld λ Henry, 1968) is applicable to all latent class models. Under the law, different models can be generated by either altering the number of latent classes or restrictions to be imposed on the associated probabilities. Mixed use of the methods gives flexibility in the application of latent structure analysis. To facilitate understanding, we will first explain unrestricted models. The items will be called variables in the explanations below to maintain consistency in terminology with latent class variable(s).

2.3.1 Unrestricted models

Shown in Table 1 is the four-way cross-classification of 2475 cases with respect to the manifest variables $\underline{A}$, $\underline{B}$, $\underline{C}$ and $\underline{D}$. Let $\pi^{ABCD}_{\underline{ijkl}}$ denote the probability that a randomly selected individual is at level ($\underline{i}$, $\underline{j}$, $\underline{k}$, $\underline{l}$) with respect to the joint variable ($\underline{A}$, $\underline{B}$, $\underline{C}$, $\underline{D}$), where $1 \leq \underline{i}, \underline{j}, \underline{k}, \underline{l} \leq 3$ in the present analysis. Had we been able to observe a latent variable $\underline{X}$ consisted of $\underline{T}$ classes, we would have a five-way table comprised of ($\underline{A}$, $\underline{B}$, $\underline{C}$, $\underline{D}$, $\underline{X}$). Let $\pi^{ABCDX}_{\underline{ijklt}}$ denote the joint probability that an individual is at level ($\underline{i}$, $\underline{j}$, $\underline{k}$, $\underline{l}$, $\underline{t}$) with respect to the joint variable ($\underline{A}$, $\underline{B}$, $\underline{C}$, $\underline{D}$, $\underline{X}$).

Insert Table 1 about here

Concerning the last joint probabilities, equation (1) holds true due to the law of local independence, given class $\underline{t}$ of the variable $\underline{X}$ (for $1 \leq \underline{t} \leq \underline{T}$)

$$\pi^{ABCDX}_{\underline{ijklt}} = \pi^{X}_{\underline{t}}\, \pi^{\bar{A}X}_{\underline{it}}\, \pi^{\bar{B}X}_{\underline{jt}}\, \pi^{\bar{C}X}_{\underline{kt}}\, \pi^{\bar{D}X}_{\underline{lt}}\,, \qquad (1)$$

where $\pi^{X}_{\underline{t}}$ denotes the probability that an individual is in class $\underline{t}$ with respect to the variable $\underline{X}$, and $\pi^{\bar{A}X}_{\underline{it}}$ denotes the conditional probability that an individual is at the $\underline{i}$th level on the variable $\underline{A}$, given class $\underline{t}$. $\pi^{\bar{B}X}_{\underline{jt}}$, $\pi^{\bar{C}X}_{\underline{kt}}$ and $\pi^{\bar{D}X}_{\underline{lt}}$ can be similarly defined for the varables $\underline{B}$, $\underline{C}$ and $\underline{D}$. The interpretation of equation (1) is straightfoward: the manifest variables $\underline{A}$, $\underline{B}$, $\underline{C}$ and $\underline{D}$ are independent of each other within each class of $\underline{X}$.

Summing cells in the hypothetical five-way table across $\underline{T}$ classes of $\underline{X}$, we would obtain Table 1. Thus, we have

$$\pi^{ABCD}_{\underline{ijkl}} = \sum_{\underline{t}=1}^{\underline{T}} \pi^{ABCDX}_{\underline{ijklt}}\,. \qquad (2)$$

Substituting equation (1) into equation (2), we can rewrite equation (2) as

$$\pi^{ABCD}_{\underline{ijkl}} = \sum_{\underline{t}=1}^{\underline{T}} \pi^{X}_{\underline{t}}\, \pi^{\bar{A}X}_{\underline{it}}\, \pi^{\bar{B}X}_{\underline{jt}}\, \pi^{\bar{C}X}_{\underline{kt}}\, \pi^{\bar{D}X}_{\underline{lt}}\,. \qquad (3)$$

The probabilities defined above are subject the usual constraints:

Table 1

Cross-Classification of Satisfaction with Job (A), Firm (B), Income (C) and Life in General (D) Among Japanese Men (N = 2475)

		Satisfaction C								
		Low			Medium			High		
Satisfaction		Satisfaction A			Satisfaction A			Satisfaction A		
D	Satisfaction B	L	M	H	L	M	H	L	M	H
Low	Low	68	10	22	4	1	1	8	3	2
	Medium	6	48	20	1	9	5	3	4	4
	High	16	10	78	2	3	20	4	5	25
Medium	Low	42	16	17	8	2	1	2	1	5
	Medium	20	62	19	7	49	14	1	8	10
	High	12	28	93	4	16	101	1	9	89
High	Low	35	13	33	8	7	11	11	6	11
	Medium	10	22	25	2	26	19	4	19	39
	High	19	21	184	7	17	205	24	24	654

$$0 \leqq \pi^{ABCD}_{ijkl},\ \pi^{ABCDX}_{ijklt},\ \pi^{X}_{t},\ \pi^{\bar{A}X}_{it},\ \pi^{\bar{B}X}_{jt},\ \pi^{\bar{C}X}_{kt},\ \pi^{\bar{D}X}_{lt} \leqq 1\ ; \tag{4}$$

and,

$$\sum_{ijkl}\sum\sum\sum \pi^{ABCD}_{ijkl} = \sum_{ijklt}\sum\sum\sum\sum \pi^{ABCDX}_{ijklt}$$

$$= \sum_{t} \pi^{X}_{t} = \sum_{i} \pi^{\bar{A}X}_{it} = \sum_{j} \pi^{\bar{B}X}_{jt} = \sum_{k} \pi^{\bar{C}X}_{kt} = \sum_{l} \pi^{\bar{D}X}_{lt} = 1. \tag{5}$$

The iterative procedure provided by Goodman (1974a, 1974b) yields the estimates for the basic set of parameters ($\hat{\pi}^{X}$, $\hat{\pi}^{\bar{A}X}$, $\hat{\pi}^{\bar{B}X}$, $\hat{\pi}^{\bar{C}X}$, $\hat{\pi}^{\bar{D}X}$) that are the maximum likelihood estimates, terminal maxima (0 or 1) or some other solutions. The estimate of π^{ABCD}_{ijkl} obtained from equation (3) can be used to compute the estimated expected frequency, $\hat{m}_{ijkl}$, for Table 1 by

$$\hat{m}_{ijkl} = N\, \hat{\pi}^{ABCD}_{ijkl}\ , \tag{6}$$

where N is the total number of observations, i.e., 2475 in our study. Let n_{ijkl} denote the corresponding observed frequency. Then, the likelihood ratio chi-square statistic defined by

$$LR^2 = 2 \sum_{ijkl}\sum\sum\sum n_{ijkl} \log(n_{ijkl}/\hat{m}_{ijkl}) \tag{7}$$

is known to be minimized by the maximum likelihood estimates for the basic set of parameters. (See Matsuda, 1982a, as to the decision rule for selecting the estimates.) The fit of an unrestricted latent class model applied to the four-way table can be tested, when the parameters are locally identifiable (Goodman, 1974a), with degrees of freedom

$$df = \prod_{u=1}^{4} h_u - 1 - [T\{\sum_{u=1}^{4} (h_u - 1) + 1\} - 1], \tag{8}$$

where h_u is the number of the categories of the manifest variable u: h_u = (3, 3, 3, 3) in Table 1. Hence, T of an unrestricted model must not exceed 8 for Table 1 in order to have positive df. In case a model should produce extreme estimates of parameters, i.e., 0 or 1, Goodman (1974b) recommends adjustment of df as if the corresponding true parameters were fixed at the extreme values. It means that the model must be treated as a restricted one.

When T = 1, the model, referred as M1 hereinafter, is a usual log-linear model of no ineteractions applied to Table 1. Unrestricted models are in general suitable for exploratory purposes in the sense that an analyst is not in a position to test any theoretically derived model. He only expects that the obtained results will reveal meaningful response patterns like those demonstrated by Clogg (1979) and Goodman (1975). In the present analysis we hoped to find scalable response patterns and what Goodman (1975) called some unscalable ones. From our pilot analysis, models with more than five latent calsses seemed to pose tremendous interpretational difficulty. Therefore, we tested here five models with T ranging from 1 to 5. In contrast to unrestricted models, restricted models require prior knowledge, firm or provisional, about the structure of the probabilities in the basic set. Hence, they serve confirmatory purposes.

2.3.2 Restricted models.

Let Y and Z denote the latent variables pertaining to covert evaluation of the attained intrinsic and extrinsic rewards, respectively. The two latent variables form a 3 x 3 table (see Table 2) in which cell (r, s) can be treated as the tth level of a new latent variable X. Thus, we have indeed 9 classes in our first restricted model. The law of local independence applies to the joint occurence of Y and Z, or alternatively stated, to X.

Insert Table 2 about here

Category orders of the variables $\underline{Y}$ and $\underline{Z}$ were assumed to correspond to those of the manifest variables described in section 2.2, i.e., low, medium and high for r, s = 1, 2, 3. As a matter of fact, the exact wording or the form of cognition, whether verbal or nonverbal, is not crucial in our approach. Only the oder is important.

From equation (8) it is clear that the model of 9 latent classes, M9, is not locally identifiable. Therefore, it was necessary to impose restrictions on the parameters in the basic set in accordance with our propositions which were translated into the following equality constraints:

$$\pi^{\bar{A}X}_{\underline{it}} = \pi^{\bar{A}X}_{\underline{it}+3} = \pi^{\bar{A}X}_{\underline{it}+6} \qquad \text{for } \underline{t} = 1, 2, 3; \qquad (9)$$

$$\pi^{\bar{B}X}_{\underline{jt}} = \pi^{\bar{B}X}_{\underline{jt}+3} = \pi^{\bar{B}X}_{\underline{jt}+6} \qquad \text{for t} = 1, 2, 3; \text{ and,} \qquad (10)$$

$$\pi^{\bar{C}X}_{\underline{kt}} = \pi^{\bar{C}X}_{\underline{kt}+1} = \pi^{\bar{C}X}_{\underline{kt}+2} \qquad \text{for t} = 1, 4, 7. \qquad (11)$$

No restriction was necessary for $\underline{D}$, because it was held to reflect both $\underline{Y}$ and $\underline{Z}$.

To test the fit of a restricted model, the degrees of freedom derived from (8) must be adjusted for the number of non-redundant restrictions, $\underline{d}$: i.e.,

$$\underline{df}^* = \underline{df} + \underline{d}. \qquad (12)$$

$\underline{d}$ is non-redundant, since the restricted parameters are still subject to constraints (4) and (5). For $\underline{M9}$, $\underline{d}$ = 21.

Modified restricted models were constructed lest $\underline{M9}$ should fail to fit the

Table 2

Latent Variable X Arising from the Joint Latent Variable (Y, Z)

		Variable Y			
	r =	1	2	3	
	s = 1	π^X_1	π^X_2	π^X_3	π^Z_1
Variable Z	2	π^X_4	π^X_5	π^X_6	π^Z_2
	3	π^X_7	π^X_8	π^X_9	π^Z_3
		π^Y_1	π^Y_2	π^Y_3	

Note. π^Y_r and π^Z_s denote the probabilities that an individual is at level r and s on the variables Y and Z, respectively.

data well. First, we let the variables A and B also reflect $\underline{Z}_2$ in model M9-10. To add to it, the variable C was put under the influence of Y if cognition Z was moderate, i.e., $\underline{Z}_2$. The underlying premise was that moderate covert evaluation about the extrinsic rewards, $\underline{Z}_2$, would permeate manifest satisfaction with job and firm, and that $\underline{Z}_2$ would help covert evaluation of intrinsic rewards, Y, confound income satisfaction. In other words, we added to M9 all the dotted paths in Figure 1 for $\underline{Z}_2$. In terms of model specifications, we withdrew restrictions (9), (10) and (11) for the latent classes 4, 5 and 6. Second, the variable C was similarly treated in M9-20 as a partial compound indicator of $\underline{Y}_2$ in addition to $\underline{Z}_1$, $\underline{Z}_2$ and $\underline{Z}_3$. At the same time, the variables A and B were subjected to the influence of cognition Z, when cognition Y was moderate, i.e., $\underline{Y}_2$. That is, the latent classes 2, 5 and 8 were exempted from the above restrictions. As the third modified model, M9-30, all the contsraints were relaxed for the latent class 5 where both cognition with respect to Y and Z were moderate, i.e., $\underline{Y}_2$ and $\underline{Z}_2$. Finally, we constructed M9-40, retaining the restrictions except for the latent classes 2, 4, 5, 6 and 8 comprised of $\underline{Y}_2$ or $\underline{Z}_2$.

Further modifications might become necessary in case these models were not still acceptable on account of local unidentifiability, unsatisfactory fit or uninterpretability of the estimated parameters. Though there were a number of possible ways to introduce modifications, we confined ourselves to the models lying between M9 and the above four models in complexity. Variations of M9-10, -20, -30 and -40 were generated by adding one or two of the dotted paths in Figure 1 to the extremely restriced model, M9, as shown in Table 3.

Insert Table 3 about here

Table 3

Paths Added to M9 in the Modified Models—

M9-1's, M9-2's, M9-3's and M9-4's.

Model	Added Paths	
M9-10, 20, 30, 40	Z ---> JOB, FIRM	Y ---> INC
M9-11, 21, 31, 41	Z ---> JOB, FIRM	
M9-12, 22, 32, 42		Y ---> INC
M9-13, 23, 33, 43	Z ---> JOB	
M9-14, 24, 34, 44	Z ---> FIRM	
M9-15, 25, 35, 45	Z ---> JOB	Y ---> INC
M9-16, 26, 36, 46	Z ---> FIRM	Y ---> INC

See the text for the explanation of the variables. These paths are expressed by the dotted lines in Figure 1.

2.4 Model selection criteria.

Multiple criteria were employed to guard against under- and overfitting, on the one hand, and to choose a useful final model in future substantive applications, on the other. First, unidentifiable models should be eliminated from the consideration. Among identifiable models, then, those which yielded large chi-square values ($\underline{LR}^2$) in light of the degreees of freedom ($\underline{df}$) were also to be discarded. The judgement in this respect was based on the ratio of $\underline{LR}^2$ to $\underline{df}$ and the ordianry significance level, $\underline{p}$. From our earlier experiences, it appeared reasonable to set the bounds as follows:

$$.80 < \underline{LR}^2 / \underline{df} < 1.20 \text{ and } .100 < \underline{p} < .600.$$

Finally, should more than one model satisfy the above criteria, they were to be compared with each other in regard to the error rate incurred in assinging respondents to the modal latent classes. The best model should have the minimal error rate (see Clogg, 1979) defined as

$$\underline{E} = \sum_{\underline{ijkl}}\sum\sum\sum \hat{\pi}_{\underline{ijkl}}^{\underline{ABCD}} (1 - \hat{\pi}_{*}^{\underline{ABCD\bar{X}}})$$

where $\hat{\pi}_{*}^{\underline{ABCD\bar{X}}}$ is the maximum conditional probability given a joint response ($\underline{A}$, $\underline{B}$, $\underline{C}$, $\underline{D}$).

3. Results

The fit information of the unrestricted models is summarized in Table 4 including $\underline{M4}$ and $\underline{M5}$ which are in fact to be treated as restricted models for the reasons stated in the previous section. None of the models are acceptable according to our second criterion: their $\underline{LR}^2$ statistics are too large. Nonetheless, the estimates ($\hat{\pi}^{\underline{A\bar{X}}}$, $\hat{\pi}^{\underline{B\bar{X}}}$, $\hat{\pi}^{\underline{C\bar{X}}}$, $\hat{\pi}^{\underline{D\bar{X}}}$) of $\underline{M4}$ and $\underline{M5}$ exhibit patterns suggestive of the dimensions assumed in the cognitive space. In Table 5 only the estimates under M4 are listed, since essentially identical patterns result from M5. These estimates represent the degree to which each variable accurately reflects the underlying cognition, provided that a given model is correct. Therefore, those of substantial size, i.e., > .600 are of primary interest in the present analysis and the standard will be maintained hereafter. Within each latent class, the modal levels of JOB and FIRM agree in Table 5, while the conditional probabilities pertaining to INCOME and LIFE behave differently. This can be considered as weak evidence that JOB and FIRM are manifestations of common cognition. More direct confirmation is expected to result from the 9 latent class models.

Insert Tables 4 and 5 about here

The first 9 class model to be tested is M9 which is most strictly restricted according to the hypothesis. The model does not satisfy the criterion of parameter identifiability. Hence, it is necessary to fit the modified models of which 15 are unidentifiable as shown in Table 6. Among the identifiable ones, the reasonable fit is found under M9-10, -13, -15, -41, -43 and -44 in light of the second criterion. However, M9-10 and M9-15 should be eliminated due to their relatively large error rates (.238 and .249) as compared with those of the other four models (< .190). The differences among the remaining models are so small in terms of both error rates and patterns of the estimated parameters in the basic set ($\hat{\pi}^{\underline{X}}$, $\hat{\pi}^{\underline{\bar{A}X}}$, $\hat{\pi}^{\underline{\bar{B}X}}$, $\hat{\pi}^{\underline{\bar{C}X}}$, $\hat{\pi}^{\underline{\bar{D}X}}$) that acceptance of any one of them as the final model should not cause serious problems. After careful examination of the estimates, we decided to accept M9-13 for the sake of interpretability of the estimated parameters. However, in order to maintain tenability of our conclusions, we will refer to the points where the model

Table 4

Test Results of the Unrestricted Models

Model	T	LR^2	df	LR^2/ df	p
M1	1	2078.32	72	28.87	.000
M2	2	545.64	63	8.66	.000
M3	3	259.32	54	4.80	.000
M4*	4	126.64	46	2.75	.000
M5*	5	87.45	38	2.30	.000

Note. The df of M4 and M5 are adjusted for the extreme estimates as if the models were constrained to take those values.

Table 5

Conditional Probabilities ($\pi^{\bar{A}X}$, $\pi^{\bar{B}X}$, $\pi^{\bar{C}X}$, $\pi^{\bar{D}X}$) Estimated Under M4

Manifest Response	Conditional Probability		Latent Class 1	2	3	4
JOB	$\pi_{it}^{\bar{A}X}$	i = 1	.629	.106	.033	.009
		2	.126	.783	.031	.683
		3	.245	.111	.936	.923
FIRM	$\pi_{jt}^{\bar{B}X}$	j = 1	.715	.064	.012	.031
		2	.085	.772	.051	.093
		3	.200	.165	.937	.876
INCOME	$\pi_{kt}^{\bar{C}X}$	k = 1	.796	.552	.001	.481
		2	.086	.333	.145	.309
		3	.118	.115	.854	.210
LIFE	$\pi_{lt}^{\bar{D}X}$	l = 1	.391	.223	.000*	.161
		2	.261	.516	.073	.316
		3	.348	.261	.928	.524

Note. The extreme estimate under the model is marked by *.

differed from M9-41, -43 and -44.

Insert Table 6 about here

The estimated parameters in the basic set under the final model M9-13 are presented in Table 7. First, the conditinal probabilities pertaining to FIRM, $\hat{\pi}^{\bar{B}X}$, show a pattern consistent with our hypothesis. Due to the equality constaints (10), it suffices here to examine the parameters for classes 1, 2 and 3. The lowest level of FIRM (B_1) reflects Y_1 with 70.3 percent accuracy. Accuracy as an indiactor of latent cognition Y increases at the higher levels of the variable—92.4 and 93.7 percent for B_2 and B_3, respectively. Contrary to the expectation concerning undifferentiation of JOB and FIRM, cognition of class 4 (Y_1, Z_2) is likely to take contrasting manifest expressions in these variables: while it is the highest level of JOB (A_3) that most accurately reflects the cognition (63.7 percent), dissatisfaction with firm (B_1) arises from the same cognitive state as explained above. Except for this anomaly, the patterns among the remaining parameters, $\hat{\pi}^{\bar{A}X}$ and $\hat{\pi}^{\bar{B}X}$, are congruent with our hypothesis despite the partial removal of constraints (9). The accuracy rate of JOB for classes 1, 2 and 3 (as well as 7, 8 and 9) increases as a monotone function of cognition Y—63.1, 77.3 and 93.8 percent for Y_1, Y_2 and Y_3, respectively. Interaction of Z_2 in classes 5 and 6 appear to be small: the conditional probabilities of the modal levels of JOB, A_2 and A_3, increase as a monotone function of cognition Y. The values, .737 and .809, are close to those of classes 2 and 3 (as well as 8 and 9).

Insert Table 7 about here

Second, INCOME appears to be a good indicator at the extreme levels, C_1 and

Table 6

Fit Information of the Restricted Models, _T_ = 9

Model	LR^2	df*	LR^2/ df	p	Error Rate
M9	60.37	—			
M9-10	28.35	29	.98	.499	23.8
-11	37.30	—			
-12	60.37	—			
-13	40.72	36	1.13	.270	17.6
-14	49.72	40	1.24	.140	13.7
-15	32.07	32	1.00	.463	24.9
-16	49.96	39	1.28	.113	12.3
M9-20	33.78	—			
-21	45.15	37	1.22	.168	19.6
-22	60.37	—			
-23	56.33	—			
-24	51.22	37	1.38	.060	16.6
-25	49.63	—			
-26	47.87	—			

(Continued)

(Table 6 continued)

M9-30	52.57	——			
-31	52.66	38	1.39	.057	15.0
-32	60.37	——			
-33	56.95	39	1.46	.031	15.7
-34	56.32	41	1.37	.056	19.9
-35	56.81	——			
-36	56.18	——			
M9-40	19.57	——			
-41	33.76	34	.99	.480	16.4
-42	60.37	——			
-43	39.89	36	1.11	.301	17.9
-44	45.08	38	1.19	.200	17.8
-45	25.64	——			
-46	38.04	——			

Note. Unidentifiability of a model is indicated by —— in this column.

Table 7

Estimates for the Parameters in the Basic Set Under Model M9-13

Parameters		Latent Class								
	t =	1	2	3	4	5	6	7	8	9
	(r, s) =	(1,1)	(2,1)	(3,1)	(1,2)	(2,2)	(3,2)	(1,3)	(2,3)	(3,3)
$\hat{\pi}^{X}_{t}$		.142	.025	.098	.023	.100	.158	.022	.011	.420
$\hat{\pi}^{\bar{A}X}_{it}$	i = 1	.631	.000	.029	.087	.104	.014	.631	.000	.029
	2	.143	.773	.034	.276	.737	.178	.143	.773	.034
	3	.226	.227	.938	.638	.159	.809	.226	.227	.938
$\hat{\pi}^{\bar{B}X}_{jt}$	j = 1	.703	.025	.008	.703	.025	.008	.703	.025	.008
	2	.111	.924	.056	.111	.924	.056	.111	.924	.056
	3	.186	.050	.937	.186	.050	.937	.186	.050	.937
$\hat{\pi}^{\bar{C}X}_{kt}$	k = 1	.906	.906	.906	.509	.509	.509	.001	.001	.001
	2	.067	.067	.067	.411	.411	.411	.195	.195	.195
	3	.028	.028	.028	.080	.080	.080	.804	.804	.804
$\hat{\pi}^{\bar{D}X}_{lt}$	l = 1	.406	.996	.304	.000	.067	.084	.359	.149	.302
	2	.329	.005	.000	.000	.677	.607	.104	.000	.106
	3	.265	.000	.696	1.000	.256	.309	.537	.851	.864

$\underline{C}_3$, in reflecting $\underline{Z}_1$ and $\underline{Z}_3$, respectively, with 90.6 and 80.4 percent accuracy. By contrast, $\underline{Z}_2$ has no distinctive manifestation in terms of income satisfaction. It is likely to be expressed as either low or medium level on the variable with comparable probabilitities. Given $\underline{Z}_2$, dissatisfaction with income, $\underline{C}_1$, has even higher probability (50.9 percent) than that of the hypothesized relevant level, $\underline{C}_2$ (41.1 percent), though the difference is minor.

Third, inspection of the parameters pertaining to LIFE, $\hat{\pi}^{\bar{D}X}$, reveals spillover effects due to cognition $\underline{Y}$ in classes 3, 5 and 9 where the modal levels of JOB, FIRM and LIFE agree. Concerning classes 3 and 9, highly evaluated intrinsic rewards, $\underline{Y}_3$, is likely to induce satisfaction $\underline{A}_3$, $\underline{B}_3$ and $\underline{D}_3$, whether extrinsic rewards are evaluated poorly, $\underline{Z}_1$ (class 3), or highly, $\underline{Z}_3$ (class 9). The conditional probabilities $\hat{\pi}^{\bar{D}X}$ for these classes are .696 and .864, respectively. The effect can also be found at the intermediate levels of satisfaction, $\underline{A}_2$, $\underline{B}_2$ and $\underline{D}_2$, but is limited to that arises from joint cognition ($\underline{Y}_2$, $\underline{Z}_2$) of class 5: moderate evaluation of intrinsic and extrinsic rewards manifest itself as moderate JOB, FIRM and LIFE with 73.7, 92.4 and 67.7 percent accuracy, respectively. Spillover effects due to cognition $\underline{Z}$ are present in classes 2 and 8, but in the opposite directions. Poorly evaluated extrinsic rewards, $\underline{Z}_1$, of the former class produces dissatisfaction with life, $\underline{D}_1$, discounting moderate cognition $\underline{Y}_2$; and, $\underline{Z}_3$ of the latter induces manifest satisfaction with life, $\underline{D}_3$, either additively to or independently of $\underline{Y}_2$. $\underline{D}_1$ and $\underline{D}_3$ of these classes are fairly distinctive with respective accuracy rates of 99.6 and 85.1 percent. Satisfaction with life, $\underline{D}_3$, of class 9 is another evidence of the spillover effect due to $\underline{Z}_3$ which acts here in concert with $\underline{Y}_3$. The observed spillover effects can be summarized in terms of the following response patterns;

(3313:31) and (2202:22) of classes 3 and 5 due to $\underline{Y}$;

(2211:21) and (2233:23) of classes 2 and 8 due to $\underline{Z}$; and

(3333:33) of class 9 due to $\underline{Y}$ and $\underline{Z}$.

The numbers denote the modal levels of the variables $\underline{A}$, $\underline{B}$, $\underline{C}$ and $\underline{D}$ given ($\underline{Y}$, $\underline{Z}$), respectively. Zero in the second set means a lack of primacy among the parameter of the variable. The last pattern has the largest base in terms of the latent class size ($\hat{\pi}^{\underline{X}}$)—42.0 percent—as compared to all other response patterns. The sizes of class 3 as well as 5 are approximately 10 percent, while classes 2 and 8 are smaller in size—2.5 and 1.1 percent, respectively.

Finally, response patterns of classes 1, 4 and 7 do not allow straightfoward interpretations in favor of either compensatory or spillover hypothesis, since interpretations based on the agreement or disagreement of modal levels are no longer applicable a) in the absence of primacy of the conditional probabilities pertaining to LIFE in classes 1 and 7, and b) due to the aforementioned anomaly of class 4. The lack of primacy of $\hat{\pi}^{\bar{C}X}$ in class 6 adds to the difficulty of interpreting the disagreement of the modal levels $\underline{A}_3$ and $\underline{B}_3$, on the one hand, and $\underline{L}_2$ on the other. Nonetheless, if LIFE is assumed to result also from some averaging operations on cognition $\underline{Y}$ and $\underline{Z}$, the patterns of classes 6 and 7 can be considered as a different kind of spillover effects. The modal levels of LIFE in these classes are low in distinctiveness; $\hat{\pi}^{\bar{D}X}_{26}$ and $\hat{\pi}^{\bar{D}X}_{38}$ are .607 and .538. By contrast, the response pattern of class 1 is relatively more consistent with the compensatory hypothesis than the other, provided that the effect of cognition ($\underline{Y}_1$, $\underline{Z}_1$) is attenuated by (covertly) perceived fulfilment in nonwork activities. Yet the compensation is not sufficient enough to give primacy to $\underline{D}_2$ or $\underline{D}_3$. Another compensatory effect can be inferred, though indirectly, from the results of class 4 in which $\underline{L}_3$, satisfaction with life, is the unambiguous summary manifestation of the perceived quolity of life. Given the size and the distribution of the conditional probabilities of the modal levels $\underline{A}_3$ (.637), $\underline{B}_1$ (.703) and $\underline{C}_1$ (.508), it seems reasonable to consider that LIFE of this class is the product of compensation accruing from nonwork activities. The proportions classes 1 and 4 are 14.2 and 2.3 percent, respectively.

Before closing this section, a note must be made concerning the differences of M9-13 from M9-41, -43 and -44 with respect to response patterns (see Table 8). Departure of M9-13 from the rest is limited to classes 3, 4, 7 and 8 that are all small in size, i.e., < 10 percent (in M9-13). Differences in the size of these classes are less than 3.7 percent. Moreover, the discrepancies in class 7 disappear if we lower the standard for primacy to .537; the response pattern of this class under M9-13 is then (1133). Similarly, with this new standard, the patterns of class 3 under M9-44 and class 8 under M9-41 become identical with those of the corresponding classes under M9-13. Given usual minor fluctuations in the estimates depending on the choice of start values, discrepancies of this magnitude seem negligible.

Insert Table 8 about here

4. Discussion

Dual goal of the present analysis was mostly met. First, it provided empirical evidence that satisfaction with job and firm (or activities in the case of the self-emplyed) were undifferentiated among Japanese men because of the common cognitive base pertaining to intrinsic rewards of work. In the final model, however, it was necessary to allow the moderate covert evaluation of extrinsic rewards of work to permeate job satisfaction. Partly as a result of

Table 8

Departure of M9-13 from M9-41, -43 and -44

with Respect to Response Patterns

M9-13	(3313)	(3103)	(1130)	(2233)
M9-41		(3003)	(1133)*	(2033)*
M9-43			(1133)*	
M9-44	(3310)*	(1202)	(1133)*	(2033)

Note. The differences in the asterisked patterns disappear if the standard for primacy is lowered. See the text for explanations.

this modification, a minor but interesting anomaly was found in the contradictory levels of satisfaction with job and firm in class 4. In a mobile society, the imbalance will be resolved by changing employment. However, in view of the unusually distinctive satisfaction with life expressed by them, dissatisfaction with firm appears bear little importance to them or, more probably, to be compensated by nonwork activities. Further studies seem needed to shed light on their cognitive algebra.

Based on the belief that work had central importance in life, we postulated that life satisfaction was the summary evaluation derived from the two kinds of cognition concerning rewards of work. According to the selected model, life satisfaction of approximately 65.4 percent of the population was determined chiefly by either (classes 2, 3, 5 and 8) or both (class 9) of them. The proportion increases to approxmately 83.5 percent given that our interpretations about the response patterns of classes 6 and 7 are viable. That is, they constitute the two principal dimensions in the cognitive (sub)space specialized for the subjective evaluation of the personal aspects of life. Nevertheless, the obtained results indicate that cognition of other kinds significantly interact with work-related cognition in calculating life satisfaction among the remaining 16.5 percent of the population. To them there are other important dimensions in the space. Coexistence of different structures of the cognitive space has not been recognized in the previous studies which instead claimed to verify a single-structure model generally known as the spillover or compensatory hypothesis. A second goal of the present analysis was to clarify this point by applying a more relevant statistical technique to the survey data representing a large population.

Although there remains much to be improved, the final model comprised response patterns congruent with either hypotheis. Therefore our postulate was upheld. While the difference may not be entirely attributable to the properties of the employed statistical techniques, latent structure analysis has the advantage over frequently used regression analysis. As is well-known, the latter is suitable for analyzing linear relationsuhips in the data. Interactions among the independent variables are usually omitted from proposed models of satisfaction. The former, in contrast, is designed to expalin away interactions by introducing a latent variable according to the law of local independence. By virtue of this, complex response patterns such as those identified here can be unveiled through latent structure analysis, whereas a coefficient of a given independent variable in regression analysis depicts a single effect on the dependent variable. For example, the effect of income satisfaction in a regression model may not vary depending on the levels of job and/or firm satisfaction. It must be recalled that the relationships among the satisfaction items under study are, as explained in the foregoing section, neither unidirectional nor additive (see also Matsuda, 1982b). This adds to the benefit accruing from the present approach beside the advantages discussed in introduction, namely conformity with the measurement level of the items and incorporation of response errors in expressing latent cognition. Thus we believe that our model is more tenable than those of earlier studies.

In sum, our cognitive model based on the premise of the centrality of work in life was consistent with the empirical observatons. Yet, some refinements are felt necessary in future work, for instance, by including indicators appropriate for cognition pertaining to nonwork activities. Also needed is an adequate explanation as to why income satisfaction failed to be a distinctive indicator of cognition Z in classes 4,5 and 6. It must be determined whether it is attributable to the nature of the cognition or to the lack of validity of the questionnair item. The use of multiple indicators may help solve the problem.

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