ORGANIZATIONS, FACTORS AND CODES:

A METHODOLOGICAL ENQUIRY INTO

BERNSTEIN'S THEORY OF

EDUCATIONAL TRANSMISSIONS

BY

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TITLE: ORGANIZATIONS, FACTORS AND CODES: A METHODOLOGICAL ENQUIRY INTO BERNSTEIN'S THEORY OF EDUCATIONAL TRANSMISSIONS.

ABSTRACT: Despite the wide currency of Basil Bernstein's theory of educational transmissions and its power to explain the 'deep' structural transformations of schools and other organizations, testing his theory empirically has proven to be both difficult and inconclusive. This appears to be because the principles of structure (or 'codes') might be expected to intrude into the very methodologies and instruments of analysis of organizational study. Findings carried out in other areas of organizational research (notably those in the 'Aston' tradition) appear to corroborate this suspected effect, paticularly where it has been shown that certain empirical measures of structural variables exhibit predictable levels of internal consistency or reliability, depending on the sample of organizations being studied. The explanation of this phenomenon would appear to lie in the patterns of redundancy (or scale reliability) that can be derived from the more general informational theory of regulation of Ashby - which can be shown in turn to have some clear points of correspondence with Bernstein's theory of codes. It is therefore suggested that any statistic of correlation between structural properties representing 'classifications' or 'frames' should be consistent with this more general theory by tapping these 'deeper' features of organizational structuring. Such a statistic is the canonical correlation coefficient which allows a researcher (by multivariate methods) to measure the degree of redundancy between two sets of variables at a level which is not accessible by the analysis of single correlations. This method was applied to variables representing different categories of structure from four sets of organizational data available through the Aston Databank and associated published reports. Very high (and significant) levels of correlation were found between canonical variates, particularly in the more rigorous and detailed tests with the two large heterogeneous samples of work organizations (the original Aston Study and Child's National Study). In each case this method yielded much higher levels of interdependence among structural properties than those indicated by conventional methods of regression and factorial analysis. The implications of these findings in so far as they lend support to Bernstein's theory of educational transmissions, as well as their import for general problems of organizational theory and research, are discussed in the concluding chapter.

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CHAPTER ONE

THE PROBLEM: EMPIRICAL TESTING OF BERNSTEIN'S SOCIOLOGY OF SCHOOL ORGANIZATION

Although the sociology of the school as formulated by Basil Bernstein has attracted a great deal of interest in recent years (1) it has proven to be very difficult to test empirically in that investigations derived from the theory have not generally demonstrated its usefulness in concrete situations. There are several reasons for this difficulty, not least of which are the Durkheimian influences which lead, as we shall see below, to rather confusing definitions of structural variables. Bernstein's work has also been accused of an unnecessary obscurity of expression and terminology which, according to some critics such as Pring (2), adds litle to the insights of commonsense. At the back of these difficulties, however, lies the very large problem of rendering the abstract theoretical framework of Bernstein into a precise set of empirically testable propositions. The attempt to solve this problem constitutes the main aim of this dissertation project.

In this first chapter there will be a brief outline of Bernstein's sociological writings on the school, followed by a critical evaluation of the only published empirical study of the secondary school which explicitly set out to test Bernstein's theories. From an examination of this study, namely that of King (3), it may become clear that the apparent lack of support 'in the field' of Bernstein's model of school structure can be explained in terms of the inconsistencies in this researcher's formulation of the hypotheses as to the expected directions of association among the variables observed. This difficulty can only be overcome, it will be argued, when the theory itself has been re-stated in a form which resolves the ambiguities and contradictions which arise when such a complex

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1 Most of the references to Bernstein's sociology of the school are contained in Basil Bernstein, *Class, Codes and Control*, Vol.3 (London: Routledge and Kegan Paul, 1977) 2nd ed; for sympathetic treatments and extentions of his theories see the following: Jerome Karabel and A.H. Halsey, "Editors' Introduction", *Power and Ideology in Education*, (Oxford: Oxford University Press, 1977); Michael Thompson, "Class, Caste, the Curriculum Cycle and the Cusp Catastrophe", *Higher Studies in Higher Education* 1(1976), 31-45; for some critical appraisals see Rex Gibson, "Bernstein's Classification and Framing: A Critique", *Higher Education Review* 9(1977), 23-46; Mohamed Cherkaoui, "Bernstein and Durkheim: Two Theories of change in Educational Systems", *Harvard Educational Review* 47(1977), 556-564; Easthope *et.al.*, "Bernstein's Sociology of the School", *Research Intelligence*, 1(1975).

2 R.A. Pring, "Bernstein's Classification and Framing of Knowledge", *Scottish Educational Studies* 7(1975).

3 King has caried out most of the empirical testing of Bernstein's sociology of the school; for studies of the secondary school see R.A. King, "Bernstein's Sociology of the School - Some Propositions Tested", *British Journal of Sociology* 27(1976), 430-443; "Bernstein's Sociology of the School- a Further Testing", *British Journal of Sociology* 32(1981), 259-265; "Sec-

theory is tested by conventional correlational methods. The aim of this dissertation therefore is to develop such a framework in order to demonstrate both the theoretical utility of Bernstein's theory and at the same time perhaps to show how the theory can enrich and inform more conventional approaches to school organization.

At the end of this chapter, three broad approaches to the resolution of this problem will be suggested, which will provide in turn a general direction for each of the following chapters. It is suggested first of all that the sociology of the school needs an evolutionary approach such as that provided by Bernstein's theory in order to account for the 'deep structural' shifts in patterns of school organization. In the light of this discussion, an attempt to develop a methodology which is derived from Bernstein's theory but compatible with well-accepted multivariate methods, will be made. Finally, the demonstration of the empirical utility of this framework in analyzing work organizations will follow. The attention here is primarily given to the secondary school, since this has been the main arena of the testing of the theories of Bernstein and where most parallel organizational research has been carried out. Studies of work organizations are by no means irrelevant, and frequent reference will be made to these as they bear on the main problem.

Central to Bernstein's sociology of the school is the assumption of the normative response of educational institutions towards changes in the social division of labour. This theory owes much to Durkheim's writings on education and to his early works on the division of labour - despite the importance that Marxian concepts of class and Meadian theories of the self have played in its detailed development(4). Bernstein's aim has been to develop a theoretical framework for the description and analysis of the changing forms of 'cultural transmissions', particularly in societies undergoing industrialization and modernization. As these societies become more 'open' with respect to the role options available to their members, so corresponding changes may be expected in the patterns of normative and cultural controls. In accordance with Durkheimian concepts of 'anomie' and of types of solidarity ('mechanical' and 'organic'), moral regulation under conditions of rapid social change becomes a central problem for socializing institutions such as the family and the school. The fundamental shift from communal towards individualized forms of moral regulation and for patterns of authority and of control provides Bernstein with his major theoretical distinctions, notably in his well-known sociolinguistic theories of 'restricted' and 'elaborated' codes. In his sociology of the school, however, this primary distinction has been subtly developed as the original Durkheimian category of 'organic' solidarity and is seen to have evolved

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ondary Schools: Some Changes of a Decade",*Educational Research* 23(1981), 173-176. For Studies of the primary school, see *All Things Bright and Beautiful: A Study of Infant Classrooms* ,(London: Wiley, 1978) and "The Search for the Invisible Pedagogy",*Sociology* (September, 1979).

4 As well as the "Introduction" to the third volume of *Class,Codes and Control* see Bernstein's account of the development of the sociolinguistic theory, "A Brief Account of the Theory of Codes" in the first volume (1971), reprinted in V. Lee(ed.),*Social Relatioships and Language* (London: Open University and Routledge and Kegan Paul, 1973).

For a re-statement of the sociology of the school and a refutation of the validity of the Marxian derivation of Bernstein's theories, see Rachel Sharp, *Knowledge, Ideology and The Politics of Schooling* (London: Routledge and Kegan Paul, 1980), pp. 44-46.

in new directions. The development of the Durkheimian model has gone through three stages by no means watertight or distinct, as we shall see, each has brought with it new concepts and terms. It is important, before we go on to look at the empirical test of this theory, to describe it in full, paying attention to the introduction to Bernstein's own account of the development of his theory of school structure(5).

The first stage of Bernstein's theory of the school is enccmpassed by three papers relating to Changes in the Moral Basis of Schools - 'Sources of Consensus and Disaffection in Education', 'Ritual in Education' and 'Open Schools - Open Society?'. The first of these sets out a substantive opposition between the instrumental culture of the school on the one hand and the expressive culture on the other(6). Although this distinction was transcended in the third paper, it allowed at least for a different focus of attention from that which was suggested by the organizational approaches to school structure which dominated the sociology of the school as an institution in the 1950s and 1960s, in a return of attention to the analyses of those social relationships which 'controlled the transmission of the social order'(7). This first paper set out to provide a typology of the different kinds of role involvement which might develop among pupils as a form of reaction to each of these cultures of the school (from 'commitment' through to 'alienation'). Though interesting as a point of departure, this typology is (as Bernstein claims in his 'Introduction' to the third volume) rather too mechanistic and perhaps too derivative of a rigid structural-functionalist framework. In the second paper the moral basis of the modern comprehensive school is described and analysed in relation to another continuum, from 'stratification' based on high degree of ritualization of the expressive order, to 'differentiation' which relies on an individual mode of control and determined to a large extent by the demands of a pluralistic, instrumental culture(8).

The most important break in Bernstein's thinking however occurs in the last paper of this first stage ('Open Schools - Open Society?') where the structural-functional model is put aside in favour of a more penetrating opposition in the patterns of normative relationships in both cultures, that is in the degree of 'openness' or of 'closure'. This new opposition at once frees the original typology from the technical determinism of Parsons and at the same time opens the way for the development of the original Durkheimian framework. The opposition between 'openness' and 'closure' relates not merely to the expressive culture but to the in-

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5 Bernstein, *Class, Codes and Control*, Volume 3.

6 *Ibid.*, p.38: "I propose to call that complex of behaviour and activities in the school which is to do with conduct, character and manner the 'expressive' order of the school, and that complex of behaviour and activities which generate it which has to do with specific skills, the 'instrumental' order."

7 *Ibid.*, pp. 3-4. This project as defined by Bernstein was to re-orient the study of the school away from the narrow concerns of organizational theory discussed in more detail in the following chapter. See for example the review of this approach by Charles E. Bidwell, "The School as a Formal Organization" in *Handbook of Organizations*, ed. by James G. March (Chicago: Rand McNally, 1965).

8 *Ibid.*, p.64: "Educating for diversity of economic and social function in pluralistis societies often involves a strengthening of the instrumental and a weakening of the expressive order of the school within the state system".

strumental as well, and instead of the two categories we now have four. An important byproduct of this development is that the integrative or moral sphere is no longer merely a residual category seen only in peer-group rituals but becomes rather an all-embracing principle from which all aspects of the school - its curriculum, pedagogy and organization - are to be understood.

Central to the notion of 'openness' is the shift away from the 'purity' of symbolic categories which was the very basis of the order of the 'stratified' school and the 'celebration' of a 'mixing' of categories at various levels of values, of subject areas and of teaching groups. This 'mixing' represents a rather recent tendency within the regulative patterns of 'organic' solidarity since it appears to make explicit its fundamental ethic - the triumph of diversity, individuation and of equality of opportunity. The new 'openness' is not confined any longer to the instrumental sphere alone but rather by its own internal paradoxes, even brings into the light previously neglected rigidities within earlier descriptions of work relationships. Whereas in the earlier paper on ritual, bureaucratic roles and therapeutic relationships were elided as alternatives to traditional forms, by this new distinction one would need to separate these much more finely. According to the more precise specification of the changes in the instrumental and in the expressive order of the school now provided(9). the school now moves away from bureaucratic categories such as subject areas and hierarchies of authority and status towards a more fluid, unbounded symbolic system which is more in tune with the moral condition of its surrounding society.

The break that Bernstein made with the instrumental concerns of American functionalism of this period also marked a falling-off of interest in the purer forms of ritual. Henceforth the main line of force in his conceptual scheme would be along an axis that opposed the formalized, hierarchical insulations of bureaucratic structures and the more fluid, innovative and experimental educational practices that were beginning to predominate in the 1960s in the form of progressivism and comprehensivism. The second stage of Bernstein's development was in defining this opposition more precisely and in examining its own internal ambiguities and problematic as a vehicle of cultural and social reproduction. This stage is typified by what are perhaps his two most important papers 'On the Classification and Framing of Educational Knowledge' and 'Class and Pedagogies: Visible and Invisible'(10).

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9 *Ibid.*, Appendix B pp. 52-3. One should note that Bernstein's use of the terms 'instrumental' and 'expressive', though similar to Parsons' usage in a superficial sense in his functional paradigm of systems of action, are by no means co-terminous with these. One very important difference in Parsons' inclusion of 'latency' or 'pattern-maintenance' as an 'instrumental' category, where in Bernstein's system, this is an aspect of 'expressive' culture. See T. Parsons in collaboration with R.F. Bales and E.A. Shils, *Working Papers in the Theory of Action* (New York: Free Press, 1953, re-issued in 1967).

10 *Ibid.*, Chapters 5 and 6. 'Classification and Framing' is the first draft of a paper published in a slightly different form in several other editions. See for example, *Knowledge and Control: New Directions for the Sociology of Education* (London: Collier-McMillan, 1971). It also appears in *Class, Codes and Control* Vol.1 (London: Routledge and Kegan Paul, 1972).

This distinction between the most 'pure' and the most 'mixed' of regulatory patterns is further defined in terms of two broad dimensions - the strength of the boundary between objects ('classification') and the possibilities for combining these('framing'). In educational terms these would be illustrated respectively by the strength of subject identities and by the rules governing the pacing or timing of learning sequences. When one examines the traditional English secondary school (e.g. a pre-war grammar school) then it appears that its 'purity' depends both on a 'strong' boundary-maintenance and a very limited range of options available to the teacher or pupil at any one time for arranging the contents of the curriculum into teachable and examinable sequence. Movement towards 'mixing' on the other hand depends on a weakening of the boundary between subject areas (as in the 'integrated day' of the junior school) and in widening the number of possibilities for the pacing of learning. The conjunction of these two dimensions led Bernstein to restate the patterns of closure in terms of an opposition between two 'codes' - the 'collection' code and the 'integrated' code. This deeper opposition subsumed those of the earlier types (e.g. 'differentiated' - 'stratified', 'open' - 'closed') and have a wider applicability outside of schools since they touch on fundamental cultural forms(11). They may be considered to originate both in the changes in the division of labour and its allied regulative tendencies such as the 'more penetrating, intrusive forms of socialization under conditions of ambiguity'(12).

One of the most important questions explored in these papers is the so-called 'paradox' of the integrated code. If the condensed symbolic forms of ritual and hierarchy were in the past uniquely suited to the creation of a moral consensus, then how can one expect the new regulative principle of integration with all its relativistic tendencies, its ambiguity and its extreme individuation to accomplish anything like the same degree of social cohesion? The answer to this question is suggested towards the end of the 'Classification' paper and further exploration of this problem is made in 'Class and Pedagogies' with particular relationship to social reproduction. The nub of the solution seems to be that there is indeed a form of ideological closure generated through the integrated code. This is not however explicit or overt, since at a surface level it encourages openness and diversity, as we have seen above. Rather, this form of closure or exclusion is a byproduct of the high level of abstraction or of generality on which the code depends for its very definition. Its power to regulate and to socialize is all the more 'penetrating' and 'intensive' simply because it does not commit social actors to a specific course or to creating a specialized output, but rather towards the acquisition and maintenance of a more general attitude, orientation or ideational framework (such as 'curiosity' or 'co-operativeness' in the case of progressive infant schooling). The very 'invisibility of the regulative principle sets up in turn a powerful mechanism of 'closure' which is realized through implicit rather than through explicit rules and guidelines and has therefore important implications for the reproduction of social classes.

This 'paradox' is developed in the 'Class and Pedagogies' paper around the theme of 'play' as an infant school pedagogy. This has particular value as a socializing vehicle since it challenges the practices of the 'old' or propertied middle class by posing the possibility of a less

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11 *Ibid.*, Appendix A to "Class and Pedagogies".

12 *Ibid.*, p.111.

overtly repressive, more personalized and democratic form of child-rearing. The integrated code can be specified here as an explicit set of practices which originates within the 'new' middle class and pre-supposes a 'long educational life', an 'elaborated' socio-linguistic code and the transformation of the role of the mother into an agent of 'cultural' rather than of 'physical' reproduction(13).

This new pedagogy presents problems and contradictions for all social classes, however: for the 'old' middle class which is threatened as we have seen by the challenge to conventional forms of the division of labour and by the dissolution of 'objective' hierarchies of authority and value; for the working class parents who find their informal experience and common-sense intuitions devalued by progressive theories of child development, which produces an even greater degree of discontinuity between the working-class home and the school; for the 'new' middle class itself whose members experience 'a sharp and penetrating contradiction' between the spontaneous, egalitarian ethos of the code and the constraints of economic survival and privatised identity(14). It is perhaps no wonder, in the light of these almost-universally-felt tensions that in the past decade such a reaction against the 'invisible' pedagogy should have set in from which those very 'fractions' of the middle class who did so much to promulgate it(15).

We come then to the third stage of the evolution of Bernstein's theory, which is characterised by the attempt to return to the original Durkheimian problem of formulating the relationship between school and work. The problem is stated at the end of the 'Class and Pedagogies' paper in the suggestion that in capitalist societies the crucial integration, that between work and education, is always avoided because work 'epitomizes class relationships'.

This brings out the fundamental contradiction of education as 'play' or as a preparation for leisure alone, since work 'can only be brought into the school in terms of the function of the school as a selective mechanism or in terms of social/psychological adjustment to work'(16). If this is so then one must ask under what conditions work and education might be integrated at the level of 'social principle', and what might be the changing relationship between the two as capitalist society itself experiences a shift in its regulative mechanisms in both these areas. The attempt to grapple with the macro-analytical and comparative implications of his theory is at present a fairly novel development, confined mainly to one published paper, 'Aspects of the Relations between Education

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13 *Ibid.*, p.125.

14 See observation by Brian Davies, *Social Control and Education* (London: Methuen, 1976): "Behind every collapsing toilet-roll holder, there may hide a future squatter's notebook", p. 132.

15 For a Marxist account of the class tensions behind the discrediting of progressive theories in Britain during the 1970s, see Steve Baron, Dann Finn, Neil Grant, Michael Green and Richard Johnson, *Unpopular Education: Schooling and Social Democracy in England since 1944* (London: Hutchinson, 1981).

16 Bernstein, *Class, Codes and Control*, Vol. 3, p.135.

and Production'(17).

Building on the previous insight that the structure of relationships of production and those of education in capitalist societies are not necessarily subject to the same regulative principles, Bernstein considers the inter-relations between school and work as a separate problem of his coding theory. The main concern therefore lies in outlining the conditions for the 'relative autonomy' of cultural production (the area of 'control') from the sphere of production (the area of 'power'). The purpose here is to give a greater degree of specificity to the theories of 'relative autonomy', a phrase which is frequently used by Marxist writers, but so vague as to be in constant danger from reductionist theories which view the moral and the instrumental character of schooling as directly determined by the needs of the capitalist mode of production(18). The 'crucial relation between education and production', Bernstein asserts, is the strength of the classification between these two categories', and that where this classification is strong, then the principles, contexts and possibilities of education are not integrated with the contexts, processes and possibilities of production'. The combination of this strength of classification and of the second opposition which he introduces ('simple' or 'extended' systemic relationships) produces three main possibilities for typifying the inter-relationship between school and work: (a) nineteenth century entrepreneurial capitalism ('strong classification and simple systemic relationship'); (b) twentieth-century capitalism ('strong classification and extended systemic relationships') and (c) some state socialist societies such as China, Roumania and Cuba ('weak classification and extended systemic relationships').

Unfortunately, as Sharp has pointed out, this typology is tautological unless its formal categories can be used to specify the dynamic characteristics of the inter-relationship between school and work in some causal sense, preferably in some concrete historical instance(19). In all fairness to Bernstein, however, it must be said that the paper may be programmatic, and should be seen perhaps as an initial attempt to explore the macro-analytical implications of his theory rather than as a definitive and final statement on this vast topic.

TESTING BERNSTEIN'S THEORIES IN THE SECONDARY SCHOOL

Having briefly outlined Bernstein's sociology of 'educational transmissions' we now turn to consider the problem of testing it empirically. Of particular concern is the case of the secondary school since it is here that one can find similarities between the testing of Bernstein's theories and the vast literature on the empirical study of organizational structure. It is here too that one finds a precisely articulated set of empirical

17 *Ibid.*,(second edition, 1977 only), Ch. 8.

18 For a Marxist usage of the term 'relative autonomy' see L. Althusser, "Ideology and Ideological State Apparatuses" in *Lenin and Philosophy* (London: New Left Books, 1971). As an example of reductionist explanations, see the discussion of the 'correspondence principle' by S. Bowles and H. Gintis, *Schooling in Capitalist America: Educational Reform and the Contradictions of Economic Life* (London: Routledge and Kegan Paul, 1976).

propositions developed and submitted to investigation over a ten-year period, namely in the work of King. Although, as it will be argued, this set of propositions has been logically misconstrued, it is of some importance to consider just how the theory may be validly tested empirically.

King's research sets out to explore the following questions raised by Bernstein's sociology of the school (a) does the distribution of 'instrumental' and 'expressive' variables suggest that some schools tend to be 'open' while others are 'closed'? (b) have secondary schools in general become more 'open' or less ritualized over the previous decade (1969-79)? (c) is Bernstein's theory of school structure a fruitful source of empirically- testable insights, or has it a merely metaphoric value? King operationalized Bernstein's theory by drawing on the 'open-closed' typology which appears at the end of the 'Sources of consensus and Disaffection' paper. Although this did not include at this stage the full model of educational codes (that is 'classification and framing'), it has points of comparison with the more mature theory, being representative of the second stage, as outlined above(20).

King constructed 130 structural variables (or scales) which were based in turn on over a thousand items of data. These scales covered such areas as the structure of the curriculum, assessment procedures, the extent of school rules, the degree of emphasis on assemblies, uniforms and prefect systems, the organization of out-of-school activities and of pastoral care. Among the 'instrumental-closed' variables were such items as the extent of 'streaming', the degree of standardization and of formalization of role performance. In each of these cases a high score indicated a 'high degree of closure or purity'(21). The 'expressive-closed' variables were based on such items as the frequency of detentions, the use of 'paper' controls in relation to punishment, the awarding of prizes for good behaviour and various measures of 'ritualization' which had to do in the main with the prefect system. 'Instrumental-open' variables included such items as the extent of non-streaming, the incidence of 'setting' and the range of options available, while the 'expressive-open' variables were based on the ritualization of the house system, the activities arranged for parents and parents' access to teachers.

King hypothesized that if Bernstein's theory were correct, then the 'closed' variables (both instrumental and expressive) would correlate positively with one another but negatively with the 'open' variables. From this hypothetical schema King produced 351 correlations from data of the original survey of seventy-two schools and later from the data of the forty-five schools of the follow-up study of ten years later, of which twenty-nine had retained their original status while sixteen had

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19 R. Sharp, op. *cit.*, pp. 61-66.

20 See note 3 above. The second ('follow-up') study of secondary schools did include an (unpublished) report of a pilot study into 'classification and framing'. This was based on a teacher-completed questionnaire covering the extent of teacher and pupil control over three aspects of school knowledge (organization, selection, pacing) in several subject departments. See *Curriculum and Organizational Change in Schools* (1980), Social Science Research Council, Mimeo.

21 Many of these organizational scales had been adapted from a previous study of formal school structure and were based on the model of D.S. Pugh *et al.*,

become comprehensives. The results, from the point of view of Bernstein's theory appear to be rather disappointing. Only 14.2% of the correlations based on the first survey data were found to be statistically significant in the predicted direction (e.g. 'closed' and 'open' variables being positively correlated), which meant that the great majority of the correlations (i.e. 84.8%) were 'unexplained' by Bernstein's theory(22). The correlations that did appear to support the theory tended to be those within each category of variable (e.g. the 'block' of variables designated as 'instrumental-closed'). The exception here was the 'expressive-closed' category where there was some evidence that styles of authority and of punishment were not related in the predicted manner. The correlations between different kinds of variables on the other hand gave 'only limited support' to the hypothetical framework derived from Bernstein's theory.

We turn now to consider the comparison of school structures over the ten-year period (1968-1978), both in terms of the changes in the average scores and in the pattern of inter-correlations among the variables themselves. Here, the 'follow-up' results appear to be contradictory. In the first instance, that is in the changes of average scores, there does appear to be some support for the theory. Compared with the earlier period, there is now less streaming and more mixed-ability teaching(23). There appears to be less emphasis on the prefect system and a counter-tendency towards more democratically-elected school councils. Sex differences have also been de-emphasized. In the second instance, however, King concludes that 'there is little evidence of a patterned trend towards openness in secondary schools'(24). King's generally negative reaction to the theory in the light of this evidence is based on what he claims to be the absence of a predicted polarization in the patterns of inter-correlation. In other words, it was not found in general, that over the period the inter-correlation predicted by the code for the first study had been accentuated as the theory would have us believe. King found, on the contrary, that there was a greater tendency towards 'openness' among those twenty-nine schools which had not 'gone comprehensive' but had maintained their status.

On many counts therefore, it would appear that Bernstein's sociology of the secondary school has failed to find empirical support. King's criticism is echoed by many other theorists(25) who find the structuralist approach to be misguided and who prefer instead more closely-argued historical studies. Indeed the tendency, even in theoretically-inspired Marxist studies of education today gives precedence to the notion of 'history from below(26) because of the dangers of reification inherent in macro-analytical

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"Dimensions of Organizational Structure", *Administrative Science Quarterly*, 13(1968): 65-105. See R.A. King, *School Organization and Pupil Involvement* (London: Routledge and Kegan Paul, 1973).

22 King, "Bernstein's Sociology of the School - Some Propositions Tested", p. 439.

23 King, "Secondary Schooling - Some Changes of a Decade", p. 173.

24 King, "Bernstein's Sociology of the School - a Further Testing", p. 261.

25 See note 1 above, especially critiques of Cherkaoui and of Gibson.

26 See Dario Melossi and Massimo Pavarini, "Some Observations of Recent Literature" in *The Prison and the Factory* (London: Macmillan, 1981) p. 193.

structuralist categories. The failure of a particular kind of structural analysis such as that of Bernstein to take into account the viewpoint of the actor is also seen to be a major disability, even if there is ample room for testing his theories at the interpretative as well as the normative level. In the light of the apparent failure of the theory to find verification at the latter level where after all it was originally formulated is one led therefore to disregard it and to turn to interpretive approaches or to more finely-grained historical studies which by and large abjure the precise quantification of organizational variables?

Such a conclusion may however be premature unless we are absolutely certain that King's empirical test has been adequate, both in terms of the formulation of the hypotheses from the theory and in the methodology employed to test these. King admits that his conclusions 'must be endorsed by more robust testing'. Perhaps the ten-year period may not be long enough to perceive the major changes implied by the notion of an institutionalization of an entirely new code. Perhaps too, the schools which King included in his first study were already extensively 'de-ritualized' and the instrumentation of the typology was not sensitive enough to pick up the very small changes of a ten-year period. If the 'integrated code' implies a second penetrating transformation of the school as took place when the 'collection' code gained its ascendancy towards the end of the nineteenth century, one would need a far more wideranging sample of schools taken over a longer time series than that provided by King's observations.

A CRITICAL EXAMINATION OF KING'S HYPOTHESES

What is of greater interest than these largely methodological considerations, however, is the soundness of King's hypotheses as to the patterning of the correlations among the structural variables. It seems strange that there may be support for Bernstein's theory in one sense, at the level of the changes in the average levels of raw scores of the variables, but that there is very little apparent support at the deeper level of their inter-relationships. One is therefore led to look a little more closely at the hypotheses on which King based his study and from which he concluded that the theories were so inadequate to explain the actual changes in school structure.

Let us consider the hypotheses of the first study, based on the 1968-1969 survey. These were:

1. Variables measuring features in each of the four basic categories should correlate significantly and positively.
2. Variables measuring instrumental-open features should correlate significantly and positively with those for expressive-open features.
3. Variables measuring instrumental-closed features should correlate significantly and positively with those for expressive-closed features.
4. Variables measuring closed features should correlate significantly and negatively with those for open features.

As reported above, King concluded that because only a fraction of the correlations predicted from the hypotheses were significant, that

the theory was of only limited use. Let us examine each of these hypotheses in two separate stages - with regard to the correlations expected within each of the four categories (hypothesis 1 and secondly at the correlations expected between categories (hypotheses 2-4).

a) Corelations within Categories: It is hard to deny that however one may view the issues, the scaling procedure itself employed by King which enabled him to reduce the 'thousand or so' data items to twenty-seven variables, is to a large degree supportive of the hypothesis. One might take as an example the 'Formalisation of Instrumental Performance' scale which was derived from the 'Aston' schedule rather than used in a previous study of school organization rather than from Bernstein's theory:

Formalisation of Performance Scale

Item
Marks or test results displayed on list
Examination results in school magazine
Examination results displayed on list
Work or test results reported to parents
Mean item analysis value 0.822(27).

The last statistic is to be interpreted as a measure of the dimensionality or scalability of the four items included as derived from the Brogdon-Clemens procedure. Since many, if not most, of the variables were constructed in this manner, it must be inferred that the fact that scales yielded acceptably high values in all of these studies indicates a good degree of within-category correlation that does not appear in King's presentation of results. It is largely, if not entirely, arbitrary, in other words, whether on represents each of the above items as scales or whether one submerges their high inter-dependence in a single score. However, to be consistent with Bernstein's theory, it should be pointed out that any significant degree of inter-item correlation (which is what an acceptably high index of scalability actually means) is to a large extent a hidden form of support for the hypotheses as formulated here.

At the other extreme, there does not appear to be in King's theoretical schema any explicit basis for deciding just what percentage of significant correlations in the predicted direction constitutes a reasonable ground for rejecting a null hypothesis - is it fifty per cent, seventy-five or even ninety per cent? This is particularly disturbing since even the most rigorous test of dimensionality, the scale model, does not depend on a simple percentage of significant correlations, but is based on the ratio of the covariation of the items and the total variation of test scores(28).

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27 One might compare this scale with two 'expressive' variables: 'social distance between pupils and teachers', a two-item scale with a 'mean item analysis value' of 1.00, indicating perfect internal dimensionality and 'parents'access to teachers' which had a 'mean item analysis value' of 0.914 (three items). To achieve these values the inter-correlations among the items would have to be extremely high indeed. A more complete discussion of the theoretical implications of scale values is to be found in the third chapter, together with a comparison of the various scale procedures. (Scales cited above here are taken from King, *Curriculum and Organizational Change* (1980).

28 See for example the well-known Kuder-Richardson formula for determining test reliability in G.A. Ferguson, *Statistical Analysis in Psychology*

	SPEC1	SPEC2	SPEC3	SPEC4	SPEC5	SPEC6	SPEC7	SPEC8
SPEC1	1.00000	.30255	.06928	.26253	.40378	.13408	.20199	.09194
SPEC2	.30255	1.00000	.13341	.13039	.18245	.02245	.15753	.21413
SPEC3	.06928	.13341	1.00000	.03645	-.04869	.02174	.05570	.22653
SPEC4	.26253	.13039	.03645	1.00000	.45050	.29685	.28276	.20355
SPEC5	.40378	.18245	-.04869	.45050	1.00000	.15346	.21722	.10522
SPEC6	.13408	.02245	.02174	.29685	.15346	1.00000	.14668	.29930
SPEC7	.20199	.15753	.05570	.28276	.21722	.14668	1.00000	.27195
SPEC8	.09194	.21413	.22653	.20355	.10522	.29930	.27195	1.00000
SPEC9	.09114	.30727	.13299	.01915	.10142	.17360	.08757	.11903
SPEC10	.01840	.20662	.03715	.18147	.28740	.02734	.29325	.16661
SPEC11	.13131	.35315	.06447	.14285	.14612	.07601	.12616	.17149
SPEC12	.24026	.22228	.13312	.28428	.42978	.15293	.26769	.23780
SPEC13	.11519	.15453	.08279	.25377	.18058	.08644	.36038	.12826
SPEC14	.43841	.24721	.09439	.46148	.49324	.26227	.12765	.11874
SPEC15	.43651	.15499	.10269	.29313	.40860	.10128	.06039	.11019
SPEC16	.50425	.19283	.12776	.34453	.37048	.09556	.10086	.13709

	SPEC9	SPEC10	SPEC11	SPEC12	SPEC13	SPEC14	SPEC15	SPEC16
SPEC1	.09114	.01840	.13131	.24026	.11519	.43841	.43651	.50425
SPEC2	.30727	.20662	.35315	.22228	.15453	.24721	.15499	.19283
SPEC3	.13299	.03715	.06447	.13312	.08279	.09439	.10269	.12776
SPEC4	.01915	.18147	.14285	.28428	.25377	.46148	.29313	.34453
SPEC5	.10142	.28740	.14612	.42978	.18058	.49324	.40860	.37048
SPEC6	.17360	.02734	.07601	.15293	.08644	.26227	.10128	.09556
SPEC7	.08757	.29325	.12616	.26769	.36038	.12765	.06039	.10086
SPEC8	.11903	.16661	.17149	.23780	.12826	.11874	.11019	.13709
SPEC9	1.00000	.17652	.24608	.12356	.05713	.11194	-.01580	.01765
SPEC10	.17652	1.00000	.32094	.50505	.48920	.14600	.05638	.09678
SPEC11	.24608	.32094	1.00000	.29783	.14448	.16128	-.02276	.15443
SPEC12	.12356	.50505	.29783	1.00000	.29403	.22064	.25633	.19020
SPEC13	.05713	.48920	.14448	.29403	1.00000	.15057	.14527	.11550
SPEC14	.11194	.14600	.16128	.22064	.15057	1.00000	.41980	.40400
SPEC15	-.01580	.05638	-.02276	.25633	.14527	.41980	1.00000	.40747
SPEC16	.01765	.09678	.15443	.19020	.11550	.40400	.40747	1.00000

Table 1:1 Correlation Matrix of Sixteen Functional Specialisms (Aston Scale 51.01. See Appendix 'A'), on a sample of 142 manufacturing Organizations.

Let us take for example the most basic of structural scales used in the 'Aston' scheme, upon which King based his scaling procedure, that of the organizational division of labour or of 'functional specialization'. This is a well-defined scale of sixteen non-workflow specialisms for each of which a score of 1 is given for possession by the organization and a 0 for non-possession. Pugh and Levy in fact used this scale as a paradigm case of the construction of organizational variables on the psychometric model(29). In order to maximise the possible inter-correlations by basing this scale on a sample of similar rather than dissimilar organizations, I have drawn up a correlation matrix of these sixteen specialisms as they were distributed among the manufacturing organizations included in the original Aston studies and the various replications(30) - see Table 1:1. If one accepts that a correlation coefficient of 0.2 constitutes a significant level (at 1% level of confidence, 0.15 at 5% level on a two-tailed test)(31) for a sample of this size (n=142), then it would appear that even such a basic and scalable property as this may fall well below the criteria imposed by King on the variables derived from Bernstein's model of school organizaton. As seen from the table, out of 120 possible correlations, 69 (or 57.5%) fail to reach significance at the 1% level, while 55 (or 46%) do not reach significance at the 5% level. Should one therefore conclude that the scale has only a poor to middling value as a structural measure ? If so, what could one make of other scales of the 'Aston' schedule (such as the centralization measure with Brogden-Clemens values of only .4) which may have just the same proportion of significant intercorrelations between items, but which seem to have provided extremely useful operational measures for organizational analysis?

(b) Correlations between Categories: Just how much importance should one attach to the low percentage of significant predicted correlations that King found among variables distributed across the different categories derived from the model of Bernstein? Here at least King does suggest a statistical model, the factorial, as a basis for the test: 'This kind of approach enables Bernstein to propose a single or limited number of factors external to the school to explain a great variety of changes occurring within. However, the results presented here do not strongly support the concomitant idea that particular organizational forms and practices, conceptually similar when classified using the various categories, would tend to be associated with one another'(32). Although the reference is to external factors here, the implication is that King is looking for a

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and Education (New York: McGraw-Hill, 1966).

29 D.S. Pugh and P. Levy, "Scaling and Multivariate Analyses in the Study of Organizational Variables" *Sociology* 3(1969), 193-213.

30 Data were taken from the Aston Data Bank, courtesy of the SSRC Research Archive, university of Essex. Studies included in this sample were those of the original Aston survey, Child, Hickson and Inkson, Hinings and Lee and Pheysey and Payne. See reports of these studies in Pugh and Hinings(eds.) *Organizational Structure*.

31 G.H. Fisher, *The New Form Statistical Tables* (London: University of London Press, 1965), Table X.

32 King, "Some Propositions Tested", p.440.

–Product-moment correlations between selected structural variables, Aston (A) and National (N) samples

Structural variable			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Functional specialization	A	-														
		N	-														
2	Legal specialization	A	32	-													
		N	27	-													
3	Overall role specialization	A	87	34	-												
		N	87	23	-												
4	Overall standardization	A	76	27	80	-											
		N	78	18	83	-											
5	Standardization of selection, etc.	A	–15	47	09	23	-										
		N	34	09	31	44	-										
6	Overall formalization	A	57	26	68	83	38	-									
		N	69	20	73	87	47	-									
7	Recording of role performance	A	66	11	54	72	–12	75	-								
		N	70	02	68	79	26	77	-								
8	Overall centralization	A	–64	–04	–53	–27	30	–20	–27	-							
		N	–28	–33	–43	–46	–38	–53	–22	-							
9	Autonomy of organization	A	50	–15	40	06	–52	–02	10	–79	-						
		N	05	19	11	14	02	18	10	–42	-						
10	Chief executive's span	A	22	15	34	28	04	32	32	10	02	-					
		N	10	–11	14	12	15	16	–01	–06	03	-					
11	Subordinate ratio	A	25	–14	05	13	–46	04	39	–14	–14	–16	-				
		N	07	–20	05	–10	–27	–19	03	41	–12	–10	-				
12	Vertical span (height)	A	57	48	66	57	23	48	33	–28	–06	24	–05	-			
		N	51	41	55	51	24	48	39	–41	10	–06	–28	-			
13	Percentage workflow superordinates	A	–53	21	–38	–37	39	–24	–52	52	47	12	–50	–01	-		
		N	–31	08	–23	–05	08	05	–01	–16	–14	–08	–45	05	-		
14	Percentage non-workflow personnel	A	58	11	56	51	–02	46	43	–40	–32	10	01	21	–43	-	
		N	07	03	–04	03	09	14	00	–04	15	14	–20	–13	–27	-	
15	Percentage clerks	A	17	12	29	31	31	29	08	–04	–05	12	–24	–01	–05	46	-
		N	–29	06	–26	–23	09	–07	–22	05	–03	23	–28	–10	08	44	-
16	Traditionalism	A	–36	–13	–26	–24	06	–47	–54	39	30	–22	–17	–14	19	–26	–08
		N	–22	04	–14	–12	–16	–31	–29	14	04	–03	17	–21	–01	–10	05

Number in sample: Aston, 46; National, 82.
Decimal points omitted.
The 95 per cent level of confidence applies to correlations of 0·29 in the Aston sample and falls between 0·21 and 0·22 in the National sample.

Table 1:2 Reproduced from J. Child, "Organizational Structure and Strategies of Control", in D. Pugh and C.R. Hinings(eds), *Organizational Structure*, Table 3:3, p. 34.

single factor (or a limited number of factors) among his variables, as a means of testing Bernstein's theory of adaptive change. Unfortunately he does not submit the data to a conventional factorial analysis, so it is difficult to tell whether or not it might have been possible to extract a number of significant factors from the observed communalities between the variables(33). Comparison with the 'Aston' studies again would indicate however that it is possible to derive very strong underlying 'dimensions of structure' even when a large number of individual correlations fail to reach statistical significance. If one examines the correlation matrix of structural variables in both the original Aston study and its major replication (the National Study of Child, reproduced in Table 1:2) it appears that the majority of correlations are not significant (at the 5% level, the one used by King)(34).

Although it may appear that the empirical results show quite a low degree of inter-correlation, in the absence of a theoretically-based level of acceptance, the following points need to be made about (a) the need to set an upper limit or ceiling to the degree of inter-correlation (b) the possible differences between levels of correlation within the 'open' variables as against the 'closed' variables (c) the importance of the distribution of significant correlations relative to the diagonal of the matrix as against the percentage of these as a raw indication of inter-dependence.

(a) The need of a 'ceiling': In the light of the apparent paucity of inter-correlation by King's reckoning, it may seem rather otiose to talk about a 'ceiling' when the 'floor' or 'foundation' is not too visible. Nevertheless it should be noted that a very rich pattern of inter-correlation would be just a great a source of suspicion as a very poor one. If the individual items and variables tended to inter-correlate to a high degree, then the battery of structural measures would produce quite a freakish distribution indeed, one that tended towards a very flat if not a bi-modal shape(35). Schools, according to such a test, would belong either to one category or the other, that is to say they would be entirely 'open' or entirely 'closed'. In other words, a test which had such a high pattern of inter-dependence could only run counter to the historical evidence that the institutionalization of a code is a slow, if not a glacial process. It would

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33 Modern factorial techniques often reveal large discrepancies between the observed communalities and those that are estimated through an iterative procedure - another reason to distrust a 'percentage' test based on individual correlations.

34 For a clear exposition of the distributional implications of high levels of test homogeneity, see Arthur Jensen, *Bias in Mental Testing* (London: Methuen, 1980), esp. Fig 4.2, p.65.

35 Michael Thompson, "Class, Caste,the Curriculum Cycle and the Cusp Catastrophe", p.36. Thompson's whole point of course is that the 'integrated code' by definition runs counter to the 'smooth, gradual, evolutionary tradition enshrined in Parsonian sociology', and by necessity almost, would only emerge through 'catastrophic' change. This is quite an extreme interpretation and does not in itself seem to be a necessary condition for the validation of Bernstein's theories (see Chap. 2 for further discussion on this point).

Table 1:3 Reproduced from R. King, "Bernstein's Sociology of the School: Some Propositions Tested", *British Journal of Sociology*, 27(4) (1976): 437.

Variable No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Punishments public	1														
	2														
Punishments ritualized	3	29													
	4														
		(-)													
	5	43		30											
						(-)									
	6	23				23									
						(-)									
	7					28									
						(-)									
Hierarchy and its ritualization	8					46	30								
	9														
	10							29							
	11	29							27		35				
Prefects' powers	12							29			30	25			
						(-)									
	13					25				25	27	27	40		
Teacher-pupil differences	14	49									26			25	
	15	36		26	24									23	

certainly contradict the evolutionary basis of the coding theory in the Durkheimian model and would as well, probably go against the experience of most members of the schools themselves. There is no doubt that such a pattern may give some credence to Thompson's 'catastrophe' theory of the 'integrated code'(36) and that it would itself be a source of great theoretical interest, but it could also lead one to suspect that the measures themselves might be producing the distribution because of their built-in redundancies of a semantic rather than a statistical nature.

(b) Differences in levels: Might it not be possible that, in the absence of a theoretical explanation to the contrary, we should not expect the 'open' variables to be as tightly intermeshed with one another as the 'closed' variables? This must be only a point of discussion for the present, but it would seem that if the 'overt' structure of the 'integrated code' is one of possibility and opportunity, then at the relational level at least (which is that tapped by the organizational scales) there should be a much lower level of internal redundancy? King found that this was generally so empirically, with a far greater number of significant correlations in the predicted direction among the 'closed' variables (thirty-seven in all) than among the 'open' variables (three only). To some extent this may have been a result of the number of variables employed in each instance, but it does raise an issue of theoretical concern.

(c) Position of correlations in the matrix: Of some interest in recent years to factorial theory is the pattern of inter-correlation known as the 'simplex', which often eludes more conventional techniques and can often only be revealed by intelligent inspection of the matrix of correlations itself. In this pattern variables are ordered in such a way that the correlations are largest near the main diagonal and consistently decrease the farther away they are from this main diagonal. The reason for this is that each correlation represents a step or a stage in an incremental pattern, but steps that are far apart do not have to show much association (one might give as an example here the importance of addition and subtraction to learning how to multiply, but the low levels of correlation between these component skills that one might find in a random sample of school children)(37). Although such a pattern can usually be accounted for by a single factor, it does raise the possibility of establishing meaning in the data that is not offered by King's rather crude approach. If one looks at the correlation matrix of 'expressive-closed' variables that he presents (Table 1:3, based on King's Table II, 1976), it would appear that even without prior arrangement of the order of variables, the correlations do appear to confirm broadly to a 'simplical' pattern, being distributed along the main diagonal in a linear manner. It would seem therefore that

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36 There has been growing interest in recent years not only in the 'simplex' but in other topological models of factorial structure such as the 'circumplex' and the 'radex', see Roger N. Shepard, "The Circumplex and Related Topological Manifolds in the study of Perception", in *Theory Construction and Data Analysis in the Behavioural Sciences*, edited by Samuel Shye (San Francisco: Jossey Bass, 1978). Most of these were inspired by Louis Guttman's original article "A Generalized Simplex for Factor Analysis", *Psychometrika* 20 (3) (1955): 173-192.

37 King, "A Further Testing", p.261.

one should attend to the implications of such a positioning of the significant correlations in the matrix before making any conclusions based merely on their raw percentage.

The 'Further Testing' of Bernstein's theory of the school

Up to now we have dealt only with the hypotheses of King's first investigation. We turn to comsider those of the follow-up study and to submit them to critical examination as well.

> King expresses his hypotheses as follows:
> The ascendancy of the integrated code, the concomitant eclipse of the collection code, and the continuing polarization of the codes would be confirmed if when comparing 1969-9 with 1978-9 at the later date:
>
> i. There were more statistially significant positive correlations and fewer negative ones between open variables and the correlations were significantly larger.
>
> ii. There were fewer positive correlations and more negative ones between closed variables and the correlations were smaller.
>
> iii. There were fewer positive correlations and more negative ones between open and closed variables and the correlations were smaller(38).

Unfortunately, as with the hypotheses of the first study these do not appear to stand up too closely to critical inspection. There were two main principles implied by this formulation which we will consider in turn:
(a) that the institutionalization of each code is indicated by the strength of the positive association between its constituent variables.
(b) that the weakening of the measured association between categories ('open vs. closed') indicates the 'ascendancy' of one coding pattern (in this case that of 'integration').
Each of these principles may be challenged.

(a) The first principle is based to begin with on a rather inconsistent view of the meaning of a correlation within each categorical type (i.e. 'open' and 'closed'). The use of scaling theory will demonstrate this point. We have already seen that the scales were derived in the first place from a large number of individual items. We have already seen that each of these scales depends in turn on a degree of inter-item covariance or inter-item correlation. Now as the school system as a whole is hypothesized to shift towards more 'openness', would one expect that (according to the second hypothesis just above) those scales measuring 'closed' variables should fragment or dissolve as their underlying homogeneity is eroded by the transition to the new code? This is clearly not the case, nor would one expect it to be, since it appears that the 'mean item analysis' values of the scales has remained high over the ten year period for both types of variables. Why should one expect therefore that the inter-correlations

38 It should be noted that the number of items in each of the scales varied considerably, see the original scales in King, *School Organization and Pupil Involvement*.

between the variables of the 'closed' categories should decrease, while for the 'open' categories increase, since the very same principles of internal homogeneity applied to individual items as to the variables themselves?(39). It would seem that King here confused the anticipated changes in the absolute levels of the variables with the direction of change in their patterns of association at two different times of observation.

(b) The second principle, relating to the third hypothesis, implies that the test of the 'ascendancy' of the new code relies on the weakening of the association between its variables and those of the other ('and the correlations were smaller'). An objection might be raised here however that it is the strength rather than the weakness of the negative association between the two classes of variables that would indicate the 'ascendancy' of the 'integrated code'. Since both types of code ('openness' as well as 'closure') depend on an single cumulative process, we would expect that the degree of 'variance explained' by a single unitary factor to be greater rather than smaller if Bernstein's theory were valid. To the extent that this hypothesis contradicts the previously stated principle that 'the opening-up of one variable should be associated to that of the other'(40), then we should anticipate a 'tightening' of the negative associations across the opposed categories, and therefore larger rather than smaller correlations. There may be limits to this tendency, as we have seen earlier, in that an extremely rich pattern of inter-dependencies might lead one to suspect rather too high a degree of semantic redundancy in the instruments themselves. It would not, however, as does this principle, violate the whole logic of Bernstein's theory of school structure.

CONCLUSION

From this analysis of King's hypotheses it may appear that his conclusion that the testing of Bernstein's sociology of the school shows it to be 'in part, empirically false' to be somewhat premature, not to say ill-founded. Such a conclusion would only be justifiable had it been shown that the hypotheses were derived from the very terms in which the model itself was formulated. Such a brief critique is not intended to depreciate King's attempt, but to point out the extreme difficulty of formulating an empirically-testable hypothesis that is based on conventional measures of association such as Pearsonian correlations. Part of the difficulty may be due to the way in which the theory was originally expressed, but it does not seem that Bernstein's use of language, though original and perhaps idiosyncratic, is in any way obscurantist. The general lack of empirical reference and research during the development of his sociology of the school (in contrast to that of his sociolinguistic theory) may be a better explanation, since it is only when one grapples with empirical data does one find the unrecognized difficulties and ambiguities entailed in the simple act of measuring the categories of coding.

It would seem that the above analysis has demonstrated at least three areas of concern which need to be fully addressed before one can

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40 R. King, *Curriculum and organizational Change in Secondary Schools*, p.13. This is reflected in the third hypothesis as well, namely that the correlations between 'open' and 'closed' variables might be expected to become both more negative and smaller over time.

arrive at a formulation of the theory that is empirically testable:

(i) the need to develop a theoretical framework for translating the principle(s) of coding into recognizable scales. Does scale construction itself perhaps embody a 'collection code' or an ' integrated code' as its major organizing principle? Whatever the answer, how does one approach the problem of measuring variables defined accoding to an opposing principle? These problems were surely suggested by a discussion of King's first set of hypotheses, and need to be first resolved by some framework that is internally consistent with that of Bernstein's theory.

(ii) the need to distinguish empirically between the 'surface' features of a code as represented by the changing levels of their component variables and the 'deep' or 'latent' features of structuring as represented by the changing interrelationships among these variables. Such a distinction can best be made by reference to the existing literature on school organizational structure generally. Such an exercise in cross-referencing might at the same time fill out the lamentable lack of an empirical basis to Bernstein's theory and demonstrate the wider applicability of its rich conceptual framework.

(iii) the need to develop a set of analytical procedures which will not only demonstrate the theory in practice but which have a precise statistical basis. Such a set of procedures could then perhaps release organizational analysis into more deductive approaches to the formulation and testing of hypotheses.

It must be pointed out that the search for an empirical test of Bernstein's theories should not rely on their earlier formulation, such as that employed by King, but rather on their mature version of 'classification' and 'framing'. In other words King's empirically-based rejection of the theory of codes is not only flawed by the type of methodological difficulties just noted, but also by the fairly crude type of functionalism which informs the earlier formulations. Notable in these was the over-emphasis given to the causal links between the division of labour in society and that in the school, and the unidimensionality of the 'open/closed' typology which penetrates both the expressive and instrumental orders. The more mature theory, however, is far more indeterminate as to the direction and strength of causal relationships between school and the social order, as well as being (by virtue of its development of internal structural categories of insulations and control) a far more tractable instrument of analysis.

OUTLINE OF THE THESIS

The following chapters will attempt to provide some solutions to the problems set out above, and will include a demonstration of the theory based on samples of work organizations. The choice of these samples, rather than of school organizations for the empirical test, is dictated to some extent by the greater availability of superior types of data sets for diverse work organizations than for schools, as well as by the great similarity that appears in a review of the literature between these two kinds of samples. Moreover there is no theoretical reason why work organizations should not be used, since as Bernstein has himself demonstrated, the regulative principles of production can readily be constituted under

the categories of classification and framing(41). Such an analysis, based on large samples of diverse organizations, might be extremely fruitful, in addition, in raising important issues as to the relationships between the forms of schooling and those of production.

In the following chapter the fundamental problems of the sociology of the school as an organization will be reviewed. This will follow a 'developmental' perspective, in that it will be argued that the models of school organization that now have currency (e.g. loose coupling, organized anarchy) are curiously unreflective in their neglect of the importance of the historical development of the school as a bureaucratic agency for understanding the present forms of subunit autonomy. This review leads directly, in the third chapter, to a consideration of the anomalies of scaling and measurement thrown up by comparative studies, especially those deriving from the Aston tradition of organizational analysis, which King drew on heavily for his test of Bernstein's theory. These will be shown to be reconcilable in the fourth chapter both with Bernstein's theory of codes and with information theory principles such as those of 'requisite variety' and 'requisite hierarchy'. This theoretical statement of the problem of scaling leads in turn to the methodological one of how best to tap the 'deeper' aspects of organizational structuring with existing methods of factorial and multivariate analysis. On the basis that a statistical measure is available, the following (sixth) chapter sets out to demonstrate how a construction of 'latent' variables of organizational structure might yield far more satisfactory levels or prediction than those available to conventional univariate analysis, and may point indeed to the existence of important processes of structuring that have been unobserved up to now. In the final (seventh) chapter the implications of these findings are discussed, both in terms of providing some evidence for the empirical testing of Bernstein's codes and for the sociology of organizations in general.

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41 Bernstein, "Aspects of the Relations between Education and Production", *Class, Codes and Control*, Vol.3, "We can use the concepts of classification and framing to indicate the codes of education *and* the codes of production", p. 181.

CHAPTER TWO

A DEVELOPMENTAL PERSPECTIVE ON SCHOOL STRUCTURE: WEBERIAN AND POST-WEBERIAN APPROACHES

In order to establish the relevance of Bernstein's sociology of the school it will first be necessary to show how it can help distinguish between those 'surface' and 'deep' features of organizational structure in a way that is not possible with conventional approaches. If this can be demonstrated then it may be possible to develop some greater theoretical insight into the meaning of the correlations between the dimensions or the variables which describe these structural features. What follows then is a review of the school as an organization which might demonstrate the relevance, if not the necessity of an evolutionary perspective such as that provided by Bernstein's theoretical framework. This may show at the same time that there already exists within the established empirical literature on comparative organization a good deal of support for Bernstein's models of structural change which can only become evident when the correspondences between the two are adequately formulated. The emphasis will therefore be more on 'instrumental' rather than on the 'expressive' variables as defined in the previous chapter. This is a choice dictated by convenience and by interest rather than by the logic of the theory which in its recent formulations does not draw such a simple distinction between these areas. The aim is not to provide an exhaustive review of this vast and complex field within the sociology of education, but rather to argue a position, perhaps a trifle selectively, so that its main contours will become apparent. The argument put forward is that, without a theoretical framework rooted in a developmental framework, many of the most elementary features of school organization cannot be properly understood.

It is perhaps ironic that sociologists of education in the early 1970s were beginning to reject the bureaucratic model of school organization and structure just at the time when, had they perhaps looked more closely, they may have found a radical change in the organizational literature that rendered inaccurate the over-rationalized, 'people-processing' approach of the previous decade. This view that the approach to the 'school as an organization' implied a rigid, monolithic and hierarchical conception of educational authority, bound to an apparatus of rules and procedures and predicated on assumptions of technological or macro-societal determinations was being extensively revised at this time (as we shall see in the final section of the following review). If only this stereotype of the 'organizational perspective' were not so firmly entrenched then it is possible that the flight towards an inter-subjectivist, micro-analytical perspective encouraged by the 'new directions' movement on the sociological literature might not have been so general. It might in fact be argued that had the organizational perspective been better understood, then the gulf between the two approaches to the educational institution (the 'normative' and the 'interpretive') might not have been so constricting or perhaps so damaging(1). If we look at the following areas of organizational enquiry we might discover that many of the findings are entirely consistent with a non-deterministic, voluntarist view of school structure. In order to cover the main points of the literature in this field, with partic-

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1 J. Karabel and A.H. Halsey "Editors' Introduction", *Power and Ideology in Education* (Oxford: Oxford University Press, 1977).

ular reference to the secondary school and to demonstrate the importance of the evolutionary framework, the following headings will be used:

(a) The school as an organization - what is the status of the so-called conflict between 'bureaucratic' and 'professional' authority within an evolutionary model of school structure?

(b) The theoretical significance of research into team teaching.

(c) Innovation and bureaucracy in secondary schools - is there a negative relationship between these?

(d) The theoretical significance of 'post-bureaucratic' models of school structure (such as the view of the school as a 'loosely-coupled' system')(2).

The School as an Organization

It may seem, in retrospect, that the classical formulation of the tension between the 'bureaucratic' source of authority in schools and the 'professional' or the 'collegial' may have been misconceived. In the first place, as we have seen, it reinforces an over-rigid notion of the bureaucratic model which is not supported by the evidence and may as well be based on a misreading of Weber's original formulation of this type. In the second instance, it has tended to root the source of the teacher's autonomy within a rather primitive craft-technology based on his supposed social and physical isolation in the classroom - an interpretation which is no longer historically tenable, nor theoretically sound. The result of this artificial dichotomy has been perhaps to reinforce at the level of policy and practice the epistemological controversy between 'normative' and 'interpretative' perspectives mentioned above. In one direction the 'bureaucratic' emphasis served to legitimate a large number of programmes in the 1960s which suffer from a rather naive belief in 'rational' and technological solutions to educational problems(3). In the other direction the belief in the potential of the individual teacher as an autonomous professional inspired a sophisticated but often misconceived subjectivist orientation that held out to its adherents an unrealistic expectation of the possibility of radical change through a redefinition of classroom 'realities'(4).

Perhaps the most developed statement of the perceived dilemma in the search for the source of authority in schools is to be found in

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2 This model was first proposed by Karl. E. Weick, "Educational Organizations as Loosely Coupled Systems", *Administrative Science Quarterly* 21(1976): 1-11.

3 There have been many critiques of the impositions of the 'input-output' model on to schools. For a well-argued review of these, see Arthur Wise, "Why Educational Policies Fail: the Hyper-rationalization Hypothesis", *Journal of Curriculum Studies* 9(1)(1979): 43-57.

4 The work of the early period of the 'new directions' approach has been subjected to a good deal of recent criticism, not least of all from its former advocates, many of whom now adopt a 'radical' perspective which goes far beyond the 'interpretative' perspective. See R. Sharp's account of Michael Young's theoretical development in *Knowledge, Ideology and the Politics of Schooling* (London: Routledge and Kegan Paul, 1980), pp.76-86. This critique Young finds 'wholly convincing', see his review of Sharp's book, *British Journal of Sociology of Education* (June, 1981).

the writings of Corwin(5) who first attempted to formulate a number of empirically-researchable dimensions of organizational structure. Corwin divided organizational power and authority structures into three components: (1) the control system comprising the official hierarchy of offices, the informal prestige system and the power hierarchy, (2) rules and procedures which provide guidelines for regulating members' conduct, and whose number, scope and specificity define the degree of standardization (3) the division of labour which is determined by the 'assignment of responsibilities laterally into distinct units at the same level of the hierarchy'. Corwin's framework, with its obvious debt to Weber's ideal-type of bureaucratic structure(6) and to Parsons' comments on the unresolved tensions in this model between hierarchy and expertise(7) states the dominant theme in this area of organizational literature: that is the incompatibility between the division of labour with its attendant norms of professionalism and the apparent conflict between this principle and that of the concentration of authority in large public organizations. It remains to be seen, however, whether this conflict is upheld in the empirical literature and whether the dilemma might be restated in a more theoretically acceptable form.

It may be useful first to sketch im some of the comparative organizational background to this wider question of professional autonomy, before coming back to consider authority in schools. Here the relationship between the two forms of authority, the 'bureaucratic' and the 'professional' is not as simple as it might appear from the fore-going discussion. From a number of empirical studies it would seem that there is certainly a 'strategic difference in the patterns of control' (whether through specialization or through a high degree of specificity of work procedures) but there need not be a conflict or a tension between the two. Hage and Aiken, for example, found in a study of agricultural organizations in the U.S. that participation in decision-making was positively correlated with the number of occupational specialisms and the degree of professional training and activity(8).

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5 Ronald Corwin first set out his conceptual scheme in the form of a proposal of an 'empirical taxonomy' of educational organizations, based on profiles (cf. 'Aston' approach), "Education and the Sociology of Complex Organizations", in *On Education - Sociological Perspectives,* edited by Donald A. Hansen and Joel E. Gerstl,(New York: Wiley and Sons, 1968), pp.156-223. He later implemented this framework in a study of professional conflict, *Militant Professionalism: A Study of Organizational Conflict in Hish Schools* (New York: Appleton-Century-Crofts, 1970), and in a study of innovation, "Innovation in Organizations: the Case of Schools",*Sociology of Education* 48(1973): 1-37.

6 Weber set out several main properties of his 'pure' or 'ideal' type of bureaucracy - regulated official tasks, a functional division of labour, a hierachy of offices, procedural rules and trained officials, the separation of resources from those of private individuals, appointment by merit. See Max Weber, *The Theory of Social and Economic Organization*,translated by A.M. Henderson and Talcott Parsons, edited with an introduction by Talcott Parsons(Glencoe, Ill.: Free Press and Falcons' Wing Press, 1947), pp.329-341. See also accounts by Martin Albrow, *Bureaucracy* (London: Pall Mall Press, 1970) and by D.S. Pugh, D.J. Hickson and C.R. Hinings, *Writers on Organizations: An Introduction* (London: Hutchinson, 1964).

7 T. Parsons, "Introduction" to Max Weber(trans.), *Theory of Social and Economic Organization.*

8 Gerald Hage and Michael Aiken, "Relationship of Centralization to other Structural Properties", *Administrative Science Quarterly* 12(1967): 72-92.

The findings of Blau *et al.*, based on studies of public bureaucracies, suggest that 'centralized authority is well-suited for the coordination of tasks differentiated into simple routines but not for professional specialties'(9). Child, summarizing the results of a number of studies using the 'Aston' approach (including his own 'National Study' concluded that the 'unitary conception of organizational structure' (of the Weberian ideal-type 'does not posit an identity of structuring activities and decentralization, but rather a recognition of how these dimensions form two related elements in the strategy of administrative control'(10). This conclusion is similar to that of Hinings and Lee: 'As organizations regulate more and more of behaviour, so they decentralize'(11).

If it is *de*centralization rather than centralization in other words which is associated with the 'structuring' of organizational activities, then it is difficult to see how a high degree of division of labour could somehow be incompatible with the elaboration of bureaucratic authority. These empirical studies of a wide range of organizations therefore did not hold out the possibility that professional authority may emerge from and depend on the bureaucratization of work rather than conflict with bureaucratic forms as a matter of theoretical principle. What is suggested then is the possible uses of an evolutionary approach to this dilemma rather than a static one which may be fixated on one particular stage of this process.

The notion that the division of labour together with other 'structuring' variables such as the standardization of rules and procedures may be an alternative rather than a rival strategy would seem to hold for schools as for these more diverse samples of organizations. Rather than being inimical to bureaucratic forms of authority it would seem that the division of labour among staff is highly correlated with these, particularly when these are substituted for more direct and personal supervision of the traditional kind. Heward, for example, who carried out an investigation into the organizational structure of a varied sample of twenty-five schools in the English West Midlands (using a variant of the Aston schedule) found that measures of the 'structuring of activities' (such as specialization, standardization and documentation) correlated positively with one another but negatively with centralization of authority(12). This finding compares

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It should perhaps be noted that Hage and Aiken's findings differ from those of Child in that they found centralization to be correlated with the other bureaucratic dimensions (e.g. formalization) but not with specialization. This difference is discussed below.

9 Peter Blau, Wolf V. Heydebrand and Robert E. Stauffer, "The Structure of Small Bureaucracies", *American Sociological Review* 31(1966): 179-92. See also Peter Blau and Richard Schoenherr, *The Structure of Organizations* (New York: Basic Books, 1970).

10 John Child, "Organizational Structure and Strategies of Control: A Replication of the Aston Study", in *Organizational Structure: Extensions and Replications, The Aston Programme II,* eds. D.S. Pugh and C.R. Hinings, p. 41.

11 C.R. Hinings and Gloria Lee, "Dimensions of Organizational Structure and Their Context", in *Organizational Structure* eds. Pugh and Hinings, p.6.

12 Christine M. Heward, *Bureaucracy and Innovation in Schools* (Unpublished Ph. D. Thesis, 1975).

with that of Heron who used a similar schedule to study a sample of publicly-run community colleges in Canada. Heron's conclusions are instructive in that they show the advantages of a time-series analysis to unravel the evolutionary processes involved in structural configurations. He concluded that 'in their early years colleges were relatively unspecialized and unstructured, were somewhat decentralized and had a small degree of autonomy. In their later years colleges were generally highly specialized and structured, were highly decentralized and had a considerable degree of autonomy'(13). Cross-sectional approaches such as that of Holdaway *et al.* basedon a similar population showed a rather different result however, one that suggests that specialization is quite low in educational organizations and although negatively correlated with centralization, is also not strongly related to other 'structuring' variables(14). One of the difficulties with correlations between specialization and other structuring variables at the school level may be that of measuring it precisely. Kelsey, who used the Aston methodology to compares school structures in Yorkshire and Alberta concluded that 'what the Aston study called Functional Specialization is not something that can be observed in individual schools'(15). If this is true and if the cross-sectional design can make a good deal of diference to the patterns of inter-dependence between the dimensions of structure, then questions of methodology (instrumentation, sampling) assume the greatest importance in testing theories of school structure(16).

If there is, as Child suggests, a unitary bi-polar dimension of organizational structure, then this surely has implications for Bernstein's theory of coding. This is so for two reasons: (1) it indicates the existence of a single strong primary factor of organizational structure which explains a good deal of the total variance in organizational scores; (2) its very bi-polarity suggests that evolutionary processes may be at work as negatively loaded variables (such as centralization) emerge in highly structured organizations, indicating a different principle of structuring. It is interesting to note that this latter tendency could be interpreted as the emergence of 'weak framing' since if one were to operationalize this concept it is difficult to imagine how one could fail to include some index of decentralization(17). It is instructive to note too in this context that King's pilot investigation into 'Classification and Framing' in a number of secondary school departments (n=25) employed a measure of 'framing' which was closely modelled on the Aston centralization scale - the higher the level at which a decision about the organization, selection and pacing of knowledge, the stronger the 'framing'(18). Despite some

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13 R.P. Heron, *Growth Stages in the Development of College Structures* (University of Alberta: Unpublished Ph.D. Thesis, 1972).

14 E.A. Holdaway, J.F. Newberry, D.J. Hickson and R.P. Heron, "Dimensions of Organizations in Complex Societies: the Educational Sector", in *Organizational Structure*, eds. Pugh and Hinings, Chapter 8.

15 J.G.T. Kelsey, *Conceptualization and Instrumentation for the Comparative Study of School Structure and Operation*, University of Alberta: Unpublished Ph.D. Thesis, 1973).

16 See Pugh and Hinings, "Concluding Remarks" to *Organizational Structure*, p. 168.

17 Bernstein defined 'framing' as 'the degree of control or discretion of the teacher of pupil process over the organization, selection and pacing of knowledge transmitted', *Class, Codes and Control* Vol.3, p. 89.

of the difficulties of operationalizing the structural characteristics of the school just mentioned, it does seem that there is an immediate correspondence between the two 'strategies of control' that emerge from the factorial analysis of organizational variables and the two principles of structure suggested by Bernstein's coding theory. In order to explore this correspondence in more depth it will first be necessary to attend to the meaning in the literature of that most fundamental concept of Durkheimian theory, the division of labour.

One of the reasons for the ambiguities surrounding the measure of the division of labour in schools, apart from some of the methodological problems pointed out by Kelsey, may have been the failure of theorists to distinguish between two different types of professional 'autonomy'. By one approach, autonomy is often seen to be based on a 'craft' model which depends in turn on a pre-bureaucratic form of authority, in fundamental conflict with the restrictions of a rule-bound, centralized and standardized administrative apparatus. By a second approach, one which might be labelled an 'emergent' type, autonomy is derived from and supported by a highly elaborated bureaucratic infra-structure. Without a theoretical and methodological basis for making this distinction the organizational study of the school appears to have reached an impasse which neither an interpretative nor a counter-rationalist critique can provide a satisfactory solution. Before going on to look at the empirical studies of the most developed example of the second approach to autonomy in practice - that is the team-organized (or 'multi-unit' primary school), it may be of some value to look first at theoretical attempts to solve the dilemma of authority in schools. One might identify three main approaches to this: (i) the 'craft-autonomy' model of teaching; (ii) the 'interacting spheres' model and (iii) the 'contingency' model. This last-mentioned is of particular interest since it provides a major theoretical orientation for the research literature on the innovative primary school.

(i) The 'craft-autonomy' model: This model is based on the assumption that teaching is necessarily outside the realm of bureaucratic control except perhaps for the most ritualized encounters between teachers, administrators and parents, simply because of the physical and social isolation of the teacher at his place of work, in the classroom. This approach gives rise to the 'cellular' or 'egg-crate' model of the school and has obvious links with the study of craft organization in other fields such as the construction trades, where the theoretical understanding of the raw materials by the operatives is low and necessarily intuitive(19). The main exponent of this model has been Lortie who has claimed the 'the bureau-

18 King, "A Pilot Investigation into Classification and Framing", Appendix to *Curriculum and Organizational Change in Secondary Schools*, pp. 16-21. King used a variety of scales to compose a score out of a total of sixteen for 'teacher's control' and out of thirteen for 'pupil's control' - each covering the three aspects of 'framing' as defined above.

19 For the unsuitability of the formal bureaucratic mode to craft technologies (implied by the 'contingency' model, see below), see Arthur L. Stinchcombe, "Bureaucratic and Craft Administration of Production", in *The Sociology of Organizations: Basic Studies*, eds. Oscar Grusky and George Miller(New York: Free Press, 1970). See also Charles Perrow, *Complex Organizations: A Critical Essay* (Glenview, Ill.: Scott, Foresman, 1972), Chapter 4.

cratic model, in emphasizing the formal distribution of authority, does not prepare us for the many events that actually occur in public schools' and that ' teachers lay claim to and get, informally, certain types of authority despite lack of formal support for it in either law or school system constitutions'(20). Such an approach which emphasizes the pre-bureaucratic or charismatic sources of authority informs Bidwell's classic analysis of the formal structure of the school(21). In the absence of a well-defined technology and a clearly-articulated professionalism, school organizations are 'structurally loose'. The real threat to formal school authority arises through the endemic tendency of such an organization towards 'debureaucratization' which can only be offset by the development of a set of normative principles to which teachers might adhere. This model, still based on the internal development of teaching as a non-routine set of 'craft' skills has provided the focus of much of the organizational literature, as seen above in the analysis of the empirical studies. It is characterized by a deep suspicion of the relevance of the legal-rational model of authority to school organization and by a concurrent vagueness of the causal processes that might explain the patterns of school structure. Bidwell, for example, stressed the limited knowledge that we have about the 'interplay of bureaucratization and professionalism in the schools'(22) while Lortie claimed that the 'several strands of hierarchical control, collegial control and autonomy become tangled and complex'(23). The elaboration of theory as we shall see in the discussion of the two following approaches lies in the penetration of the normative and technical components of professionalism (often at the expense of the 'craft' model) and in the more precise specification of the causal links between this and the bureaucratic model.

(ii) The 'interacting spheres' model: This approach was developed by Hanson(24) from the writings of Lortie and of Bidwell. It represents a more explicit and formalized statement of the inter-dependence between the authority of teachers and that of administrators. Hanson suggested the following organizational characteristics that 'shape the processes of school governance and decision-making': (1) two interacting spheres of influence in the school with identifiable types of decisions 'zoned' (Lortie's term) to each party; (2) a base of authority for administrators

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20 Dan C. Lortie, "The Teacher and Team-Teaching: Suggestions for Long-range Research", in *Team Teaching*, eds. J.T. Shaplin and H. Olds Jr.(New York: Harper and Row, 1964), pp. 270-305.

21 Charles E. Bidwell,"The School as a Formal Organization", in *Handbook of Organizations*, ed. James G.March(Chicago: Rand McNally, 1965).

22 *Ibid.*, p.992.

23 Dan C. Lortie, "The Balance of Control and Autonomy in Elementary School Teaching", in *The Semi-Professions and Their Organization*, ed. A. Etzioni (New York: Free Press, 1969), p.1.

24 Mark Hanson, "Beyond the Bureaucratic Model: A Study of Power and Autonomy in Educational Decision-Making", *Interchange* 7(2)(1976-7): 27-38. There is probably little that is novel in Hanson's model theoretically as the problems of accommodation have been dealt with at length in general theoretical literature on organizations. See, for example, Eugene Litwak, "Models of Organization which Permit Conflict", *American Journal of Sociology*, 67(1961): 177-84.

and one for teachers, legitimized by organizational charters and professional ideology and expertise respectively; (3) identifiable constraints on the authority of both spheres; (4) processes of 'decisional accommodation'; (5) direct and indirect strategies for management of behaviour of members of each sphere; (6) defensive strategies used by members of each sphere to protect their members from outside 'intervention'.

What is interesting about this model is that it lays the basis for an interactive approach to the relationships between the two parties or 'spheres'. Rather than merely co-existing they achieve autonomy only through the active assertions of their respective responsibilities in a well-defined 'game' which has both written and unwritten rules. This model has some obvious links with conflict theory (in the assumption of built-in tensions) yet it has emerged from a largely functionalist tradition which its author explicitly recognizes (in references to Parsons, Katz and Argyris). One might ask however whether this latter tradition provides any insights into the causal, rather than to the merely formal statement of the bases of authority in schools. How might one go about unravelling the different strands of 'Lortie's tangle' - the interaction of normative-legal, technical and bureaucratic elements of school structure - by placing them in into some kind of causal sequence. This is a rather more difficult task than that attempted by Hanson or by the 'craft' theorists and brings us to consider the contribution of one school of functional theory, that of the 'contingency' model.

(iii) The 'contingency' model of organizational structure: The dilemma of authority in schools as suggested by these preceding models probably reflects a deeper confusion in functionalist theory as to which are the main determining influences on the organizational structure of schools and of school systems. The problem seems to reside not merely in the low technological development of instruction nor in the demonstrably poor articulation between the two 'spheres' of authority but rather in the ambiguity of functionalist theory itself in assigning a causal priority either to technical or to legal-normative factors as the main source of the teachers' and of administrators' authority. Are schools 'structurally loose' because of the alleged under-development of a rationalized set of techniques of instruction or because the legal and other normative bases of the authority of schools as a whole are eroded by other influences, such as their vulnerability to political intervention? Are teachers (and by implication, educational officials) exposed to these interferences because they lack and historically-developed basis for autonomous action or because, quite simply, they do not know how to 'deliver the goods' with any degree of certainty? The charge by Musgrove that schools are 'under-powered and over-administered' is not a new one(25). If this charge is true it is the task of theory to explain the peculiar structural arrangements of schools in such a way that the causal process behind them - whether in the political or in the task environment - can be satisfactorily explained.

The theoretical issue here has been well-expressed in terms of functionalist theory by Dreeben who notes that Parsons' two theoretical papers on organization have 'strikingly different' formulations of the causal sequence, the first being stated in terms of societal values, goals and

25 F. Musgrove, *Patterns of Power and Authority in English Education* (London: Methuen, 1971), p. 13.

functions, the second in terms of organizational activities(26). Dreeben also notes that there are great difficulties with the functional classification of schools by the first formulation as 'pattern-maintenance' serving organizations - a category that would include a large number of organizations with markedly different structures including universities (which resemble hospitals rather than schools), theatres, symphony orchestras and museums and art galleries. This author claims that the difficulty lies in the logic of Parsons' formal (AGIL) scheme itself, which can only remedy such anomalies in its own terms, that is to say, by re-defining the four-function paradigm at one level down in generality ('Are schools as G-type of pattern-maintenance organizations while museums are all L-type') (27). The answer, he suggests, lies instead in a recognition of the type of work which is actually carried out in different kinds of institutions and in exploring the implications of these differences for variations in structure.

Dreeben is particularly concerned lest this 'activities' perspective should degenerate into a crass technological determinism, since 'it leaves open the question of how the parts are related to each other and how the organization is related to its environment, both questions which must be conceptualized'(28). The source of the legitimation must still be specified, therefore. Dreeben's emphasis on the technical contingencies of the classroom ('the imperious demands of classroom pressures, the absorption of teachers' attention in events occurring in the classroom, the mandatory attendance of pupils, the uncodified nature of their technology')(29) has an explicit and recognized debt to Lortie's view of teaching. However, by restating the problem of authority in terms of a well-defined theoretical scheme, his formulation suggests a set of causal propositions as to determinants of school structure and thereby the possibility of deliberate interventions to expand the professional autonomy of teachers in predictable ways.

The 'contingency' model attempt to make explicit this 'activities' orientation of functionalist theory, by setting out hypothesized interdependencies between tasks, structures and goals. The general principle behind this theory is that task environments (as defined by 'goals') present 'constraints' on the types of structural configurations that could prove to be viable. For example, where the task environment is stable and predictalbe, then each task can be broken down into a defined number of repeatable functionally-differentiated routines which are adequately coordinated by standardized rules and procedures, and regulated by a hierarchy of offices. However, where the task environment is variable and unpredictable (due to the lack of understanding of the 'raw material' or to the crudeness of the technology), a far more effective structure would be one which allowed for a high degree of specialization and autonomy of the oper-

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26 Robert Dreeben, "The Organizational Structure of Schools and School Systems", in *Explorations in General Theory: Essays in Honor of Talcott Parsons* Vol.II, ed. J. Loubser *et al.*, (New York: The Free Press, 1976), p.865. This ambiguity in functional theory is probably inherited from Durkheim - see discussion by A. Giddens, *Studies in Social and Political Theory*, (London: Hutchinson, 1977), p. 29.

27 Dreeben, "The Organizational Structure of Schools", p. 868.

28 *Ibid.*, p. 869.

29 *Ibid.*, p. 870.

ating units. Since this approach applied to the school, it would make some sense to review the literature briefly, particularly as it bears on the theoretical explanation of the 'tangle of control'.

The research literature inspired by the 'contingency' model would suggest that it is more rather than less task-interdependence which is the driving force behind the structural development of the school (in the directions suggested by Bernstein's theory). Paradoxically, as 'contingency' theorists would argue, the most effective vehicle of autonomy is not the preservation of the 'egg-crate' model of the school but rather the development of 'integrated' patterns of collaboration and a developed system of decision-making. There is a good deal of evidence to this effect, coming from various countries and corroborated by changes in management practice 'on the ground'(30). A study of high schools in the United States, carried out by Derr and Gabarro, for example, which used a 'contingency' approach explicitly(31) suggested that 'organic management practices such as the sharing of supervisory roles and the use of cross-functional teams were all associated with organizational effectiveness' (as indicated by dropout rates, attendance and absence of serious acts of misbehaviour). If the implication is that organizations will develop in ways which have been shown to produce measurable results (not always a justified assumption, as the 'loose coupling' hypothesis would suggest), then there is some *prima-facie* support for the influence of technological and managerial innovations in the organization of work. The recent study of twelve inner London comprehensives by Rutter *et al.* would support this general inference of the central position of coordinative teaching practices in explaining school structures and outcomes. This study revealed a positive association between the interdependence of teaching and a number of pupil outcomes, both academic and non-academic, after certain background factors had been controlled. It seemed that the degree to which teachers in a school violated the principle of 'splendid isolation' was an important positive predictor of effectiveness(32). An observational case study of the management practices in a large English comprehensive carried out by Richardson(33) which employed a 'socio-technical' approach underlined the importance of the intensity of communication among staff, both senior and junior, in understanding the day-to-day operation of the school. The implication of these studies is that the very complexity of the modern comprehensive, in its multiplicity of specialized functions and 'zones' of commitment and responsibility, involves the classroom teacher willy-nilly in a matrix of power and authority far too diffuse to fit the hierarchical assumptions of the conventional bureaucratic model.

Can it be demonstrated, however, that such an emergent type of decontralization in contrast to the more primitive, pre-bureaucratic type,

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30 See, for example, Geoffrey Holroyde, *Managing a Comprehensive School: The Application of Management Practice in a Large Comprehensive School*, (Sidney Stringer School and Community College, 1973), Mimeo.

31 C. Brooklyn Derr and John J. Gabarro,"An Organizational Contingency Theory for Education", *Educational Administration Quarterly* 8(1972): 26-43.

32 Michael Rutter *et al.*, *Fifteen Thousand Hours: Secondary Schools and Their Effects on Children* (London: Open Books, 1979), p.113, esp. Fig. 7.5.

33 Elizabeth Richardson, *The Teacher, the School and the Task of Management* (London: Heinemann, 1973); see also *Authority and Organization in the Secondary School*, Schools' Council Research Studies (London: Macmillan, 1975).

These studies revealed nevertheless a large degree of internal variability in the acceptance of an innovation such as team teaching. Any school, even one subjected to an 'engineering approach', appears to be a patchwork quilt of differing practices, both formal and informal. This variability is consistent with the findings of King in a study of 'informal' infant classrooms(37) who suggests that the 'integration' of one dimension of structure (e.g. the organization of knowledge) does not necessarily imply the 'integration' of another (e.g. over the teacher's control of pacing). The characterization of any school as 'traditional' or 'innovative' (or perhaps any classroom) would therefore seem to be subject to qualification, a finding which lends some support to the 'evolutionary' as against the 'catastrophic' model of change discussed in the first chapter(38). Charters and Packard, whose longitudinal design enabled them to look at changes in the same schools over several years, observed that 'the effect of unit organization or instructional interdependence should not be construed as a mass conversion to team teaching, since in only three (out of fourteen) schools did instructional interdependence constitute a simple majority'(39). The interpretation of any regression-based analysis in an area where 'variance explained' is seldom more than fifty percent seems therefore to be fraught with qualification and adumbration. It is these random factors as much as anything else which must make one suspicious of global, if not apocalyptic claims about the rapidity with which a cultural complex such as 'code' is institutionalized in schools.

Is there, however, no clear and affirmative theoretical result which could be gleaned from these studies, one which might relate to the school as a structural entity? From the evolutionary view one might be interested in looking more closely at the changing role of the principal. in opposition to the perspective taken so far in this chapter which suggests that task interdependence might be associated with a more diffuse power environment, one might for the sake of argument assert that the contrary is more likely. This counter interpretation is in fact put forward by Musgrove who reads in the increased visibility of teaching under the 'open plan' not the development of autonomy through collaboration but rather its subversion through the destruction of the traditional insulations of the 'collection' code. Musgrove claims that 'the considerable degree of autonomy that teachers have enjoyed in the privacy of their classrooms is undermined by educational architects. The danger is that open schools will be characterized by timidity, uniformity and mediocrity'(40). In contrast to the evolutionary perspective - and in implied sympathy with a 'craft' view of professionalism, Musgrove sees the power of the new code to derive from its extension of older forms of visibility (he compares

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37 R. King,"The Search for the Invisible Pedagogy", p.447. King concluded that the fact that the three elements of 'framing' appeared to vary independently of one another was 'incompatible with the existence of the invisible pedagogy as an integrated code'. This conclusion is questioned in the following chapter.

38 See Chapter 1, p.13.

39 Charters and Packard, "Task Interdependence", p.26.

40 Musgrove, *Patterns of Power and Authority*, p. 58. A similar claim has been made by Wallace that 'there are pressures working in the physical' of the open plan building which in contradiction to the child-centred approach to learning, also based on the 'panopticon' analogy. See G. Wallace, "The Constraints of Architecture on Aims and Organization in Five Middle Schools", in *Middle Schools*, eds. A. Hargreaves and L. Tickle, p. 137.

'open plan' to Bentham's 'panopticon') rather than from the subtler forms of an 'invisible' surveillance which can only be produced by the restructuring of perception and cognition.

The view that the newer techniques are really only a disguised attempt to consolidate centralized authority through a greater efficiency in the technology of surveillance offered by the 'open plan' and collaborative teaching does not however seem to find support from this series of empirical studies. The original Stanford studies indicate a decrease in principal's influence while the replication by Charters revealed a rather patchy effect ('Many principals were reported to have maintained or increased their prior levels of involvement in the affairs of teachers' classrooms, but some were seen to have made a substantial withdrawal')(41). In the 'follow-up' by Cohen *et al.* to the original Stanford studies, further exploration of the effects of work-interdependence revealed two different styles of principal's involvement - one of 'supportiveness'(to the extent to which teachers perceived the principal to provide resources and to offer praise and advice) and one of 'supervision'(based on teachers' perceptions of the principal as involved mainly with hierarchical matters such as teacher evaluation and classroom discipline). In a sample of more traditional ('low interdependence') schools, 'supervision' was found to have mildly positive effects on levels of teacher satisfaction (*beta* = +.15) whereas in the more innovative sample ('high interdependence' schools) its effects were markedly negative(*beta* = -.52). By contrast, in both types of school 'supportiveness' was shown to have high positive effects and this was more pronounced in the 'high interdependence' schools. Whatever the difficulties in interpreting these findings in the light of previous observations on the internal variability of school structure, it seems very likely that the power environment of the innovative school is one that encourages either 'timidity' or 'conformity'. Rather the reverse seems to be more plausible, namely that the higher levels of interdependence, in an open plan setting seems to be associated with a more diffuse and perhaps volatile pattern of distribution of power and authority.

Of some interest from the point of view of the anticipated levels of inter-correlations within each type of school in the regression analysis carried out by Cohen *et al.* of 'teacher satisfaction' on a number of independent variables ('principal supervision', 'supportiveness', 'educational background', 'materials variation'). It was shown that 'the total amount of variance accounted for by these variables is quite low in 'low interdependence' schools (R^2 = 16%); it is almost twice as high in 'high interdependence' schools (R^2 = 30%)'(42). It might seem from this finding that the interdependence score of a school is of some value in identifying not only the level of prediction as we have seen, but that it is also related to the patterns of inter-correlation among the variables themselves - the distinction made earlier between 'surface' and 'deep' structure. Although this finding is of only passing interest to these researchers it does have some theoretical significance by giving support to the inference made in the previous chapter that the move towards 'integration' would be associated with a higher degree of inter-correlation among polarized variables

41 Elizabeth G. Cohen, Anneke Bredo and Kenneth Duckworth,"Organizing the Elementary School: Problems of Teacher Interdependence and Complex Instructional Practice",(Stanford, California: Stanford Center for Research and Development in Teaching, 1976).

42 *Ibid.*, p. 19.

(e.g. 'supervision' vs 'supportiveness') rather than, as King hypothesized in his 'Further Testing' of Bernstein, a lower degree.

Having established that there may be a good deal of theoretical and empirical support for the hypotheses that there may be a loose adaptive relationship between the task environment of the school and its internal patterns of authority in the directions suggested by the evolutionary model, we turn to consider the implications of this hypotheses for the study of innovation in the secondary school, where perhaps the tendencies noted in the case of the primary school are not as pronounced.

(c) Bureaucracy and Innovation in the Secondary School

The theoretical and empirical literature discussed so far provides an intellectual context to the problem of understanding the concrete and historical changes in the secondary school. In many secondary schools the 'loss of the stable state' (as Musgrove puts it)(43) is perhaps the single universally-felt condition of the past two decades. The comprehensive re-organization of the secondary sector has been accompanied by a number of fundamental though largely unstudied effects on their organizational arrangements, while the extension of the school-leaving age, the rapid changes in the ethnic composition of many inner-city schools have all been marked by new directions in the structure of the curriculum and the demand for a new range of pastoral and welfare services. To add to these, inherited largely from the age of expansion, there have been in recent years the uncertainties imposed by financial constraints, the politically-generated demand for greater vocational relevance and for public accountability and for visible improvements in efficiency(44). This about-face has led to a 'crisis of legitimation' in many areas of primary and secondary schooling previously committed to change within a 'progressive' mode(45). What are the implications of such a turbulent conditions for the organizational structure of the large, diversified secondary school?

The debate necessarily centres again around the problem of the bureaucratic model, which is seen by the so-called 'post-bureaucratic' school of thought(46) to be inimical to adaptive change. In this interpretation the typical public secondary school is large (over 1,000 pupils), bound by standardized rules and procedures, highly departmentalized, dominated by a central authority and ridden with disaffection and conflict.

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43 Quoted by E. Richardson from an address, *Authority and Organization*, p. 21.

44 Gerald Bernbaum(ed.), *Schooling in Decline* (London: Macmillan, 1979).

45 J. Lynch,"Legitimation Crisis for the English Middle School", in *Middle Schools: Origins, Ideology and Practice*, eds. A. Hargreaves and L. Tickle, (London: Harper and Row, 1980), Chapter 7.

46 See Warren G. Bennis, *Changing Organizations* (New York: McGraw-Hill, 1966); "Post-Bureaucratic Leadership", *Trans-Action* 6(July/August, 1969): 45-51; also, Victor A. Thompson, *Modern Organizations* (New York: Alfred A. Knopf, 1961). Many 'contingency' theorists take a more selective view of the responses of the bureaucratic school to segments of the task environment that do not conform to the routinized pattern of public schooling. See Perrow's discussion of a hypothetical non-routine unit *(Complex Organizations,* pp. 73-74) and the empirical study of an alternative educational programme in an American comprehensive by Philip A. Cusick *et al.*, "Organizational Structure and Student Behaviour in Secondary School", *Journal of Curriculum Studies*, 8(1976): 3-14.

Such a school, this literature suggests, would therefore be least likely to innovate whether it be in the instructional area (the 'technological core') or in its patterns of administration and governance. Do empirical studies of the secondary school however conform to this model, or do they suggest a more differentiated and ambiguous interpretation of the possible interdependencies between size, complexity and innovation in public secondary school organization? We will examine some of these possible interrelationships in turn.

Complexity, size and innovation in the secondary school: The relationship between size and bureaucratic structure, in the first instance, would appear to be well documented. Anderson, for example, from a study of thirty-eight junior high schools in the United States concluded that increases in size 'necessitates additional levels of hierarchy, a more elaborate status system, a more minute division of labour, increased span of control and greater procedural specification'(47). Anderson also noted a generally depressing effect of size on levels of innovation. This finding, which does not follow from the theoretical possibilities that have been suggested for the institutionalization of innovations in the more bureaucratized context of higher education as formulated by Clark where size, through its effects on internal differentiation might lead to higher levels of innovation(48).

This alternative interpretation, which would suggest a positive link between school size and levels of innovation is supported by Corwin's empirical research, subject to what looks like an 'upper ceiling' on the size of the school. A regression analysis of the structural characteristics of 131 high schools in the United States showed a strong independent effect of size on innovativeness (*beta* = +.389) even when structural variables as described above (themselves partly a consequence of size) were controlled for statistically. This relationship seemed however to be curvilinear as forty-five percent of the least innovative schools 'were disproportionately likely to be middle-sized'(49). This suggests that Anderson's findings would need to be subjected to greater scrutiny in terms of his sample. It would appear that very small and very large organiz-

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47 James G. Anderson,"Bureaucratic Rules: Bearers of Organizational Authority", *Educational Administration Quarterly* 2(1966): 7-34; *Bureaucracy in Education* (Baltimore: Johns Hopkins Press, 1968), p. 157.

48 Terry N. Clark,"Institutionalization of Innovation in Higher Education: Four Conceptual Models",*Administrative Science Quarterly*, 13(1968): 1-25. Clark's main models are 'organic growth', 'differentiation' and 'diffusion'.

49 Corwin, "Innovation in Organizations", p.25. This is similar to the curvilinear relationship found by G.H. Moeller and W.W. Charters Jnr. between bureaucratization and teachers' 'sense of power'. The mediating importance of formal structure between size and professional autonomy is suggested by the finding here of a moderately strong relationship between bureaucratization and size (r = +.43). "Relationship of Bureaucratization to Sense of Power among Teachers",*Administrative Science Quarterly* 10(1966): 444-455. The notion that there is an optimum size for a secondary school recalls earlier research of L.G. Barker *et al.*, *Big School - Small School* (University of Kansas: Report to U.S. Office of Health, Education and Welfare, 1962).

ations are both poor environments for innovation. The causal implications of this finding have still, however, to be discussed.

Apart from the direct background effects of size (if such exist), what configuration of structural variables independently affect a school's readiness to innovate? Hage and Aiken hypothesized that a higher degree of complexity and lower degrees of centralization, formalization and 'efficiency emphasis' would promote change in schools(50). However, it appears that this hypothesis was not put to a rigorous test from the rather small data base employed(51). Corwin's research would tend to support these propositions however. He found that among the most innovative schools standardized procedures were relatively uncommon, and a much higher proportion of these had decentralized patterns of authority(52). However, the rather low levels of variance explained by the cross-sectional design and the apparently contradictory results might lead one to suspect that the generic constraints to innovation derived from the 'post-bureaucratic' approach are a poor guide to predicting the level of innovation in any one particular school.

In contrast to these cross-sectional approaches, Daft and Becker carried out a longitudinal study of the innovativeness of thirteen school districts in Illinois over two periods (1959-60 to 1963-64 and 1968-69 to 1971-72) and at the same time separated in their independent measures administrative from technical innovations(53). The result of their analysis was to show that the effect of size is largely spurious if one is predicting innovations in the 'technical core' of instruction, since the size effects must be mediated through a complex pattern of internal differentiation - including 'complexity' (as indicated by 'teacher professionalism')(54). Daft and Becker conclude that 'low formalization, decentralization and high complexity (i.e. professionalism) are suited both to the initiation and adoption of innovation in the technical core. The opposite structural conditions appear to facilitate innovation in the administrative

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50 Jerald Hage and Michael Aiken, *Social Change in Complex Organizations* (New York: Random House, 1970).

51 See critical review of Hage and Aiken's research in educational organizations by Joseph B. Giaquinta, "The Process of Organizational Change in Schools" in *Review of Research in Education,* ed. Fred Kerlinger,(Ill.: Peacock, 1973), p. 197.

52 Corwin claims for example that: 'a committed faculty might overcome any of the procedural constraints that one found in standardized schools, but under less than optimal conditions experimental programmes can be easily defeated by standardized procedures and a lack of necessary personnel'.

53 Richard Daft and Selwyn W. Becker, *The Innovative Organization: Innovation Adoption in School Organizations,* (New York: Elsevier, 1978).

54 Daft and Becker, pp. 136-8. These authors dispute Hage and Aiken's conflation of occupational diversity with professional expertise. This may be an important theoretical point (made for example by George Friedmann, *The Anatomy of Work* , London: Heinemann, 1956) but does not directly touch on the argument made here. Whether innovation is, as Corwin or Hage and Aiken would have it, generated by a kind of creative conflict that grows out of occupational diversity, or develops out of the rationalization of the technical core, the decentralizing effects of the division of labour are much the same. For further research into the 'conflict' perspective

domain. High formalization, centralization and low complexity (professionism) fit the adoption of innovations which pertain to the organization itself. These innovations are often pushed on to the technical core'(55).

These researchers claim that the process of innovations follows an evolutionary pattern, not unlike that noted above in the case of Heron's study of Canadian public colleges. The first type of innovation tends to be 'top-down' as changes in the organization are initiated by officials. Thus organizational complexity is a 'consequence not a cause' of the centralization of authority. Here the absence of occupational diversity can actually facilitate the process of administrative innovation since it meets with little resistance from below. At the second stage, however, once the organizational framework is firmly established, innovations tends to flow from the 'bottom-up' in that it is generated by the professional activity of teachers themselves. Administrators will then be perceived by teachers as the main resistors to change as autonomous professional activity races in front of the bureaucratically-defined 'needs' of the system.

Such a model demonstrates the intricacy of the processes which can lie behind the observed correlations between size, complexity and centralization on the one hand and innovation on the other. If we look at an organization such as a school district at one point in time we can obtain a different set of correlations from those taken at another stage of the sequence described. One's interpretation is complicated as well by the operational definitions of concepts - for example whether innovations are 'technical' or 'administrative' and whether 'complexity' is measured by the diversity of occupational categories or the degree of professional expertise and activity. The general outlines are however, clear, in that the increasing rationalization of the organization, beginning with the administrative apparatus and extending towards the technical core appears to be the most important 'engine' of innovation.

Support for this evolutionary interpretation of the ambiguous relationships between bureaucracy and innovation at the individual school level comes from Heward's study in the West Midlands, mentioned above(56). Heward used 'Aston-type' measures of school organization (similar in many respects to those of Corwin) in order to predict the degree of adoption of different types of innovation (curricular, audio-visual, managerial, extra-curricular). Contrary to the predictions of the 'post-bureaucratic' model, she found in the main that a bureaucratic type of organization was often conducive to the adoption of innovations in the technical core, with 'centralization' as a strong negative influence. Heward concluded that innovation in schools is not antithetical to or subversive of bureaucratization, but rather that 'it is embedded in bureaucratic structure'. In contrast to the findings of Corwin and the 'axiomatic' theory of Hage(57) Heward claimed that 'it is possible that only schools with strong institut-

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here see E.M. Beck and M. Betz, "A Comparative Analysis of Organizatonal Conflict in Schools", *Sociology of Education* 48(1973): 59-74.

55 *Ibid.*, p. 144.

56 C.M. Heward, *Bureaucracy and Innovation in Schools*, p. 204(all references below).

57 Jerald Hage,"An Axiomatic Theory of Organizations", *Administrative Science Quarterly* 10(1965): 289-320. It is interesting to note a similar conclusion coming from a comparative study of the organizational and 'climate' structures of two manufacturing organizations in the West Midlands ('Aston' and 'Brum'), carried out by D.C. Pheysey and D.S. Pugh,"Influence of Struc-

ional bureaucratic support can incorporate novel activities and social arrangements and institutionalize them'. From this fairly strong conclusion one might be persuaded that bureaucracy in schools can be something of a two-edged weapon. The literature suggests that one should first pay attention to the total configuration of structural variables before making predictions as to their likely effects on different types of innovation in secondary schools.

Before proceeding with the next section it is important to note that the analysis has so far tended to underline the utility of the bureaucratic model in approaching the structure of the school. Just as one might expect the newer forms of professional collaboration emerging within the structures that were already extensively bureaucratized, so one finds in the present analysis a degree of support for the development of 'integrated' forms of work organization within a structure organized on the principles of 'collection'. It seems that the evolutionary, incremental approach has more to offer therefore than either the 'craft-autonomy' model which fixes the technology of teaching at a pre-bureaucratic stage or the 'post-bureaucratic' model which depreciates the continuing importance of the bureaucratic background for the success of emergent or innovative forms. These conclusions from the review of the Weberian and neo-Weberian literature are broughtinto sharp focus as we turn to consider an antithetical approach, one which would deny the simplifying assumptions of the formal bureaucratic framework and deal with the school as either a 'loosely-coupled system' or, more colourfully, an 'organized anarchy'.

(d) Schools as 'Loosely-Coupled' Systems: Post-Weberian Models of Organization

We come then to consider a model of school structure which has deceptive similarities both with the proto-anarchism of the 'craft-autonomy' model and with the 'new directions' critique of the socio-technical or 'contingency' approaches to formal structure. This is the 'loosely-coupled' hypothesis which shares with the others a fundamental scepticism as to the utility of objective rationalist models of school systems. However, whereas the 'craft-autonomy' model is inspired by a kind of liberal-humanist pessimism as to the possibilities of 'social engineering' and the 'new directions' school base their critique on a radical epistemology, the version of organizational thinking which is now gaining ascendancy is perhaps lacking in any consistent theoretical or philosophical position. It expresses above all the sense of contradiction and distrust towards the rationalist tradition of available theories of organization, but apart from some provocative metaphorical insights into the nature of schools and of other organizations, seems itself to be fraught with unresolved theoretical difficulties.

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ture at Organizational and Group Levels", in *Organizational Behaviour in its Context: The Aston Programme III*, eds. D.S. Pugh and R.L. Payne (Farnborough: Saxon House, 1977), Chapter 5. It was the more 'mechanistic' organization ('Aston') whose members felt a higher degree of involvement in the groups' activities, contrary to the conventional wisdom that Weber's 'ideal-type' brings with it inevitable 'dysfunctions' that undermine autonomy and produce alienation.

The view of the school as a 'loosely-coupled' system has been well summarized from the recent literature by Bell as follows: "Given that educational goals are ambiguous and may well not occupy a focal position in school life, the way in which schools attempt to fullfil these goals is equally unclear. Even when the goals are expressed in the most general terms related to the facilitating of learning, different educational and political ideologies lead teachers to approach their task in a number of ways. More fundamentally, however, teachers are often unsure about what it is pupils have learned and how, if at all, learning has actually taken place"(58). The research of Bell and his associates into the introduction of mixed ability teaching in a large comprehensive school showed how departmental autonomy could actually lead to a reversal of official policy. There seems to be something more in this finding than the mere 'debureaucratization' of the school generated by the pull of the isolated teacher against official directives, or even the random events which produce the 'unexplained' variance in regression models of school behaviour. The 'autonomy' noted by Bell was not that of individual teachers buth rather that of large subunits of the organization itself, the supposedly 'functional' entities of the rational division of labour. However, this autonomy does not seem to produce the disintegration of the organization, but can in fact save it from over-zealous reform. What we appear to have isolated here is a different strategy or principle of organization. The danger that lies in this discovery however is that of elevating a different evolutionary principle to the status of a novel or even a radical theory.

The phrase 'loose coupling' was originally used by Weick to describe school systems(59) and builds on the work of Buckley, Glassman and Landau(60). The school, he suggests, is something like an 'unconventional soccer match' where there are few 'rational' rules and 'the entire game takes place on a sloped field' but must be played nevertheless 'as if it makes sense'. It is argued by Weick that the separateness and lack of interaction between each part of the system have an 'evolutionary importance'(61). 'Loose coupling' allows portions of the organization to persist and evolve independently, it provides the organization with a 'selective sensing mechanism', it permits the local adaptation of units and the 'retention of a greater number of creative mutations than might a 'tightly coupled' system. It localizes breakdowns and disruptions as well, and thus encourages self-determination by the subunits, which is relatively inexpensive. However, there is a negative side to each of these advantages, as Weick notes. 'Loose coupling' tends to leave people to solve their

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58 L.A. Bell,"The School as an Organization: A Re-appraisal", *British Journal of Sociology of Education* 1(1980): 188; for report of research, see L.A. Bell, R.C. Pennington and J.B. Burridge,"Going Mixed Ability: Some Observations on One School's Experience", *Forum 21* (1979).

59 Karl E. Weick,"Educational Organizations as Loosely-Coupled Systems", *Administrative Science Quarterly*, 21(March, 1976): 1-19.

60 The origins of this model are traced by Howard E. Aldrich,*Organizations and Environments* (Englewood Cliffs, N.J.: Prentice-Hall, 1979), pp. 76-86.

61 Weick, "Loose Coupling", pp. 6-9. See also Aldrich, *Organizations and Environments*, pp. 80-82. Note that 'evolutionary' in this context means 'adaptive' while in the heading to this chapter it means 'developmental' and therefore has little teleological connotation.

problems alone and in its lack of interdependence, inhibits the diffusion of innovations to other parts of the organization.

The principle of 'loose coupling' has met with a good deal of acceptance from theorists of educational organization, perhaps because it has arrived at a time when there has been a fair degree of disillusionment with the experiments of the 1960s when change tended to be imposed from 'above'. It has also an apparent appeal to conflict theorists who are attracted by the alternative to the one-dimensional, over-rationalized and harmonious model of school organization presented in the literature. Foremost among the latter are Meyer and Rowan(62). These theorists interpret 'loose coupling' as the antithesis of contingency theory in that they claim that 'structure is disconnected from technical (work) activity and activity is disconnected from its effects(63). What is it then that is holding large complex organizations together? Largely, Meyer and Rowan would argue, it is the credibility extended by the outside world to the 'ritual classifications' (grades, examination passes, certificates) which the school produces. These authors ascribe to the 'craft-autonomy' model of teaching in that any claim of central authority to control instructional activity directly is 'evanescent'. What matters however is the confidence which the elaborate classifications of educational orgaizations can inspire (They are the sacred rituals that give meaning to the whole enterprise, both internally and externally')(64). As the 'loose coupling' model suggests, such an arrangement can be both inexpensive and effective in maintaining support in a pluralistic environment. If credibility is all, then the formal structure of school organization becomes 'in good part a social myth and functions as a myth whatever its actual implementation'(65). It seems that whoever manages these ritualized categories (to the extent that this is feasible) controls the outcomes of the educational system.

Theoretical problems with the 'loose coupling' hypotheses: Although the interpretation of Meyer and Rowan has a degree of superficial appeal, it nevertheless illustrates the contradictions inherent in the model. It is ironic that the Weberian 'conflict' perspective which underlies their interpretation of the social meaning of credentials in a complex, bureaucratized society should depend almost entirely on a traditional source of authority(66). The 'ritual' categories and the 'ritual' subunits about which they speak so loosely have indeed far more to do with Durkheimian concepts of 'collective consciousness' and the segmental division of labour than they have with any modern social forms based on interdependence and rules. Perhaps this is precisely what these authors intend. If so, such an interpretation of 'loose coupling' would render irrelevant the major theoretical underpinnings of the sociological tradition as formulated by

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62 John W. Meyer and Brian Rowan,"The Structure of Educational Organizations", in *Environments and Organization*,ed. Marshall Meyer *et al.*(San Francisco: Jossey Bass, 1978).

63 *Ibid.*, p. 79.

64 *Ibid.*, p. 93.

65 *Ibid.*, p. 107.

66 A more sophisticated neo-Weberian interpretation of the social market value of educational credentials is to be found in Randall Collins,*The Credential Society: An Historical Sociology of Education and Stratification*(New York: Academic Press, 1979).

its 'founding fathers'(Marx, Weber, Toennies, Durkheim)(67). Such a regressive tendency in social theorizing is however generated from contradictions that have not been resolved within the 'loose coupling' model rather than an extraordinarily original sociological vision.

The 'loose coupling' hypothesis incorporates a degree of hierarchy and of complexity inits basic concepts such as the 'subassembly'. Simon has claimed (quoted by Aldrich)(68) that our ability to recognize 'loose coupling' depends on a hierarchical model: 'The fact that many complex systems have a nearly decomposable, hierarchic structure is a major facilitating factor enabling us to understand, describe and even to 'see' such systems and their parts'. This interdependence of hierarchy and 'loose coupling' therefore lead to the conclusion that one cannot force the latter to bear too great a theoretical load by itself without major distortions of organizational analysis. The contradictions that arise from an overemphasis on the concept of 'loose coupling' are manifested in the way it has been misapplied to two areas of organizational life, the structural and the symbolic, or in Bernstein's original terminology, the 'instrumental' and the 'expressive'. Let us consider each in turn.

From an 'instrumental ' viewpoint the notion of 'loose coupling' should not necessarily imply an agglomeration of segmental entities as Meyer and Rowan and even Dreeben(69) seem to think. If one were to look for real examples of the 'quasifeudal' subunits then one would need to look perhaps at tha national armies of the fourteenth century(70) or the decentralized forms of traditional authority in English administration in the sixteenth and seventeenth centuries(71). As Aldrich interprets the 'active' form of 'loose coupling' however, it is entirely compatible with March and Simon's concept of 'factoring' of organizations into functionally and structurally differentiated subdivisions (not unlike the 'contingency' model)(72). As the term is formulated by Weick, however, there is no way of deciding whether 'loose coupling' refers either to a segmental or a differentiated division of labour or whether functional or structural alternatives are preferred.

In the 'expressive' or symbolic sense, the 'loose ccupling' model shares several superficial characteristics of the 'construction of reality' approach which has informed the 'new directions' school of the sociology of education. Weick claims for example that: 'Given the ambiguity of

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67 See Robert A. Nisbet,*The Sociological Tradition* (London: Heinemann, 1967), Chapter 1.

68 Herbert A. Simon, "The Architecture of Complexity",*Proceedings of the American Philosophical Society,* 106(December): 467-82, quoted by Aldrich, *Organizations and Environments,* p. 85.

69 See for example Dreeben's use of segmental imagery to describe the structure of the modern school: 'Finally, quasi-feudal administrative strucutres are likely to arise when enough members of an organization have interests and problems in common to support collective association (e.g. school principals)" "The Organizational Structure of Schools and School Systems", p. 871.

70 Barbara W. Tuchman,*A Distant Mirror: The Calamitous Fourteenth Century,* (Harmondsworth: Penguin, 1978), Chapter 4.

71 Vernon K. Dibble,"The Organization of Traditional Authority", in *Handbook of Organizations*,James G. March.

72 Aldrich, *Organizations and Environments*,pp. 85-6.

'loosely-coupled' structures, this suggests that there may be increased pressure on members to construct or negotiate some kind of social reality they can live with'(73). However, it should be pointed out that if this is true then the normative outcome would not be in 'rituals' but 'rules', not the unreflective following out of a condensed symbolic system but rather a self-conscious and flexible set of normative guidelines to everyday practice. The inability of the 'loose coupling' theory to allow its proponents to make such fundamental distinctions is surely the sign of some degree of sociological naïveté in the manner in which it has been formulated and applied to educational organizations.

'Post-Weberian' Theory and Bernstein's Educational Codes

Despite the theoretical problems of the 'loose coupling' model, there is about it an intuitive appeal that deserves serious attention in the light of the argument developed here. There is a similar appeal to a related 'post- Weberian' theory of educational organizations, that of the 'organized anarchy', developed by March, Olsen and Cohen among others(74). As this term suggests, Weberian models of rationality (and this includes 'contingency' theory to a large extent) are often wildly inappropriate to an organization where the order of administrative priorities is not 'given' by any objective criterion (such as profitability, sales volume), where participation is fluid and where problems, solutions and decision-making processes might well be seen as independent streams of events rather than as parts of the same confluence. Despite the rather facetious terminology that the proponents of this model frequently use ('garbage-can' models of choice), there is an important point to be made. It may indeed be inappropriate to apply models of organization developed on factories, the military and business organizations to schools where the technology and goals are by no means as clearly defined nor the links between them as tractable by rationalized models.

Of some interest then is the apparent similarity between certain aspects of these approaches to Bernstein's concepts of 'classification' and 'frame'. On the face of it one might see 'loose coupling' as an example of the 'collection code'. Indeed the manner of its definition would immediately suggest this. Weick notes that 'loosely coupled' events are 'responsive but each also preserves its own identity and some evidence of its physical or logical separateness'(75). As with objects, so with events. Aldrich points out: 'The time it takes one variable to affect another is an important linkage factor. How long does it take for an effect to appear? The longer the time span, the looser the coupling'(76). This interpretation suggests both strong 'classification and framing' and give some apparent support to the fixation of these theorists with the ritual-

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73 Weick, "Loosely Coupled Systems", p. 3.

74 James G. March, Johan P. Olsen *et al.*, *Ambiguity and choice in Organizations* (Universitetsforlaget: 1976). See also Michael Cohen, James G. March and Johan P. Olsen,"A Garbage-can Model of Organizational Choice", *Administrative Science Quarterly* 17(1972): 1-25.

75 Weick, "Loosely Coupled Systems", p.3.

76 Aldrich, *Organizations and Environments*, p. 77.

ized features of organizational structure and symbolic order. However, if this rather regressive comparison is not appropriate, if not actually misguided, then may not the inference that 'loose coupling' (and by implication the 'organized anarchy') is a manifestation of the 'collection code' also be open to question? One might seek in other words to define the concepts in a more sociologically consistent and rigorous manner than they have hitherto been used.

The obvious alternative to the above is to see these (post-Weberian' models as expressions, not of some primitive 'collection code' but rather as attempts to surpass the mechanistic features of this code, but somehow lacking in the conceptual apparatus to make its internal direction explicit. If it is possible to see 'loose coupling' as a more highly evolved form of organic solidarity then the interest in the ritual features, according to Bernstein's theory, fall into place - not as structural or organizational properties which, as we have seen, is somewhat anachronistic, but rather as aspects of an ideological closure which is 'emergent' from a dense system of implicit rules. If this is so then it may be more accurate to think of these models of organization as a poorly-articulated attempt to formulate a theory of the 'integrated code'.

Support for this reading of the 'post-Weberian' models might be found from the 'causal texture' typology of organizational environments of Emery and Trist(77) which is derived in turn from the cybernetic modelling of Ashby(78). This sets out four degree of interconnectedness of the organizational environment ranging from 'random placid' where there is no systematic linkages between parts to the 'turbulent' where one might say that changes in any part had rapid and significant effect on every other part. Between these two extremes there is first the 'placid, clustered' environment and then the 'disturbed-reactive' type. According to Emery and Trist there is an adaptive relationship between environment and organizational structure. Thus the 'placid, clustered' type is said to be that to which a large, centralized and hierarchical organization is particularly suited. It is interesting however to note that the third type ('disturbed-reactive'), based on Ashby's multistable environment is 'poorly joined', although at a relatively high stage of systemic evolution(79). It achieves this, not by the detailed linear or sequential arrangement of the component parts but rather through a high degree of interaction between a few of the parts at a time. This environmental description certainly fits the 'loose coupling' model quite well, in particular the 'reactive' form as defined by Aldrich which is typical of a politicized internal environment. If this analogy is correct then it would appear that 'loose coupling' as the internal counterpart of environmental interconnectedness may be typical of a relaxation of the symbolic and structural constraints that have characterized the school of the 'collection code'. Not least of these is the primordial classification which set the school apart from its immediate environment and created the closure of Bernstein's early model.

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77 F.E. Emery and L.E. Trist,"The Causal Texture of Organizational Environments", *Human Relations* 18(1965): 21-32, in *Systems Thinking* ed. F.E. Emery (Harmondsworth: Penguin Education, 1969), Chapter 12.

78 W. Ross Ashby, *An Introduction to Cybernetics* (London: Methuen, 1965); *Design for a Brain: The Origin of Adaptive Behaviour* (London: Chapman Hall, 1960).

79 Ashby, *Design for a Brain,* p. 193, p. 205.

Plausible as this interpretation may seem, how can one tell whether it is any more 'correct' than that of Meyer and Rowan whose conceptualization of the connections between parts of the school and its environment is closer to that of the simpler 'placid, random' type? Are schools and other organizations really as bound by 'ritual classifications' as these authors make out, or have they evolved towards an extremely fliud and dynamic version of the 'post-bureaucratic' stage? Theoretically at least it seems more likely that the latter interpretation is correct and that the rule-bound, complex quality of school organizaton is no less relevant than it was when the socio-technical and 'contingency' models held sway in the literature. It is however the absence of a base-line that creates the fundamental ambiguity in the interpretation of these models and the consequent confusion between the unique events of a segmental, autarchic organization and the sophisticated context-bound systems of rules that characterize evolved forms of organic solidarity.

The sociology of education in general and that of the school in particular seems to have suffered from the absence of a 'synthetic' model which could unite these two perspectives. While organizational theory seems to have been starved cf theoretical developments and to have fallen into the crassest conceptual errors, the 'new direction' approach seems to have stimulated a surfeit of theorizing which has lacked the most elemental sense of historical and structural location. Is it possible, however, to develop a form of structural analysis which could resolve in a simple and direct way some of the problems we have met here so far? The problem here is essentially the same as that met in the previous chapter in the discussion of the testing of Bernstein's sociology of the school. The hypotheses which King formulated, though so plausible did not stand up to close scrutiny. The difficulties involved in testing this theory reappear here in the review of the literature and are reducible to one simply-stated problem: when is a correlation between two elements of organizational structure to be considered as an index of closure (or 'tight coupling')? Such a question is not only deceptively simple in that it provokes a stock response, but it implies as well all kinds of further problems as we have seen in the previous chapter (what kinds of elements are we talking about, what degree of unexplained variance is permissible, what relevance does the pattern of correlation have). Until this question is answered, however, it is impossible to comment on such findings as those of King in the study of infant classrooms that the dimensions of 'framing' tend to vary independently of one another. Is this perhaps an example of 'loose coupling' and by implication an expression of relaxed framing, or is it, as King's interpretation would have it, grounds for rejecting the notion of the 'integrated code' as a unitary concept? Unless the sociology of the school can attempt to provide clear indications as to how these fundamental questions can be answered it will lack a firm basis as a systematic field of enquiry. It is for these reasons we turn to examine the theoretical problems involved in the most elementary forms of organizational analysis - that of constructing a scale to measure a structural variable.

CHAPTER THREE

THE SCALING OF ORGANIZATIONAL ATTRIBUTES AND ITS THEORETICAL IMPLICATIONS

There are two aspects to the problem of interpreting a correlation between two elements of organizational structure. The first of these, that of scaling, we will look at in this chapter, while the second, that of the factorial modelling of organizational structure we will examine in chapter five. These two aspects are of course not so separated that they can be given an entirely independent treatment in each case. If the sociological model of Bernstein and the organizational theories of the school are to be tested empirically it should be possible to show just how and when elements of structure interrelate with others of the same category (such as measures of instrumental activity) as well as to those of other categories. It is some indication of the magnitude of the task set by King in his empirical testing of Bernstein's model of the school that almost all the research literature reviewed in the previous chapter was concerned with just one of these four categories set out in the first chapter, namely that of the 'instrumental-closed' variables. This should not be cause for alarm since in the first place it is difficult to find parallel empirical studies among the other categories and secondly because the main purpose here is to unravel the theoretical implications of methodology rather than to arrive at a definitive test. It will become clear(as it may have already been in the course of the review) that the distinctions between the categories are less and less significant as the theory is explicated. The conclusion of the previous chapter for example that segmental forms of ideological closure were perhaps disguised as 'loose coupling' of instrumentally-defined units does suggest a deeper level of 'connectedness' than the four-category scheme represents.

To restate the conclusions derived from the previous chapter: it appeared that schools, like many other organizations decentralize more and more as they 'regulate' activity by impersonal and technical controls. This seems to erode the dogmatic distinctions made frequently in the literature between 'bureaucratic' and 'professional' forms of authority which should rather be considered as mutually interdependent forms. If one considers this interdependence in an evolutionary or developmental sense then at one end of the scale there is the 'craft-autonomy' model of teaching which may still exist in smaller, highly centralized institutions and at the other end there is the 'post-bureaucratic' form in which work activity is professionalized and authority diffusely distributed. Bureaucratic norms (which would be embraced by Bernstein's 'collection code') should then be considered as a type of intermediate form, a necessary framework which depends on explicit and elaborated controls even of everyday detail. The main theoretical danger arises when this framework begins to evolve into decentralized and delegated patterns of control and manifests features of subunit autonomy which often bear a surface resemblance to the anterior form of the 'craft-autonomy' model. Theory in this instance fails to accommodate to practice and there are tendencies towards inter-subjectivist approaches to school structure that often blur important developmental processes(1).

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1 An interesting instance of this tendency is to be found in David Hamilton's analysis of 'open plan' adaptations of rural one-room schools in Scotland. Although Hamilton's approach suggests at times the invisible pedagogy'

The main difficulty with such a developmental model has been finding a way to test it. There is a degree of confirmation in Child's finding of a unitary and bipolar factor underlying the various measures of bureaucratic structure, but it is not at all clear how even this might be interpreted into the terms of Bernstein's theory. What seems to be lacking here is a theoretical basis for predicting which variables should be correlated with others and in which direction, without sole recourse to the indictive techniques of factor analysis for support. In order to arrive at such a basis, we would need to begin with the correlations within the sets of variables themselves, even among their component elements since these are indistinguishable from the variables in many cases. Such a task necessarily implies a theory of scaling and perhaps as well some kind of a framework for translating the abstract propositions of organizational theory into a scaling procedure. In this enterprise the following questions arise: (1) How have scale values been derived in the organizational literature discussed above? (2) What theoretical issues have been involved in interpreting these values? (3) What are the implications of scale values for the estimation of the levels of correlation among structural variables? In the following chapter we will discuss whether it may be possible to develop a theoretical framework which might throw some light on the issues raised in interpretation.

(1) Scaling Organizational Variables The Aston group's use of psychometric procedures to establish the empirical relevance of constructed properties of organizational structure represents perhaps the most rigorous application of scaling techniques in the literature. The procedure chosen (the Brogden-Clemens coefficient) tests for the internal consistency and dimensionality of a construct (such as specialization) on the criterion of the mean item analysis value of the scale, each value being based on a biserial correlation between itself and a total score(2). As Mansfield has indicated(3), there appear to be two main reasons for the choice of this kind of technique which is rather more rigorous than the simple item analysis test. First, as Pugh and Levy have stated, 'the basic methodological problem to be faced was whether the results on single items could be added up to form, if not an interval dimension, at least a stable ordered scale to represent the characteristic'(4). The second reason was

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of Bernstein, it is beset by some conceptual ambiguities as these: 'The introduction of open planned ideas into rural schools was relatively easy. Many of the 'new methods' advocated at that time (e.g. non-streaming, vertical grouping) had always been an inevitable part of their stock in trade. In this sense therefore, rural schools have never ceased to be open plan'. See *In Search of Structure: Essays from an Open Plan School* (Scottish Council for Research in Education: SSRC Research Report, HR3455).

2 D.S. Pugh and P. Levy ,"Scaling and Multivariate Analyses in the Study of Organizational Variables", *Sociology* 3(1969): 193-213.

3 Roger Mansfield,"Bureaucracy and Centralization: an Examination of Organizational Structure", *Administrative Science Quarterly* 18(1973): 477-488.

4 Pugh and Levy,"Scaling and Multivariate Analyses", p. 195.

that perhaps in the order in which items were distributed or added on, the outline of an evolutionary pattern of organizational development could be discerned. Levy and Pugh claim to have chosen the Brogden-Clemens coefficient because, like the Guttman scale, it satisfies the rigorous psychometric criterion of reproducibility of an individual's items from a knowledge of his score. This means, according to Stouffer, that 'the items have an order such that, ideally, persons who answer a given question all have higher ranks on the scale than persons who answer the same quesion unfavourably(5). The Aston procedure was to treat organizations as individuals and to equate the endorsement of a structural property (usually by the organization's chief executive) with a 'favourable answer'(6).

In studies of the school, Kelsey, King and Heward have adopted a similar procedure with some success as have Holdaway *et al.*in studies of post-secondary institutions(7). Tyler used a similar scaling procedure (the Guttman technique) with teaching specialisms in Canadian school districts and established that there was some utility in this approach at this level of analysis(8). He also found as the second point above would suggest, that the rank order of 'popularity' of the ten specialisms sampled was relatively stable across different types of school district even when they were broken down by year of observation and type. Farrell used the Guttman techniques to analyze the evolutionary pattern among the departments of education in Latin American countries, but found it of only limited predictive value, perhaps because of the heterogeneity of the specialisms included and because he did not make use of the more sophisticated modification of the technique such as that proposed by Leik and Matthews(9).

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5 S.A. Stouffer,"An Overview of the Contributions to Scaling and Scale Theory", in *Measurement and Prediction* (New Jersey: Princeton University Press, p. 195.

6 Pennings questions the extent to which such an 'endorsement' constitutes a valid or reliable index of a central organization construct. His validation of the Aston scales as against alternative methods which involve informants from many sections of the organization raises some doubts as to the dimensionality and to the communality they share with other measures of the same variables. There appears to be an over-representation of the structure of the production side of the organization as well in the Aston schedule, Pennings claims. See J. Pennings,"Measures of Organizational Structure: a Methodological Note", *American Journal of Sociology* 10(1973): 686-704.

7 J.G.T. Kelsey, *Conceptualization and Instrumentation for the Comparative Study of Secondary School Structure and Operation* (Edmonton, Canada: Unpublished Ph.D. Thesis, 1973); R. King, "Bernstein's Sociology of the School-Some Propositions Tested",*British Journalof Sociology* 27(1976), *School Organization and Pupil Involvement* (London: Routledge and Kegan Paul, 1973); C.M. Heward *Bureaucracy and Innovation in Schools* (University of Birmingham, England: Unpublished Ph.D. Thesis, 1975); EE.A. Holdaway *et al.*, "Dimensions of Organizations in Complex Societies: the Educational Sector", in *OrganizationalStructure: Extensions and Replications, The Aston Programme II,* eds. D.S. Pugh and C.R. Hinings(Farnborough: Saxon House, 1976) Chapter 8.

8 W.B. Tyler, *Teaching Specialization as a Structural Property of Alberta School Systems* (Edmonton,Canada: Unpublished M.Ed. Thesis,1970).

9 Joseph P. Farrell,"Guttman Scales and Evolutionary Theory", *Sociology of Education* 42(1969): 271-83. For a more complete modelling of such processes,

The studies of team organization in primary schools carried cut by Charters and his associates, though directed primarily at the attitudinal domain was informed by some of these techniques in the measurement of task interdependence(10). There is also an implied measure of scalability in King's pilot investigation of 'classification and framing' in secondary school departments which is particularly interesting from a theoretical viewpoint since the problems which King encountered were similar to those raised by the centralization scale of the Aston studies(11).

(2) Theoretical Issues Arising from Scale Values

There are two issues from the scale values yielded by the Aston measures, both of which devolve on the centralization index. The first is the apparent variability of the correlation between the scores of centralization and other structural measures, despite Child's 'dictum' quoted in the previous chapter that centralization and 'structuring' are to be seen as alternative strategies of control and would therefore tend to be negatively correlated. The second is the exceptionally low scale value of this index of centralization (only .4, not normally an acceptable value) by the original Aston group. These two issues have been connected, but it will be argued that the confusion which has resulted over the meaning of these findings is caused by an inadequate treatment in the literature. From the point of view of testing Bernstein's theory they most certainly are related issues since if decentralization is to be seen as a manifestation of 'weak framing' then a low scale value, as King has argued, has implications for the confidence we might place in the dimensional properties of the 'integrated code'. We will examaine each of these issues in turn before developing a more complete theoretical analysis in the next section.

Centralization and 'structuring': The issue of the inconsistency of results between Child's National Study and the original Aston studies has been the subject of debate in recent literature(12). There seems to be some doubt as to whether what Donaldson describes as the 'compensatory relation-

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see Robert K. Leik and Merlyn Matthews,"A Scale for Developmental Processes", *American Sociological Review* 33(1968): 62-75.

10 W.W. Charters Jnr. and John S. Packard,"Task Interdependence, Collegial Governance and Teacher Attitudes in the Multiunit Elementary School", (Eugene, Oregon: Center for Policy and Management, University of Oregon, 1979).

11 R.A. King,"A Pilot Investigation into Classification and Framing" *Curriculum and Organizational Change in Secondary Schools - Testing Bernstein's Sociology of the School* (School of Education, Exeter, England: Report of a Research Project, 1980), pp. 16-21.

12 Besides Mansfield,"Bureaucracy and Centralization", and Greenwood and Hinings,"Centralization Revisited", see Sergio E. Mindlin and Howard Aldrich, "Inter-organizational Dependence: A Review of the concept and a Re-examination of the findings of the Aston Group", *Administrative Science Quarterly* 20(1975): 382 -92, and Lex Donaldson, John Child and Howard Aldrich, "The Aston Findings on Centralization: Further Discussion", *Administrative Science Quarterly* 20(1975): 453-460.

Correlation of Centralization With Other Structural Variables in National Study Subsamples Stratified by Size

Size band		Structural property		
		Functional specialization	Standardization	Formalization
1				
Mean =	150.7	+.51	+.06	−.45
s.d. =	25.9			
N =	13			
2				
Mean =	310.4	+.10	−.33	−.38
s.d. =	42.4			
N =	16			
3				
Mean =	503.2	+.29	+.19	−.03
s.d. =	42.4			
N =	16			
4				
Mean =	1,142.9	+.14	−.20	−.18
s.d. =	236.3			
N =	16			
5				
Mean =	2,338.6	+.04	−.22	−.19
s.d. =	273.5			
N =	10			
6				
Mean =	6,347.5	−.67	−.33	−.24
s.d. =	1,763.4			
N =	11			

Table 3:1 Reproduced from R. Mansfield,"Bureaucracy and Centralization: An Examination of Organizational Structure", *Administrative Science Quarterly*, 18(1973): 487.

ship between greater delegation of decision-making and greater structuring of bureaucratic controls' is supported by the original Aston findings of a multidimensionality rather than of a unitary factor(13). The apparent reason for this inconsistency was the difference in the organization status of the samples. Since within the Aston sample head branches and subsidiaries were considered side by side, the possible result was a distortion of centralization scores and a consequent underestimation of it (negative) correlation with 'structuring' variables such as standardization, specialization and formalization. This hypothesis has not however stood up very well to closer inspection. Both Dondalson and Aldrich have re-analyzed the data, comparing like with like in each sample, but were still unable to find a clear confirmation. Donaldson, for example, rejected this 'sampling' explanation as inadequate, concluding that 'the resolution of this puzzle needs to be looked for elsewhere'(14). Greenwood and Hinings(15) suggest that part of the problem may lie in the conceptualization and measurement of 'centralization'itself, a point to which we shall return in a discussion of scale values in the following sub-section.

From the point of view of the evolutionary theory presented in the previous chapter it would appear to be not unlikely that the value of the correlation between these variables would depend to a great extent on what stage of the developmental sequence one was drawing one's sample. If, as organizations grow larger and more differentiated they tend to have more decentralized patterns of decision-making, one might expect a positive correlation based on smaller organizations to change to a negative one for a sample of larger ones. This pattern is surely suggested by the structural analysis of schools by Heward, of colleges by Heron and of school districts by Daft and Becker, reviewed in the previous chapter. It is apparently also supported within a wider sample of organizations. Mansfield demonstrates from the National Study data that when the total sample is broken down into homogeneous sub-samples in which size is held relatively constant a 'different and inconsistent' pattern emerges among the correlations (See Table 3:1, based on Mansfield, 1973: Table 3, p. 487). As this table demonstrates, the correlation between centralization and specialization is 'strongly size-dependent', ranging from -.67 in a sample of the largest organizations to +.51 among the smallest, with evenly spaced values in between. This pattern need not be seriously brought into question moreover by the finding of Holdaway *et al.* that centralization and standardization were positively related in their sample of colleges(16), despite the objection raised by Greenwood and Hinings to this effect. Such a relationship may only suggest more careful consideration of the characteristics of the sample and of the way in which 'centralization' was measured, a point to which we now turn.

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13 For a multi-dimensional interpretation of bureaucratic structure see also Bernard C. Reimann,"On Dimensions of Bureaucratic Structure: an Empirical Re-appraisal", *Administrative Science Quarterly* 18(1973): 462-476.

14 Donaldson,"The Aston findings on Centralization", p. 456,

15 Greenwood and Hinings,"Centralization Revisited"*ASQ*,21(1976): 151-155.

16 E.A. Holdaway,"Dimensions of Organizations" in *Organizational Structure*, Tables 8:3 and 8:4, pp. 124-125.

Scale values and centralization: Another approach to the inconsistencies and non-linearities of the centralization-'structuring' correlation has been through a reconsideration of the scale properties of the centralization measure itself. Mansfield(17) raises a number of methodological issues which suggest that the root cause of these inconsistencies could lie in the fact that the centralization scale does not really stand up to the more rigorous criteria one should demand of it (in comparison with those for other variables) and therefore should not be considered as a unidimensional property. A more selective correlational analysis based on subscales of this variable might therefore reveal that the 'compensatory relationship' to be localized on a number of specific functions. Such an approach which is based - not as Mansfield's own analysis was on subsamples - but rather on a total sample of organizations including all size groupings was that taken by Greenwood and Hinings, though inspired by Mansfield's conceptual distinctions of scale types.

Mansfield distinguishes between two forms of scale measure, namely 'scalar' and 'vector'. The former, like a measure of mass, has magnitude but no direction and can be indexed simply by a number which indicated 'more' or 'less' of a quantity. If a concept meets the necessary standards of construct validity (does it adequately sample the universe of the attributes of the property?) and face validity (is there equality of the scale units?) then it may be operationally defined as a 'scalar' measure. However if one imposes that requirement of directionality on top of these, then some test should be made to see whether in fact all the items are pulling the same way. This distinction is quite relevant to the structural measures, according to Mansfield. While we might ask of standardization and formalization that they merely meet the 'scalar' requirements in that every item should positively correlate with the total score, there is an extra requirement for a 'vector' scale - we would also expect that the items (or subscales based on groups of these) should correlate with one another. This higher degree of internal organization is entirely appropriate to the centralization measure, he argues, because the score on this scale represents not just a cumulative total but 'the average extent to which the laws of decision-making is centralized over a range of different types of decisions'(18).

Now since, as we have seen the choice of the original Aston group of the Brogden-Clemens procedure was simply because it did give some indication of the dimensionality of items, the very low scale value for centralization looks a lot more serious than if such a value had been yielded for one of the other 'structuring' variables. Apparently aware of this the Aston group carried out a principal components analysis of the centralization items to find out whether there might be groups among them with a higher degree of internal reliability, without success. A second analysis then divided the items into three intuitively similar groups on the basis of whether they concerned the individual, the subunit, or the whole organization. This yielded a more positive result, with Brogden-Clemens coefficients of .64, .60 and .59, which suggested that centralization could be better viewed as a set of subscales rather than as a single dimension (or 'vector').

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17 Mansfield,"Bureaucracy and Centralization".

18 *Ibid.*, p.485.

Greenwood and Hinings(19) then used this background as a starting-point for the further exploration of the 'compensatory' hypothesis of the relationship between centralization and standardization on a new set of data, taken from a study of 176 English local authority departments. They broke down the scales for both of these variables into four sets of subscales (covering personnel, role execution, use of resources and external relations). They then carried out an item analysis of each of these eight (i.e. 2 X 4) indices and found that they did individually hang together internally. However, did the subscales intercorrelate themselves within each structural dimension? Curiously enough, for the standardization scales which did not, according to Manfield's criteria, have to meet the requirement of high internal consistency, the inter-scale correlations were quite high - an indication that organizations tended to standardize activities in general rather than a few of them at a time. However, the centralization subscales, which should have intercorrelated 'if an overall score of centralization is to have any sense', in fact did not. These authors concluded from this the verification of Child's theory that standardization and centralization are compensatory controls, cannot be obtained from any data using the Aston schedule (which includes Child's data) until the centralization schedule is shown to have internal consistency'(20). Their own particular analysis of the intercorrelation of the subscales revealed only a partial support for Child's theory even with the greater flexibility that this allowed. They conclude that centralization using the Aston schedule needs to be handled with care 'since the low reliability of the Aston measure...suggests that centralization is a more complex concept than standardization and formalization'(21).

(3) Scale Values and Correlations among Structural Variables

It would be tempting to leave the debate where it now stands - in almost total confusion as to the implications of scale values. As with the discussion of the 'integrated code', we find a concept (decentralization) which may well be an index of a unitary dimension of structure, but paradoxically, because of its own lack of interal reliability we cannot use it with any degree of confidence. Again, as we saw with King's data those variables which might only be required to meet 'scalar' criteria (i.e. the 'instrumental closed' variables like formalization or standardization) yielding a higher degree of internal structure than an 'open' measure, namely decentralization. This confusion is increased rather than decreased with the parallel finding reported from the study of Holdaway *et al.* that the centralization scale for their data produces a Brogden-Clemens value of .78 when this variable was positively correlated with standardization(22). Might it not be possible therefore that the expectation of a high Brogden-Clemens value (and of a dimensionality) is not always appropriate? Is there any connection between the internal consistency of the centralization scales and its pattern of correlation with the 'structuring' variables? If, as we have seen, the evolutionary (or developmental model) shows a changing association between centralization and the structuring variables across subsamples based on increasing size, might

19 Greenwood and Hinings, "Centralization Revisited".

20 *Ibid.*, p. 154.

21 *Ibid.*, p. 155.

22 Holdaway *et al.*, "Dimensions of Organizations", p.122.

Table 3:2 Patterns of Dispersion of Centralization Scores across Subsamples Stratified by Specialization, Standardization and Formalization.

National Study Data: N=82

Role Specialization	**High(45+) (n=28)**	**Medium(30-44) (n=19)**	**Low(0-29) (n=33)**
Centralization			
Mean	88.92	102.63	104
Variance	127.238	266.34	417.385
Role Specialization			
Mean	60.14	35.05	16.8
Variance	201.64	9.425	30.47
Correlation Coefficient	-0.6213	-0.087	+.04
Standardization	**High(100+) (n=22)**	**Medium(75-99) (n=24)**	**Low(0-74) (n=31)**
Centralization			
Mean	89.18	94.00	107.16
Variance	142.32	196.00	447.32
Standardization			
Mean	113.8	85.5	62.72
Variance	72.25	57.15	90.25
Correlation Coefficient	-0.63	-0.07	+0.03
Formalization	**High(30+) (n=29)**	**Medium(20-29) (n=29)**	**Low(0-19) (n=21)**
Centralization			
Mean	89.27	98.93	108.95
Variance	128.6	209.67	545.22
Formalization			
Mean	35.79	25.55	14.71
Variance	17.8	6.45	17.97
Correlation Coefficient	-0.28	-0.11	-0.36

one not expect as well a changing pattern of internal correlation or consistency among the very items which constitute these 'dimensions' of structure?.

A simple test of this proposed link between scale and correlation values might be to see whether the 'compensatory' relationship of scale values for the 'structuring' variables as that of the centralization measure is confirmed by the data gathered on a sample of organizations. It might also be of some interest to explore the different patterns of support or otherwise among the various 'structuring' variables themselves, since these vary in the extent to which they could be seen as indices of complexity or of control. For the purpose of illustration and of continuity with previous literature, particularly the analysis of Mansfield, the data from the National Study of Child was taken to test this version of the 'compensatory' relationship. This data set provides a comparative sample of eighty-two organizations, stratified for size, and free of many of the problems connected with choosing the appropriate 'level of analysis' that appears to beset other samples, particularly in the area of educational organization.(See Table 3:2).

The purpose of this analysis is to explore the interrelationships between 'deep' and 'surface' features of the compensatory relationship between centralization and the other structuring variables. Do we for example only find a high negative correlation when scale values of organizational variables exhibit certain properties (e.g. high internal consistency for 'structuring' variables, low for centralization). Is the pattern which Mansfield observed over bands of size perhaps mediated by variations in the 'deeper' patterns of item interdependence within the scales themselves. In order to explore this proposed link, however crudely and tentatively, we need an index of the scale values of individual variables as they are broken into three bands (high, medium and low) based on each of the three 'structuring' variables. The index chosen is the variance of each measure itself, on the assumption that this value is largely determined by the item covariances rather than by the sum of their unique individual probabilities(23).

On the face of it, there is substantial support for the suggested link between correlation and scale values from Table 3:2. The variance (a proxy index of internal homogeneity) of the centralization scores increases consistently across the subsamples, in every case at least doubling in size from the least to the most 'structured'. In only one instance, that of the low formalization subsample, is this trend accompanied by a negative rather than by a zero or positive correlation. However in this case the negative correlation between size and formalization (-0.36, n=21) does not reach the required value for significance at the 5% level and could probably be discounted. It should in any case be contrasted with the highly significant correlation values that do go in the direction suggested, (i.e. for the highly standardized and specialized subsamples). We might infer from this comparative analysis that the chances of unidimensionality (or of the 'vector' property) being established for the centralization scale appears to diminish as organizations become more explicitly structured. The trend is universal in the sample and should therefore

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23 As Jensen points out (*Bias in Mental Testing*, p. 69), "Thus item intercorrelations essentially are the most powerful determinants of the distribution of scores. Item difficulties alone affect skewness, whereas item intercorrelations affect the variance and the general shape of the distribution".

Table 3:3 'F' Test Values of Ratios between the Subsample Variances of Structural Measures (based on Table 3:2, National Study Data, n=82)

A.'Structuring' Variables

Num./Den.	Role Specialization	Standardization	Formalization
High/ Medium	$14.69^{\underline{**}}$ (df = 27,18)	1.2 (df = 21,23)	2.76^{**} (df = 28,20)
High/ Low	$6.636^{\underline{**}}$ (df = 27,32)	.8 (df = 21,30)	.98 (df = 28,20)
Medium/Low	.45 (df = 18,32)	.63 (df = 23,30)	.35 (df = 28,20)

B.Centralization (Within above sub-samples)

Low / Medium	2.1^{**} (df = 32,18)	2.28^{*} (df = 30,23)	2.6^{**} (df = 20,28)
Low / High	3.28^{**} (df = 32,27)	3.14^{**} (df = 30,21)	$4.24^{\underline{*}}$ (df = 20,28)
Medium/ High	2.22^{*} (df = 18,27)	1.377 (df = 23,21)	1.63 (df = 28,28)

* = significant at 5 per cent level (one-tailed test)
** = significant at 1 per cent level (one-tailed test)
$\underline{*}$ = significant at 5 per cent level (two-tailed test)
$\underline{**}$ = significant at 1 per cent level (two-tailed test)

raise questions as to the desirability of imposing such high scale values for centralization measures in organizations that show a high degree of internal consistency in their 'structuring' areas(24).

Are the differences noted here statistically signifiant? Although this criterion is by no means essential to the general support for the suggested link, having the advantage of a rigorous comparison of the variances may be useful. The appropriate test here is that for the significance of the difference between the variances of independent samples, which is a simple 'F' ratio of the variances drawn from the subsamples. In normal circumstances the obtained significance level of this ratio should be doubled to meet the probabilities arising from placing either of the two variances into the numerator - the so-called 'two-tailed' test(25). If this rigorous criterion were applied to compare the variances of centralization and of the 'structuring' variables across the subsamples set out in Table 3:2, then very few of the 'F' ratios would be significant, even when the extreme subsamples of each dimension are drawn (Table 3:3). It is important to note however that the comparisons which alone meet this criterion (at the 1% level) are those based on both categories of the measure of role specialization, since the variance of the most apecialized subsample is very high indeed (Table 3:3). If, however, we were to consider one 'tail' only of the 'F' distribution, then several more of the comparisons reach significance at the 5% level. This is particularly evident in the case of the centralization scores where all but two of the comparisons are statistically significant, if one follows the procedure of placing the variance of the centralized scores of the less structured subsample into the numerator, as indicated by the model. Even here, it should be noted, the comparison between the centralization variances of the most 'formalized' group and of the least meets the more rigorous (two-tailed) criterion, though at a lower level of significance than that noted above in the case of the specialization scores. The very consistency of these findings might lead one to ask whether the pattern so revealed may cause systematic distortions to the estimations of the error variances of the dimensions of organizational structure and of their correlations.

These distortions might be of quite a different order from those normally encountered by statisticians. In the conventional case these violations of the assumptions as to the homogeneity of the variance across subsamples as a preliminary to the analysis of variance of the various experimental effects are not considered to seriously threaten the validity of the 'F' test. What is suggested in this case however is something far more fundamental than these 'random' and sporadic violations of the usual assumptions(26). The above comparisons would indicate rather some systematic and perhaps cumulative distortion of the patterns of error variance which would almost certainly affect the estimation of the correlations

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24 W.B. Tyler, *Teaching Specialization as a Structural Property*, Appendix B, pp. 93-93. Coefficients of scalability for ten teaching specialisms were much higher for the city districts with over one hundred teachers (n=30) than for those with under one hundred (.8 as against .4), using Guttman-Goodenough method.

25 George A. Ferguson,"Significance of the Difference between Variances", in *Statistical Analysis in Psychology and Education*, pp.181-83.

26 As set out by Ferguson, *Statistical Analysis*, p.376.

between the dimensions of structure. If the 'deep' structural patterns of interrelationship were in fact to resemble those of the model of regulation then there would be several predictable violations of the assumptions that errors are randomly distributed within variables and between them. The following possibilities are in fact suggested: (a) for each measure of an organizational variable there could be a determinate relationship between the average score for a subsample and its level of measurement error; (b) among the 'structuring' variables (e.g. specialization, standardization) the patterns of error may decrease with average score but in the case of the 'control' variables the incidence of error may increase; (c) there may be some theoretical basis to this inverse error distribution in that the higher level of error in one type of variable may be compensated for by a higher level of interdependence among another type of variable.

Because of the cumulative and interconnected patterns of error distribution some serious loww of power of the normal test of the significance of the correlation coefficient may well result, even when there has been some correction for the attenuation by the conventional formulae. Attention to the properties of the model may considerably simplify the rather awesome task of correcting for the complex pattern of violation of assumptions oulined above, entailing as they do the covariation of error terms with 'true' scores, covariation of error terms between variables (whether negative or positive) and the compounding of these systematic disturbances in the combined variances against which any observed covariation among the 'true' scores is to be compared. The fact that so many of the comparisons of the variances for the centralization variable are significant in the sense predicted would seem to lend an element of support for this cumulative view of the pattern of error in that this variable would be expected to be more sensitive than the 'structuring' variables to the violations of normal assumptions. The fact that such a distribution of error does appear to follow clearly from the theoretical model of regulation (and the theory of codes, by implication) suggests that there may be more direct and rigorous ways to test this model empirically than by the tortuous and perhaps unreliable attempt to estimate exactly the proportions of error variance of every individual scale.

Conclusion: It would seem in the light of the discussion of this chapter that any estimation of the correlation between the measured values (or scores) of structural variables takes place against a causal pattern between the 'deep structural' factors as revealed in the distribution of scale values. If these factors appear to have systematic influence on the amount and direction of error among scale variances, then it follows that the correlations between the variables or scales themselves may be subject to predictable levels of distortion as a result. This insight, based on scale theory may have a good deal more importance for the testing of Bernstein's theory than it may appear, when one recalls that no attempt was made in King's research to correct for this influence on observed correlations. Unless these deeper patterns of interdependence are somehow taken into account then the levels of observed correlations are both unreliable and impossible to interpret accurately. We turn therefore in the following chapter to uncover the theoretical basis of these systematic patterns.

CHAPTER FOUR

VARIETY, HIERARCHY AND SCALING: AN INFORMATIONAL INTERPRETATION OF BERNSTEIN'S THEORY OF CODES

Does the theory of codes throw any light on the complex issues of scaling as discussed in the organizational literature? In order to answer this question we would have to start at a very basic level such as the possible connection between the internal consistency of a scale and the two 'codes' of structure proposed by Bernstein. More specifically perhaps, what is the connection between each of the two aspects of the 'codes' ('classification and framing') and the degrees of dimensionality as suggested by Mansfield's distinction between 'scalar' and 'vector' properties shown by the distribution of the items? This is the problem to which we now turn. We will examine it from two perspectives, previously unrelated but in fact theoretically quite close: (i) that of Bernstein's theory of 'codes' and (ii) that of the formal theory of regulation as put forward by Ashby.

(i) Bernstein's Codes and Scaling Theory

If we consider the question of 'classification' first, then at one extreme, it could mean that each of the items on a scale represented a separate or unique 'factor' even though each correlated to some extent with the total score. In the parlance of factor analysis, in such a structure each item would be contributing to the total test variance only through its unique properties and would by definition not be correlated with any of the other items(1). One might for the sake of argument, call this an extreme or primitive form of the 'collection code' which bears some resemblance to the 'scalar' properties proposed by Mansfield as the minimal criteria for certain organizational variables. If this is an 'ideal type' of scale structure, what then is its opposite? At the other end we could imagine the case where all the items were loaded heavily on one general background factor, and where each item perfectly predicted not only the total score, but also that of every other item. This would produce a rather unusual distribution of scores indeed, with a bimodal shape. Such a distribution could only occur if all the items had equal difficulty and perfectly split the individuals in the sample into two even groups with 50% passing each item. By any measure of scaling, such a test would show very high indices of reliability and internal consistency (though it would not rate very highly on a reproducibility index, since it would not discriminate well enough). In terms of Bernstein's categories, since all the items are interchangeable, one might say that such an 'array' of attributes would be 'weakly' classified. Its internal interdependencies do produce a high degree of 'integration', as the coding theory implies.

By taking these two extreme or limiting cases, one might see that the more that items are 'loaded' on a general factor, the more likely it is that such a scale would tend towards unidimensionality. The reproducibility of a set of scores would therefore represent an approximation to

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1 Dennis Child, *The Essentials of Factor Analysis* (London: Holt, Rinehart and Winston, 1970).

the loading of items on a general factor(2) and therefore display a tendency towards 'integration' rather than towards 'collection'. There are important reasons however why a perfectly reliable scale would not be desirable. The most obvious one is that only one item of a test would be needed to obtain perfect prediction of all others, and so the lengthening of a test would be largely a waste of effort. What is most useful to a test constructor is a degree of balance between the unique and common variation that an item denotes. This would allow for the items to produce a 'normal' distribution with well-known statistical properties and with considerably greater theoretical appeal than a 'one-shot' or 'all or nothing' test with perfect internal reliability.

These polarities of internal item structure therefore provide practical demonstration of the principle of 'classification'. What however of 'framing'? If we do apply the same approach as that suggested by Mansfield we would need to specify that the minimal requirement for scaling this property would be higher than for those of the 'structuring' variables in which 'classification' is more evident. Consequently this demands a higher level of inter-item correlation than that specified for 'scalar' properties. From this it follows that any scale which could validly be used to indicate the average degree or strength of 'framing' must first, by the arguments put forward so far by organizational theorists, have the appropriate patterns of 'deeper' structure. If this is so then the scale value must have more than a purely methodological significance.

If the strength of 'classification' is determined by the uniqueness or lack of interdependence of the items on a scale, then it is obvious that in the case of 'framing' we are dealing with something quite different. The 'tightness' of the centralization scale (if it is to meet the criterion of dimensionality) would seem to indicate that 'strong framing' demands (rather than denies) a high level of inter-item correlation. If this is so it is the lack of autonomy of these subunits that would provide the principle behind the more rigorous scaling criteria here. The scale expectations appear therefore to be reversed in the production of the features of the 'collection code'. Just as the high interdependence of the items on a 'structuring' variable would indicate a degree of 'integration' or interchangeability, so here a similar pattern of interdependence would indicate the opposite, namely the presence of the 'collection' principle. This may appear to be paradoxical perhaps, but it is implied in the definition of each dimension of the 'code'-strong 'classification' emphasizes the 'apartness' of objects and is therefore negatively related to their interdependence, while strong 'framing' is defined by the absence of autonomy of separate units, their reliance on a higher point in the hierarchy and their interdependence within some over-arching scheme. The dimensions of the 'codes' therefore express in a slightly different way the two 'evolutionary principles' of Aldrich's analysis - 'loose coupling' and 'hierarchy'(3). It remains to be seen what implications this distinction may

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2 Benjamin W. White and Eli Saltz,"Measurement and Reproducibility", in *Scaling: A Sourcebook for Behavioural Scientists* ed. Gary M. Maranell(Chicago: Aldine, 1974). These authors note that "While it appears to be true that a highly reproducible scale will tend to measure a single factor, ...not all single factors will be highly reproducible", p. 191. This is not as important a point as it may appear theoretically, since it merely means that a reproducibility has a lower limit than a test of perfect interdependence.

3 Aldrich, *Organizations and Environments*,p.80.

have for the study of organization, but first some insight may be gained by restating the theoretical discussion in a more formal and deductive way.

The utility of a formal model of the interrelationships between the variables may throw some light on the operation of the 'compensatory' relationships between decentralization and 'structuring' as these are expressed not in a simple correlational sense but at a much 'deeper' level of the intercorrelations between the constituent items that make up the measures of these constructs. The theory of Bernstein does appear to take us a little farther into this unchartered terrain, but it still does not demonstrate in a rigorous manner the necessity for the 'compensatory' relationship as suggested by the reverse polarities of the 'coding' dimensions of his model. We seem as well to be left with some of the ambiguities of the 'loose coupling' concept. How are we to distinguish empirically, for example, between the primitive forms of this phenomenon (as in the 'egg-crate' model of the school) which are really an expression of the principle of 'collection' and its more 'evolved' manifestations which appear to be produced not by the strength of 'classifications' but rather from the weakness of 'framing'. This 'emergent' type of autonomy may indeed celebrate 'apartness' as it is realized in an individuated or stylized kind of identity, but how can it be distinguished empirically from those contexts which are associated with a more traditional kind of eccentricity, rooted in the old-fashioned or traditional 'classifications'? Such is the problem of representing the subtle differences between the modes of organic solidarity.

Consistency and 'Constraint'

We might begin by asking what it is exactly that internal consistency in a set of items is in fact maximizing. The answer, according to Cronbach, is the redundancy of the measure, that is to say the degree to which information about any one item reduces the uncertainty about all the others(4). From a different perspective, however, the internal structure is actually increasing the variation or the 'spread' of the test scores as a whole. It is much more difficult to guess the score of a randomly chosen individual from a distribution based on an internally consistent test than from one where the test was lacking in this consistency. As White and Saltz point out: 'the total score variance increases with reproducibility, being at a minimum when the item covariances are zero, and reaching an upper limit when item covariances are maximal'(5). A good test is one which somehow optimizes both of these conditions - too much internal interdependence or redundancy makes for a bimodal or else a very flat distribution of items, while too little means that the distribution of scores will tend to be 'peaked' around the average, and any underlying dimensionality of the distribution will be difficult to discern. How might this notion of 'redundancy' be expressed in a more formal way however, so that we might be able to explain the apparently diverse tendencies of the scale values of the different 'dimensions' of organizational structure?

'Redundancy' is a useful concept since it immediately brings into play the very powerful theory of information which has been employed in other areas of social science, such as the psychological study of percep-

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4 L.J. Cronbach,"Coefficient Alpha and the Internal Structure of Tests", *Psychometrika* 16(1951): 297-334.

5 White and Saltz, "Reproducibility", p. 182.

tion, with some effect. Garner, for example, is able to throw some light on the 'paradox' of the internal structure of the test producing greater variation of the test as a whole in terms of the distinction between internal and external 'constraint' (a term which is very like that of 'redundancy)(6). The former term refers 'entirely to the constraint existing within a system of variables', while the latter 'refers to the constraint between this system of variables and some external referent system of variables'(7) The total structure of a 'system' of variables can be seen therefore as the interdependence between the external and the internal sets of variables as well as the intercorrelations within these sets. The way one may view the system underlines the ambiguity of the problem of scaling. If one wishes to maximize the amount of variation that can be 'mapped' on to an external referent, then one would need to introduce as much redundancy(constraint) as possible into the internal structure of the set of predictor variables.

Garner expresses this rather elusive point as follows: 'The primary effect of introducing redundancy into a system of variables is to redistribute the total constraint. Redundancy decreases the amount of external structure at the same time that it increases the amount of internal structure'(8). The greater external variety of a set of scores is therefore bought at a cost and that is the introduction of redundancy or homogeneity into a set of scale items. The maximum external variation of a distribution of scores would occur when we have the rather boring instance when there is not only dimensionality but the same 50% of individuals passing and failing every item. Any variance measure can be translated, as Garner and McGill demonstrate, into an estimate of an uncertainty value, on the assumption that the underlying distribution is a normal one. If this is so, then just by obtaining the variance of the distribution of a variable we should have a rough idea of its patterns of internal redundancy and could perhaps make use of this equivalence in making parallels between the patterns of scaling and a more general model of regulation.

We have still not 'pinned down' the rather ambivalent concept of redundancy until we can relate it to a theoretical scheme which might suggest what is 'internal' and what is 'external'. Without such a scheme we would be hindered from translating the organizational distinction made by contingency theorists between environment and organization, just as we would be unable to distinguish between different kinds of organizational variables in terms of Bernstein's dimensions of coding. In this latter instance we would be trapped into what could be a poorly-based expectation that all scale values should be equal. The cybernetic model of regulation may however be extremely useful at this point since it provides a very clear theoretical basis for making these distinctions.

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6 'Constraint' and 'variety' (just as 'redundancy' and 'uncertainty') are definable in terms of each other. See W. Ross Ashby, *An Introduction to Cybernetics*: "Constraint is the relations between two sets and occurs when the variety that exists under one condition is less than the variety that exists under another". p. 127.

7 Wendell R. Garner, *Uncertainty and Structure as Psychological Concepts* (London: John Wiley, 1962), pp.149-50.

8 *Ibid.*, p. 153; for an attempt to measure the organizational division of labour through external indices of variety, see W.B. Tyler, "Measuring Organizational Specialization: The Concept of Role Variety", *Administrative Science Quarterly*, 18(1973): 383-392.

(ii) Scale Values and Regulation

Let us take the first of these problems, that of distinguishing between an organization and its external environments. This does not seem conceptually to be too difficult as can be seen for example in the distinction made in the studies reviewed between 'context' and 'structure' with the former including variables such as technological complexity, size and environmental fluctuations. The possibility that size may also be an important structuring or internal variable as well is a source of some theoretical concern(9) but the distinction empirically is not too difficult to make in general. However, if we can separate 'context' from 'structure' in this manner, how do we conceptualize in formal terms the relationship between measures of variety within and between these variables? What is the connection between technological complexity and the distribution of internal constraint as indicated say, by the scale values on a structural variable?

First of all it is necessary to be precise about the type of interdependencies we are talking about, since 'internal' and 'external' variables need some general framework of reference. Such a framework has been provided by Emery and Trist who have drawn up a four-category schema for classifying the types of possible relationships for this approach. In the first place there is the (area of internal interdependencies', while at the other end there is the area of interdependencies which belong to the environment itself (e.g. the correlations between 'contextual' variables). In the middle, as it were, there are the two areas of 'transactional interdependencies' (i.e. one for each direction). These theorists are particularly interested in the second of these areas, in the construction of the typology of environmental connectedness. They emphasize the point that 'the laws connecting parts of the environment to each other are often incommensurate with those connecting parts of the organization to each other, or those that govern the interchanges'(10). This point seems to be particularly relevant if one wishes to escape from a crude kind of environmental determinism which often afflicts functional analysis and indeed was evident in some of Bernstein's early papers. However, in order to be sure that the area of analysis is well and truly in the first of these categories, that of internal interdependencies, we need to be sure in the first place as to the theoretical problems that distinguish it from other categories in the scheme.

The model of regulation, as encapsulated by Ashby in terms of the 'Law of Requisite Variety' provides an over-arching scheme for approaching these four types of interdependence(11). This is a very loose framework which lays down the minimal condition for system survival in terms of the effectiveness of the regulating part to suppress the variety of the incoming disturbance from the environment to such an extent that the values of the system's 'essential variables' are not driven outside of acceptable limits. As a 'systems' approach it should not be confused with

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9 Pugh and Hinings, "Concluding Remarks", *Organizational Structure*,pp. 172-4.

10 F.E. Emery and E.L. Trist,"The Causal Texture of Organizational Environments", *Systems Thinking*, ed. F.E. Emery(Harmondsworth: Penguin Education, 1970), p. 243.

11 Ashby, *An Introduction to Cybernetics*, p. 93; for 'Law of Requisite Variety' see pp. 202-18, reprinted in *Systems Thinking*, ed. F.E. Emery, Chapter 6.

the far more ambitious (some would say dubious) attempts to treat organizations as 'living systems' or 'real objects'(12). As Ashby states 'every material object contains no less than an infinity of variables and therefore possible systems'(13). In practical terms this model suggests that nothing more than that there is a degree of 'transinformation' between the regulating part of an organization and its environment, which is similar in theoretical terms to a correlation coefficient(14). This 'law' has been stated more simply perhaps by Haberstroh: 'Another way to put this principle is that if the environment can disturb a system in a variety of ways then effective control requires a regulator that can sense the disturbance and intervene with a commensurately large repertory of responses'(15).

Regulation and Variety : The central mechanism of regulation in cybernetic theory is an exchange of information ('transinformation') between an environmental disturbance (D) and a regulatory (R) which affects the output component (Y) whose performance in turn affects the values of a variable(E) essential for system survival. Effective control requires therefore that a regulator can sense these disturbances and intervene with an appropriate response which can force the values of the essential variable (S) within acceptable limits. The relationships between the components of the model (i.e. D,R,Y, and E) can be expressed in terms of the 'variety' (or level of unpredictability) observed in the states a regulator can assume - that is the range of its repetoire of responses. for successful adaptation to occur, the variety of the structure of the regulator must be at least sufficient to cope with that of the incoming environmental disturbance. This relationship has been expressed by Ashby as the 'Law of Requisite Variety' ('only variety can destroy variety')(16).

Since variety can be expressed in informational terms (i.e. 'bits' of information) it follows that the process of regulation can be reduced to an equation not unlike that of a correlation coefficient seen in the terms of a communicative process. The 'transinformation' between the regulator and the disturbance is in fact expressible as a 'contingent uncertainty' term (the informational equivalent of a correlation coefficient) which can be formulated as the maximum variety of the regulator minus that quantity of variety which exists when the state of the disturbance is known (i.e. the 'error' or residual variation of the prediction). When the regulator is a determinate function of the disturbance (i.e. when the 'error' term is zero) then the transinformation or correlation between the regulator and the disturbance is at maximum and the range of values of the essential variables is minimized.

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12 See for example, James G. Miller, *Living Systems* (New York: McGraw-Hill, 1978); for critique of this approach see Talcott Parsons' contribution to Review Symposium on Miller's book, "'Concrete' and 'Abstracted' Systems", in *Systems Thinking*, ed. F.E. Emery, Chapter 6.

13 Ashby, *An Introduction to Cybernetics*, p. 93.

14 See Roger C. Conant,"The Information Transfer Required in REgulatory Processes", *IEEE Transactions on System Science and Cybernetics* 5(1969): 334-338.

15 Chadwick J. Haberstroh, "Organizational Design and Systems Analysis", in *Handbook of Organizations*, p.1176.

16 W. Ross Ashby, *An Introduction to Cybernetics*, pp. 202-18.

The mechanism of regulation can therefore be seen as a constraint placed upon the value of the regulator, given a certain environmental condition. How can the variety of the regulator be increased therefore? If one is merely interested in the interface between the regulator and its environment, then the answer is fairly straightforward - by the structural and functional differentiation of the responses available at any one time. The capacity of the regulator to map adequately the environment, to sense and respond to its dissturbances as they occur, depends on two opposed capacities - to produce and transmit as large a repetoire of reponses as are necessary for the survival of the system, and secondly to restrict these to specific times and places as determined by the state of the environment. While the first of these capacities can be seen in terms of variety (i.e. the degree of differentiation of the system as seen from outside), the second can be understood in terms of constraint or the restriction of variety - which depends on the co-ordinative capacity of the system components rather than on their independent or even their aggregated capacities(17).

The two cybernetic principles of variety and constraint (or their informational equivalents in the formal theory of communication - uncertainty and redundancy) are threfore inextricably related. They are basic to an understanding of organizational processes as expressed in three aspects of system theory: (a) the distinction between external and internal constraint; (b) the structural-functional as against the control orientation whic identifies sociological theories of organization and (c) the implications which they hold for a thecry of control through the principle of 'requisite hierarchy'. The following discussion of these issues is directed not merely at the formulation of the links between these theoretical perspectives, but also towards the derivation of precise relationships between information theories and standard statistical procedures.

(a) External and Internal Constraint: If for the sake of argument we ignore the complexities of the interdependencies of the environmental disturbance and treat it as a unitary 'stimulus' variable, then it is possible to see the direct analogies between the theory of regulation and the statistical techniques discussed in the previous section. As Garner shows the terms 'constraint', which 'which refers to the amount of relatedness or structure of a system of variables' can be divided into three components - total constraint, internal constraint and external constraint(18). By means of an illustration of a three variable case, Garner shows that the external constraint can take the form of a multiple contingent uncertainty while the internal constraint can be expressed as a contingent uncertainty between the two predictor variables. Each of these terms has a precise analogy in statistical theory, since each can be expressed in terms of the amount of error reduction that occurs in predicting one variable when either one (simple contingent uncertainty) or two or more (multiple contingent uncertainty) predictor variables are known. The distinction between contingent uncertainties and conventional statistical measures

17 See the discussion by Ashby of the implications of a cybernetic theory of coordination for the problem of size,"Systems and their Informational Measures", in W. Ross Ashby and George J. Klir(eds.),*Trends in General Systems Theory*,(London: Wiley Inter-science, 1972).

18 Wendell R. Garner, *Uncertainty and Structure as Psychological Concepts*, p.145.

is that the latter indicate the degree of redundancy in a relationship (by estimating the proportional reduction of error) while in the former it is the amount of error reduction that is of interest(19). Certain statistical routines (such as the CROSSTABS on the SPSS Package) do nevertheless provide a proportional measure - the 'uncertainty coefficient' estimated from amounts of information in both a symmetric and an asymmetric sense. As Garner points out, the partitioning of constraint between the external and the internal components presents the same difficulties as arise with the problem of codeterminacy and collinearity among predictor variables in conventional regression analysis. In other words, unless the predictor variables are completely unrelated or 'orthogonal' (i.e. the internal constraint or redundancy is zero), the the order in which the variables are introduced into an equation will have a considerable effect on their causal or predictive importance.

One can of course make further comparisons between informational measures and the analysis of variance, where the total amount of 'variance explained' in a predicted variable is partitioned by means of a sum of squares procedure to various sources arising from either main or experimental effects or their interaction(20). The important point to be made, however, is that the distinction between an external 'mapping' of the environment and an internal 'integration' arising from interdependencies among system components has an important bearing on how we may see the incidence of variety. A reduction in the redundancy in the internal term has the necessary consequence (given a constant amount of total constraint) of increasing the redundancy in the external term - (i.e. constraint is merely redistributed). The introduction of redundancy into the internal term has therefore the converse effect of boosting the external variety of the system as a whole and therefore enhancing its regulatory capacity. The double-edged nature of internal organization can be seen even at the level of scale values, as described in the third chapter, where it was seen that the dimensionality of a construct (i.e. the ability to 'map' empirical instances in precise gradations) relies on the average level of intercorrelation among its consitituent items.

(b) Segmentation, Differentiation and Internal Complexity: Rather than being in competition with each other, therefore, the two aspects of constraint should be seen as working together to produce a more efficient and viable system. As briefly outlined in the second chapter, the congruencies or correlations between the elaboration of these two components has a direct manifestation in sociological theories of organization derived from Durkheimian functionalism. In the first instance there is that school which has emphasized the importance of the maximization of external variety, with stress on the adaptive capacities of organization. This tradition associated with the Parsonian school of structural-functionalism and the socio-technical models of organization rooted in theories of contingencies and constraints arising from environmental pressures, has concentrated on the division of labour as a fundamental category of organization. This division of labour is seen, as Sutherland has pointed out

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19 See Norman H. Nie *et al.*, *Statistical Package for the Social Sciences*, (Second Edition), (New York: McGraw-Hill, 1975), pp.226-227.

20 W.R. Garner and W.J. McGill,"Relation between Information and Variance Analysis", *Psychometrika*, (1956)(21): 109-114.

to evolve under two modalities - the first which produces the functionally specific allocation of tasks and the seccnd whereby functions may be split up even further into non-interchangeable or structurally unique specialisms(21). The combination of the two levels of degree to which these two modalities may occur (segmentation, differentiation) produces a two-by-two table of structural ideal-types. Associated with each of these organizational ideal-types, according to Sutherland is a unique set of control properties, ranging from dogma and ritual for the most primitive through to ethics / autoregulation for the most evolved(22), located in turn in each of four types of environment.

The emphasis on the modalities of internal control would seem however to place Bernstein's theory of codes firmly within the second vector of organizational evolution, that is within what Sutherland calls the 'dynamic' mode of analysis. The dimensions of this mode he identifies as the 'degree of complexity' of the organizational components and their 'degree' of acceleration which produce a four-fold table congruent with each of the four 'ideal-types', ranging from low complexity and low acceleration Type I) to high complexity and high acceleration (Type IV). It is not too difficult to see in this typology very similar axes of differentiation to those of Bernstein's 'classification and framing', since these do appear to be reducible to the variety of distinct objects within an 'array' (complexity) on the one hand, and their degree of association (acceleration) on the other. Here the stages of development do appear to follow a logical sequence, with the autarchic components of low complexity at one extreme of the typology and the highly complex, highly volatile and interdependent organization at the other. The intervening stages are respectively the bureaucratic type of high complexity and low acceleration and the technocratic, with its low levels of internal complexity (or poorly defined boundaries of organizational identities) and its high levels of association and interdependence, manifested in concern with personalized relationships. Each of these four ideal-types of the dynamic or control modality can be seen to be associated with each of those of the structural-functional sequence and can each be located in turn within the four patterns of 'causal texture' of environments identified by Emery and and Trist(23).

Before looking into the implications these types may have for the analysis of the coding theory, it is first necessary to delve more deeply into the control modality in order to see just how internal constraint of hierarchy may be patterned. We therefore return to the formal model of regulation.

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21 John W. Sutherland,"Towards an Array of Organizational Control Modalities", *Human Relations* 27(2)(1974): 149-168; see also by the same author: "System Theoretic Limits on the Cybernetic Paradigm", *Behavioural Science* 20(1975a): 191-200 and *Systems: Analysis, Administration and Architecture* (New York: Van Nostrand, Reinhold Company, 1975b).

22 It is interesting to note that Sutherland does not regard the most structurally and functionally differentiated ideal-type as the most developed, but rather the 'professional' type which is functionally segmented and structurally differentiated.

23 F. Emery and E.L. Trist,"The Causal Texture of the Environment", *Human Relations*, 18(1965): 21-32. The four types are 'placid,random', 'placid, clustered', 'disturbed,reactive' and 'turbulent'.

(c) 'Requisite Hierarchy': In order to deal with the specific problem of the low internal interdependencies of the centralization scale we need to introduce a new principle which both extends and complements Ashby's 'Law of Requisite Variety'. What happens for instance when the regulating parts are imperfect, in which there is both ignorance about the environments and a distinct lack of appropriate 'repertoires' of response? This deficiency can be remedied to some extent by first of all arranging the regulators in sequence (Ashby's 'serial' system) so that the output of one part becomes the input of the next and so forth. However, even then there will be a degree of 'slippage' since it cannot be assumed that each regulating part will be without error and the cumulative effect of these errors can seriously affect the overall effectiveness of the regulation. In such a system, based on cumulative serial connections, it is possible to introduce 'governors' or control and monitoring units which specialize in reducing the uncertainty inherent in the act of primary regulation. Because of the sequential characteristics of the primary regulation, it follows that each of the 'governors' would be linked in a pyramidal fashion, with each level specializing in turn in the reduction of error in the one immediately below it. This principle has been formalized by Ahmavaara as the 'Law of Requisite Hierarchy'(24).

What, however, can this abstract, deductive logic tell us about the interrelationships between the scale values of the variables of organizational structure? The advantage of such a formulation is that it suggests under what conditions one might expect the variety generated by the 'structuring' variables to differ substantially from that which is determined by the values of the 'governors'. If the capacity of the former set of variables is indicated by their internal interdependencies, then it would seem to follow that the capacity of the 'governors' in the regulatory process is also indicated by the 'tightness' of the various decision-making functions as expressed by the dimensionality of the centralization scale. The requirement of the organizational theorists that centralization should exhibit the properties of a 'vector' scale therefore seems to make sense, in a hierarchical scheme which is by definition linear and to some extent 'integrated'. The total variety generated through the internal structuring or redundancy of items within this 'vector' serves to depress the final 'ignorance' of the system as a whole.

It would seem therefore that this elaboration of the regulatory model provides the analyst with two important indices of structural properties, expressed quite simply in the form of the inter-item covariances of each dimension of control. However we have not yet specified the relationship between these two sets of properties in such a way that might explain the lack of dimensionality that appears to beset the scale of centralization in cross-sectional samples of modern complex organizations. In order to do this we need to spell out first in full the principle of 'requisite hierarchy' as formulated by Ahmavaara: "The weaker the average are the regulatory abilities and the larger the uncertainties of available regulators the more hierarchy is needed in the organization of regulation and control to attain the same result of regulation, if possible at all"(25). It follows then that the lack of regulatory ability at the level of the

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24 A.Y. Aulin-Ahmavaara,"Cybernetics as the Foundational Science of Action", *Cybernetica* 3(1975): 171-200; "The Law of Requisite Hierarchy", *Kybernetes*, 8(1979): 259-66.

25 Ahmavaara,"The Law of Requisite Hierarchy", p.262.

individual units can somehow be corrected or compensated for by the introduction of hierarchy into the system as a whole. It expresses in a simple and logical way why the two dimensions of Bernstein's collection code ('strong' framing and classification) tend to go together in that the lack of internal interdependence within the 'array' can be compensated by a stricter control over the output of each element. It also reinforces the intuitive insight of Mansfield that the 'scalar' characteristics of the primary variables of structure should be accompanied by 'vector' ones for centralization.

It must be concluded therefore that the modalities of control can not be adequately analysed without some theoretical recognition of the hierarchical component. It may also be hypothesized that the lower levels of evolutionary complexity and acceleration will be more likely to incorporate more of this component than will the more developed types, simply because the former are not predicated on high levels of regulatory capacity at the level of the primary unit. Given the opposite, however, one can readily imagine the difficulties of maintaining hierarchical control (particularly of the highly centralized variety), not only because such a mechanism is rendered functionally superfluous, but also because it poses enormous problems of coordination and communication. Where the internal costs of hierarchy are too great, alternative strategies - indirect control or increases in the capacities of the primary regulators would appear appropriate. The model does not appear to fit the distriution of authority within each of the 'ideal-types' of control - ritual, tradition and dogma, typical of primitive systems which are based on a depreciation of the capacities of the lower levels of regulation, while the more evolved patterns of control (ethical and normative compliance or auto-regulation) place a premium on responsiveness and authenticity at the primary level. It is not sufficient therefore to deal with 'regulation' as such without specifying the role that this hierarchical principle plays within the total matrix of relationships among organizational units, including their patterns of internal correlation.

Conclusion: It has been argued that the scale of values of organizational variables are directly related to the organizational properties they measure and that these are located in different points of the regulatory process. Since a high reliability coefficient of a scale indicates a strong level of unidimensionality of the underlying construct in an organizational sample, one must be careful not to expect such high values unless they are justified within the model itself. Since the scale values are directly related to the variances of the organizational variables or dimensions, it is proposed that such values can be directly translated into informational equivalents and that their expected values can be related back to the model of regulation which is formulated in terms compatible with a theory of information transfer.

By following this logic one might expect that low values of reliability would predominate among items that were measuring organizational properties which were not based on a high degree of variety in the model. Such low (or 'scalar') values would be expected for example among a sample of organizations whose environmental conditions were stable and predictable (e.g. characteristic of a 'placid,random' field), particularly when the variables observed measure features of basic or primary structuring such as the functional division of labour. Even within the same sample however, if one were to measure other features, such as the concentration of authority, then entirely different levels of reliability (i.e. the 'vec-

tor' properties) would be anticipated by the model of regulation, since these reflect a compensatory effect. The two principles of regulation, expressed in this joint expectation are, respectively, the Law of Requisite Variety and the Law of Requisite Hierarchy.

These predictions as to the likely incidence of scale values appear to be consistent with the theory of coding put forward by Bernstein, as set out in the first chapter, in so far as scale items can be seen as objects in an array governed by rules of separateness ('classification') and interdependence ('framing'). It therefore appears quite inappropriate to take only the observed or superficial levels of association among structural variables without placing these within the context of the 'deeper' features of structuring which suggest the effects of contradictory patterns even on the degree of correlation which may be possible. Expressed in Bernstein's terms, the scale values of a structuring variable such as the division of labour represents the principle of classification (perhaps in its purest form) and may be expected to vary from 'strong' to 'weak' in its manifestations as the regulatory components of the system or organization evolve or become more internally interdependent (and perhaps, as we shall see, also more externally differentiated in a structural-functional sense). Conversely the production of 'weak' frames - blurred hierarchical distinctions and implicit rather than explicit procedures of operation characteristic of a decentralized strategy of control - relies on a relatively low level of interdependence among the 'governors' and restores them in many respects to the level of a relationship more typical of 'mechanical' rather than 'organic' solidarity.

The conjunction of strong classifications and strong frames (the 'collection code') is therefore typical of a system where the hierarchical principle compensates for a relatively low level of capacity (or competence) of its primary regulators. Given a higher levels of capacity of the latter, the hierarchical control may be relaxed (or 'weakened'), but it should be noted that this manifestation of 'weakness' is, in informational terms, the converse of that which creates integration among the primary regulators. In other words, the process of greater interdependence at the primary level generates variety while the deregulation of controls which usually accompanies this actually decreases variety. This tendency of a greater overt degree of organic solidarity at the lower organizational level to be paralleled by a type of mechanical solidarity at the higher levels may appear 'paradoxical' but it is not at all incompatible with formal principles of regulation and control. We turn now to consider the implications of these formal aspects for exploring the 'deeper' relationships among whole blocks of variables rather than individual items.

CHAPTER V

BERNSTEIN'S CODES AND FACTOR THEORY

If Bernstein's theory of educational codes is to meet with a fair and accurate empirical test then some recognition must be made of the effects of their deeper patterns of structuring on the visible correlations between the structural variables themselves. As we have seen, the 'collection' or the 'integrated' characteristics of these patterns are apparently reflected in the properties of the measures. Now it is well known that these very properties have defined effects on the correlation between the two sets of scores they yield. This 'attenuation effect' places a limit on the maximum correlation between the scores and could therefore be expected to reduce any observed correlation by a determinate quantity(1). The usual solution to this problem, curiously not applied in any of the studies mentioned so far, is to 'correct' a correlation coefficient for attenuation(2), which results in a better and a higher estimate of the 'true' correlation between the variables. This appears to present an attractive and ready-made solution to the problem of offsetting the distorting effects of 'deep structural' patterns of coding on observed correlations. However, as seen above, the correction formula is based on the assumption that the error terms in each measure are uncorrelated either with one another or with the 'true' scores(3). Such an assumption is clearly violated by the above model which proposed that there are systematic and predictable distributions of the error term according to the observed levels of each attribute and its location within the general schema of regulation. Such a violation of the normal parametric assumptions behind the estimates of the underlying or 'true' correlation therefore presents a novel constraint on the maximum correlation possible between two sets of organizational scores.

Although these violations of the assumptions behind the usual estimates of reliability are to some extent offset by the size and heterogeneity of a sample of organizations, the formulation of the theory demands a more general solution which would apply to a more restricted case. If there is a common factor or code underlying the observed correlation, how might it then be discovered and how might its true strength be estimated? Plausible as this analogy between codes and factors might be, the use of inductive techniques offered by factorial or component analysis is apparently fraught with difficulties. On the other hand a purely deductive approach suggests problems of quite a different order, since it contains within it the seeds of circularity or tautology. If we claim for instance that

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1 Helen M. Walker and Joseph Lev, *Statistical Inference* (New York: Holt Rinehart and Winston, 1953). The maximum possible correlation between two variables is estimated as the square roct of the product of their individual reliabilities.

2 Walker and Lev, *Statistical Inference*. See also George A. Ferguson, *Statistical Analysis in Psychology and Education* (New York: McGraw-Hill, 1966), pp.382-3. The estimate of the 'true' correlation is the observed correlation divided by the maximum possible correlation.

3 Ferguson, *Statistical Analysis*, p. 376.

any correlation, no matter how high or low, is itself an index of the 'coding' of the variables at a 'deeper' level then the theoretical model becomes self-justifying and unfalsifiable by any empirical test. The rhetorical question of Davies - 'Is anything mightier than the code?'(4) - and the affinity which this author demonstrates between the theory of codes and the work of Bourdieu would seem to emphasize the dangers of an over-determinism in which all observed relationships are resolved by a kind of theoretical 'legerdemain'.

Are there nevertheless rigcrous limits that one might apply to avoid the traps of raw empiricism and of over-determinism? The most satisfactory solution to this dilemma would seem to lie in a demonstration that the model of regulation could account for most of the interdependence between the structural variables. In order to avoid the 'Chinese box' of constantly imputing the existence of a common factor which explains the intercorrelation of error or residual terms, it would be necessary to make one single correction of an observed relationship in the direction indicated by the model. Any departure of this corrected correlation from a value of unity would then perforce be taken to that extent as a lack of support for the existence of a common underlying factor, once defined. There might of course be some 'room for manoeuvre' within this extremely rigorous test of the hypothesis, but it would be expected that the values of the corrected correlations would be extremely high (i.e. 0.9 or thereabouts) on the average.

Before we embark on the construction of such a rigorous test of the theory of codes, several theoretical and methodological issues will need to be dealt with. It will be necessary - (1) to examine the general problems raised by the factorial studies of organizational attributes from the point of view of the theory of regulation; (2) to state Bernstein's theory of classification and framing in such a way that allows for their precise empirical demonstration in the correlations across the different types of structural categcries (in this case with emphasis on the 'instrumental' variables, whether 'closed' or 'open'); (3) to examine any possible links between all three of the issues so far raised - factorial approaches to organizational structure, the theory of codes and the estimation of the 'true' correlation between organizational variables; (4) to develop statistical expressions which relate the observed correlations in a manner which is consistent with the general model of regulation and the theory of codes, as outlined in the previous chapter. Only when these four stages have been passed will it be possible to approach the empirical organizational data and then to submit the general propositions of the theory of codes to a rigorous empirical test in the following chapter.

(1) Factorial Approaches to Organization Structure

Factorial and component analyses of organizational scores on the dimensions of bureaucratic structure present a very direct approach to the problem of accounting for the intercorrelations between tests and their component items(5). There are however, considerable difficulties in rely-

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4 Brian Davies, *Social Control and Education*, (London: Methuen, 1976). Davies claims that Bourdieu invites us to 'enter a Chinese box, Parisian style, to a world transfixed by definition', p. 133.

5 Jae-On Kim and Charles W. Mueller, *Factor Analysis* (London: Sage, 1976); also Dennis Child, *The Essentials of Factor Analysis* (London: Holt, Rine-

ing on these techniques for the discovery of 'codes' in the same manner as they are often used to reveal common factors or components within a given pattern of correlation. On the surface it cannot be denied that the possibility of extracting one principal component or factor which explains a good portion of the variance among a number or dimensions and then calling this the 'code' is quite plausible. Unlike the reliability estimate this extraction of the common factor does not merely indicate the degree of interdependence among the items or tests; it can be submitted to further statistical manipulations ('rotation') so that one can discern just how this common variance is distributed in terms of more precisely defined and perhaps more meaningful individual 'factors'. The aim of the analyst in this latter phase is to achieve 'simple structure' in the terminal or rotated solution(6) which allows him to reduce a large number of related variables to a small number of independent (or minimally-correlated) factors. This approach has been widely applied to the study of organizational structures, in comparative samples as well as on those of colleges and schools.

Empirical examples of the factorial analysis of structural variables: The Aston studies and their various replications illustrate very clearly many of the difficulties associated with the factorial or principal component approach to the analysis of organizational structure. in the original Aston study(7) the intercorrelations among selected structural variables were subjected to a principal component analysis and a solution was found by means of a rotation('graphic'). The result was an apparent four-component structure - 'structuring of activities', 'concentration of authority', 'line control of workflow' and 'relative size of supportive component' - with the first of these accounting for thirty-three percent of the total variance among the measure of structure. The National Study replication also presented a factorial solution based on the same variables, in which the components were rotated according to a 'varimax' as well as a 'graphic' technique (both of these are 'orthogonal' in the sense that they impose a constraint of non-correlation between the factors of the terminal solution)(8). The profiles of the factor loadings obtained from these two studies were very similar, as Child demonstrates, but the status of the 'concentration of authority' component appears to raise important conceptual issues. It would appear that the location of the 'centralization' dimension in relation to the other structural variables is different in

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hart and Winston, 1970).

6 Thurstone's attempt to define rules of thumb for the definition of 'simple structure' have been summarized by Harry Harman, *Modern Factor Analysis*, (Chicago: Chicago University Press, 1967), p.98. These criteria have the effect of maximizing the number of zero loadings while leaving only a few large loadings for each variable.

7 D.S. Pugh, D.J. Hickson, C.R. Hinings and C.M. Turner,"Dimensions of Organizational Structure", *Administrative Science Quarterly* 13(1968): 65-105.

8 John Child,"Organizational Structure and Strategies of Control: A Replication of the Aston Study", *Programme II* (Farnborough, Hants.: Saxon House, 1976), Table 3.5.

each solution. This difference may well be the result of variations in the sampling procedure in each study, but it appears to illustrate as well the limitations of the entire factorial approach to the isolation of 'deeper' patterns of organizational structure.

The place of the 'concentration of authority' component deserves some greater discussion in the case of the National Study. It would appear that there are two solutions in this instance which are compatible with the relative factor loadings of the 'centralization' scores. The first, similar to the Aston solution, is that derived from a 'varimax' rotation which yields moderately high factor loadings on the first factor (-0.43) and a significant fourth factor (accounting for 8.5% of the total variance) with loadings of -0.57 for 'centralization' and +0.75 for 'autonomy'. The alternative solution is presented by the unrotated approach which yields a 'moderately high' (negative) loading on 'centralization', but no significant loading at all on any fourth independent factor (i.e. this last factor disappears altogether). The choice of the one or the other of these solutions is of considerable theoretical importance. Child shows that the case for accepting the first ('rotated') solution is rather weak because the correlation between 'centralization' and 'autonomy' is artificial in the first place, since both variables were derived from the same six-point scale. The acceptance of the second solution would seem to be of 'major conceptual interest' since it would appear to reveal the existence of a single factor that 'represented a configuration of all the more important structural variables: specialization, standardization, formalization, centralization and vertical span' which in turn, Child argues, 'accords closely with Weber's conceptualization of the structural features of bureaucracy'(9). As argued in the second chapter above, the importance of this first unrotated factor does give some indication as to the existence of an underlying 'code' of structure compatible with an evolutionary model. Nevertheless, such an inference will need to be based on sound theoretical arguments and not merely, as we shall see in the next section on the amount of variance such a factor 'explains'.

The Educational Sector: The extension of the Aston methodology to educational bureaucracies is of particular interest to the theory of educational 'codes' and reveals as well the ambiguities and difficulties of the factorial approach. The study of twenty-three Canadian colleges by Holdaway *et al.* included a principal component analysis followed by a 'varimax' rotation performed on the main structural variables. This yielded a three-factor solution which appeared 'most logical' in terms of the factor loadings on the variables(10). These terminal factors were - 'bureaucratic control', 'administrative configuration' and 'non-workflow proportion'. They were found however to differ substantially from those of both the original Aston and the National studies, particularly with regard to the loadings on the first factor. In the 'college' analysis, for example, 'formalization' and 'standardization of personnel procedures' were associated positively with 'centralization' and negatively with 'autonomy' - the exact opposite of the signs found for the loadings of these variables for the comparatively-based samples. The contrast was found to be most pronounced for the loadings of the 'functional specialization' measure which loads most highly on the second factor (+0.63) together with 'chief

9 *Ibid.*, p. 39.

10 Holdaway *et al.*, "Dimensions of Organizations", p. 126.

executive's span' (-0.80), percentage of clerks (+0.60) and percentage of non-workflow personnel (-0.15). We have already noted that the problems of measuring functional specialization at this level, but this would not alone account for the reversal of the signs of the respective loadings for the other 'structuring' variables in this organizational sector. It is, as the authors state, 'a remarkable result'(11).

The distinction made here between 'bureaucratic control' and 'administrative hierarchy' is not supported however by studies of school structures. These tend to reveal on the whole a more unitary conception of bureaucratic organization. Heward's adaptation of the Aston methodology, for example, shows a 'strong intercorrelation' between the three crucial structural measures of specialization, standardization and centralization, with the loading of the centralization measures both high and negative (-0.56) as noted in the National sample and to a lesser extent in the original Aston study. Moreover, the hypothesis that the specialization measure would have the strongest relationship with the other measures, though technically not confirmed, did find some support in its very high loading on the first factor (-0.877) for the number of non-specialist teachers, (+0.618) for the number of subjects in the curriculum(12). Other studies, such as those of Corwin, which have employed a Weberian approach to school structure, have also suggested a more unitary factorial basis, with a higher degree of tension (as shown in a negative correlation) between measures of professional expertise and the other variables(13). This has not been incompatible with a bi-polar component of structure, however. Heward concluded that the discovery of the strong first factor may lend some support to the unitary concept of bureaucracy in the case of schools. However her conclusion is qualified by the suggestion that comparative and historical studies of bureaucracy does not allow for a generalization of this result(14). While such caution is perhaps justifiable, it does not advance the theoretical interpretation of the factorial structures very far, in that we would always be limited in our conclusions by the peculiarities of the sample from which any structural data was drawn.

Factors and codes: the significance of the 'unitary' concept: Should the confirmation of a unitary dimension of bureaucratic structure depend on the individual characteristics of the sample of organizations being studied as Heward's conclusion would suggest? The problem with such an approach is that it tends to ignore the systematic differences in scale values, correlation coefficients and other indices of 'integration' which may be affecting the degree of importance ascribed to any one factorial solution. There are of course many difficulties in attributing a theoretical meaning to any one factor arising from the factorial approach in a more general sense- those of factor indeterminacy(15) and of the effects

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11 *Ibid.*, p. 126.

12 C.M. Heward, *Bureaucracy and Innovation in Schools*,(Unpublished Ph.D. Thesis, University Of Birmingham, 1975).

13 Ronald G. Corwin,"Innovation in Organizations: the Case of Schools", *Sociology of Education* 48(1973): 1-37.

14 Heward, *Bureaucracy and Innovation*, p. 200.

15 Louis Guttman,"The Determinacy of Factor Score Matrices with Implications for Five other Basic Problems of Factor Theory", *British Journal of Statistical Psychology*, 8(1954): 65-81.

of choice of tests on the variance explained by any one factor are well known(16). However there are specific problems that seem to emerge when one is dealing with the factorial structure of organizational attributes that provide an even stronger case for a cautious interpretation of factorial solutions. Foremost among these as we have seen, is the tendencyfor the size of any one observed correlation to be affected by underlying patterns of association within and between the organizational dimensions themselves.

There appear to be two quite important features of the factor or component analysis which could affect the interpretation of any particular solution and therefore indirectly provide some support for the existence of a 'code' of organizational structure: (1) whether of not the final factors are derived from an 'orthogonal' or an 'oblique' rotation; (2) whether the researcher has pursued a search for a 'simple structure' (i.e. a clear pattern where each test tends to load on only one factor) at the possible cost of the loss of explanatory power of a strong first component or factor. Both of these strategies have implications for the theory of codes. In the first instance the choice of an orthogonal rotation of the factors emphasizes the external rather than the internal patterning of constraint, as defined in the previous chapter. By forcing any factors to be uncorrelated with one another we are deriving a model which is more in keeping with a structural functional interpretation of a correlation matrix. Here the identity of the various dimensions is maximized and elaboration is achieved by an increase in the complexity of the elements rather than by their fusion. By inference any relaxation of this constraint with the same 'input' matrix of correlations tends to emphasize the internal structure of the matrix and highlights the interchangeability or cohesion of functions and structures rather than their externally-oriented identities(17).

This distinction, which is represented by the choice of 'orthogonal' or 'oblique' rotation of the factors, bears directly on the second decision of the factor-analyst - what importance he should ascribe to the achievement of a meaningful or a logical pattern of factor loadings in setting a limit on the intercorrelation of the extracted factors. Here again, there seems to be some clear implications for a theory of codes. Supposing that we a re looking at the factorial structure of a 'primary' regulator such as the complexity of the division of labour, then the 'simplicity' of the structure of the factors in a terminal solution would seem to be an index of the 'strength of classification' within that particular array. On the other hand the degree of constraint that might be necessary to achieve such a clear set of oppositions between pairs of factors (as indicated by the 'delta' value set by the analyst)(18) would be an indication of the degree of 'weakening of the classification' which already existed in the array. A mild degree of intercorrelation is usual in the achievement of simple structure, whereas in highly interdependent fields this

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16 Jae-on Kim,"Factor Analysis", in Norman H. Nie *et al.*, *Statistical Package for the Social Sciences*, (London: McGraw-Hill, 1975), 2nd ed. Kim claims that the 'variance accounted-for' is of no particular interest in a terminal solution because it reflects only the number of variables for a given factor included relative to the total number of variables. p. 478.

17 Wendell R. Garner, *Uncertainty and Structure as Psychological Concepts* (New York: Wiley, 1962). 'The primary effect of introducing redundancy into any system of variables is to redistribute the total constraint'.p.153

18 Kim,"Factor Analysis", p.486. The value of 'delta' can be controlled by

would perforce become very high and tend to dominate the patterns of complexity thrown up by any solution.

It can therefore be seen that factor-analytic methods bear a very close relationahip to the central concepts of constraint, variety, regulation and hierarchy in terms of which the theory of codes has been developed. These methods provide as well opportunities for demonstrating the ways in which a range of structures can be extracted from an observed pattern of correlation among structural variables, given different emphases and assumptions. However, it will be asked whether this conceptual convergence actually helps to clarify the problem as to the theoretical status of the unitary construct of bureaucracy. What is the factorial equivalent of such a construct and what relationship might this have to the model of regulation and to the theory of codes? Might one expect for example that the code of 'collection' or of 'integration' be revealed by some higher order or secondary factoring, or is the existence of a strong first dimension sufficient evidence for a 'deep-structural' pattern, as suggested by Child in the case of the Weberian 'ideal-type'? Are there moreover other possibilities for demonstrating the existence of such patterns in the data than those conventionally used, such as the 'simplex' model proposed by Guttman and his students(19).

Psychometric analogies to the unitary construct of bureaucracy: Although the factor-analytic approach holds out the possibility of reducing a large number of tests to a few dimensions, we are still left with the problem of choosing the 'best' terminal solution in terms of a theoretical scheme which can make some sense of the individual factors so yielded. In organizational studies this problem is complicated by the variations between solutions which seem to depend on the unique properties of the samples from which they were derived. One cannot therefore - as Thurstone suggested for isolating independent factors of mental abilities - expect to find either 'invariance' (consistency of factor content from one analysis to the next) or 'uniqueness' (identical configurations of the extracted factors in terms of their test loadings)(20). Simply because the factorial structures may be expected to vary in ways that are in keeping with the characteristics of the typical organization being studied, factor solutions will tend to be context-dependent. The 'unitary' construct of organization may prove to be entirely chimeric.

One way to approach this problem may however be suggested by the psychometric debate about the factorial structure of intelligence. In their quest for a 'unique' solution to the structure of mental abilities,

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the user in various solutions offered on statistical packages such as the SPSS, in order to make the terminal solution more or less 'oblique' or correlated. A 'delta' value set very high (e.g.+0.75) usually yields a nonsensical structure with factor loadings and factor correlations tending towards unity.

19 Roger N. Shepard,"The Circumplex and Related Topological Manifolds in the Study of Perception", in Samuel Shye(ed.) *Theory Construction and Data Analysis in the Social Sciences* (San Francisco: Jossey Bass, 1978), Chapter 2. See also above, chapter I, note 36.

20 L.L. Thurstone, *Multiple Factor Analysis* (Chicago: University of Chicagc Press, 1947). See also Dennis Child, *Essentials of Factor Analysis*, pp. 55-56.

the debate in this field has waged back and forth between those who hold that the correlations among mental tests reveal a general factor ('g') and those (like Thurstone) who hold that the correlation between mental tests reveals a multi-dimensional model in which less importance is attributed to the initial (unrotated) factor or component. On the analogy presented above it would appear that the large and important factor called 'structuring of activities' in the organization samples presents a similar problem in that it is not clear as to the extent to which some of the other dimensions (e.g. the 'concentration of authority') are independent of it. This problem cannot be solved in any definite mathematical way since the total variance (i.e. external plus internal constraint) does not change - the solutions merely provide different perspectives on the same 'objective' data. There appear to be three main approaches to this dilemma in the psychometric literature which could serve as a guide nevertheless: (1) the extraction of 'g' by way of a relatively straightforward mathematical operation which allows one to characterize a battery of tests in terms of its largest and most central factor or component (the distinction between these two depends on whether estimates of communalities or unities are placed along the main diagonal and is not basic to this discussion); (2) the rotation of independently-derived factors to 'simple structure' so that 'g' is absorbed by the factor-correlations in an 'oblique' solution; (3) a mixture of these two strategies, in which the first principal component or factor is first extracted and the residual matrix of correlations is rotated orthogonally to approximate 'simple structure'(21). The correlation between the different factors which allows for the absorption of 'g' into an 'oblique' solution therefore presents an interesting parallel to the 'unitary' construct of bureaucracy as discussed by Child. How close is this analogy, however, and how far can it be taken in the search for an empirical test of a theory of 'codes'?.

The conclusion that one might come to in the light of the preceding analysis is not that the general factor should not be taken as evidence for a single principle of bureaucratic organization. Rather it would appear to be a very imperfect index of a principle of 'integration' which in terms of Bernstein's theory, is not manifested in classically-bureaucratic organizations at all. The reason for the conclusion is as follows. If each 'test' of structure is found to be highly saturated with a general factor, then it would appear that the 'battery' (such as the 'Aston Full 'O' schedule) was extremely homogeneous and therefore subject to some extent to a principle which underlay its conceptual cohesiveness. One might then tend to ignore that portion of the unique (non-common) variance which was not due to error(22) and formulate a theory of structure which was

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21 Arthur R. Jensen, *Bias in Mental Testing* (London: Methuen, 1980), pp.257-58.

22 The total variance of a test is conventionally partitioned into three components: (a) common variance - that shared with other tests; (b) specific variance - that which is not shared with any other test; (c) error variance - which is due to imperfections in test measurement. The last two components are often combined and termed 'unique' variance. See D. Child, *The Essentials of Factor Analysis*, pp. 34-36.

based entirely on that part of variance of each test which was shared with other tests. In this case, one could go even one step further and treat this common variance as though it were reducible to a single dimension. In other words the 'unitary' construction of organizational score variance reproduces at an inter-test level the distinction between 'vector' and 'scalar' properties which have already been encountered among test items. By this analogy it would seem rather unrealistic and even misguided, to expect that a cohesiveness which was not expected in all instances of the individual scales to be exhibited among the tests themselves.

In terms of the theory elaborated so far, it would seem that Child's test of the Weberian constuct by the explanatory power of a single unrotated general factor of structure, analogous to Spearman's 'g', is misconstrued. Any expectation that factor loadings of all the structural variables on such a factor would be uniformly high is predicated on the notion of a unitary construct of bureaucracy which by definition would be manifested in terms of a 'collection' of loosely-related factors. The structural pressures which might produce a 'tight' relationship between these factors - which Child anticipates - would most likely be found only when the organizations in the sample has developed 'post-bureaucratic' features. A number of high factor loadings of all the structural dimensions on a single unrotated factor might therefore be a manifestation of the principle of 'integration' and not that of 'collection'. From the analogy of scale theory as developed in the previous chapter, one might expect 'scalar' rather than 'vector' properties to be revealed in the intercorrelations of 'structuring' measures of highly complex organizations of the bureaucratic type, but that the opposite might apply to the indices of control such as 'centralization' and 'autonomy'. The degree of variance accounted for by the first factor is therefore to be interpreted against the pattern of evolution of complexity and control rather than a raw index of the internal reliability or homegeneity of the Weberian construct or of tests derived from it(23).

The coding theory of Bernstein therefore provides a theoretical basis for the interpreting of the factorial structures that might be consistent with attempts to demonstrate the Weberian 'ideal-type' of bureaucracy. It provides a researcher with some alternative to the extremes which have characterized the approaches to this problem so far - whether it be in an 'ad hoc' kind of relativism which leads one to expect unique configurations of factors, or in the theoretically dubious expectation of high loadings on the first or general factor. Instead it would be more faithful to the principle of 'collection' that the 'ideal-type' represents to expect quite a large number (say five or six) factors which could be

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23 As a matter of interest only, the variance accounted for by the first factor (about 32%) is considerably smaller in the organizational samples than that usually displayed in the case of 'g' (about 50%). Such a quantity is of course notoriously unreliable - in the former instance it is affected by the systematic patterns of intercorrelation which are dependent on the evolutionary stage of the organization sampled (see previous chapter) which in the latter the importance of 'g' can be manipulated by varying the sample of test items in such a way that 'group' factors are seen to predominate. The implications of these different strategies of mental testing are discussed by Jensen, *Bias in Mental Testing*, pp.213-248. Jensen's account is perhaps itself 'biassed' towards the 'unitary' construction of intelligence.

readily rotated to 'simple structure' with a slightly correlated (or 'oblique') solution. This is in fact what we do find in practice, even though in some samples a first factor may assume slightly more prominence than others. What is important for the manifestation of a principle of 'collection' is the commonality of each test (as given by the sum of squared factor loadings across the factors) rather than the unidimensionality of the whole 'battery' of tests which tap the principal components of structure. The 'unitary' nature of the Weberian construct must therefore be demonstrated in terms which are consistent with the peculiar patterns of correlation that are consistent with the principle of 'collection'. This leads us to expect a certain degree of complexity in the number of factors of the terminal solution, but only low levels of correlation between them.

The 'Simplex' Model of Factorial Structure: Because of the indeterminacy of factor solution, some of the modellers of mental abilities have turned towards the 'simplex' and related topological representations of the underlying structures of a correlation matrix. What are the implications of this for the study of organizations? The simplex in the form proposed by Guttman is first of all discerned when it is possible to find equalities between the correlation of two variables of a matrix and the product of the correlations between each of these and third or immediate variable (assuming that the rows and columns are monotically ordered)(24). Some of the best examples of the Guttman simplex come from learning experiments where each level of skill formation is commonly found to be a linear combination of the preceding levels. In this case the more remote in time the two tests chosen, the lower the accuracy of prediction. As a rough fit to the simplex model Humphries suggests that correlations between initial and final measures should be lower at all stages than correlations between adjacent measures(25). As we move away from the main diagonal, therefore, correlation values should decrease. As noted above in the first chapter, it was found to be somewhat curious that one of the tables presented by King (a correlation matrix of the 'expressive-closed' variables) appeared to be a fit to these criteria, even though there seemed to be no explicit rationale for ranking the scales in this category in this particular manner. It may be of some interest therefore to look at this model more closely since at least it would appear to provide a more sophisticated method for interpreting structure than merely counting the number of significant correlations, as King does(26).

One of the more obvious objections to the application of the simplex model to organizational data is that the correlations between measures of 'structuring' and those of 'centralization' do not follow the classical pattern. Instead of finding the highest correlations along a diagonal of subsamples (grouped by size or some other monotonic variable) we find instead that the middle categories can exhibit the lowest levels of inter-

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24 See note 19 above. Also see Guy J. Groen,"Stochastic Processes and the Guttman Simplex", *Psychometrika* 36(1971)93): 289-302.('A perfect simplex is a correlation matrix where elements r_{ij} have the property that, for all $i\ j\ k$, $r_{ij} = r_{ij}r_{jk}$', p. 290).

25 Lloyd G. Humphries,"Investigations of the Simplex", *Psychometrika* 25(1960)(4): 313-323. ('In selection research one should not be satisfied with validation of predictors against the earliest possible criteria'.p.318).

correlation while the highest are at the extremes of the diagonal. If we were to take a typical organization in the National Study sample through a growth sequence then it would appear that the observed correlations, particularly in the middle region of size and differentiation, would reveal low values thus causing a severe deviation from the expected clustering of all the main variables around the main diagonal(27).

This inferred departure from the simplex model may be explicable in terms of the deeper and more systematic tendencies among the variables and their constituent items, but they are by no means allowed for in the model as it stands. The distortions to the inter-variable correlations which are attributable to the effects of measurement error are to a large extent tractable by attenuation procedures or variants of these(28), but there is no way at present of applying the model to cases where there are such systematic variations in different areas of the matrix of correlations. Again classical test procedures for correcting for error do not apply to instances where the distribution of error is itself of theoretical interest. For these reasons then, it is not at all likely that the simplex model, based on different measures of structural properties, is any more appropriate than normal factorial techniques to a developmental sequence which manifests itself by so many distortions to the values of observed correlations.

Factorial studies of *organizational 'climate'*: If this discussion has done nothing else, it may have brought out many of the theoretical problems raised by a simplistic approach to organizational structures where the extraction of factors is made by inductive procedures. Nowhere are the dangers of a theoretical application of these techniques more clearly seen perhaps than in the study of organizational 'climates'. The recent literature on schools is indeed particularly relevant to this discussion(29). In these investigations, researchers typically take a number of indices, whether based on factual or perceptual data, and employ factorial methods to group the items into scale or dimensions whose meaning is imputed by the distribution of variable loadings. Factor 'profiles' are then constructed for each member of the sample and the various configurations are interpreted according to a schema. In view of the previous discussion

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26 See Chapter I. The reference is to R. King,"Bernstein's Sociology of the School - Some Propositions Tested", *British Journal of Sociology* 27(1976)(4): Table II, p. 437.

27 In the absence of longitudinal data that might allow for a closer approximation of the learning experiments, it is assumed here that the cross-sectional correlations within stratified subsamples give an approximation as to the relative strengths of inter-dimensional correlations across adjacent 'stages of growth'.

28 For a discussion of the algebraic complexities involved in correcting for attenuation in the simplex, see Guy J. Groen, "Stochastic Processes and the Guttman Simplex", pp. 299-301.

29 George F. Madaus, Peter W. Airasian and Thomas Kellaghan,*School Effectiveness: A Reassessment of the Evidence* (London: McGraw-Hill, 1980); Douglas Finlayson,"Organizational Climate: a Concept in Need of Educational Research and Practice", *Research Intelligence* (1975: 22-36). For an application of climate research as a phase of the Aston studies programme, see D.S. Pugh and R.L. Payne(eds.), *Organization Behaviour in Context: the Aston Programme III*(Farnborough: Saxon House, 1977).

there are apparently many grounds for the misconstruction of factors yielded by such an approach. Not only is there the irreducible problem of factor indeterminacy, but more specifically, there are the implications of the factorial solution employed (e.g. whether 'simple structure' was achieved at the cost of high factor intercorrelaton for example). There is also the need to interpret the pattern of correlation according to the particular features of the organizations sampled - as suggested by an evolutionary framework. Thus a battery of tests which was heavily loaded with scales measuring 'autonomy' may yield a very low factor loading for a sample of highly evolved or 'post-bureaucratic' organizations, even though this may be an important structural feature of the sample. Low scale values could be expected to reduce the value of the maximum correlation of the correlations yielded, just as the evolutionary characteristics of the organizations studied may have predictable effects on the ways in which different subsets of the variables 'cluster' on a particular factor or component.

It follows from these objections to the inductive method that when items are selected or retained simply because they show high communalities then the result could be a 'hodge-podge' with little power to elucidate or confirm any particular theory or constructed type. An example of this weakness may be provided by the recent investigation of school 'ethos' by Rutter and his associates which embraced both structural and emotional aspects of organization life. In this investigation the authors defined 'ethos' in terms of thirty-nine 'process' variables chosen out of a total of forty-six (indexing such features as 'academic emphasis', 'use of rewards and punishments', 'degree of pupil participation', 'degree of staff skill') on the basis of their having statistically significant correlations with at least one outcome variable (academic attainment, behaviour, attendance, delinquency). However, as Goldstein points out, even in statistical or methodological terms, this approach is suspect since any composite score of the variables with the larger correlations will almost certainly yield significant predictions of outcomes(30). Such a use of inductive techniques gives rise as well to the problem of multicollinearity, produced by extremely high interdependencies between the 'process' variables. The difficulty of interpreting the results of such regression analyses of measures of school effectiveness on to 'blocks' or groups of internal or process variables is perhaps merely one more example of the by-products of a neglect of the theoretical meanings of degree of intercorrelation itself as a possible manifestation of organizational structuring(31). For these reasons therefore it appears to be necessary to look for more sensitive methods and instruments than those presented by conventional factorial studies. As seen here, these methods do not appear to allow the analyst to escape from the theoretical considerations of inter-item and inter-test correlations - both communality and reliability of estimates are subject to the same 'deep structural' influences. Before proceeding with the theoretical and methodological issues involved here it will however be necessary to formulate Bernstein's theory of codes

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30 Harvey Goldstein, "The Statistical Procedures", in Tizard *et al.*, *Fifteen Thousand Hours: A Discussion,* with a Response from the Authors,(London: University of London Institute of Education, 1980),pp.21-25.

31 M. Rutter *et al.*, *Fifteen Thousand Hours* (London: Open Books,1979), see also Goldstein (note 30 above) and P.F.W. Preece,"Fifteen Taus and Rhos", *British Education Research Association Newsletter,* August, 1979.

in such a way that its fundamental categories are directly translatable into scale and correlation values(32).

(2) Factorial Solutions and Coding Categories

One of the apparent anomalies of the search for an empirical basis of Bernstein's codes by means of a factorial solution is that the correlation matrices of structural variables may be expected to exhibit entirely different patterns of association at various stages of structural evolution among the organizations sampled. Thus one might expect that a 'unitary' solution based on the structuring variables such as standardization and formalization would be possible when the organizations exhibited post-bureaucratic features, but that such a solution would not be likely when a number of 'control' variables were entered into the matrix since by the model of regulation these should exhibit relatively lower levels of interdependence. Consequently the 'mix' of structural variables, as well as the stage of observation, could both significantly reduce the explanatory power of the first principal component, without necessarily invalidating the model. This presents something of a dilemma for research and will need to be resolved by departure from the conventional approach to correlation and factoring as used in the studies reviewed above. However this dilemma also has implications for the formulation of Bernstein's theory in an empirically testable form. These will first have to be recognized and resolved.

One of the most obvious of the problems associated with Bernstein's theory of codes is that the meaning of 'framing' seems to have undergone something of a change as the specification of the theory became more and more precise. In the first paper where it was used ('Classification and Framing'), the term 'frame' seems to refer to the levels of control which teacher and pupil exercise over the selection, organization and pacing of knowledge(33). In terms of empirical measurement of this feature, one might expect that the mean levels of centralization scores would be higher in a 'strongly framed' than in a 'weakly framed' classroom (or organization). However, in the more formal definition of this term in the appendix to the 'Class and Pedagogies' paper (34) 'frame' refers to the relationships between object arrays in different spaces and has no direct connection with the pattern of authority and control. In this instance the emphasis is on the variety of objects and the number of relationships that they can exhibit rather than on the substantive question of control and has therefore implications for the patterning of interdependence of both types of variables as suggested by the model or regulations, rather than the 'control' or hierarchical dimension alone. This more formal statement of the theory therefore brings with it a number of problems which directly bear on any empirical test achieved by the usual apparatus of tests, correlations and factorial analysis.

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32 The difference between communality and reliability estimates is due to the presence of 'specific error' in the estimate of reliability. that is, specific error variance = reliability - communality ($S = r - h^2$). For a discussion, see D. Child, *The Essentials of Factor Analysis*, p. 36.

33 Basil Bernstein, *Class, Codes and Control*, Vol.3(London: Routledge and Kegan Paul, 1977), 2nd ed., p. 89.

34 *Ibid.*, pp. 151-6.

In the first place, by widening the definition to include all relationships between objects, the later formulation would appear to embrace those very processes which produce complexity - and by inference strength of 'classifications' as well as those which, as just mentioned, refer to the substantive issues of hierarchical control. If some minimal correlation between objects (i.e. scale items) is necessary for the formulation of a 'collection' as exhibited say by 'scalar' features then any simplistic generalization of this definition of 'frame' would interfere with the most fundamental principle of this mode of regulation. This resides in the paradox that some communication between objects (i.e. 'weak framing') is necessary for the realization of the strong features of insulation and exclusion that characterize this code, particularly in its more mature and bureaucratic form. Such a low level of interdependence typical of 'scalar' properties are of course distinguishable in degree from the much higher levels that characterize 'vector' properties which ultimately reduce rather than increase the surface complexity of the array (as manifested in the 'weak classifications produced by an oblique factorial solution, or by the extraction of a single strong general component). This paradox which is built into the dynamic properties of the codes has therefore to be recognized in the method of testing itself.

More important than this distinction perhaps is the need for some recognition of what the 'array' actually contains. If the 'objects' are primary structuring variables (e.g. the number of teaching specialisms) then one might expect a different 'modality' of association than that expected among an array of control measures. As the model of regulation suggests, the level of 'framing' will perhaps be specific to the content of the objects themselves, rather than being uniformly 'strong' throughout the whole range of variables, both 'primary' and 'control'. Any tendencies towards 'integration' among the latter might only be anticipated in samples of fairly immature or undeveloped organizations (such as the early stages of growth of the Canadian colleges studied by Heron)(35). Such a pattern (which is incidentally quite compatible with the distributions from the National Sample) would apparently be opposed to Bernstein's model of evolution - at least in the sense that weakness of 'framing' is typical of more evolved systems - simply because he has neglected to indicate the contradictory tendencies among measures of hierarchical control.

When taken in conjunction, these two approaches to 'framing' (the formal and the substantive) in the end have greater force than when considered separately. The implications that this might hold for Bernstein's coding theory are perhaps greater than might appear ar first sight and point to two possible sources of confusion in the development of the theory. The first confusion arises from the connection between the importance of some degree of correlation within the 'pure' form of the collection code and the evolutionary sequence as illustrated in the famous example of the four lavatories in the Appendix to the 'Class and Pedagogies' paper. The second has to do with the ambiguities and difficulties of the formulation of the paradox expressed in the 'Classification and Framing' paper ('The overt structure of organic solidarity of integrated codes creates through its less specialized outputs mechanical solidarity'). It is possible that

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35 P. Heron, *Growth Stages in the Development of Canadian College Structures*, (Unpublished Ph.D. Thesis, University of Alberta, 1972). See also quotation by Pugh and Hinings, *Organizational Structure: The Aston Programme II*, p. 168.

this paradox, expressed in terms of the nexus between symbolic and relational forms of regulation, could be reformulated in terms of the compensatory patterns of variety and hierarchy?

In the former instance, it may be pointed out that the choice of the 'strongly classified and framed' example as a point of departure may be mistaken. The attributes of this lavatory ('stark, bare, pristine, the walls painted a sharp white') may indeed represent a more mature type of 'collection' than does the second example, which appears to be more disorganized than 'relaxed' in the covertly artful manner of the integrated types that come later. Since this first severe example is in fact a prime manifestation of the 'protestant ethic' it would have been more accurate therefore, to keep the sequence in accord with the logic of regulation. the possible re-arrangement of the sequence bears on the latter point which is substantive rather than formal - that by obscuring the sequence of the collection code, the 'fundamental paradox' as expounded in the earlier paper is perhaps rendered more difficult and arcane than needs be. Once it is recognized that 'framing' or association enters into the production of both codes, then the polarization of the principles as represented in the 'four lavatories' sequence must appear as rather too rigid and potenttially misleading(36).

The 'paradox', it will be recalled, of the coding theory resided, according to Bernstein, in the fact that the mechanical solidarity of the collection code creates 'through its specialized outputs organic solidarity, while the less specialized outputs of the integrated code appear to produce 'the covert deep closure of mechanical solidarity'. The reason for this appears to lie in the way that the very elaboration of an ideological position produces a closure that does not result from the more implicit or tacit symbolic apparatus of the collection principle. This is however left as a 'paradox' and its mechanism is not explained. However, this difficulty may be resolved to some extent if one were to superimpose the parallel categories of the model of regulation - that is 'variety and hierarchy' - on to those used by Bernstein. Might it not be possible to recognize in the elaboration of the principle of control or hierarchy the source of 'organic solidarity' which Bernstein attributes to the collection code? By the same token it is not inconceivable that the closure which Bernstein perceives within the integrated code could be a result of the deterioration of these mechanisms with the consequent production of an implicit or tacit uniformity among those who are bound by idea rather than a visible source of authority. The 'law of requisite hierarchy'(37) at any rate leads one to look for such paradoxical effects as the deregulation of control apparatus is a predictable consequence of any increase in the self-regulation or efficiency of the primary regulators (or actors in this case). The paradoxes of technique and hierarchy, autarchy and autonomy are apparently rendered more tractable when they are related back to the principles of regulation.

Although more could be said about the possible parallels between

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36 The re-arrangement of the sequence here is suggested by Sutherland's four 'ideal types' of system, based in turn on the well-known model of 'causal texture of organizational environments of Emery and Trist. Bernstein's base-line example would appear to be clearly 'placid,clustered'(or the second stage) rather than 'placid,random'.

37 A.Y. Ahmavaara,"The Law of Requisite Hierarchy", *Kybernetes* 8(1979): 259-66.

the neo-Durkheimian terminology of Bernstein and the cybernetic model, it is sufficient at this stage merely to point out that they are both apparently compatible with the theory of measurement and scaling discussed in the previous chapter. If it is possible to envisage the 'classification and framing' both of 'structuring' and of 'control' variables and to discern in their distribution something of the compensatory (or 'paradoxical') interrelationship noted earlier, then the ground is cleared for a more rigorous empirical test of Bernstein's coding theory. It remains, however, to choose a statistical method which will allow these theoretically important patterns of interdependence to shine out more clearly than in the conventional correlational approaches to organizational structure. We turn then to see what light information theory can throw on the problem of statistical analysis.

(3) Information Theory and Multivariate Analysis

In order to draw together the two strands of information theory and correlational analysis, it would perhaps be useful to return to the regulatory model discussed in the previous chapter. It was proposed there that the degree of internal organization of the structural variables might be considered as an index of the regulatory capacity of the average organization within a sample observed. This led on to the deduction that there would be an information value for the distribution of items in a scale, based on a posited equivalence between the entropies of the distribution and the scale reliability value. If it is necessary to choose a method of analysis which will allow the interrelationship between structural variables to be more precisely observed according to the predictions from the model of regulation then this link will nedd to be made more precise in order to generalize to the multivariate case. If a 'code' does exist in any empirical sense, which statistic should one choose to best estimate its full information value? This may be seen to have three aspects: (1) the relationship between information theory and the measures of variance of test scores; (2) informational equivalents of the reliability or internal homogeneity of a scale; (3) measures of the relationship between two sets of variables whose internal patterns of interdependence are themselves not homegeneous - and the informational equivalent of such measures. When we have discussed these questions in turn we will then be able to discuss the choice of a statistic for the empirical analysis in the following chapter.

The relationship between information measures and standard statistical theories have been explored by Garner and McGill(38) and Kullback(39). In regards to the first problem ('1' just above), it would seem that the normal distribution can be expressed as a probability density from a knowledge of the variance and width of the interval of the scores(40). Put another way, the mean information in any observation relating to the hypoth-

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38 W.R. Garner and W.J. McGill,"The Relationship between Information and Variance Analyses", *Psychometrika* 21(3)(1956): 219-228.

39 Solomon Kullback, *Information Theory and Statistics*, (New York: Dover Publications, 1968).

40 The information estimate of a normal distribution is given by Garner and McGill as: est $U(y) = \frac{1}{2}\log_2 2\pi eV(y) - \log_2 m$ (where 'm' is the category width of 'y'). p. 226

esis that 'x' lies within certain confidence limits can be expressed in terms of the 'entropy' of all such hypotheses. From a knowledge of the maximum entropy (or urcertainty) of the value of 'x' we can then look at the next two problems ('2' and '3' above) which depend for their resolution in different ways on the reduction of this uncertainty when the values of other variables (other 'x's' or a set of 'y's' are known. From the ratios between observed (i.e. predicted) and the maximum uncertainties of the values of 'x' we can therefore express any relationship in an informational manner. There are two methods of deriving such an expression - one based on the analysis of variance and the other from the value of the correlation coefficient(41). In either case it is not difficult to see that the internal consistency of a scale can be translated directly into an informational measure(42), based on the average uncertainty in predicting each item value from each of the others. The internal entropy of a scale, derived from normal measures of consistency or homogeneity, can therefore express in a more theoretically exact form such notions as 'scalar' and 'vector' properties and establishes a direct link between test theory and the model of regulation elaborated earlier.

One of the problems of the informational model arises, however, when we consider one type of interrelationship ('3' above). What should one do to express a correlation not just between an 'x' and a 'y' but rather between sets of such variables considered simultaneously? What is of interest here is not the aggregated values of the 'x's' and 'y's' but the internal interdependencies within each set as well? Clearly here the assumptions of normal test theory break down since it is not proposed that the variance of aggregated scores within each set (even if these have first been standardized) will be homogeneous. There are several adaptations of test theory to deal with this instance which yield 'F' values comparable with those derived by normal methods(43), but these are not appropriate to the present case, since it has already been established in the previous chapter that the violation of the assumption is itself of some theoretical significance. The search for an equivalent informational measure is therefore linked to a more fundamental question - the choice of a statistic which best expresses the realtionship between sets of variables whose aggregated values are known to have heterogeneous variances. Fortunately, however, these are not totally independent questions since what is needed

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41 The information value of a correlation is given by Kullback in terms of the expression $I(1:2) = \frac{1}{2} \log (1-r^2_{xy})$, (p.8), while the analysis of variance ratio can be expressed, as Garner and McGill show, in equation: $\text{est } U(y ; x) = \frac{1}{2} \log_2 [V(y) / V_x(y)]$, (p.227).

42 The usual estimate of the reliability of a scale is given as an 'F' ratio of the between persons' mean square and the within items mean square (error term). These two values van be readily inserted into the Garner and McGill equation to yield an informational estimate of the reliability coefficient (i.e. $\frac{1}{2} \log_2$ [M.S. between people / M.S. within items]).

43 There are several methods of estimating a test's reliability when the assumption of homogeneity of variance is violated. the best known of these is Hotelling's Generalized Student Ratio (T^2), whose 'F' ratio is the same as that for the classical test when test variance is perfectly homogeneous. This statistic is available on both the SPSS and BMDP packages and is discussed in both manuals.

is really the same thing, whether expressed in statistical or informational values, that is to say the most 'informative' linear function which expresses the relationship between two classes of structural variables.

The link between these two problems has been discussed by Kullback(44). In the first place it appears that the best way to summarize a single common property shared to some extent by a number of variables is by means of a 'linear discriminant function' which maximizes the divergence within the population in terms of this property. This function therefore yields a new 'variate' with a normal distribution - a principal component from which scores for each individual in the sample can be easily computed as a composite of the weighted scores of the original variables (usually called 'factor scores'). However, it will be recalled from the previous discussion that a straightforward factor analytic solution is not appropriate here since what is needed is a function that best expresses the relationship between two sets, rather than a single function that is necessarily subject to distortions arising from deeper or hidden evolutionary effects.

The statistic that is required in this case, therefore, is that which expresses the maximum association between a pair of discriminant functions. This has been identified by Hotelling as the largest canonical correlation, a measure which is based on the value of a root which maximizes the relationship between two sets of variables, derived by normal calculus procedures (i.e. setting the determinant to zero)(45). This statistic, which Kullback calls 'the most informative and most divergent linear discriminant function', can be rendered quite readily into an information value since it is equivalent in form to a simple correlation between the two constructed variates(46). A canonical correlation between two classes of structural variables is therefore an apparently suitable measure for expressing the dynamics of the processes of regulation which have eluded the more conventional statistical approaches.

The advantage of this approach is that it is not constrained by the assumption of normal test theory that the variance of the test need be homogeneous across all items. Rather the opposite may be the case, since each item (or subset of items) may be treated as a separate variable and its patterns of association with the others may be allowed to vary within any one scale. This approach therefore takes account of the distortions that arise as there have been revealed in the case of the organizational data discussed above. Instead of suppressing these effects by correcting for attenuation, this statistic allows one to treat them as an important experimental effect. Each item contributes in a different way to the new constructed 'variate' which is of course assumed to be normally distributed and therefore treated in the usual fashion as a dimension of a bivariate distribution for correlational analysis. This variate is the background factor which explains the relationship between the residuals

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44 Kullback, *Information Theory and Statistics* , Chapter 6. See pp. 88-89 below.

45 H. Hotelling,"Relations between Two Sets of Variables", *Biometrika* 28(1936): 321-377.

46 The formula is as given in footnote 41 above for a single correlation coefficient. The full information value of 'explained' variance from the extracted canonical correlations is found by multiplying the residuals - i.e. $I(1:2) = -\frac{1}{2}\log_e (1-\rho^2_1)(1-\rho^2_2)(1-\rho^2_3).....(1-\rho^2_k)$. See Kullback, *Information Theory and Statistics*, p. 203.

produced when the variables are intercorrelated - an effect which is not dissimilar to the problem of 'spurious' correlation(47). The canonical analysis therefore adds another dimension to the rather 'flat' picture of univariate regression techniques. Because it allows for a number of dependent variables to be introduced simultaneously into the predictive equation it avoids the rather constricting assumptions that the dependent terms should have uniform variance or else they should be taken one at a time(48).

(4) The Multivariate Analysis of Organizational Data- Predictive Models

The problem of choosing a statistic which best represents the internal variations within different groups of structural variables has therefore been rendered simpler by a consideration of the links between the informational model and the multivariate analysis of organizational data. Since well-established routines exist in the statistical packages for the computation of canonical correlation, the exploration of organizational relationships along the lines suggested by the model of regulation is facilitated to some extent, since this could otherwise present a formidable computational problem. Before actual empirical examples are submitted to such an analysis, however, it remains to be shown just how this measure of correlation is derived, as well as how it might be related to Bernstein's coding theory as formulated in the preceding section. From this discussion it should be possible to suggest some hypotheses which could be brought forward as a basis to the empirical analysis of the following chapter.

The aim of canonical correlation, as has been outlined above, is to extract one or more pairs of linear combinations of each of two sets of variables so that the correlation between each pair is maximized(49). One of these sets may be treated as dependent and the other as independent, although the resulting correlation will be the same whatever the model chosen. The extraction of the first set to canonical variates is followed by a second procedure which accounts for the remaining variance in a similar manner - and so on. This iterative procedure is similar to that of principal component analysis, except that the solution (or root) is constrained by the level of correlation between the two sets and not simply by the 'variance explained' within the variables taken 'en bloc'.

This canonical correlation technique has in fact been described as 'double-barrelled principal components analysis' since it yields a correlation coefficient between two components rather than between two aggregated scores across a sample of items. It is admirably suited, as we have seen, to the present purpose since it allows one to explore the relationship between two theoretically distinct components of a single dimension. It is also superior to the multifactorial approach whereby, for example,

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47 See a discussion of this in the simplest (i.e. three variable) term by George A. Ferguson, *Statistical Analysis in Psychology and Education*, p. 389.

48 The exception here is when 'repeated measures' of the same variable are taken. In this instance, should the tests not exhibit homogeneous variance at different times, then a univariate analysis would be more appropriate.

49 Maurice M. Tatsuoka, *Multivariate Analysis: Techniques for Educational and Psychological Research* (New York: Wiley, 1971).

a 'concentration of authority' factor is regressed on one denoting the 'structuring of activities', since the canonical approach itself enters into the estimation of the weights by which the variates are constructed in order to maximize the 'variance explained' of one dimension by another. The canonical variates will therefore in most cases bear little resemblance to the components estimated by the conventional techniques reviewed above, yet they preserve the theoretical relationships that are of major interest(50).

The statistic which summarizes the total degree of interrelationship between the two sets of variables is usually expressed as Wilks's 'lambda', which is the product of all residual variances of all the coefficients of alienation (i.e. unexplained variation) of the individual roots (or squared canonical correlation coefficients). The value of 'lambda' when subtracted from unity will give a good indication of the total degree of relationship between two sets of variables, since it yields a precise value of the 'variance explained' of one set of variables by another. It is however a composite index of all the roots or eigenvalues of the associational matrix (explained in more detail in the next chapter) and in practice is usually analyzed by means of a 'dimension reduction analysis' so that the relative contribution of individual pairs of canonical variates can be assessed. Of most interest usually is the significance of the first root or eigenvalue, larger than the rest, since if the value of this falls within the levels of confidence set by the 'null hypothesis' then the total analysis will also fail to reach significance(51).

There are two other test however which one should pursue to estimate the importance, as distinct from the statistical significance of a canonical coefficient, however high the value that it may take. The first is to determine what percentage of its 'trace' (or sum of all the eigenvalues of the relevant matrix) that it represents. Since the largest coefficient can be no smaller than the largest correlation between the predictor and the criterion variables, then it is possible to imagine the case where an atypically larger observed correlation may give a biassed result. One might therefore require that if a coefficient represented less than half of its trace, that one should pay attention to more than just the first root by pursuing the analysis to include the second and perhaps the third significant term of the trace. The other statistic of interest is what is known as the 'redundancy index'(52). This is something like the usual Pearsonian coefficient of correlation squared, since it represents the degree of overlap or 'variance' explained in one set of variables by a canonical variate of the other. It is usual to take notice of the index which shows how much of the variance among the criterion (or dependent variable) is explained by the first or most powerful canonical variate formed among the predictor (or independent) variables. Despite the fact that this statistic is apparently resonant with the theory of regulation

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50 *Ibid.*, p. 183. It should be noted that 'principal components' rather than 'factor analysis' is the correct analogy, since the estimation of communalities is not involved. This point reinforces the previous distinction made between the two 'factorial' approaches, in that the principal components method merges unique and common variance to give hybrid common 'factors'.

51 See Eli Cohen and Phil Burns,"SPSS - Manova: Multivariate Analysis of Variance and Covariance",(Illinois: Vogelsback computing Centre), Document No. 413, Northwestern University, June 1977, p.41. See also, Tatsuoka *Multivariate Analysis*, p. 187-8.

set out above (i.e. it uses the same terminology of 'redundancy'), it cannot figure very large in the empirical test of the theory, which is more concerned with the relationships between the hidden or canonical variables.

Multivariate Analysis and Reliability. While the canonical variates are held to be a more accurate instrument for detecting the relationship between variables of organizational structure, there is still the problem of dealing with the inconsistencies that occur in measurement. These may arise from two sources - (1) those which derive from differences in the means of the individual indices of structure and (2) those which are caused by differences in the standard deviations or variances of those indices. Either of these can distort the values of a canonical correlation coefficient - the first by injecting an unwanted element through the value of the 'constant' component of a multivariate analysis, the second by restricting the contribution of any individual variable to a canonical variable, and hence to the value of the overall correlation because of restriction of the upper limits of initial association (i.e. attenuation). These two problems are discussed by Maxwell(53) with an illustration from examination marking. To help overcome some of these difficulties, Maxwell uses the correlations of the original variables rather than their covariances (normally used by statistical packages) but demonstrates that even with this modification, the variables with the lower variances play less significant roles than they might have. He concludes that 'there is little doubt that this value (i.e. the overall canonical correlation between two sets of scores) could be increased by an improvement in examining techniques to give more reliable scores'. It would seem to follow from this that a correlation coefficient which is meant to estimate the 'true' relationship between the dimensions of structure would need to be instructed by these observations in that it should be based on a matrices of correlation coefficients rather than of covariances, and that these coefficients should be first corrected for attenuation(54). However, this step may not be necessary, should initial canonical correlations exhibit very high values (i.e. 0.9 and above).

Estimating the Strength of the 'Coding' Principle. What is the relationship between a canonical correlation coefficient and the codes of Bernstein? Is it sufficient merely to show that a much higher coefficient is yielded when the techniques described above are employed rather than conventional correlational analysis? An indirect approach to this problem may be provided by looking at the uses to which some other researchers have put canonical techniques in educational research, notably in estimating the strength of school as against home effects on educational outcomes(55).

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52 Cohen and Burns,"SPSS - Manova", p. 66.

53 A.E. Maxwell, *Multivariate Analysis in Behavioural Research* (London: Chapman and Hall, 1977), pp. 89-91.

54 It should be noted that the introduction of correction for attenuation at this stage reinforces the approach of the previous discussion of this issue in this chapter not to deal with the problem of unequal variances by a 'global' procedure which assumes comparable variances within subscales.

55 Richard Noonan and Herman Wold,"NIPALS Path Modelling with Latent Variables: Analyzing School Survey Data Using Nonlinear Iterative Partial Least Squares", *Scandinavian Journal of Education* 21(1977): 33-61.

Researchers such as Noonan and Wold have put this technique to use in exploring the strength of latent variables which are specified as linear combinations of observed or manifest variables, in a manner analogous to the present attempt to find the 'deep' as against the 'surface' structural relationships within school organizaiton. In these terms, the 'codes' of Bernstein are the 'latent' variables which are only imperfectly observed through their manifest features The added complication in this instance is of course the systematic variations in the expected errors with which structural variables are observed. The techniques developed in the area of 'school effects' go far beyond the needs of the present problem, in that they allow for the presence of several 'latent' variables, linked in a causal sequence. In the terms of Noonan and Wold, the model chosen here to represent the aspects of Bernstein's codes (classifications and frames) is that where two 'latent' variables are bound by a single 'inner' relationship (i.e. expressed only between these variables themselves). This relationship, estimated by the iterative techniques of these modellers, has been shown by Lyttkens(56) to yield exactly the same numerical values as the canonical variate analysis technique.

If there is a 'coding principle' in the organizational data, then it follows that it must lie at an even deeper level than that observed in the zero-order correlations between elements of organizational structure and control. Rather it appears possible to define such a principle in terms of the first or strongest canonical correlation coefficient derived from a multivariate analysis of these observed correlations. This approach would treat the variables of 'framing'(e.g. centralization, autonomy) as the criterion or dependent variables and those of 'classification' (e.g. the 'structuring variables' such as specialization, standardization and documentation) as the independent or predictor variables, though the size or significance of the prediction is not affected by this ordering. It is expected in such an exploratory analysis as this that very high values of the first canonical coefficient will be yielded even before correction may be made at the primary level of the correlations entered into a matrix. Should this occur, we may conclude that the 'true' value of the underlying correlation would be very close to unity, as hypothesized at the beginning of this chapter. As an instrument of analysis, the canonical correlation offers the possibility for estimating the 'deeper' relationships between the components of structure with a greater degree of reliability than that provided by canonical procedures. In the following chapter, before proceeding with the empirical test, this method will be better explained, and the links between the cybernetic model, multivariate analysis and Bernstein's coding theory made more explicit.

56 E. Lyttkens, "Regression Aspects of Canonical Correlation", *Journal of Multivariate Analysis* (1972)(2): 418-439.

CHAPTER SIX

TESTING BERNSTEIN'S THEORY OF CODES WITH SAMPLES OF WORK ORGANIZATIONS

In the past chapters it has been asserted that the previous attempts to find empirical evidence for Bernstein's theory of codes (notably those of King) in a sample of organizations have been misguided and inadequate. The grounds for this rejection of conventional approaches are several. It is claimed that the principle of coding should be seen not as a surface feature of organizational structure but should be construed as a factor or 'latent' variable that is not accessible by aggregating the values of surface characteristics (such as taking a crude count or statistical average of observed correlations among individual items or scales). It follows then that the statistical reconstruction of such a factor is likely to be contaminated by the intrusion of the effects of the coding principle itself into the very processes of observation, such as on the size of scale values which may exhibit either 'vector' or 'scalar' properties. We were therefore led to enquire into the systematic distribution of these effects in the National Study data of Child. It was observed that the scale values were indeed predictable from a knowledge of the average size of the organizations sampled, and that there appeared to be an inverse relationship between the properties of scales based on items that measured the competence of the primary systems of regulation (such as the degree of the division of labour) and those that measured characteristics of control or hierarchy. It therefore seemed possible to base the relationship between these components of structure on the well-established principles of cybernetic theory (in particular those of 'requisite variety' and 'requisite hierarchy') which appear to explain the distribution of scale values. The measurement of Bernstein's coding categories ('classifications' and 'frames') is therefore rendered more tractable if it is seen in terms of estimating the strength of the relationship between these two broad areas of structure, rather than in terms of the correlations among individual items. In keeping with the factorial approach (i.e. the search for 'deeper levels' of relationship) it seems appropriate to use the canonical correlation approach ('double-barrelled principal components analysis') rather than the usual methods that seek to establish a single unitary (or first) factor among a set of structural variables.

The next link in the chain of reasoning is to establish that there is an informational basis to the statistic chosen as the index of the coding principle. This is necessary so that the constraints within the distribution of scale items which produce their unidimensionality or otherwise can be seen to be adequately represented by the canonical correlation between the two blocks of structural measures. This might both help to make clearer the rather intuitive use of informational and cybernetic principles inherent in Bernstein's categories and at the same time explicate the connections between the theoretical approaches that inform this version of the empirical test (i.e. cybernetics, coding theory and the theory of scaling). When this is established then it will be possible to proceed with the test itself. The organizations used for this test are not drawn from education but rather from production. The two samples, that of the original Aston study and that of Child's National Study, were chosen because Bernstein's theory has equal theoretical relevance to the world of work (as the paper on 'Education and Production' has demonstrated) and because

King's measures of school structure were explicitly modelled on the original Aston scales. Since these samples are well described in the literature referred to in previous chapters it will not be necessary to provide a great deal of detail on their composition. Some analysis of the partitioning of the individual items into a tractable number of variables will however be appropriate. The results of the analysis, using the multivariate regression procedure of the Statistical Package for the Social Sciences (contained in the MANOVA facility) will be provided for both of these samples which were accessed through the Aston Databank held by the Social Science Research Archive(1). A discussion of these results will follow in the fourth section.

(1) Information Theory and Canonical Analysis

It is not necessary here to repeat the steps by which it was deduced in the previous chapter that the method of canonical correlation seems to be the most appropriate technique for measuring the relationship between 'classifications' and 'frames' at a deeper level than is possible by the more conventional Pearsonian statistic, but rather to explicate the method itself and its affinities with the informational theory of regulation. There is, as Kullback demonstrates(2) an 'a priori' relationship between statistics and information theory. In fact the latter has been defined by Green as 'the application of statistical notions to the problem of transmitting information'(3). The task remains, however, of translating this relationship into practical measures of correlation. One method of making this relationship has been drawn by Kullback who suggests that we consider the 'information' of statistical tests as grounds for discriminating in favour of one hypothesis rather than another. The basis for rejecting a null hypothesis is therefore given in terms of the information yielded by the likelihood ratio of two probability density functions, based on the hypothetical (normal) distribution of one or more variables. If, for example, both the null and the alternative hypotheses were equiprobable thenthe amount of information would be zero (i.e. the value of the logarithm of 1).

This approach can, as Kullback shows, be easily applied to the bivariate case. In this instance the two hypotheses are (1) that under the null hypothesis two variables 'x' and 'y' are independent with respective probability densities 'g(x)' and 'h(y)'; (2) under the alternative hypothesis the two variables are dependent with probability density (f(x,y)'. It therefore follows that the mean information of discriminating in favour of the alternative hypothesis is given by integrating the logarithm of the ratios which are yielded by comparing each pair of observations of the two variables (considered as a bivariate normal density) with the distribution of each observation taken separately (i.e. the marginal normal densities). This value will be zero if the overall ratio is unity and it will reach its maximum value (theoretically infinity) when the ratio is more favourable to the alternative or experimental hypothesis. This

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1 *Databank of Information from the Aston Programme of Organizational Studies*, File No. 922, held by the Social Science Research Archive, University of Essex, Colchester, U.K. (Depositor J. Child, 1976).

2 Solomon Kullback, *Information Theory and Statistics*, (New York: Dover Publications, 1968), p. 2.

3 P.E. Green Jnr., *IRE Transactions on Information Theory*, Vol. IT-2: 91-94).

informational measure can be derived directly if one wishes, from the Pearson correlation coefficient by using the formula:

$$I(1:2) = -\tfrac{1}{2}\log(1-\rho^2) \quad (4).$$

The multivariate case is more complex but actually results in a very similar informational expression of the correlation to that just given. The aim here is to find the measure of relation between two sets of variables by obtaining th most informative and most divergent linear discriminant function. This function is actually a set of weights (comparable with regression coefficients) which still maximize the correlation between the two sets. In the terms of the discussion of the previous paragraph the ratio of probabilities is found by a ratio of the determinants if two sets of matrices, one being within the cells (or error) covariance matrix and the other the total variance matrix. The logarithm of this ratio (e.g. the eigenvalue whose square root is the canonical coefficient) yields an informational value in exactly the same form as that just given for a bivariate correlation. The significance of this root is given by a chi-square whose probability value is provided by most statistical packages (such as the BMDP and SPSS-MANOVA)(5).

Because the solution to the determinantal equation which maximized the correlation between the 'latent' or constructed variables of each set is in the form of a polynomial expression, there will necessarily be as many roots as there are variables in the smaller set. The summary informational statistic is therefore properly based not on one coefficient, but rather the product of the residuals of all correlation coefficients associated with each root:

$$I(1:2) = -\tfrac{1}{2}\log\left[(1-\rho^2_{c1})\ (1-\rho^2_{c2})\ (1-\rho^2_{c3})\ldots(1-\rho^2_{ck})\right] \quad (6)$$

(where k is the number of variables in the smaller set).

Although this is based on the Wilks's Lambda statistic, there are other approaches to providing a comprehensive or summary statistic, notably Hotelling's trace statistic which is based on the sum of the roots or eigenvalues of the determinantal equation(7). For the purpose of the following analysis more attention is paid to the value of the first canonical correlation, usually expressed as Roy's largest root statistic, than on these summary statistics which express the 'coding principle' in its fullest form since they are based on the total 'variance explained' in one set of constructed variables by those of the other. Of interest of course as well is the actual amount of variance being explained in the observed set of dependent variables by the constructed variate(s) of the independent set. It is very difficult to specify what would be the lowest level of interest here (sometimes called the 'redundancy index') since even an extremely low amount of 'variance explained' (say five percent) could have a deal of theoretical import (the other 95% may just represent a kind of background 'noise' or error).

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4 Kullback, *Information Theory and Statistics* p. 8.

5 The approximate criterion for testing the significance of these roots is given by M.S. Bartlett,"The General Canonical Distribution",*Annals of Mathematical Statistics*, 18(1947): 1-17.

6 Kullback, *Information Theory and Statistics*, p. 203.

7 These indices, with others, such as Pillai's criterion are discussed by Cohen and Burns, *SSPS-MANOVA*, p. 39.

The possibility does exist, therefore, of translating the most interesting measure of association into an informational equivalent with minimal computational difficulty. Since one can relate 'classifications' to 'frames' in this way an important connection has been made between the theory of educational codes and the informational model of regulation which has explained the vagaries thrown up by the methodological questions of scaling different points of an evolutionary sequence. Without this translation of the abstract model of regulation into a statistical procedure, the precise method of testing Bernstein's coding theory empirically would probably remain obscure. The availability of such a translation need not imply, however, that it should always be rigorously applied, since there will always be a relationship (though not of course a linear one) between the canonical coefficient and its informational equivalent. It merely needs to be pointed out that the canonical coefficient may, in general terms, be seen to indicate the degree of 'transinformation' that exists within a set of structural variables, (i.e. betweeen those of 'primary structuring' and those of 'hierarchical control'). It remains to be seen just how this canonical correlation is derived before going on to discuss the sample of organizations and their measures in the following section.

Multivariate Linear Regression Analysis using SPSS-MANOVA: The technique chosen for estimating the strength of the canonical correlation is incorporated in the subprogram MANOVA (Multivariate Analysis of Variance and Covariance) of the Statistical Package for the Social Sciences(8). The technique is similar in form to that for univariate multiple regression formulated as:

$$y_i = \beta_0 + \beta_1 x_{i1} = \beta_2 x_{i2} + \ldots\ldots + \beta_p x_{ip} + \varepsilon_i \text{ for } i + 1 \ldots n$$

where the independent variables x_i are fixed with known values, y_i is the is the dependent variable , the error term is independently and normally distributed with a mean of zero and homogeneous variance. The regression coefficients (b_i's) are the unknown parameters to be estimated. The model for multivariate regression resembles this formulation except that the dependent variable is a vector of q-components. The set of p independent variables is the same and the parameters to be estimated consist of pxq elements and the error term is a vector of q components with a mean vector zeroes and a homogeneous variance-covariance matrix. Just as one may use a least-squares technique to estimate the regression coefficients of the univariate model, the MANOVA program uses the same method to estimate the matrix of pxq regression coefficients for the multivariate regression mcdel. Whereas the null hypothesis in the univariate case can be expressed as:

$$H_0 : \beta_1 = \beta_2 = \beta_3 = \ldots\ldots\ldots\ldots \beta_p = 0$$

the equivalent formulation for the multivariate model can be expressed as:

$H_0 : \underline{B}_{(p-1)xq} = 0$ (where p is the number of independent variables and q the number of dependent variables). The subprogram provides four tests of significance for the multivariate regressior - Wilks's Lambda, Hotelling's trace criterion, Roy's largest root criterion and Pillai's criterion,

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8 *Ibid.*, pp. 62-64. The formulation of the technique given here follows the SPSS documentation fairly closely in notation and terminology.

all functions, as explained above of the characteristic roots of the determintal equation that minimizes the error sum of squares and cross product matrix, as explained above. The subprogram also prints out (STATISTICS11), for each subset, the percentage of variation in the original variables accounted for by each of the canonical or 'latent' variables and the cumulative percentages (should there be more than one significant variate discovered). This is the equivalent of two redundancy indices for the dependent and independent (covariate) variables respectively, with the former possibly providing more interest (i.e. if one sees the hierarchical component as necessarily dependent on the structuring variables).

(2) Organization Samples and Structural Variables Employed in the Empirical Test.

The search for a coding principle in the form of a single, powerful canonical coefficient was carried out on each of the two samples - the original Aston sample and the National sample - accessed through the Aston Databank held at the Social Science Reseach Archive. The Aston sample consisted of fifty-two diverse work organizations with a minimum of 250 employees in the Birmingham area of England as observed in the early 1960s. They included a number of kinds of factories, business offices, public utilities, retail stores both publicly and privately owned, both independent and owned by larger entities(9). The data on these organizations was gathered largely through interviews with the chief executives of the unit and with as many departmental heads as seemed necessary. The sample and measurement of the National sample was similar to the Aston one in that it covered a diversity of work organizations. However, as Child points out, it differed in several respects - organizations were located in more than one region of Britain, the sample was confined to whole units with a high level of functional autonomy, only business organizations were included, and the sample was stratified by size from just six industries (electronics, pharmaceuticals, daily newspapers, advertising, confection manufacture and insurance (mainly life))(10). Data was collected from late 1967 to the end of 1969, using methods and instruments developed by the original Aston study and all the fieldworkers had been trained by the Aston research team. Data from this study has already been discussed in so far as it was used to illustrate the problems of scaling at the end of Chapter III above.

Despite the high quality of this data, accessing it in a form that was compatible with SPSS processing proved to be both difficult and time-consuming. The original data tape provided by the Social Science Research Archive was neither formatted nor sorted. Since the full version of the Aston study was preferred a second tape containing the sorted card images (nineteen for each organization) was duly prepared. Owing to errors

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9 The sample and data collection of the original Aston sample have been described in papers by Pugh *et al.*, "Dimensions of Organization Structure", *Administrative Science Quarterly*, 13(1)(1968): 65-105; "The Context of Organization Structures", *Administrative Science Quarterly*, 14(1)(1969a): 91-114.

10 J. Child, "Organization Structure and Strategies of Control: a Replication of the Aston Study", *Administrative Science Quarterly*, 17(1972): 163-77.

in some of the lines due to missing cards, this has required a painstaking search of the printed-out file. A third tape was then prepared for SPSS analysis. A datalist of 447 variables was formatted and the entire databank extract ('Full 0') for each of the two studies chosen was read into the newly-created SPSS file. This file was subsequently transferred to a disk at the University of London Computing Centre in 1981 and was accessed in the usual manner from the University of Kent Computing Laboratory(11). The reason for this rather extended process in the place of a direct reading of only localized parts of the file(12) will be clearer when the variables are discussed. In order to carry out the fine-grained kinds of analysis required by the multivariate approach adopted here, it was necessary to have the most detailed data on individual scales rather than the aggregate scores (e.g. overall centralization, standardization etc.) provided on card number five.

The variables of most interest for the exploration of the coding principle were those concerned with structuring and control. These included the role specialization measure (16 categories based on almost over a hundred items), standardization (based cn over ninety separate items grouped into seventeen functional areas), formalization (formed by a count of the number of documents available in the organization based on sixty-three individual items grouped into eight scales covering three areas - role definition and identification, role activation and the recording or role performance) and centralization (a scale consisting of thirty-seven items indicating at which of five levels a decision is taken). While the groupings of these three areas of formalization items was carried out simply by splitting the items as they occurred into more manageable scales of comparable length with those of other areas, it was not possible to reduce the centralization items in such an 'ad hoc' manner. Nor do these items fall naturally into the domain of one or other of the functional non-workflow specialisms (e.g. item 14/12 'decide when overtime is to be worked) as do the items concerned with standardization. In order to reduce this scale to a number of structural variables that would yield interpretable results (a large number of dependent variables could produce a large number of significant eigenvalues) it was decided to group these items into nine variables on the basis of their-scale variances, thus capturing whatever importance that such values may hold for clustering the items within an evolutionary sequence(13). The centralization subscales therefore were treated as a 'block' of dependent variables within a multivariate model.

The selection and reduction of the scores on the structural variables provide therefore a total of fifty subscales which can be partitioned fairly readily into two blocks representing 'complexity' on the one hand and 'control' on the other. The choice of exactly where the partition

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11 The author is indebted to Miss Joan Dobby of the Kent Computing Laboratory for her asistance in preparing the data for SPSS analysis.

12 V.G. Richards, "Research Note: The Aston Databank", *Organizational Study*, 1980,1(3): 271-278.

13 The clustering of subscales so that some will have a large and others a small variance of course is a potential source of violation of the assumption of the multivariate model that the q-measures have a uniform variance. SPSS-MANOVA provides a statistic (Pearson and Hartley's F-max) which tests this assumption. Rejection of the null-hypothesis indicates that a univariate approach is to be preferred.

may lie is to some extent a theoretical one, but there is some element of arbitrariness. Child for example included both standardization and documentation as elements of control in his univariate approach, while complexity is defined in terms of role and functional specialization and level of specialist qualifications(14). While it is possible in some circumstances to follow this division for an empirical test of a theory of regulation, it is desirable here that control be seen purely in terms of the centralization variables, mainly because these would constitute the most rigorous definition of 'framing' in Bernstein's terms. The fact that the factor analysis of the structural variables led to the postulation of a separate dimension ('concentration of authority') which subsumed both centralization and lack of autonomy in the Aston sample presents an additional challenge. by using a different method of analysis it may be possible to find an undeniable relationship between this dimension and the degree to which activities are structured. The methodological status of the lack of autonomy variable has been called into question by Child(15) and is not used in the present analysis. Some difficulty arises too from the fact that while the National sample data is complete, there are one or two gaps in the Aston data as selected here. For the sake of compatibility then, it was decided to drop four of the seventeen possible standardization subscales and one of the eight formalization subscales. It is unlikely that this omission affects the overall value of the multivariate analysis, or that any possible comparison with a univariate analysis in which all subscale scores are included.

While it may have been preferable to carry out a test of Bernstein's theory on a sample of schcol organizations, there are some cogent reasons for choosing a sample of work organizations as represented by the one hundred and thirty-four analyzed below. Not only is the quality of the data far greater than that available in data sets for school or educational organizations, but there are some theoretical advantages in locating an initial test of a neo-Durkheimian theory in a broad sample than in the more specialized one of schools. The categories of structure proposed by Bernstein are, moreover, as applicable to production as they are to education, and are intimately related, as his recent extensions of the theory of codes have suggested. Another advantage of these samples is that they include a wide range of organizations (in the National sample case, stratified by size). The cross-sectional design applied to such a heterogeneous sample has the effect of randomizing the distribution of any error factor that may be a source of distortion if one sampled only at one point in an evolutionary sequence (this advantage applies as well of course to the univariate analysis).

(3) Results of Multivariate Analysis of the Aston and National Samples

The two samples were submitted to an anlaysis by SPSS-MANOVA according to the partitioning set out above. Nine centralization variables were regressed by the nultivariate procedure on to thirty-six 'structuring variables' (sixteen specialization, thirteen standardization and seven documentation). The STATISTICS ALL option was invoked, even though a good deal of the output (particularly that concerned with the significance of

14 Child,"Predicting and Understanding Organization Structure", *Administrative Science Quarterly*, 18(1973): 168-85.

15 Child,"Organization Structure and Control", in Pugh and Hinings(eds.) *Organizational Structure*, p.3.

		ASTON SAMPLE	NATIONAL SAMPLE
Test Statistic			
Within Cells (error)			
Bartlett's sphericity		sig. =0.36	sig. = 0.01
F(Max) criterion		sig. =0.0075	N.S.
Canonical Correlations	-First	0.98 (sig.=0.073)	0.89 (sig.=0.0025)
	-Second	0.97 (sig.=0.27)	0.83 (sig.=0.08)
Redundancy Indices			
% var explained by	Can.Var(first) of Dependent Vars.		
	-Dep.vars.	13.44	13.55
	-Ind.vars.	13.02	10.78
	Can.Var,(first) of Indep.Vars.		
	-Dep.Vars.	3.055	4.74
	-Ind.Vars.	3.15	3.77

Table 6:1 Results of Multivariate Regression Analysis for Aston and National Organizational Samples (nine centralization subscales regressed on thirty-six 'structuring' variables subscales).

the effect of the constant term) was not relevant to this analysis. The procedure prints out the correlations between the individual items and each canonical variate as well as the standardized and unstandardized regression weights for the canonical variates (i.e. eigenvectors) should one wish to reconstruct these (an option not available under the older SPSS-CANCORR procedure which will however output the canonical scores to a separate file). From this detailed output of individual regression weights and correlations it was possible to regroup the individual subscales for each structural variable and thereby to calculate the correlation between each of the original variables and its respective canonical variate. It should be pointed out that the canonical correlation, unlike factor analysis, estimates the relationship between two constructed variates, one for each set - hence its 'double-barrelled' connotation mentioned earlier. The results of these analyses, the general procedure and the one derived from the reconstructed variables, are summarized in Table 6:1 and 6:2 respectively.

Table 6:1 reveals a remarkable similarity in the results of the regression analysis across the two organizational samples. If one looks first at the size of the first canonical correlation and at the redundancy indices, the pattern of regression is one of a single high first eigenvalue (accounting for 40% and 30% of the explained variance respectively, as indicated by the trace values) and quite low levels of overlap between the canonical variates and the observed variables. This would seem to indicate that while one can obtain a very high and significant correlation between the 'latent' or canonical variates of the two sets, such a construction is achieved at the cost of ignoring almost all the observed variance as indicated by the primary measures of structure, particularly in the case of the independent variables where less than 5% of the variance in the observed indices is explained by the canonical variates. Nevertheless, if for theoretical reasons one were to follow the notion of the 'latent' variable rigorously as being the only reliable index of the 'coding' principle, the the chi-square significance tests do point to there being 'something there' which is binding the two sets of variables together. In this connection the fact that the first canonical correlation of the Aston sample falls just short of the 5% level of confidence for rejection of the null hypothesis should not be taken too strictly, since dropping one or two of the less important independent variables (among the documentation subscales say) can have the effect of lowering the degrees of freedom for this test and hence of achieving the desired level(16). Initially,

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16 This prediction was confirmed by carrying out a similar regression with the same dependent variables but only half the number of independent variables (chosen by taking the odd numbers of each variable set). The first canonical correlation for the Aston sample was 0.93 (sig. = 0.002), but the two test statistics (Bartlett's and F-Max) still indicated the preferability of an univariate analysis. As one might expect with this slight improvement in prediction, halving the number of variables led to almost a doubling in the values of the redundancy indices. This may indicate that this measure is to some degree largely an artifact of the length of the variable test. To check this a similarly reduced analysis was run through with the National sample produced like results - an increase in the significance of the two canonical correlations (though a slight drop in value to 0.8 and .77 resp.) and significant increase in the redundancy indices, especially for the independent set's canonical variate.

	Aston Sample	National Sample
	First Canonical Corr.	
Structural Variable	Canon. Var. of Dep. Vars.	
Centralization	0.366 *	0.368 *
	Canon. Var. of Indep. Vars.	
Role Specializaton	0.1719	0.23 *
Standardization	0.17	0.21 *
Formalization	0.143	0.19

* = significant at the 95 per cent level of confidence (0.29 for Aston sample, 0.21 for National)

Table 6:2 Correlations of Original Structural Variables with Canonical Variates.

therefore, the multivariate analysis lends considerable support for the hypothesis suggested by Bernstein's theory of codes - namely that complexity and control are indivisible features of organizational structure.

Although this first impression of support for the 'coding' principle, some attention should be paid to the earlier statistics presented by the SPSS-MANOVA procedure and listed at the top of the Table 5:2. the first of these, Bartlett's test of sphericity, is a function of the error correlation matrix and indicates the probability for rejecting a null hypothesis that the dependent variables are uncorrelated, in which case a univariate regression is more appropriate. This test points to a rejection of the null hypothesis in the case of the National sample (at 0.01 level) but that for the Aston sample it would be more appropriate to carry out a number of univariate regressions on each of the subscales and then to aggregate the variances explained by each. The second of these statistics, the F(Max) statistic of Pearson and Hartley is computed to test the assumption of the homogeneity of the variance among the dependent variables. to some extent, as was explained earlier, the allocation of centralization items to the various subscales on the basis of their correlation with the overall variable score invites the violation of this assumption of the multivariate procedure. Again it is the Aston sample which consistently shows the greater appropriateness of a univariate procedure, since the F-Max) statistic that suggests the rejection of the assumption of homogeneity of variance among the subscales is quite large (F = 6.35 with 9.15 degrees of freedom). This failure of the tests of the Aston sample to meet the conditions of multivariate analysis does not however imply any loss of support for the 'coding' principle or for the theory of regulation. Rather it indicates the utility of the multivariate approach in confirming the multidimensionality of the centralization measure (as indicated by its low scale value in the Aston sample) and in providing an empirical instance where factorial or correlational procedures may be inapproprite, since these assume homogeneous variance within a composite index.

Turning to the second part of the analysis, we may find out which of the three structural variables - role specialization, standardization or formalization - is most highly correlated with the canonical variate for this set of subscales. Is the division of labour (overall specialization), for example, as important as the other two variables? As can be seen from table 6:2, the correlation between the original structural variables and the canonical variates is not generally very high. This is perhaps to be expected in the light of the low values for the redundancy indices and may to some extent be an artefact of the large number of subscales included in the regression (see footnote 26 above). In any case, there does not appear to be a very strong case for choosing between one or other of the 'structuring' variables according to the 'loadings' which each has on the variate of the set of independent variables(17), nor do the standardized canonical weights for each of the original variables differ greatly from these low values - with an average value of between 0.2 and 0.3 across

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17 The formula for calculating the variance accounted for in variable j by the canonical variate i was based on that used for factor loadings, in which the correlations were substituted for these loadings. By this formula the correlations between each variable and the canonical variate are squared, averaged, and the square root then taken. This procedure is explained for factor loadings by Jae-On Kim,"Factor Analysis", *Statistical Package for the Social Sciences* (second edition), pp.477-478.

the subscales. It is therefore difficult to claim a prime causal place for the division of labour within the canonical variates based on the first eigenvalue, though further analysis with the CROTATE specification on SPSS-MANOVA (which allows for the rotation of axes of the correlations of the dependent variables) may yield a clearer interpretation(18).

Multivariate and Univariate Regression: A Comparison: Above all the multivariate technique shows just how seriously one might underestimate the contribution that the 'structuring' variables make to the explanation of the centralization variable. In the case of the Aston sample, a univariate regression using the original variables yields the following predictive model (standardized regression coefficients):

$Y'_i = -0.933X_{1i} + 0.424X_{2i} + .063X_{3i}$ (where X_1, X_2, X_3 are role specialization, standardization and formalization respectively and Y is the overall centralization score of an organization 'i').

The equation, which explains only 33% of the variance in centralization (adjusted R^2), might be compared with the variance explained in the centralization canonical variate by that based on the same predictor set - almost 97%. Even though one may perhaps wish to follow some of the procedures described above to satisfy the statistical tests, it is doubtful that any other value would be much lower than this. In the case of the National sample, the variance explained in the (first) canonical variate of the dependent set by that of the independent set is almost 80%, while that explained by the first two roots (both significant by step-down analysis) is 95%(19). Clearly these are orders of explanation that are not typical of the explanation of the centralization measure, even when the more powerful predictor, size of organization, is included in the regression(20). As an illustration, the identical model to that just set out for the Aston study yields the following predictor equation for the National sample:

$Y'_i = -0.096X_{1i} + 0.0173X_{2i} - 0.456X_{3i}$

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18 See Cohen and Burns, *SPSS-MANOVA*, Section V.

19 The procedure for calculating the proportion of variance explained for all the (significant) roots extracted by a multiple regression analysis is that set out by Fred Kerlinger and Elazur Pedhazur, *Multiple Regression in Behavioural Reseach*, pp. 380-381. First the value of Wilks's lambda is found by taking the product of the residuals of each canonical correlation, and the result subtracted from unity. Of course the inclusion of the non-significant roots, as is usual both in testing the overall significance of lambda, or in the 'dimension reduction analysis' used by MANOVA will increase the value of variance explained, but will not affect the significance test itself. In this case the first two roots are all that is needed to account for the separation of the two sets of variables.

20 Child tested several predictive models of the overall (de-)centralization measure on the National sample data, including contextual variables as well. He found that three variables (size, workflow integration and overall documentation) 'emerged as statistically significant predictors'. However together they account for only 45% of the variance explained. See Child "Predicting and Understanding Organizational Structure" in Pugh and Hinings(eds.), *Organizational Structure*, Table 4.7, and pp. 60-61.

This model explains only 24% of the variance (adjusted R^2) in the centralization measure, roughly a quarter the level obtained by multivariate methods.

In general the analysis carried out on these two heterogeneous organizational samples indicate a far closer relationship between the variables of control and those of complexity than is suggested either by a univariate multiple regression or by factor-analytic techniques. It will be recalled that in the latter instance the solution proposed by the analysis of the original Aston group emphasized the independence of centralization from structuring (it loaded only -0.33 on the first factor using a graphic rotation), while the solution proposed by Child for the National sample suggested a more unitary interpretation of all the structural variables (as noted in the previous chapter)(21). By contrast the present analysis suggests an almost determinate link between the component built upon centralization and that constructed from the other variables. The implications of this kind of multivariate solution need now to be discussed.

Centralization and Public Bureaucracies: As an example of how the canonical correlation coefficient may be used to reconcile some of the inconsistencies and remedy some of the confusions surrounding the centralization measure, it may be instructive to examine another data set briefly - that of 176 English local authority departments studied by Greenwood and Hinings using Aston measures(22). It may be recalled from the discussion of this study in the third chapter that these authors raised some doubts as to the interpretations of the findings based on the centralization measure because of its low reliability. They therefore considered that centralization, unlike standardization and formalization, could be considered as a set of subscales relating to the locus of authority to make decisions concerning (a) personnel (b) role execution (c) use of resources (d) external relations. Although these were found to be internally consistent, they were unrelated to each other (unlike standardization). By analysing the relationship between these subscales and the relevant standardization subscales for each of these areas, they showed that the compensatory controls argument put forward by Child (i.e. the higher the standardization the lower the centralization) was by no means true in every case. Personnel centralization supported the compensatory hypcthesis, but the centralization of role execution showed the opposite trend, while the two other subscales were not related significantly to standardization (see Appendix 'F' - "Correlation Matrix").

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21 *Ibid.*, p. 38. Nevertheless, the factor loading for the centralization measure (-0.59) was considerably lower than those for the structuring variables (average = +0.90).

22 Royston Greenwood and C.R. Hinings,"Reseach into Local Government Reorganization", *PAC Bulletin*, (1973)December issue: "Centralization Revisited: Research Note", *Administrative Science Quarterly*, 21(1976): 151-155).

The form in which the correlations are presented by Greenwood and Hinings (i.e. as matrices showing the interrelationships among the four subscales within as well as between each structural category) presents an ideal opportunity to demonstrate the relevance of the statistical procedure used above. While it seems that the interdependencies among the centralization subscales are indeed weak (only one of the six correlations is statistically significant at the 1% level), is it possible to show that these scales as a whole may relate to standardization when they are considered as a set of variables, rather than as a loose group of individual measures? The results of a multivariate regression carried out using the SPSS-CANCORR routine (the matrix input was not suitable for the MANOVA aubprogram). As can be seen from the results of this analysis (Appendix F), the two sets of variables can be weighted in such a manner as to yield a first canonical correlation of 0.52, which is significant far beyond the .001 level (chi-square = 61 with 16 d.f.). An examination of the standardized weights on each of the canonical variates of this first relationship reveals that the four subscales make vastly different contributions. At the same time the pattern of compensatory control can only be discerned with reference to the whole compcsition of the canonical variate and not, as Greenwood and Hinings argue, at the level of each pair of subscales. What this analysis appears to to show therefore is the power of the multivariate method to reveal strong patterns which at a surface level may seem patchy or tenuous. It also to a considerable extent vindicates the grouping of subscales in the manner suggested by Bernstein's categories of coding, notwithstanding the complexities that may be produced within any empirical sample.

(4) Discussion of the Empirical Test with Samples of Work Organizations

The empirical test of the relationship between complexity and control variables with these samples of work organizations has shown that the theoretically-postulated links between them, whether in terms of a model of regulation or of Bernstein's coding categories, can be clearly demonstrated. This method of testing, using a multivariate rather than a univariate approach, has shown that at a 'deeper' level of structuring, the kinds of relationships that one might expect from the theoretical bases set out in the early part of this chapter can be brought to the surface and submitted to a rigorous empirical test. One can, as we have just seen, use the well-established methods of multivariate regression both to obtain access to this 'deeper' level and to find a solution which is compatible with the principles of cybernetic theory, in contrast to the previous attempts to extract a single unitary 'Weberian' factor from the same data sets. Not only is the 'double-barrelled' principle component approach more faithful to the interdependencies within the structural variables than the single factor solution, but it can be shown as well to be directly translatable into an informational measure which succinctly expresses the degree of internal 'redundancy' between the two sets of variables.

What is most important for this kind of test is that the canonical correlation(s) attain statistical significance, and that they apparently explain more of the variance in the dependent variable set (i.e. the 'centralization' subscales) than does the conventional regression approach. On both of these counts the operational hypothesis is supported and the null hypothesis rejected. This holds indeed for both sets of data, with very high proportions of variance explained at this 'deeper' level (97% and 94%). The 'cost' of such a high relationship constructed out of the original scale items appears to have been that the surface or observed

variance of these items (i.e. of the measures of 'overall' role specialization, standardization, formalization and centralization) has to be ignored. Canonical variates built out of the eigenvectors of the respective multivariate solutions will therefore not correlate very highly, as we have seen in Table 6:2, with these original variables, but there are good reasons for not paying too much attention to this. In the first place, there is, depending on the point of structural evolution of the organizations sampled, a theoretically-induced variation in the internal reliability of one or more of the structural measures. In the case of less developed organizations this will tend to affect the 'structuring' variables more than those of control or hierarchy, while for the more developed organizations the reverse will be predicted. Secondly, it would appear that much higher redundancy indices can be obtained by reducing the number of independent variables, while still obtaining high levels of canonical correlation values. A more economical use of the measures available may therefore go some way to 'picking up' the main features of the predicted relationship without loss of information.

While this analysis points to the unity of the two levels of organizational analysis, it points equally strongly to the logic of Bernstein's theory, particularly in the necessity of considering 'classifications' and 'frames' as intimately connected by the principle of the 'code'. It is therefore apparently inadmissible that one should consider the 'frame' as a kind of free-floating category which can be studied in a variety of control contexts, since the weakness or strength of this category of structure is not interpretable without relationship to the insulation or boundary conditions of the 'classification' which exist at a more basic or primary level of structuring. The implication here is that the incidence of 'strong' framing is only one feature of organizational structuring systems, and that dimensions of structure form a single matrix of internal complexity and interdependence.

While many more kinds of multivariate analysis could be performed on the organizational samples chosen, possibly taking a different partition of variables and various subsets of the organizations, it has been sufficient for the present case to demonstrate that at the most general level (i.e. within the whole sample and including the most significant structural variables), the hypothesis of high interdependence between complexity and control. Further analysis might also explore the causal relationships between the canonical variates constructed from variables representative of those two dimensions of structuring and the context in which they are distributed. A working hypothesis here, which might also be used to test the validity of the theory of regulation, might be that any contextual effects (e.g. size, technological uncertainty) on the control variate will be entirely mediated by the effects of complexity. However, given the very high relationship between the two variates this does not appear to be a very improbable outcome of any causal analysis(23).Further analysis of this kind is beyond the scope of the present exercise, however, which was to demonstrate that purely inductive testing of Bernstein's theory of codes according to 'surface' of manifest relationships between pairs of structural variables is entirely unsatisfactory and must be substituted by deductive models that are attentive to the patterns of interdependence at a 'deeper' or 'latent' level of structuring. It remains to be seen what implications this empirical demonstration may have for the theory of codes and for organizational analysis in general.

23 Preliminary analysis with the two main samples would appear to bear out this prediction. When each of the two canonical variates (denoted as 'control' and 'structure' respectively) were reconstituted (using 'raw' canonical weights), the regression of 'control' on to 'structure', organizational size (log. no. of employees) and technology ('workflow integration') revealed comparatively small or insignificant influence of the two latter (contextual) variables. The predictive equations for each sample are as follows (standardized regression coefficients given): (see Appendix 'E')

Aston Sample: $Y_i' = .967X_{1i} + .15X_{2i} + .048X_{3i}$
R^2 (adj) = .92

National Sample: $Y_i' = .847X_{1i} + .041X_{2i} - .036X_{3i}$
R^2 (adj) = .73

Where X_1, X_2 and X_3 are respectively the 'structure' variate, size and technology and Y' is the predicted score on the 'control' variate.
(For the definition and use of 'workflow integration' as a measure of technological uncertainty, see D.J. Hickson *et al.*, "Operations Technology and Structure", *Administrative Science Quarterly*, 14(3)(1969): 378-397; see also Appendix 'A'.

CHAPTER SEVEN

CONCLUSION

The problem of testing Bernstein's sociology of the school has led into a far wider range of issues than was originally anticipated by the earlier critique of King's empirical test of the theory of codes. Not only has the nature of the link between methodology and theory in Bernstein's terms been more deeply explored, but a considerable portion of the neo-Weberian model of organizational analysis has been brought into scrutiny as well. In addition the connection with which each of these approaches to school organization have with the informational theory of regulation and concepts such as 'requisite variety' and 'requisite hierarchy' has provided an even richer theoretical overlay while at the same time offering a source of precision which has facilitated the transition towards an appropriate statistical test. The very breadth of this range of issues raised by Bernstein's sociology of organization (whether of schools or work organizations) indicates the complexity of the theoretical framework he has developed. The unravelling necessary to arrive at an appropriate method of testing his theory holds up some exciting possibilities therefore for the development of a synthetic theory of organization that incorporates elements of neo-Durkheimian thinking, systems and information theory as well as contingency and neo-Weberian approaches. What is more important, the test carried out here employs statistical procedures which are far more consonant with fundamental principles of organization than those conventionally used.

In brief, the study has indicated that a score of an individual organization on a structural variable is embedded in a field or relationships which needs to be taken into account before either that score (or a covariate of that score) is to be interpreted. To say that 'this organization is highly centralized' implies a whole field of items by which a score is constituted, and this implies in turn a network of correlations among items within a given population (i.e.a scale based on a sample of items from a conceptual 'universe' of possible items). This 'field' has two important properties for organizational study - it affects or includes the degree of interrelationships within the items of the particular scale and also limits the kinds of correlations that are likely or possible between two scales or structural variables themselves. As an example of this latter property, it may be recalled that centralization and standardization tend to be positively correlated when the internal consistency of the former is high (as observed in the study of educational organizations by Holdaway *et al.* (1), while in the original Aston study, where this scale had very low reliability, it appeared to constitute a relatively high independent factor. Systematic tendencies such as this associated with the centralization measure in particular appear to indicate that empirical correlations observed between measures of structure are affected by other influences which need to be explained at a 'deeper' level of analysis. The method chosen by King to test Bernstein's theory of codes, us-

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1 E.A. Holdaway *et al.*, "Dimensions of Organizations in Complex Societies: The Educational Sector", in D.S. Pugh and C.R. Hinings(eds.),*Organizational Structure: Extensions and Replications, The Aston Programme II*(Farnborough: Saxon House, 1976).

ing indices based on Aston-type measure, seemed to be particularly inappropriate but at the same time instructive in that it pointed to the complexities involved in any multivariate study of organizational structure.

The problem therefore seemed to be one of observing these systematic tendencies so that one might be able to judge whether a correlation coefficient of such a sign and such a strength is consistent with a theoretical expectation. Such an attempt carries with it the possibility of tautology, of course, since these tendencies or principles of association may be so pervasive that any single correlation (or lack of one) might be used as a demonstration of a 'code' and the theory would then be empirically unfalsifiable. The escape from this impasse is provided by the way that the coding theory has been formulated - as a set of integrative principles which refer to empirically-observable objects associated in different ways under the categories of 'classification and framing'. Systematic tendencies should therefore show themselves as *patterns* of relationships observed across the range of the coding categories. While single correlations are not sufficient to test this theory, a knowledge of the context (or the field) of relationships from which they are drawn may provide some degree of 'match' between observation and expectation.

It has been suggested that multivariate methods provide a better access to a coding principle than that offered by conventional univariate methods, even when the latter have incorporated some correction for attenuation caused by measurement error. These multivariate methods allow one to observe a 'deeper' relationship between two blocks of variables that might be designated as measures of 'classifications' and 'frames' respectively. In the test carried out above, the former was considered to be indicated by an organization's scores on the division of labour, the standardization and documentation of activities, while the latter category (i.e. strength of 'framing') was indicated by the level of hierarchical control or centralization of authority. To the extent that any code is a unitary principle, binding variables within these categories, then it should be possible to demonstrate an empirical relationship between variates (i.e. linear compounds) constructed from constituent subscales of each kind of variable. This did in fact appear to be the case, not only with the two large heterogeneous samples (i.e. the Aston and the National studies), but also with a more homogeneous sample of local government authorities. Not only were the correlations between the weighted compounds of these two types of variable significant, but they yielded (in the case of the Aston and National samples) three or four times the level of 'variance explained' in the dependent variate (i.e. the centralization subscales) than that observed when the same data was treated by conventional univariate regression. These linear compounds, like factors, can incorporate negative as well as positive 'loadings' and were therefore not expected to show the same degree of rigid directionality (i.e. vector properties) as composite scales such as 'overall standardization' or 'overall centralization'. They have the added advantage therefore of faithfully reflecting the complexity of relationships within the organizational set.

There are a number of implications of this finding, the most important being that there appears to be a very strong factor or principle in organizational structuring which overrides and subsumes the complexity and/or the lack of consistency found within an individual structural variable. The absence of strong intercorrelations within the items of a measure, or the relatively weak association it may have with other variables, are therefore not seen to be adequate grounds for rejecting the hypothesis that there may be a very definite pattern of interdependence observable,

should more appropriate methods be employed. By using the standard canonical weights for each variable printed out for a statistical procedure it is possible to arrive at the linear discriminant function that maximizes the loadings of each variable on this single or unitary principle (whether it be based on one or several significant canonical relations) - namely that which binds 'classifications' to 'frames'. Such a reconstructed variable may prove to be of considerable value in reconciling many of the inconsistencies noted by reviewers such as Walton or James and Jones in over twenty investigations into the empirical relationships between structural variables(2). Whereas Walton attributes inconsistencies to the lack of representativeness of the various measures which sample 'a concept's property space'(3), the present analysis suggests that a more fruitful source of reconciliation might lie within the properties of 'field' of relationships just described, since some concepts may be more difficult to 'sample' than others by virtue of their lack of complexity and that this in turn will affect their pattern of intercorrelation(4). The aim of the present theoretical schema, derived from the model of regulation, has been to set out the underlying patterns by which 'complexity' itself may be anticipated and interpreted.

In order to pursue the implications of this insight still further, let us now summarise in turn what it may hold for (i) the measurement of Bernstein's categories of coding (ii) the sociology of organizations in general and (iii) the sociology of the school.

(i) The Measurement of Bernstein's Categories of Coding

As we have seen, Bernstein's theory of codes provides a deductive moel by which one can tap the 'deeper' levels of structuring between two sets of variables - those concerned with the insulations between roles, objects and sets of activities ('frames'). However, because it is a deductive model, derived from Durkheim's theory of the division of labour, any notion of 'testing' is to some extent a distortion. A more appropriate term might be 'demonstration', since just as the cybernetic theory of regulation resides in a formal mathematical model based on information theory, so the coding typology exists neither as an 'ideal type' in the Weberian sense, nor as a set of inferred or inductively-derived set of categories (indeed the lack of empirial reference has been a major source of criticism.) The theory of codes can therefore be shown to have value only in so far as it leads to a set of hypothetico -deductive propositions which explain

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2 Eric J. Walton, "Formal Structure: A Review of the Empirical Relationships between Task Differentiation, Role Prescription and Authority Dispersion", *Organization Studies*, (1980)(1:3): 229-252. Walton goes so far as to question the utility of the very concept of formal structureas a series of dimensions, because of the inconsistencies noted. A similar conclusion is reached by L.R. James and A.P. Jones, "Organizational Structure: A Review of Structural Dimensions and their Conceptual Relationships with Individual Attitudes and Behaviour", *Organizational Behaviour and Human Performance*, 16(1976): 74-113.

3 Walton, *Ibid.*, p. 249.

4 It is a common empirical observation in psychometrics that more complex scales correlate more highly with one another. See C.L. Hull, *Aptitude Testing*, (New York: World Book Co., 1928), Chapter 6; and G.H. Thompson,

the relationships between empirical observations. While its internally consistent or law-like properties are perhaps not in dispute, the sociological value of the theory of codes may be questioned if its only function was to produce tautological propositions(5). The purpose of the present analysis was therefore two-fold: to explicate the theory in an operational and more accessible form and to demonstrate its power to reveal previously unobserved patterns of relationships observed in previous organizational research.

In the process of devising an appropriate test it has been shown that concepts of 'classification and framing' are BOTH involved with the scaling of attributes, whether they belong to 'structuring' or 'control' categories. This is to be seen as a logical development of the theory of codes, in that it provides and extra (or third) dimension to the original principles and a greater degree of methodological precision which is still compatible with the basic polarities of the four-fold typology of the internal structure of a system (as illustrated in Bernstein's typology of the four lavatories). At the one extreme one might propose an organizational sample which exhibits scale values on the 'structuring' variables which are extremely low, but whose centralization scale values are high. At the other extreme there are those organizations which typically show the opposite pattern of item intercorrelation and internal consistency. It is the latter type therefore which appears to be the more characteristic of modern multi-divisional organizations.

If one is searching for evidence that regulation at a higher level of 'organic solidarity' is achieved by a transfer from hierarchical towards technical forms then such a finding is not only relevant to the neo-Durkheimian case but it also appears to have implications for neo-Marxist interpretations of control in organizations. Durkheim saw the need for the moral regulation of industry in complex societies in order to combat the demoralized or 'anomic' condition characteristic of the transition between the earlier forms of hierarchical authority and the anticipated new order of moral individualism. This was to take place at two levels, that of the economy as a whole and that of the occupational system(6). The breakdown in hierarchical, simple forms of control is also central to the case of some neo-Marxist analyses of the capitalist enterprise, such as that of Edwards who sees the transition towards more impersonal forms as an aspect of the fragmentation of the workforce under monopoly capitalism(7). The Durkheimian approach would appear to have greater explanatory power, nevertheless, since it is concerned with the entire interplay between hier-

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The Factorial Analysis of Human Ability, (5th Edition)(Boston: Houghton Mifflin, 1951).

5 May Brodbeck,"Logic and Scientific Method in Research in Teaching", in N.L. Gage(ed.), *Handbook of Research on Teaching* (Chicago: Rand McNally, 1963), Chapter 2.

6 Emile Durkheim, *The Division of Labour in Society* (New York: The Free Press, 1964), pp. 396-409.

7 Richard Edwards, *Contested Terrain: The Transformation of the Workplace in the Twentieth Century* (London: Heinemann, 1979). Edwards presents an evolutionary typology of the forms of control - simple , technical and bureaucratic.

archy and specialization, between symbol and structure. While the neo-Marxist case does have some support in the superficial relationships of the 'compensatory hypothesis', it has little to say about the fields of interdependence within and between indices that are suggested by the theory of codes. In short, it lacks an all-embracing theory of the interrelationships between the categories dependent on power (i.e. 'classifications') and those that reflect the principles of control (i.e.'frames').

In conclusion to this section, therefore, the present anlaysis appears to confirm the hypothesis drawn from Bernstein's theory that there is an integrative principle in organizational structure. Because this principle is self-referencing - that is to say, it does not depend on an externally-imposed constraint in order to identify and sustain it, it would appear that this analysis has also vindicated the detachment of Bernstein's mature theory from its earlier functionalist roots. It also points to the need to distinguish between the 'framing' of objects that are located in the technical core and those in the control apparatus, since these appear to be governed by contradictory patterns of regulation (i.e. variety and hierarchy). This application of cybernetic principles to the coding theory has some apparent bearing on the 'paradox' of control set out earlier and might suggest how mechanical forms of solidarity can contain within them an element of openness while at the ideological level organic forms may exhibit (albeit 'covertly') patterns of closure more characteristic of the earlier type.

(ii) The Sociology of Organizations

Because the theory of codes was developed with educational institutions in mind, it is difficult to discuss its implications at the general level alone. However, there is the general phenomenon of 'loose coupling' which, as Aldrich argues, enables organizations to react with a degree of autonomy to the local environment and which operates with some tension in concert with the other general evolutionary principle, that of hierarchy. (8). The present analysis would indicate that as this version of organizational theory as formulated by Aldrich to be rather superficial, since it does not solve the fundamental problem of discovering the rules by which the identities of subunits (roles, departments) are constituted. Autarchic identities characteristic of primitive forms of 'mechanical' solidarity are indistinguishable from the more evolved forms through which 'looseness' emerges by dint of the autonomy won within a hierarchical system. By ignoring the internal processes of communication by which complexity and autonomy are achieved, the theory of 'loose coupling' appears to be guilty of the elision of functions with classifications, and of coordinative contingencies with internal hierarchies and regulative meanings. It is therefore as restricted as the Weberian theory - which it has pretensions of replacing - in its confusion of the problems of purposive or technical rationality with those of communication or normative development.

Bernstein's coding theory therefore shares a good deal in common

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8 Howard E. Aldrich, *Organizations and Environments*, (New York: Prentice-Hall, 1979), p. 80.

with the interpretative schema of Habermas(9). Bernstein proposes a model of communication which has the same design as that attributed to Habermas by McCarthy - to show that "the structural descriptions of the different stages of development can be ordered in a developmental logic, that is, in hierarchical sequence of increasingly complex and encompassing forms of rationality"(10). Although the theory of codes does not set out to establish a reconstruction of historical materialism as does that of Habermas, it does put forward a model of communicative and normative structures of institutions which is similar in its emphasis on rational action. Although such a view is not necessarily incompatible with the externally-oriented formulations of structural-functional theory in itself, since both depend on some notion of 'system' as a set of relationships between objects, it does however take a radically different orientation to institutional structures, by attempting to describe their non-adaptive and symbolic processes.

The present analysis as set out above illustrates the method of observing the internal logic of organizational development at the most general level, namely that of the code. Instead of, say, merely counting the number of distinct specialisms as given by a score based on official categories, or of taking some index from a centralization scale, the technique provides a way of estimating the contribution which such indices make to an unobserved variate and gives exact weights for reconstituting the variable in a manner that is closer to the deeper relationship between structuring and control. The empirical 'test' has shown that because the relationship can be shown to be very strong in empirical samples of organizations, it might be concluded that some better approximations of this deeper principle can be made. By implication, if such a relationship were not found to be statistically present, it might be possible to conclude that the sample does not represent any population of organizations within acceptable limits of probability. This deductive possibility in the use of the method, by comparing an empirical sample with a theoretical model, therefore offers any organizational researcher an important analytical tool. An inspection of the pattern of intercorrelation of subscales within each type of variable (e.g. thos of centralization with those of standardization) can give some idea as well, particularly with a homogeneous sample, of the degree of internal elaboration or development that is typical of the organization sampled.

(iii) The Sociology of the School

Apart from the intial implications that this approach has for the organizational study of the school, several other theoretical points

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9 Jurgen Habermas, *Communication and the Evolution of Society*, translated with an introduction by Thomas McCarthy, (London: Heinemann, 1976). The comparison between Bernstein's theory of socio-linguistic codes and a theory of distorted communication in the 'critical' tradition of the Frankfurt school has been pointed out by Claus Mueller, "On Distorted Communication", in H. Dreitzel(ed.), *Recent Sociology*,(London: 1970).

10 Thomas McCarthy, "Translator's Introduction" to *Communication and the Evolution of Society*, p. xxiii.

may be drawn. In the first instance, because of the similarity between the results of the diverse organizational sample results and those based on educational organizations using Aston schedules, it may be suggested that the method of testing Bernstein's theory as set out here could yield very similar results with a sample of schools(11). It follows too that the method might be applied to the structural measures of King's samples of school organization, particularly to the 'instrumental' variables which were based on the Aston schedule(12). Owing to the rather cryptic method used in reporting findings in this area (i.e. providing details of significant correlations based on already constituted scales), a full test of the theory of codes using the multivariate techniques set out above was not possible. There is every reason, nevertheless, in the light of the similarity between both the theoretical formulation and the methodologies employed in the area of school and of work organization to suppose that the results yielded for schools should also tend to confirm the hypotheses derived from Bernstein's theory.

At a theoretical level the implications of the above analysis are significant, notwithstanding the sparsity of appropriate empirical data on the school. First of all, it would appear to provide a defence of the theory of codes against some of its more severe critics, such as Pring who observed that Bernstein's theories are "simply new ways of stating empirical generalizations that are already fairly well known and expressible in ordinary English"(13). Such a criticism ignores the fact that common sense categories of analysis are limited by the surface features of the code and are not by themselves sufficient to provide access to its

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11 There are two obvious studies of relevance here, that of Heward, *(Bureaucracy and Innovation in Schools,* Unpublished Ph.D. Thesis, University of Birmingham, 1975) and the study by Holdaway *et al.*, "Dimensions of Organizations". Heward's study of twenty-five school organizations incorporated four subscales in the overall centralization measure, but did not report their individual correlations with one another or with the other structuring variables (see "Results", pp. 190-215). The data of Holdaway *et al.*, is accessible through the Aston Databank, but investigations carried out using multivariate techniques proved to be inconclusive owing to the fact that data on the full set of items was not provided. Several items on which the whole sample had the same score had to be rejected since their inclusion would not have permitted the inversion of their respective matrices. Preliminary analysis using SPSS-CANCORR with the Holdaway *et al.* sample did did however appear promising - two highly significant canonical correlations were yielded when seven items from the 'autonomy' scale were regressed on sixteen 'structuring' items (see Appendix). A simpler (i.e. 2x2) canonical correlation was also carried out, using the published correlations (Table 8.3, p. 124) between 'functional specialization' and 'formalization' on the one hand and 'centralization' and 'autonomy' on the other. Again this proved promising, but must be interpreted in the light of the tautological nature of the 'autonomy' scale once 'centralization' is included - a strong first canonical correlation of 0.6626 was found, (chisquare = 11.46, d.f. = 4, $p < 0.05$) (see Appendix 'G').

12 The author has been in correspondence with Dr. R. King of the School of Education, St. Luke's College, University of Exeter, with a view to obtaining access to the original data of his school surveys, unfortunately without success to date (letter to Dr. King, March 22, 1982).

13 R.A. Pring, "Bernstein's Classification and Framing of Knowledge", *Scottish*

deeper constituent principles. Such categories as are offered by common sense are also likely to be produced by coding effects since they are aspects of culture and are reflections of accepted modes of analysis and of the cognitive styles which support them. There is another danger, however, pointed out by other critics such as Gibson and Cherkaoui(14), that the categories proposed by Bernstein are too static to contain the flux of institutional change. Historical research and policy analysis do not resolve the theoretical problems of interpretation nevertheless. In this respect, Cherkaoui's preference for Durkheim's recently published history of educational thought in France(15) does not take into account the broad sociological perspective of this account, which might, in Bernstein's terms, be seen as the transformation of schooling according to the principles of 'collection', observed in its purest form perhaps in the individualized and competitive disciplines of the Jesuits. Historical research which lacks such a conceptual 'map' can commit egregious errors of interpretation, such as the recent attempts to see contemporary forms of deviancy in schools in terms of the traditional patterns of protest and rebellion of working-class youth dating from the early industrial age(16). Such interpretations completely ignore the distinction made by neo-Durkheimian theorists between 'traditional' and 'anomic' misbehaviour in schools and are consequently unable to account for important variations in the incidence and forms of deviance(17). In brief, no sociological interpretation can ignore the structural basis of its constitutive categories (e.g. of class, status or power), nor can historical analysis alone be substituted for the explanation of social change.

One of the more common abuses of Bernstein's theory of codes is to take one of its categories - more commonly that of 'frame' and to use it as a single index of organizational structure(18). This selective or partial use of the theory has several dangers, well illustrated in Ball's study of the transition to mixed ability in a large English comprehensive school. While this author appears to agree with the basic thrust of Pring's criticism, he nevertheless used the concept of 'frame' to describe the degree of teacher control over the selection and pacing of subject matter. On this basis he concludes that "there is no apparent shift in the educational knowledge code", mainly because of the persistence of the hierarchical organization after the innovation. The absence of detailed information on 'classifications' however, might lead one to question the validity

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Educational Studies, 7(2) (1975).

14 Rex Gibson, "Bernstein's Classification and Framing - a Critique",*Higher Education Review*, 9(1977): 23-46; Mohamed Cherkaoui, "Bernstein and Durkheim: Two Theories of Change in Educational Systems", *Harvard Educational Review*, 47(1977): 556-564.

15 Emile Durkheim, *The Evolution of Educational Thought*, (London: Routledge and Kegan Paul, 1977.

16 S. Humphries, *Rebels or Hooligans*, (London: Blackwell, 1981).

17 See J. Testanière, "Le Chahut Traditionnel et le Chahut Anomique", *Revue Francaise de Sociologie*, 8(1969): 17-33.

18 See for example Stephen J.Ball, *Beachside Comprehensive: A Case Study of Selective Schooling*, (London: Cambridge University Press, 1981), pp.197-198; B. Davies and R.G. Cave(eds.), *Mixed Ability in Secondary Schools*, (London: Ward Lock, 1977); U.P. Lundgren, *Frame Factors and Teaching Pro-*

of this conclusion, since in one important respect the organization of knowledge under mixed ability teaching normally implies some blurring of the boundaries between subject areas. One is therefore not entirely sure whether the persistence of social class influences on outcomes noted is wholly due to the survival of ascriptive practices or to the creative and transformative response of pupils to a less formal classroom in the manner outlined by Bernstein in the "Class and Pedagogies" paper. Without a more sensitive analysis of the processes of social and cultural reproduction it therefore is impossible to evaluate Ball's assertion as to the stability of the 'code'.

Possibilities for Future Research into the Theory of Codes

The above analysis suggests that future research into educational organizations might be directed into some fruitful channels by the concept of the 'code' as defined by Bernstein. The same might be said for the study of work organization in general, and also of the interfaces between school and work which has been outlined in the "Education and Production" paper. If Bernstein's 'structuralism' is to have any effect on the course of empirical research into the different aspects of the process of social reproduction, then it is necessary to be more specific as to how it might inform future developments. There appear to be three possible areas that can be readily identified; (a) the historical study of the structural origins of progressive education; (b) the analysis of changing modalities of control at the workplace and the implications that this may have for a theory of organization; (c) the study of the relationship between the outcomes of schooling and the organization of work - in market societies mediated through the process of 'screening' by educational qualifications. Let us examine each of these in turn.

(a)THE ORIGINS OF PROGRESSIVE SCHOOLING: Bernstein has explicitly placed the origins of progressive education in the "Class and Pedagogies" paper in the 'new' middle class, that fraction which is concerned with cultural reproduction rather than with the management and exploitation of physical property. As such, the 'invisible pedagogy' acts as an 'interruptor system' a variant of dominant class socialization which disadvantages the children of both the 'old' or propertied middle class and of the working class(19). This interpretation has been rejected, however, by Musgrove whose reading of the history of progressive education in England leads him to conclude that its roots lie within the traditional 'gentry' culture whose 'hegemony' has extended into all areas of socialization, from the ancient universities to the scouting movement. Musgrove asserts that Bernstein is 'quite wrong' to locate the origins of the progressive movement in the 'ideology of the new middle class' which was supposedly "first institutionalized in the private pre-schools, then private/public secondary schools, and finally in the state system, at the level of the infant school(20). The aim here

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cess: *A Contribution to Curriculum Theory on Teaching* (Stockholm: Almquist and Wiksell, 1972).

19 B. Bernstein, "Class and Pedagogies: Visible and Invisible", in *Class, Codes and Control*, Vol III, (London: Routledge and Kegan Paul, 1977) 2nd Ed., p.124.

however, is not to engage in this debate, but to indicate how it may be resolved within the general framework of the theory of codes.

Musgrove's argument with Bernstein (and with other social reproduction theorists such as Bourdieu) is based on his original and historically well-documented case that the aristocratic-gentry culture has proved to be extraordinarily resilient. It has been modified, in the face of a threat from bourgeois movements, not to be re-imposing a feudal sense of deference upon the lower classes, but rather by incorporating them within a leisure ethic which has valued manliness, practical skills and code of honour and fair play. Progressive education, in this context, Musgrove claims, needs to be explained not as a challenge to the cultural dominance of the propertied classes, but rather as its extension and transmutation. The independent progressive boarding schools of the early part of this century in Britain were to be seen not as a challenge to the gentry culture, but (like the counter culture which was to follow), merely its non-competitive alternative - "with the blood sports left out"(21). Musgrove claims that the aristocratic-gentry culture must be considered as still of enormous importance in any analysis of British educational practice. He cites Edward Shils' case to demonstrate that even after the fall of Empire this culture had a 'continuing influence' and even enjoyed an apparent resurgence in a post-second world war Oxford and Cambridge(22). While Musgrove does not extend his argument to include progressive primary education, which is the focus of Bernstein's paper, the implications for the theory of codes are nonetheless considerable(23). How might it come about that an apparently innovatory pedagogic form, which is a response to the 'anomie' generated by industrialism(24) be the direct product of a pre-industrial culture? How can 'openness' be generated by a culture whose overt practices have historically been those of closure?

The germs of a reconciliation of the dilemmas presented by Musgrove's case are perhaps to be found in the historically unique patterns of social control in England, which might be seen as gradualist and evolutionary. The main principle of institutional development has be consequence been largely through a modernization of traditional, hierarchical forms, rather than their ovethrow or replacement. The emphasis placed by the Victorian public schools on abstract principles of leadership, maniless, courage represents an attempt to build on and elaborate the existing cultural categories, rather than to replace them with bourgeois ideals of efficiency and self-sufficiency. It is notinconceivable, therefore, that

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20 F. Musgrove, *School and the Social Order*, (London: Wiley, 1979), p. 172.

21 *Ibid.*, p. 172.

22 Edward Shils, "The Intellectual in Great Britain", *Encounter*, 4(1955).

23 See however Musgrove's more sweeping claim that progressive schooling in general was 'another triumph for the gentry culture' in his review article, "Curriculum, Culture and Ideology", *Journal of Curriculum Studies*, 10(1978), (7): 105.

24 See Musgrove's study of the Counter-Culture,*Ecstacy and Holiness: Counter Culture and the Open Society*, (University of Indiana Press, 1974) for an extended analysis of this problem within a Durkheimian framework.

in certain historical circumstances, the cultural dominance of the ruling classes should become extended, not through the creation of an explicit and closed ideological system, but rather through the elaboration of practice. The anti-intellectualism of the English public schools as described by Musgrove is to be contrasted with their extensive internal reforms which institutionalized a particular moral ideal. The crucial difference between the utopian-progressivism which was a byproduct of this development and that which comes into being from the bourgeois reformers of Bernstein's 'invisible pedagogy' is in the role played by explicit theoretical or ideological systems. Whereas the 'new education' of the pre-school and infant school reformers was intimately related to the theories (of Piaget, Freud, Montessori, Dewey), it would appear that in the progressive secondary school movement theories were somehow incidental and secondary. Musgrove, for example, states that Freudian psychology arrived fortuitously and provided this strand of progressivism with a 'legitimating ideology'(25).

The apparent contradiction in the historical reading of the progressive movement in education may therefore be a result of the failure of the two accounts to distinguish between two distinct strains of institutional development. In the case of the private progressive boarding schools (Dartington, Bedales, Abbotsholme), it may be more profitable to trace their moral and intellectual inspiration to the gentry culture or a reaction to it as institutionalized in the Victorian public schools. In the state and private infant sector, however, the 'new middle class' might be seen as far more significant. The source of the confusion may be difficult to perceive, since at times the two strains coalesce, but the distinction is not impossible to draw in theoretical terms. Such a distinction may underlie the correctness of the use of the terms 'hegemony' and 'ideology' by the two authors, Musgrove and Bernstein respectively, to denote the differences between the modes of social control within each version of 'progressivism'(26). The contrast in the structural origins of progressivism has therefore interesting sociological implications which have yet to be drawn out and may even have been obscured by the current debate. It remains to be seen in future studies how these different modes of institutional elaboration have been both mutually supportive or perhaps contradictory and competitive, over the past century.

(b) CHANGING MODALITIES OF CONTROL: Just as the theory of codes may prove useful in the study of structure in schools, so it could yield an understanding of the changing modalities of control at the workplace. The recent upsurge in neo-Marxist perspectives on social and technical relations at work has led to a number of important insights into how the division of labour and the interdependence and control of tasks has evolved under

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25 Musgrove, *School and the Social Order,* p. 169.

26 As Williams has defined these terms, 'hegemony' denotes "the whole lived social process as practically organized by specific and dominant meanings and values", while 'ideology' is a "relatively formal and articulated system of meanings, values and beliefs". See Raymond Williams, *Marxism and Literature,* (Oxford: Oxford University Press, 1977), p.109.

different stages of capitalism(27). Broadly, adherents to these perspectives have sen the secular tendency of production to be towards the 'deskilling' of the workforce and the gradual erosion of worker discretion by a planning and managerial function. This tendency is by no means confined to manufacturing, but is rapidly being applied by the spread of new technologies to office and clerical functions as well(28). Epitomized by 'scientific management' or Taylorism, the triumph of this approach as seen by neo-Marxists is the increasing fragmentation of the workforce, the destruction of craft loyalties and, most important, the replacement of direct personal supervision by technical and ultimately bureaucratic modes of control. What is the relevance, however, of this neo-Marxist case to the theory of codes?

As developed with reference to the Aston studies, the theory of codes does have some close parallels with the neo-Marxist theory of control. First, the tendency of larger and more complex firms to replace centralization of decision-making by standardized and formalized practices (the 'compensatory' hypothesis) reflects this historic tendency at a 'surface' level. Secondly, at the 'deeper' level of the information embedded in the very measures of these variables there is a resonance with Bernstein's coding theory as well as with the cybernetic theory of regulation. This is indicated by the observation that introducing variety into one area of structure appears to have an opposing effect on another and has been seen to have paradoxical effects as, for example, when earlier modes of symbolic closure emerge under 'organic' patterns of solidarity. Thirdly, the parallel can be drawn still further if one applies Bernstein's insight that the 'structuring' variables that represent a trend to less personal modes of supervision may be taken as indicators of the strength of classifications, inherent in which is the distribution of power, while the centralization dimension ('framing') manifests the principle of control(29). Such a distinction is not however made by neo-Marxist theorists and has led to some serious theoretical distortions and rigidities in their approach to control in organizations.

The most serious distortion to arise from the neo-Marxist reading of organizational change is seen in the tendency to reduce the entire labour process to relations of exploitation and domination - in other words, to see all technical relations in terms of the political imperative of the capitalist system and to see the coordinative and managerial function in terms of hierarchical control and surveillance. The problems with such a reductionist approach are as great perhaps as those associated with

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27 Dan Clawson, *Bureaucracy and the Labor Process: The Transformation of U.S. Industry, 1860-1920,* (New York: Monthly Review Press, 1980); Harry Braverman, *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century,* (New York: Monthly Review Press, 1974); Richard C. Edwards, *Contested Terrain: The Transformation of the Workplace in the Twentieth Century,* (London: Heinemann, 1979).

28 Joan Greenbaum, "Division of Labor in the Computer Field", *Monthly Review,* 28(3)(1976): 40-55.

29 Bernstein, *Class, Codes and Control,* Vol.III, p.181.

the neo-classical and technical-functionalist theories of the firm(30). Both generate models of organization that tend to be empirically unfalsifiable and self-validating. This is because 'structure' in the conventional sense is explained away as a kind of epiphenomenon, a derivative either of the profit motive or of the drive towards technical efficiency. The boundaries between productivity (as constituted by bourgeois notions of value) and profitability (as determined by a cost-benefit function) are nevertheless themselves ideological. To engage in such a debate as to the determinance of structure is therefore to place oneself outside the conventional methodologies of hypothesis testing for the most part.

A more satisfactory approach perhaps, as suggested by the theory of codes, is to examine the ground of this discourse itself. How is it possible, for example, for traditional patterns of control and authority to be 'ideologized' and why does the elaboration and diffusion of technical expertise appear to generate political conflict outside of industrial labour relations(31)? From this perspective it may be possible to locate the issues generated both by neo-Marxist and technical-functionalist explanations of control within a pattern of evolution of organizational practice in which structural concerns are central rather than derivative. As a crude outline of an answer to this more fundamental question, one might suggest that ideological modes of control and the diffusion of political struggle are both important byproducts of a transformation of the legal-rational form of authority as defined by Weber and institutionalized in bureaucratic organization. Rather than being intrinsic to the capitalist mode of production or determined by technological changes, this pattern of authority might be considered to have its own inherent and autonomous rationality which tends to be either ignored by orthodox Marxists or confounded with purposive rationality by Weberian theorists themselves(32). The theory of codes as set out here and empirically explored would suggest that the emergent interest of theorists in power and ideology in the workplace itself reflects the structural evolution of organizations and the cultural practices which accompany these. This application of the theory of codes can perhaps also be made as we shall now see, to the reproduction of labour power, as well as to the social relationships of work.

(c) CREDENTIALS, IDEOLOGY AND CODES: The debate over the demand for credentials, the main mechanism through which the outputs of education articulate with the work process in capitalist societies, has often been falsely dichotomized in terms of an opposition between technical-functionalist and conflict models of educational stratification(33). In these versions

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30 J.R. Hicks, *Value and Capital*, (Oxford: Clarendon Press, 1946).

31 See for example the account of M. Crozier, *The Bureaucratic Phenomenon*, (Chicago: University of Chicago Press, 1964).

32 A similar case to that presented here is to be found in Boris Frankel, *Marxist Theories of the State: A Critique of Orthodoxy*, (Melbourne: Arena Publications, 1978).

33 Randall Collins, "Functional and Conflict Theories of Educational Stratification", *American Sociological Review*, 36(1971): 1002-1019.

the ever-growing demand for formally qualified labour power is seen either as a rational response of employers to the higher productivity or trainability denoted by possession of a credential or, on the other hand, as an outcome of the defensive strategies of social repetition of dominant groups. In neo-Marxist versions of the 'conflict' model credentials also have a legitimative function within the labour process itself, helping capitalist élites to divide the workforce and to sort people, via segmented labour markets into different hierarchical levels. These explanations of the demand for qualifications and the consequent inflation of their value (i.e. 'credentialism') are however very difficult to test empirically (34) and studies of the organizational basis of credentialism are hard to find(35). One might discern in the explanation of credentialism in each of these models (the technical-functionalist, the Weberian and the neo-Marxist) very similar reductionist tendencies to those found in approaches to power and control at the workplace. Each has its own contradictions. Why, for example, do employers hire educated labour but do not bother to examine the effects of their policies(36)? How can a Weberian claim that large bureaucracies are constituted by legal-rational forms of authority and yet at the same time that they ritually 'screen out' women, blacks and the under-educated(37)? Why do capitalist elites in the neo-Marxist version go to such lengths to attract and reward educated manpower and yet, inexorably, try to 'deskill' it?

The contribution of the theory of codes to these issues might be to produce more complex interpretations of the social meanings of educational qualifications. Is it not possible that the 'normative control emphasis' of large firms which Collins notes at the point of hiring may indicate an ideological predeliction that is not entirely arbitrary(38)? If one follows the logic of the theory of codes one would look for the roots of this ideology not, as Collins does, in the social struggle among ethnic groups over privileged positions nor in a naïve notion of technically generated demand, but rather in the strcutural transformations of the workplace which have produced at the same time a diffuse and fluid distribution of power and an abstract and sophisticated mode of control. The theory of codes could therefore provide a synthetic theory of social reproduction in capitalist societies since it seems to have a unique power to link the paratechnical and organizational meanings of qualifications with their

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34 Mary Jean Bowman, "Through Education to Earnings?", *Proceedings of the National Academy of Education*,3(1976): 221-292.

35 See, however, James N. Baron and William T. Bielby,"Bringing Firms Back In: Stratification, Segmentation and the Organization of Work", *American Sociological Review*, 45(1980): 737-765; also William Tyler, "Complexity and Control: The Organizational Background of Credentialism", *British Journal of Sociology of Education*, 3(1982): 161-172.

36 I. Berg, *Education and Jobs: The Great Training Robbery*, (Harmondworth: Penguin, 1970).

37 The Weberian contradiction between ideology and efficiency has been expressed in another form by Frank Parkin: "Dense children of the professional middle class, despite heavy investments of cultural capital, will continue to stumble on the intellectual assault course set up largely for their parents' own protection". *Marxism and Class Theory: A Bourgeois Critique*, (London: Tavistock, 1979), p. 61.

ideological contexts.

The central observation of the preceding section is that there is much to be gained from Bernstein's theory of codes as it is applied to the explanation of the conditions under which particular distributions of power and patterns of control are realized. Because of this orientation away from the reformist concerns of so much social theorizing Bernstein's work, as Atkinson points out, might be compared with that of Foucault whose project is similarly detached and analytical ("a discourse about discourses") (39). It is well also, Atkinson claims, well within the structuralist tradition derived from Saussure's theory of language in that it makes a fundamental distinction between the 'deep' and the 'surface' structures of social life. Bernstein's theories lead therefore neither to ethnographic accounts of social events nor to a generative theory of competence removed from structural constraints. Rather the theory of codes leads one to set out the rules or principles by which "different orders of meaning, of relevance and relation" are created(40) - that is to the 'deep' structures of performance which shape and regulate the bonds between symbol and role in ways that are often inaccessible by empiricist methodologies. This project has attempted to show how one might investigate these principles of structuring in one area of social life and has revealed the rich potential of this strand of the Durkheimian tradition for a sociology of organizations.

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38 Randall Collins, *The Credential Society: An Historical Sociology of Education and Stratification*, (New York: Academic Press, 1979), p. 43.

39 Paul Atkinson,"Bernstein's Structuralism", *Educational Analysis*, 3(1981): 85-95. Atkinson's comments are largely confined to the socio-linguistic theory but can easily be generalized.

40 Basil Bernstein, *Class, Codes and Control*, Vol.1, (London: Paladin, 1971), p. 167.

APPENDIX 'A'

VARIABLE LIST (AS SET UP BY AUTHOR FOR SPSS)

AND QUESTIONNAIRE SCHEDULE - ASTON FULL '0' SHOWING ITEMS ON SCALES OF

- FUNCTIONAL SPECIALIZATION (51.01)
- ROLE SPECIALIZATION WITHIN SPECIALIZED FUNCTIONS (51.02 - 51.17)
- OVERALL ROLE SPECIALIZATION (51.19)
- STANDARDIZATION (52.00)
- FORMALIZATION (53)
- CENTRALIZATION (54)
- WORKFLOW INTEGRATION (15.08)

Card 4, columns 56,57 66,67

FOR OFFICE USE ONLY (Scale 18.11, columns 56,57 .... 18.16, columns 66,67)

INTERDEPENDENCE

Memberships

18.11 - 18.16
050 - 055

The organization is scored according to whether it is or is not a member of the associations mentioned below.

If the organization is a member it is scored "1", if not, "0".

NOTE: This information is obtained from the associations mentioned (Consult full list of Associations in I.A.R.U.).

18.11	Any trade association	1	0
18.12	Any employers' federation	1	0
18.13	Any Chamber of Commerce or Trade	1	0
18.14	Any research association	1	0
18.15	Any management association	1	0
18.16	Any educational association	1	0

Score = _____

Card 5, columns 12,13

SPECIALIZATION

Functional Specialization

51.01
057

A function is specialised when at least one person performs that function and no other function, and when that person is not in the direct line command. No account is taken of either (a) the specialist's status, or (b) whether an organization has many specialists or only one. The information is contained in the scores to Scale Nos. 51.02 - 51.17 inclusive. For each activity for which there is a specialist (i.e., a score greater than "0" on the relevant scale) score "1", otherwise score "0".

Ring the appropriate score and enter total on line provided.

Scale No.	Item No.	ACTIVITIES TO:	Score
51.02	1	develop, legitimise and symbolise the organization's charter (public relations, advertising, etc.)	1 0
51.03	2	dispose of, distribute and service the output (sales and service, customer complaints, etc.)	1 0
51.04	3	carry outputs and resources from place to place (transport)	1 0
51.05	4	acquire and allocate human resources (employment, etc.)	1 0
51.06	5	develop and transform human resources (education and training)	1 0
51.07	6	maintain human resources and promote their identification with the organization (welfare, medical, safety, magazine, sports and social, etc.)	1 0
51.08	7	obtain and control materials and equipment (buying, material control, stores, stock control, etc.)	1 0
51.09	8	maintain and erect buildings and equipment (maintenance, works engineer, etc.)	1 0
51.10	9	record and control financial resources (accounts, costs, wages, etc.)	1 0
51.11	10	control the workflow (planning, progressing, etc.)	1 0
51.12	11	control the quality of materials, equipment, and outputs (inspection, testing, etc.)	1 0
51.13	12	assess and devise ways of producing the output (work study, O.R., rate-fixing, methods study, etc.)	1 0
51.14	13	devise new outputs, equipment, and processes	1 0
51.15	14	develop and operate administrative procedures (registry, filing, statistics, O & M)	1 0
51.16	15	deal with the legal and insurance requirements (legal, registrar, insurance, licensing, etc.)	1 0
51.17	16	acquire information on the operational field (market research)	1 0

Score =

Card 5, columns 14,15 for total score

Card 10, columns 12,13 for item 1 ....
columns 24,25 for item 7)

SPECIALIZATION

Role specialization within specialised functions 51.02
058

SPECIALISM No.1. - activities to develop, legitimise and symbolise the organization's charter

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1", otherwise score "0".

Circle the appropriate score, sum the item scores and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.1, as defined above, but which do not fit the seven items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to develop, legitimise and symbolise the organization's charter	1 0
2. specialised publicity	1 0
3. specialised public relations	1 0
4. specialised customer relations	1 0
5. specialised display	1 0
6. specialised publicity by product line	1 0
7. specialised overseas relations	1 0

Any other specialisms (please write in titles): leave unscored

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_____

_____

_____

Total score (maximum 7) = _____

_____

Card 5, columns 16,17 for total score

Card 10, columns 26,27 for item 1 ....
columns 36,37 for item 6

SPECIALIZATION

Role specialization within specialised functions 51.03 059

SPECIALISM No.2. - activities to dispose of, distribute and service the output.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1", otherwise score "0".

Circle the appropriate score, sum the item scores, and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.2, as defined above, but which do not fit the six items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to dispose of, distribute, and service the output, i.e., specialised sales or service	1 0
2. specialised pricing and order	1 0
3. specialised sales by customer or product	1 0
4. specialised sales records	1 0
5. specialised export sales	1 0
6. specialised service by customer or product	1 0

Any other specialisms (please write in titles): leave unscored

_____

_____

_____

_____

Total score (maximum 6) = _____

Card 5, columns 18,19 for total score

Card 10, columns 38,39 for item 1 .....
columns 52,53 for item 8

SPECIALIZATION

Role specialization within specialised functions 51.04
060

SPECIALISM No.3. - activities to carry outputs and resources from place to place.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1", otherwise score "0".

Circle the appropriate score, sum the item scores and enter total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.3., but which do not fit the eight items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to carry outputs and resources from place to place	1 0
2. specialised drivers	1 0
3. specialised despatch	1 0
4. specialised administration and planning	1 0
5. specialised drivers by vehicle or product	1 0
6. specialised despatch by product	1 0
7. specialised travel and excursions	1 0
8. specialised planning and administration by product	1 0

Any other specialisms (please write in titles): leave unscored

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_____

_____

_____

Total score (maximum 8) = _____

_____

Card 5, columns 20,21 for total score

Card 10, columns 54,55 for item 1 .....
columns 64,65 for item 6

SPECIALIZATION

Role specialization within specialised functions 51.05 061

SPECIALISM No. 4. - activities to acquire and allocate human resources.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1",otherwise score "0".

Circle the appropriate score, sum the item scores and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.4., but which do not fit the six items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to acquire and allocate human resources, i.e. specialised personnel for at least part of the organization	1 0
2. specialised personnel for the whole of the organization	1 0
3. specialised division by type of employee or process	1 0
4. specialised administration/records	1 0
5. specialised interviewers	1 0
6. specialised division by type of employee and process	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 6) = _____

_____

Card 5, columns 22,23 for total score

Card 10, columns 66,67 for item 1 ....
columns 78,79 for item 7

SPECIALIZATION

Role specialization within specialised functions 51.06 062

SPECIALISM No.5. - activities to develop and transform human resources.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1",otherwise score "0".

Circle the appropriate score, sum the item scores, and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.5, but which do not fit the seven items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to develop and transform human resources	1 0
2. specialised operative training	1 0
3. specialised apprentice training	1 0
4. specialised general education	1 0
5. specialised clerical training	1 0
6. specialised management training	1 0
7. specialised sales training	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 7) = _____

_____

Card 5, columns 24,25 for total score

Card 11, columns 12,13 for item 1 .....
columns 32,33 for item 11

SPECIALIZATION

Role specialization within specialised functions 51.07 063

SPECIALISM No.6. - activities to maintain human resources and promote their identification with the organization.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1",otherwise score "0".

Circle the appropriate score and sum the item scores, then enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.6., but which do not fit the eleven items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to maintain human resources and promote their identification with the organization	1 0
2. specialised security	1 0
3. specialised nurses	1 0
4. specialised canteens	1 0
5. specialised welfare	1 0
6. specialised safety	1 0
7. specialised fire	1 0
8. specialised sports and social	1 0
9. specialised other medical	1 0
10. specialised magazine	1 0
11. specialised suggestions	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 11) = _____

_____

Card 5, columns 26,27

Card 11, columns 34,35 for item 1 .....
columns 50,51 for item 9

SPECIALIZATION

Role specialization within specialised functions 51.08 064

SPECIALISM No.7. - activities to obtain and control materials and equipment.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1", otherwise score "0".

Circle the appropriate score, sum the item scores and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.7., but which do not fit the nine items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to obtain and control materials and equipment	1 0
2. specialised stores	1 0
3. specialised buying	1 0
4. specialised stores by product, material, or process	1 0
5. specialised stock control	1 0
6. specialised buyers by product or material	1 0
7. specialised stock control by product, material or process	1 0
8. specialised administration	1 0
9. specialised administration by material, etc.	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 9) = _____

Card 5, columns 28,29 for total score

Card 11, columns 52,53 for item 1 .....
columns 70,71 for item 10

SPECIALIZATION

Role specialization within specialised functions 51.09 065

SPECIALISM No. 8. - activities to maintain and erect buildings and equipment.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1", otherwise score "0".

Circle the appropriate score, sum the item scores and enter total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.8., but which do not fit the ten items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to maintain and erect buildings and equipment	1 0
2. specialised machine maintenance	1 0
3. specialised building maintenance	1 0
4. specialised electrical maintenance	1 0
5. specialised machine maintenance by process, etc.	1 0
6. specialised new works force	1 0
7. specialised surveyor or architect	1 0
8. specialised instrument maintenance	1 0
9. specialised research	1 0
10. specialised electrical maintenance by process, etc.	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 10) = _____

Card 5, columns 30,31 for total score

Card 11, columns 72,73 for item 1 ....
columns 78,79 for item 4 and
Card 12, columns 12,13 for item 5 ...
columns 26,27 for item 12

SPECIALIZATION

Role specialization within specialised functions 51.10 066

SPECIALISM No.9. - activities to record and control financial resources.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1",otherwise score "0".

Circle the appropriate score, sum the item scores and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.9, but do not fit the twelve items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to record and control financial resources	1 0
2. specialised costs	1 0
3. specialised wages	1 0
4. specialised ledgers	1 0
5. specialised cashier	1 0
6. specialised financial accounts	1 0
7. specialised costs by product, factory, etc.	1 0
8. specialised financial data processing	1 0
9. specialised salaries	1 0
10. specialised audit	1 0
11. specialised budgets	1 0
12. specialised cost follow up	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 12) = _____

Card 5, columns 32,33 for total score

Card 12, columns 28, 29 for item 1 .....
columns 38,39 for item 6

SPECIALIZATION

Role specialization within specialised functions 51.11
067

SPECIALISM No. 10. - activities to control the workflow.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1",otherwise score "0".

Circle the appropriate score, sum the item scores, and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.10., but which do not fit the six items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to control the workflow	1 0
2. specialised progress	1 0
3. specialised planning and scheduling	1 0
4. specialised progress by process or product	1 0
5. specialised scheduling by process or produot	1 0
6. specialised machine loading	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 6) = _____

_____

Card 5, columns 34,35 for total score

Card 12, columns 40,41 for item 1 ....
columns 54,55 for item 8

SPECIALIZATION

Role specialization within specialised functions 51.12
068

SPECIALISM No.11. - activities to control the quality of materials, equipment, and outputs.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1",otherwise score "0".

Circle the appropriate score, sum the item scores and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.11., but which do not fit the eight items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to control the quality of materials, equipment, and outputs	1 0
2. specialised product inspection	1 0
3. specialised product inspection by stages	1 0
4. specialised raw material control	1 0
5. specialised laboratory test of product	1 0
6. specialised division of raw material	1 0
7. specialised inspection standards	1 0
8. specialised policy and administration	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 8) = _____

_____

Card 5, columns 36,37 for total score

Card 12, columns 56,57 for item 1 ...
columns 70,71 for item 8

SPECIALIZATION

Role specialization within specialised functions 51.13 069

SPECIALISM No. 12. - activities to assess and devise ways of producing the output.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1",otherwise score "0".

Circle the appropriate score, sum item scores and enter total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No. 12., but which do not fit the eight items given, please add them to the list, but do not score them.

Item	Score
1. specialised activities to devise ways of producing the output, i.e., specialised work study	1 0
2. specialised work study by process	1 0
3. specialised methods	1 0
4. specialised policy and administration	1 0
5. specialised process planning	1 0
6. specialised production engineering	1 0
7. specialised layout	1 0
8. specialised draughtsmen	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 8) = _____

Card 5, columns 38, 39, for total score

Card 12, columns 72,73 for item 1 ....
columns 78,79 for item 4 and
Card 13, columns 12,13 for item 5 ....
columns 18,19 for item 8

SPECIALIZATION

Role specialization within specialist functions 51.14
070

SPECIALISM No. 13. - activities to devise new outputs, equipment and processes.

Examine the organization chart and the job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1",otherwise score "0"

Circle the appropriate score, sum the item scores and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.13., but which do not fit the eight items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to devise new outputs, equipment and processes	1 0
2. specialised new product research	1 0
3. specialised drawing office	1 0
4. specialised process and equipment research	1 0
5. specialised new product research by product	1 0
6. specialised division into mechanical and electrical	1 0
7. specialised pure research	1 0
8. specialised administration	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 8) = _____

_____

Card 5, columns 40,41 for total score

Card 13, columns 20,21 for item 1 ....
columns 30,31 for item 6

SPECIALIZATION

Role specialization within specialist functions 51.15
071

SPECIALISM No.14. - activities to develop and operate administrative procedures.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1",otherwise score "0".

Circle the appropriate score, sum the item scores and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.14., but which do not fit the six items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to develop and operate administrative procedures	1 0
2. specialised statistics clerks	1 0
3. specialised O & M	1 0
4. specialised division of statistics	1 0
5. specialised filing and post	1 0
6. specialised committees and policies	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 6) = _____

_____

Card 5, columns 42,43 for total score

Card 13, columns 32,33 for item 1 ...
columns 38,39 for item 4

SPECIALIZATION

Role specialization within specialised functions 51.16 072

SPECIALISM No.15. - activities to deal with legal and insurance requirements

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1", otherwise score "0".

Circle the appropriate score, sum the item scores, and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.15., but which do not fit the four items given, please add them to the list in the space provided, but do not score them.

Item	Score
1. specialised activities to deal with legal and insurance requirements	1 0
2. specialised share register	1 0
3. specialised legal section	1 0
4. specialised legal enquiries	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 4) = _____

_____

Card 5, columns 44,45 for total scores

Card 13, columns 40,41 for item 1 ....
columns 44,45 for item 3

SPECIALIZATION

Role specialization within specialised functions 51.17 073

SPECIALISM No.16. - activities to acquire information on the operational field.

Examine the organization chart and job information provided in the Interview Schedule.

For each activity for which there is a specialist score "1", otherwise score "0".

Circle the appropriate score, sum the item scores and enter the total on the line provided.

If you consider the organization contains job titles which properly belong to Specialism No.16, but which do not fit any of the three items given, please add them to the list in the space provided but do not score them.

Item	Score
1. specialised activities to acquire information on the operational field, i.e., market research	1 0
2. specialised market research by product	1 0
3. specialised economic analysis	1 0

Any other specialisms (please write in titles): leave unscored

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Total score (maximum 3) = _____

_____

Card 5, columns 48, 49, 50

SPECIALIZATION

Overall Role Specialization — 51.19 074

This scale is formed by the total scores on Scale Nos. 51.02 - 51.15, inclusive, plus the score for Scale No. 51.17.

For convenience at the data punching stage, please copy the scores from the relevant pages and enter in the space provided.

Scale No.	Specialism No.	Score
51.02	1	
51.03	2	
51.04	3	
51.05	4	
51.06	5	
51.07	6	
51.08	7	
51.09	8	
51.10	9	
51.11	10	
51.12	11	
51.13	12	
51.14	13	
51.15	14	
51.17	16	

Total score (maximum 109) =

Card 5, columns 51,52,53,54,55 for total score (Decimal point in column 54)

For card and column numbers of individual items, see righthand column at the side of each item below. The items are entered on cards 14,15,16

STANDARDIZATION

Overall Standardization (15 pages - P.1) 52.00 076

A procedure is defined as an event that has regularity of occurrence and is legitimated by the organization. Procedures are STANDARDISED when there are rules or definitions that purport to cover all circumstances and to apply invariably.

To facilitate comparison of this section with the Interview Schedule, the items have been grouped under specialism headings, but this does not imply that the scale is the sum of standardised procedures relating to specialisms.

For each of the items, circle the number representing the appropriate answer and enter this number against the item in the score column.

"Red Book" item numbers of Scale No. 52.00 are given first; Interview Schedule references are given (in brackets) at the end of each item.

"Red Book" item No.	Item No.	Items	Card 14 Columns
		Procedures connected with developing, legitimizing, and symbolising the organization's charter - SPECIALISM No.1.	
123-124	1.	TRADE MARKS; none = 0 irregular trade marks = 1 regular trade marks = 2 (21)	12,13
127-128	2.	PARTICIPATION IN DISPLAYS AND EXHIBITIONS: none = 0 irregular = 1 regular = 2 (21)	14,15
140-144	3.	CATALOGUE: none = 0 catalogue giving products = 1 catalogue giving products plus prices of standard products = 2 catalogue giving products plus prices and subject to regular review = 3 and giving the price of non-standard products = 4 and giving delivery times = 5 (24)	16,17
		Procedures connected with disposing of, distributing, and servicing the output - SPECIALISM No.2.	18,19
145-146	4.	SALES POLICY: only general aims = 0 some specific aims = 1 full sales policy = 2 (15)	

Total score to be carried forward

PLEASE NOTE: lettered items are not included in cumulative scores.

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Overall Standardization (continued - P.2) 52.00

"Red Book" item No.	Item No.	Items	~~XXXXXX~~ XXXXXX
		Procedures connected with carrying outputs and resources from place to place SPECIALISM No.3.	Card 16 Columns
(new)	(a)	Transport schedules, external: none = 0 some = 1 (65)	36,37
	(b)	Transport schedules, internal: none = 0 some = 1 (65)	38,39
	(c)	Procedures for booking transport for personnel: ad hoc = 0 procedures for certain bookings = 1 procedures for all bookings = 2 (65)	40,41
	(d)	Procedures for booking transport for goods and equipment: ad hoc = 0 procedures for some journeys = 1 procedures for all journeys = 2 (65)	42,43
	(e)	Procedures for payment of expenses for travelling to staff: no procedures exist = 0 procedures exist = 1 (65)	44,45

NOTE: Lettered items not to be included in cumulative scores.

Overall Standardization (continued - P.3) 52.00

Total score brought forward
Items 1. - 4. (from P.1)

"Red Book" item No.	Item No.	Items	XXXXXX XXXXXX
		Procedures connected with acquiring and allocating resources - SPECIALISM No.4.	Card 14 Columns
66	5.	STAFF ESTABLISHMENT: (i.e. fixed number of salaried staff posts) none = 0 staff establishment provided for = 1 (73)	20,21
67	6.	LABOUR BUDGETS: no provision = 0 labour budget provided = 1 (72)	22,23
105	7.	RECRUITMENT POLICY: no policy laid down = 0 policy exists = 1 (74)	24,25
92-93	8.	RECRUITMENT PROCEDURES: no standard procedure = 0 procedure for some jobs = 1 procedure for all jobs = 2 (74)	26,27
94-97	9.	SELECTION OF OPERATIVES: interview by superior = 0 plus interview by personnel officer = 1 grading system or interview board = 2 testing procedure = 3 outside appointer = 4 (75)	28,29
98-101	10.	SELECTION OF SUPERVISORS: interview by superior = 0 plus interview by personnel officer = 1 grading system or interview board = 2 testing procedure = 3 outside appointer = 4 (75)	30,31
102-104	11.	SELECTION OF EXECUTIVES: interview by superior = 0 plus interview by personnel officer = 1 grading system or selection board = 2 outside appointer = 3 (75)	32,33

cumulative total to be carried forward

Overall Standardization (continued - P.4) 52.00

cumulative total score brought forward

"Red Book" item No.	Item No.	Items	Card 14 Columns
		(Specialism No. 4. continued)	
106	12.	CENTRALISED RECRUITMENT PROCEDURE: not centralised = 0 centralised = 1 (74)	34,35
107	13.	CENTRALISED INTERVIEWING PROCEDURE: not centralised = 0 centralised = 1 (75)	36,37
108	14.	STANDARDISED PROCEDURE FOR GETTING INCREASES IN STAFF: no standardised procedure = 0 standardised procedure = 1 (73)	38,39
109	15.	STANDARDISED PROCEDURE FOR GETTING INCREASES IN WORKFLOW OPERATIVES: no standardised procedure = 0 standardised procedure exists = 1 (73)	40,41
		Procedures connected with developing and transforming human resources - <u>SPECIALISM No.5.</u>	42,43
110	16.	APPRENTICESHIP TRAINING: none = 0 some = 1 (81)	
111	17.	DAY RELEASE TRAINING: none = 0 some = 1 (81)	44,45
112	18.	OPERATOR TRAINING: none = 0 some = 1 (81)	46,47
113	19.	EVENING CLASSES: no encouragement given = 0 encouragement given = 1 encouragement plus financial help = 2 (81)	48,49
114	20.	COURSES FOR MANAGEMENT: no courses arranged or supported = 0 outside courses regularly supported = 0.5 courses arranged internally = 1 (81)	50,51, 52,53 (Dec. poir in col 52

cumulative total to be carried forward

Overall Standardization (continued - P.5) 52.00

cumulative total score brought forward

"Red Book" item No.	Item No.	Items	Card 14 Columns
		(Specialism No. 5. continued)	
115	21.	COURSES FOR SUPERVISION: no courses arranged or supported = 0 outside courses regularly supported = 0.5 courses arranged internally = 1 (81)	54,55, 56,57 (Dec poi in col 5
116	22.	MANAGEMENT TRAINEES: no management trainees = 0 one or more management trainees = 1 (81)	58,59
117	23.	GRADUATE APPRENTICES: no graduate apprentices = 0 one or more graduate apprentices = 1 (81)	60,61
118	24.	BLOCK RELEASE: no block release students = 0 one or more block release students = 1 (81)	62,63
131-133	25.	INDUCTION COURSES: none = 0 for a few employees = 1 for many employees = 2 for all employees = 3 (84)	64,65
		Procedures connected with maintaining human resources and promoting their identification with the organization - SPECIALISM No. 6.	
129-130	26.	CONFERENCE ATTENDANCE: none = 0 irregular = 1 regular = 2 (84)	66,67
64	27.	SALARY AND WAGE REVIEW: no provision for salary and wage review = 0 provision for salary and wage review = 1 (78)	68,69
65	28.	PERSONAL REPORTS BY SUPERIORS: no provision = 0 some provision = 1 (78)	70,71
151	29.	PERSONNEL REPORTS - SICKNESS ABSENCE: regular sickness absence reports not made = 0 regular sickness absence reports made = 1 (87)	72,73

cumulative total to be carried forward

Overall Standardization (continued - P.6) 52.00

cumulative total score brought forward

"Red Book" item No.	Item No.	Items	XXXXXX XXXXXX
		(Specialism No.6. continued)	Card 14
152	30.	PERSONNEL REPORTS - TIME-KEEPING: regular time-keeping reports not made = 0 regular time-keeping reports made = 1 (43)	74,75
153	31.	PERSONNEL REPORTS - TOTAL ABSENCE: regular reports not made on total absence = 0 regular reports are made on total absence = 1 (87)	76,77
154	32.	PERSONNEL REPORTS - LABOUR TURNOVER: regular reports not made on labour turnover = 0 regular reports are made on labour turnover = 1 (72)	78,79
155	33.	PERSONNEL REPORTS - ACCIDENTS: regular accident reports not made = 0 regular accident reports are made = 1 (87)	CARD 15 Columns 12,13
119-120	34.	HOUSE JOURNALS: none = 0 irregular = 1 regular = 2 (85)	14,15
125-126	35.	SPORTS AND SOCIAL ACTIVITIES: none = 0 irregular = 1 regular = 2 (85)	16,17
134-136	36.	HANDBOOKS, i.e. information booklets: none = 0 for a few employees = 1 for many employees = 2 for all employees = 3 (77)	18,19
137-139	37.	UNIFORMS: none = 0 for a few employees = 1 for many employees = 2 for all employees = 3 (87)	20,21
121-122	38.	CEREMONIES: none = 0 irregular = 1 regular = 2 (85)	22,23
61	39.	DISCIPLINE - SET OFFENCES: no specified set of offences = 0 specified set of offences = 1 (70)	24,25

cumulative total to be carried forward

Overall Standardization (continued - P.7)			52.00
		cumulative total score brought forward	

"Red Book" item No.	Item No.	Items	XXXXXXX XXXXXXX
		(Specialism No. 6. continued)	CARD 15
62	40.	DISCIPLINE - SET PENALTIES: not set penalties = 0 some set penalties = 1 (70)	Columns 26,27
63	41.	DISCIPLINE - DISMISSAL OF STAFF: no standardised procedure = 0 standardised procedure laid down = 1 (70)	28,29
157	42.	CENTRALISED DISCIPLINE PROCEDURE: no centralised procedure = 0 centralised procedure exists = 1 (70)	30,31
		Procedures connected with obtaining and controlling materials and equipment - SPECIALISM No. 7.	
14-19	43.	STOCK CONTROL - FREQUENCY: no stock-taking = 0 yearly stock-taking = 1 half-yearly stock-taking = 2 quarterly = 3 monthly = 4 weekly = 5 daily = 6 (34)	32,33
83-84	44.	ORDERING PROCEDURES: ad hoc = 0 by production plan = 1 by datum stocks = 2 (32)	34,35
85	45.	BUYER'S AUTHORITY ON WHAT TO BUY: not limited = 0 limited = 1 (34)	36,37
86	46.	BUYER'S AUTHORITY FROM WHOM TO BUY: not limited = 0 limited = 1 (34)	38,39
87	47.	BUYER'S AUTHORITY OVER HOW MUCH TO BUY: not limited = 0 limited = 1 (34)	40,41
88	48.	PROCEDURE FOR BUYING NON-STANDARD ITEMS: no procedure exists = 0 there is a procedure = 1 (32)	42,43
89	49.	PROCEDURE FOR NOTIFYING PURCHASES TO HEAD OFFICE, etc.: no procedure exists = 0 there is a procedure = 1 (32)	44,45

cumulative total to be carried forward

Overall Standardization (continued - P.7)			52.00

cumulative total score brought forward

"Red Book" item No.	Item No.	Items	XXXXXXX XXXXXXX
		(Specialism No. 6. continued)	CARD 15
62	40.	DISCIPLINE - SET PENALTIES: not set penalties = 0 some set penalties = 1 (70)	Columns 26,27
63	41.	DISCIPLINE - DISMISSAL OF STAFF: no standardised procedure = 0 standardised procedure laid down = 1 (70)	28,29
157	42.	CENTRALISED DISCIPLINE PROCEDURE: no centralised procedure = 0 centralised procedure exists = 1 (70)	30,31
		Procedures connected with obtaining and controlling materials and equipment - <u>SPECIALISM No. 7.</u>	
14-19	43.	STOCK CONTROL - FREQUENCY: no stock-taking = 0 yearly stock-taking = 1 half-yearly stock-taking = 2 quarterly = 3 monthly = 4 weekly = 5 daily = 6 (34)	32,33
83-84	44.	ORDERING PROCEDURES: ad hoc = 0 by production plan = 1 by datum stocks = 2 (32)	34,35
85	45.	BUYER'S AUTHORITY ON WHAT TO BUY: not limited = 0 limited = 1 (34)	36,37
86	46.	BUYER'S AUTHORITY FROM WHOM TO BUY: not limited = 0 limited = 1 (34)	38,39
87	47.	BUYER'S AUTHORITY OVER HOW MUCH TO BUY: not limited = 0 limited = 1 (34)	40,41
88	48.	PROCEDURE FOR BUYING NON-STANDARD ITEMS: no procedure exists = 0 there is a procedure = 1 (32)	42,43
89	49.	PROCEDURE FOR NOTIFYING PURCHASES TO HEAD OFFICE, etc.: no procedure exists = 0 there is a procedure = 1 (32)	44,45

cumulative total to be carried forward

Overall Standardization (continued - P.8) 52.00

cumulative total score brought forward

"Red Book" item No.	Item No.	Items	XXXXXXX XXXXXXX
		(Specialism No. 7. continued)	Card 15
90	50.	TENDERING PROCEDURE: no procedure exists = 0 there is a procedure = 1 (32)	Columns 46,47
91	51.	CONTRACTS PROCEDURE: no procedure exists = 0 there is a procedure = 1 (32)	48,49
		Procedures connected with maintaining or erecting buildings and equipment - SPECIALISM No. 8.	
32-35	52.	MAINTENANCE STANDARDISED PROCEDURES: no procedure = 0 breakdown procedure = 1 sometimes breakdown procedure and sometimes planned maintenance = 2 planned maintenance = 3 programmed replacements = 4 (61)	50,51
		Procedures connected with recording and controlling financial resources - SPECIALISM No. 9.	
36-39	53.	TYPE OF FINANCIAL CONTROL: whole unit historical = 0 job costing = 1 budgeting = 2 standard costs = 3 marginal costs = 4 (97)	52,53
40-43	54.	RANGE OF FINANCIAL CONTROL: whole unit = 0 one product = 1 some products = 2 all products = 3 all activities = 4 (97)	54,55
44-49	55.	COMPARISON WITH BUDGETS: none = 0 yearly = 1 half-yearly = 2 quarterly = 3 monthly = 4 weekly = 5 continually = 6 (97)	56,57

cumulative total to be carried forward

Overall Standardisation (continued - P.9) 52.00

cumulative total score brought forward

"Red Book" item No.	Item No.	Items	Card
		Procedures connected with controlling the workflow - SPECIALISM No. 10.	
20-25	56.	OPERATIONAL CONTROL - FIRM PLANS: firm plans exist for a day ahead = 0; a week ahead = 1; a month ahead = 2; a quarter ahead = 3; a year ahead = 4; over a year = 5; there are permanent plans = 6 (53)	58,59
26-29	57.	SCHEDULING: Scheduling is ad hoc = 0; monthly = 1; weekly = 2; daily = 3; continuous = 4 (53)	60,61
156	58.	OPERATIONS RESEARCH: none = 0; some = 1 (54)	62,63
30-31	59.	PROGRESS CHASING: no progress chasing = 0; irregular progress chasing = 1; regular progress chasing = 2 (53)	64,65
68-70	60.	COMMUNICATION - DECISION SEEKING: ad hoc decision seeking = 0; semi-standardised, i.e., routine followed in some circumstances = 1; standardised, i.e., routine followed in all circumstances = 2; project justification, i.e. cases are prepared before decisions are sought = 3 (41)	66,67 * see note below
71-72	61.	COMMUNICATION - DECISION CONVEYING: ad hoc = 0; semi-standardised, i.e. routine is followed in some circumstances = 1; standardised, i.e., routine is followed in all circumstances = 2 (41)	72,73

cumulative total to be carried forward

* Item 60: the score according to above is entered in columns 66,67 on card 15. Columns 68,69 and 70,71 have been allocated to scoring when following that used by Child in study code No.03 where this item has been split into two. Where only the one score, as set out above, is available, then columns 68,69 and 70,71 are entered as -1.

Overall Standardisation (continued - P.10) 52.00

cumulative total score brought forward

"Red Book" item No.	Item No.	Items	XXXXXX XXXXXX
		Procedures connected with controlling the quality of materials, equipment and outputs - SPECIALISM No.11.	Card 15 Columns
1-3	62.	FREQUENCY OF INSPECTION: none = 0 haphazard sampling = 1 random sample = 2 100%, i.e., continuous = 3 (48)	74,75
4-6	63.	RANGE OF INSPECTION: none = 0 some = 1 all new outputs = 2 all outputs = 3 (48)	76,77
7-9	64.	METHOD OF INSPECTION: none = 0 visual = 1 attributes, i.e. checking against a standard but not measuring = 2 measurement = 3 (49)	78,79
10-12	65.	TYPE OF INSPECTION: none = 0 either raw materials OR process OR final inspection = 1 process and final inspection = 2 raw materials AND process AND final inspection = 3 (48)	CARD 16 Columns 12,13
13	66.	SPECIAL INSPECTION PROCESS, e.g., statistical quality control: none = 0 some = 1 (50)	14,15
		Procedures connected with devising ways of producing the output - SPECIALISM No.12.	16,17
50-55	67.	DEFINITION OF OPERATIVE'S TASK: by custom = 0 apprenticeship or by profession = 1 manuals = 2 rate-fixing = 3 time study = 4 work study = 5 work study and task description = 6 (57)	

cumulative total to be carried forward

Overall Standardization (continued - P.12) 52.00

cumulative total score brought forward

"Red Book" item No.	Item No.	Items	
		(Specialism No. 13. continued)	Card 16
81	74.	OBTAINING IDEAS - PERIODICALS REPORTING: There is no standard procedure for reports to be made on the content of periodicals = 0 there is a procedure for reporting = 1 (44)	30,31
82	75.	OBTAINING IDEAS - SUGGESTION SCHEME: there is no suggestion scheme = 0 there is a suggestion scheme = 1 (43)	32,33

For SPECIALISMS No. 14 and No. 15 see next page (for office use only). The scores for these new lettered items are not to be included in the cumulative score.

		Procedures connected with acquiring information on the operational field - <u>SPECIALISM No. 16.</u>	
147-150	76.	MARKET RESEARCH: ordinary contacts with existing customers only = 0 circularises existing customers = 1 circularises existing and potential customers = 2 uses systematic market research or market intelligence = 3 uses market research involving highly specific assessment of existing and potential customers = 4 (19)	34,35

TOTAL SCORE ON ALL NUMBERED ITEMS =

FOR OFFICE USE ONLY

Overall Standardization (continued - P.13) 52.00

"Red Book" item no.	Item No.	Items	XXXXX XXXXX
		Procedures connected with developing and operating administrative and non-financial records - SPECIALISM No.14.	Card 16 Columns
(new)	(f)	STANDARDISED NOMENCLATURE FOR COMPARABILITY OF JOB POSITIONS: no standardised nomenclature for job titles = 0; some job titles standardised = 1; most job titles standardised = 2 (102)	*see note below 46,47
	(g)	STANDARDISED PROCEDURE FOR ALTERING THE NUMBER OR LAYOUT OF DOCUMENTS USED BY THE ORGANIZATION: ad hoc = 0; procedures affecting some documents = 1; procedures affecting all documents = 2 (102)	48,49
	(h)	PROCEDURES FOR THE ROUTING OF FILES: no centrally operated procedure for routing files = 0; centralised procedure for routing files = 1 (102)	50,51
	(i)	PROCEDURES FOR DATA COLLECTION FOR STATISTICAL RETURNS ON ASPECTS OF THE ORGANIZATION'S RESOURCES OR OPERATIONS: Procedure for the collection of financial data only = 0; ad hoc collection of non-financial data = 1; routine collection of non-financial data = 2 (102)	52,53
		Procedures connected with legal and insurance requirements - SPECIALISM No. 15.	
(new)	(j)	PROCEDURES FOR REVIEWING INSURANCE COVER: no standard procedure = 0; standard procedure for regular review = 1 (104)	54,55
	(k)	PROCEDURE FOR REVIEW OF THE ORGANIZATION'S LEGAL LIABILITIES (both statutory and at common law): no standard procedure = 0; standard procedure for regular review = 1 (104)	56,57
	(l)	PROCEDURE FOR INITIATING LEGAL ACTION (other than collective bargaining machinery): ad hoc = 0; standard procedure = 1 (104)	58,59

* For Card 16, columns 36,37 (item a) to 44,45 (item e) see page 2 of Overall standardization, Scale 52.00

FOR OFFICE USE ONLY

Overall Standardization (continued - P.14) 52.00

"Red Book" item no.	Item No.	Items	Card 16 Columns
(new)		Additional procedure connected with developing, legitimising, and symbolising the organization's charter. SPECIALISM No.1.	
	(m)	COMPANY NEWS AND/OR REPORTS ADVERTISED IN THE PRESS OR JOURNALS: never = 0 occasionally = 1 regularly = 2 (21)	60,61
		Additional procedures connected with disposing of, distributing and servicing the output. SPECIALISM No.2.	
	(n)	PROCEDURES FOR PREPARING WRITTEN QUOTATIONS: Written quotations are never prepared = 0 Written quotations are prepared for some products or customers only = 1 Written quotations are prepared in all cases = 2 (26)	62,63
	(o)	PROCEDURES FOR HANDLING CUSTOMER ORDERS: orders are dealt with in a variety of ways = 0 there is one set procedure for all incoming orders = 1 (26)	64,65
	(p)	PROCEDURES FOR AFTER SALES SERVICE - Catalogue listing services and/or the spare parts obtainable: none = 0 catalogue giving services and/or parts = 1 catalogue giving services and/or parts and standard charges or prices = 2 catalogue giving services and/or parts and standard charges or prices and subject to regular review = 3 catalogue giving services and/or parts and non-standard charges or prices = 4 and giving delivery times of spare parts = 5 (24)	66.67

FOR OFFICE USE ONLY

Overall Standardization (continued - P.15) 52.00

"Red Book" item no.	Item No.	Items	XXXXXX
(new)	(q)	Procedures connected with recording and controlling financial resources - SPECIALISM No.9. PROCEDURES FOR CONTROLLING THE LEVEL OF CREDIT OFFERED TO THE ORGANIZATION: none = 0 measures are taken from time to time = 1 there are regular procedures = 2 (97)	68,69
	(r)	Procedures connected with legal and insurance requirements - SPECIALISM No.15. PROCEDURE FOR INITIATING/NEGOTIATING LICENSE AGREEMENTS: ad hoc = 0 standard procedure exists = 1 (104)	70,71
	(s)	Procedures connected with acquiring information on the operational field - SPECIALISM No.16. PROCEDURES FOR SALES FORECASTING: no forecasts are made = 0 sales are forecast for up to and including: 1 month ahead = 1 3 months ahead = 2 1 year ahead = 3 2 years ahead = 4 for longer than two years ahead = 5 (19)	72,73
	(t)	Procedures connected with disposing of, distributing and servicing the output. PRICING PROCEDURES: each job individually priced - no standard price = 0 standard price list but some variations allowed = 1 standard prices for all main products, no variations allowed = 2 (26)	74,75

Card 5, columns 56,57 for total score

For card and column numbers of individual items, see righthand column at side of each item below. The items are entered on cards 17 and 18

FORMALIZATION

Overall Formalization (Five pages - P.1) 53.00
079

This scale is formed by a count of the number of documents available in an organization. No assumption is made as to the usage of documents. A DOCUMENT is at minimum a single piece of paper. Several copies of the same piece of paper may each score as separate documents if used for separate purposes (e.g., organization "A" may score 3 for unrelated pieces of paper, while organization "B" may score 3 for a docket of carbon copies each of which is detached for a particular purpose). The problem of a single piece of paper serving separate purposes has not arisen.

For each of the items, circle the number representing the appropriate score and enter this number against the item in the score column.

The items in Scale No.53.00 have been re-arranged under the headings: Role definition and identification; role activation; and role performance records. "Red Book" Scale and Item numbers are shown for comparison. Interview Schedule references are given at the end of each item.

"Red Book" Scale and Item numbers	New Item numbers	Description	XXXXXXX XXXXXXX
		ROLE DEFINITION AND IDENTIFICATION	
53.00 1 53.01	1	THIS ITEM IS FOR OFFICE USE ~~Written contracts of employment which contain more information than legal minimum:~~ for staff grades only = 0 for all employees = 1 (70)	OMITTED
53.00 3,4,5 53.01	2	Information booklets given to: none = 0 few employees = 1 many = 2 all = 3 (77)	Card 17 Columns 12,13
53.00 6-10 53.01	3	Number of information booklets: none = 0 one = 1 two = 2 three = 3 four to seven = 4 eight or more = 5 (77)	14,15
53.00 11-14 53.01	4	Organization chart given to: none = 0 Chief Executive = 1 C.E. plus one other executive = 2 C.E. plus most/all department heads = 3 C.E. plus middle management or supervision = 4 (5)	16,17
53.00 15 53.01	5	Written operating instructions: not available to direct worker = 0 available to direct worker = 1 (57)	18,19

Total score to be carried forward (excluding item 1.) _____

Overall Formalization (continued - P.2) 53.00

Score total brought forward

"Red Book" Scale and Item numbers	New Item numbers	Description	~~XXXXX~~
53.00 16 53.01	6	Written terms of reference/job descriptions for direct workers: not provided = 0 provided = 1 (9)	Card 17 Columns 20,21
53.00 17 53.01	7	Written terms of reference/job descriptions for line superordinates: not provided = 0 provided = 1 (9)	22,23
53.00 19 53.01	8	Written terms of reference/job descriptions for staff (other than line superordinates): not provided = 0 provided = 1 (9)	24,25
53.00 18 53.01	9	Written terms of reference/job descriptions for Chief Executive: not provided = 0 provided = 1 (9)	26,27
53.00 20 53.01	10	Manual of procedures: none = 0 there is a manual = 1 (44)	28,29
53.00 21 53.01	11	Written policies (excluding minutes of governing bodies): none = 0 there are written policies = 1 (9)	30,31
53.00 38 53.02	12	Welfare documents (eg about pensions, sick pay, recreation facilities) for direct workers on engagement: not provided = 0 provided = 1 (77)	32,33
53.00 40 53.02	13	House journal: none = 0 one or more = 1 (85)	34,35
53.00 54 only	14	Written grievance and negotiation procedures: none = 0 written procedures exist = 1 (70)	36,37
53.00 55 only	15	Written history of the organization: none = 0 there is a written history = 1 (1)	38,39
		ROLE ACTIVATION	
53.00 22 53.01	16	Appeal form against dismissal: none = 0 there is a form = 1 (71)	40,41
53.00 23 53.01	17	Workflow ("production") schedule or programme: none = 0 there are schedules = 1 (53)	42,43

cumulative total score to be carried forward

cumulative score total brought forward

"Red Book" Scale and Item numbers	New Item numbers	Description	xxxxxx xxxxxx
53.00 24 53.01	18	Written research programmes or reports: none = 0 there are programmes and/or reports = 1 (45)	Card 17 Columns 44,45 *** (see note below)
53.00 25-27 53.02	19	Management approval required in writing: not at all = 0 some financial matters = 1 some financial matters plus any personnel = 2 some financial matters plus any personnel plus any workflow = 3 (42)	50,51
53.00 28 53.02	20	Suggestion scheme: none = 0 there is a suggestion scheme = 1 (43)	52,53
53.00 29 53.02 30	21	Memo forms: none = 0 general heading = 1 sub-unit heading = 2 (42)	54,55
53.00 53.03 46	22	Document stating work done or yet to be done on unit of output (batch dockets, route tickets, etc.): none = 0 documents exist = 1 (54)	56,57
53.00 48 53.03	23	Written application for spending £1,000: no document = 0 documents exist = 1 (98)	58,59
53.00 49 53.03	24	Requisition for engagement of direct worker: none = 0 there is a requisition form = 1 (73)	60,61
53.00 50 53.03	25	Application form for job as direct worker: none = 0 there is a form = 1 (77)	62,63

*** Item 18: when scored as above, the score is entered in columns 44,45. Columns 46,47 and 48,49 have been allocated to scoring when following that used by Child (study code No.03) where scores have been separated for programmes and reports (so that scores here, for programmes go into cols 46,47 and for reports into cols.48,49)

cumulative total score to be carried forward

THE FOLLOWING ITEMS ARE FOR OFFICE USE ONLY

		Card 18 Columns
(a)	Expenses claim form: none = 0 one or more = 1 (98)	24,25
(b)	Form asking for references: none = 0 one = 1 (77)	26,27
(c)	Form asking for quotations for supplies of materials,et none = 0 one or more = 1 (33)	28,29
(d)	Form ordering supplies of materials, etc.: none = 0 one or more = 1 (33)	30,31
(e)	List of enquiries: none = 0 one or more = 1 (19)	32,33

NOTE: Lettered items not to be included in cumulative scores.

Cumulative score total brought forward

"Red Book" Scale and Item numbers	New Item numbers	Description	XXXXXX XXXXXX
		ROLE PERFORMANCE RECORDS	Card 17
53.00 31 53.02	26	Notification of engagement of direct worker: no form = 0 there is a form = 1 (77)	Columns 64,65
53.00 32 53.02	27	Minutes for senior executive meeting: none = 0 written minutes exist = 1 (42)	66,67
53.00 33 53.02	28	Conference reports: none = 0 reports expected from those attending conferences = 1 (84)	68,69
53.00 34 53.02	29	Agenda for senior executive meeting: none = 0 there is a written agenda = 1 (42)	70,71
53.00 35 53.02	30	Agenda for workflow (production) meeting: none = 0 there is a written agenda = 1 (43)	72,73
53.00 36 53.02	31	Minutes for workflow (production) meeting: none = 0 there are written minutes = 1 (43)	74,75
53.00 37 53.02	32	Written reports submitted to workflow (production) meetings: none = 0 reports = 1 (43)	76,77
53.00 39 53.02	33	Dismissal report/form: none = 0 there is a form = 1 (70)	78,79
53.00 41 53.03	34	Inspection record (recording both positive and negative results, not merely a rejection slip) none = 0 one or more forms = 1 (50)	Card 18 Columns 12,13
53.00 42 53.03	35	Work assessment (work study) record: none = 0 there is one or more records = 1 (58)	14,15
53.00 43 53.03	36	Maintenance record (of maintenance work done): none = 0 one or more records = 1 (61)	16,17
53.00 44 53.03	37	Record of direct worker's work: none = 0 one or more records = 1 (43)	18.19
53.00 45 53.03	38	Record of direct worker's time: none = 0 one or more records = 1 (43)	20,21
53.00 46 53.03	39	Petty cash voucher: none = 0 there is a voucher = 1 (98)	22,23

TOTAL SCORE on items 2-39 =

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Overall Formalization (continued - P.5) 53.00

"Red Book" Scale and Item numbers	New Item numbers	Description		x~~Score~~x
-	(f)	Customer complaints register: none = 0 one or more = 1	(28)	Card 18* Columns 34,35
-	(g)	Wastage/scrap records: none = 0 one or more = 1	(50)	36,37
-	(h)	List of customers: none = 0 one or more = 1	(28)	38,39
	(i)			40,41

NOTE: Lettered items not to be included in cumulative score for Overall Formalization.

	(j)	42,43
	(k)	44,45

* For items (a) to (e) see page 3 of Overall Formalization. (Scores entered on card 18, columns 24,25 (item a) to columns 32,33 (item e)

Card 5, columns 58,59,60 for total score

For card and column numbers of individual items, see righthand column at side of each item below. The items are entered on cards 19 and 20.

CENTRALIZATION

Centralization of decisions (three pages - P.1) 54.00 083

METHOD OF SCORING

Scoring for the lowest points ringed in the Interview Schedule is as follows:-

Above the Chief Executive	= 5
Whole unit	= 4
All workflow activities	= 3
Workflow sub-unit	= 2
Supervisor	= 1
Operator	= 0

For full definitions of the levels see Interview Schedule page 6.
Interview Schedule references are given at the end of each item.

"Red Book" Item Nos.	New Item numbers	Who has authority to:	Card 19 Columns
1	1	decide labour force requirements (i.e., total establishment) (72)	12,13
2	2	decide on appointments to operative level jobs (76)	14,15
3	3	decide on promotion of operatives (78)	16,17
4	4	represent the organization in labour disputes (69)	18,19
5	5	decide on supervisory establishment (73)	20,21
6	6	decide on appointment of supervisory staff from outside (76)	22,23
7	7	decide on promotion of supervisory staff (78)	24,25
8	8	decide salaries of supervisory staff (78)	26,27
9	9	spend unbudgeted or unallocated money on capital items (98)	28,29
10	10	spend unbudgeted or unallocated money on revenue items (98)	30,31
13	11	decide what type or brand new equipment is to be (33)	32,33

Total scores carried forward

Centralization of Decisions (continued - P.2) 54.00

"Red Book" Item Nos.	New Item numbers	Who has authority to:	~~XXXXX~~
		Score total brought forward	Card 19
			Columns
14	12	decide when overtime is to be worked (40)	34,35
15	13	decide on delivery dates or priority of orders (27)	36,37
16	14	determine a new product or service (8)	38,39
17	15	determine marketing territories covered (27)	40,41
18	16	decide the extent and class of market (operational field) to be aimed for (27)	42,43
25	17	decide what shall be costed (i.e. to what the costing system, if any, shall be applied) (98)	44,45
26	18	decide what shall be inspected (i.e., to what the inspection system, if any, shall be applied) (52)	46,47
27	19	decide what operations shall be work studied (57)	48,49
28	20	decide what plans shall be worked to (54)	50,51
29	21	decide what outputs should be scheduled against given plans (54)	52,53
30	22	dismiss an operative (71)	54,55
31	23	dismiss a supervisor (71)	56,57
32	24	lay down personnel selection methods to be used (75)	58,59
33	25	lay down training methods to be used (81)	60,61
34	26	lay down buying procedures (33)	62,63
		cumulative score total carried forward	

"Red Book" Item Nos.	New Item numbers	Who has authority to:	XXXXX XXXXX
		cumulative score total brought forward	Card 19
35	27	decide which suppliers of materials are to be used (33)	Columns 64,65
37	28	decide methods of work to be used (not involving expenditure) i.e., how a job is to be done (40)	66,67
38	29	decide which machinery/equipment is to be used (40)	68,69
39	30	decide allocation of work to be done among available workers (40)	70,71
40	31	decide what and how many welfare facilities are to be provided (88)	72,73
43	32	decide the price of the output (28)	74,75
44	33	alter responsibilities/areas of work of functional specialist departments (8)	76,77
45	34	alter responsibilities/areas of work of line departments (8)	78,79
			Card 20
46	35	create a new department (functional specialist or line) (8)	Columns 12,13
47	36	create a new job (functional specialist or line, of any status, probably signified by a new job title) (8)	14,15
48	37	* take over in the Chief Executive's absence (7)	16,17
		TOTAL SCORE =	

* If no-one takes over in the Chief Executive's absence, score 4.

Card 5, columns 61,62

(NOTE: Scale 54.10 here is scored for LACK of autonomy)

CENTRALIZATION

Lack of autonomy of the organization to take decisions 54.10
(two pages - P.1) 093

The score for each organization is the number of decisions which are taken outside it. This page is completed by reference to Scale No. 54.00. Copy the scores from that scale for the 23 items selected below. Each time a score of "5" appears, circle it, and mark a "1" in the score column on the extreme right. For all other scores enter "0" in the score column on the extreme right. Sum this column to give the organization's lack of autonomy score.

Item No.	Who has authority to:	Score copied from Scale No. 54.00	Score "0" or "1"
5	decide on supervisory establishment		
6	decide on appointment of supervisory staff from outside the organization		
7	decide on promotion of supervisory staff		
8	decide salaries of supervisory staff		
9	spend unbudgeted or unallocated money on capital items		
10	spend unbudgeted or unallocated money on revenue items		
11	decide what type or brand new equipment is to be		
14	determine a new product or service		
15	determine marketing territories covered		
16	decide the extent and class of market (operational field) to be aimed for		
17	decide what shall be costed (i.e. to what the costing system, if any, shall be applied)		
18	decide what shall be inspected (i.e. to what the inspection system, if any, shall be applied)		
19	decide what operations shall be work studied		
23	dismiss a supervisor		
25	lay down training methods to be used		
26	lay down buying procedures		
	Total score to be carried forward		

Card 4, columns 26,27

TECHNOLOGY

Workflow integration

15.08
040

This scale represents the first factor, taking out 58% of the variance, extracted by a Principal Components Analysis on Scale Nos. 15.02 - 15.06, inclusive.

For convenience this page is provided so that the scores on the scales below can all be recorded in one place. Repeat scores given on the relevant pages.

Scale No.		Score
15.02	Workflow rigidity/adaptability	
15.03	Automaticity mode	
15.04	Automaticity range	
15.05	Interdependence of workflow segments	
15.06	Specificity of quality evaluation of outputs	

Total =

Card 4, columns 24,25

TECHNOLOGY

Labour costs as a percentage of total costs — 15.07 039

TOTAL COSTS = aggregated fixed and variable costs for a specified period.

LABOUR COSTS = the cost of employees directly engaged on the workflow, for the same specified period for which total costs have been calculated.

If the answer in the Interview Schedule is already in the form of a percentage, enter the amount against the score on the line provided.

$$\frac{\text{Labour costs} \times 100}{\text{Total costs} \times 1} = \frac{\qquad \times 100}{\times 1} = \text{Score} = \underline{\qquad\qquad} \%$$

APPENDIX 'B'

PARTITIONING OF ITEMS AND VARIABLES FOR MULTIVARIATE REGRESSION ANALYSIS

A) 'CONTROL' VARIABLES CONSISTING OF THE SUM OF SUBSCALES OF CENTRALIZATION ITEMS AS GROUPED BELOW (IN DESCENDING ORDER OF SUBSCALE VARIANCE)

'CONTROL' SUBSCALE	ASTON SAMPLE	NATIONAL SAMPLE
CEN 1	22,27,28,29	4,6,23,27
CEN 2	4,18,20,25	3,11,19,25
CEN 3	11,12,19,32	8,10,20,22
CEN 4	1,2,10,26	7,24,26,28
CEN 5	3,14,24,1	9,18,35,36
CEN 6	13,17,21,23,36	5,16,21,32
CEN 7	5,6,8,15	12,17,29,34
CEN 8	7,9,30,34	2,30,31,33
CEN 9	16,33,35,37	1,13,14,15,37

B) 'STRUCTURING' ITEMS - ASTON AND NATIONAL STUDY SAMPLES (ITEMS GROUPED IN ORDER OF SCHEDULE)

SPEC 1 - SPEC 16	ROLE SPECIALIZATION WITHIN SPECIALIZED FUNCTION SCORE
STD 1 - STD 13	SUM OF STANDARDIZATION SCORES WITHIN SPECIALIZED FUNCTIONS NOS. 1-13
DOC 1 - DOC 7	SUM OF FORMALIZATION SCORES GROUPED WITHIN 7 SUBSCALES (ROLE PERFORMANCE ITEMS 24-45 OMITTED)

APPENDIX 'C'

SUMMARY OF MULTIVARIATE REGRESSION ANALYSIS

A) ASTON SAMPLE

B) NATIONAL SAMPLE

(OUTPUT FROM SPSS-MANOVA)

EIGENVALUES AND CANONICAL CORRELATIONS

B) NATIONAL STUDY SAMPLE

ROOT NO.	EIGENVALUE	PERCENTAGE	CUM. PCT.	CANON. CORR.	SQUARED CORR.
1	[illegible]	29.98575	29.98575	.89206	.79577
2	2.33073	18.32105	48.30680	.83917	.70421
3	1.71784	13.21977	61.52657	.79502	.63206
4	1.36107	10.47417	72.00074	.75925	.57646
5	[illegible]	9.75255	81.75330	.74763	.55895
6	[illegible]	6.21464	87.96793	.66841	.44677
7	[illegible]	5.85662	93.82456	.65738	.43215
8	[illegible]	3.99624	97.82080	.58464	.34180
9	.28318	2.17920	100.00000	.46977	.22068

- -

CANVARS 28/01/83

* A N A L Y S I S   O F   V A R I A N C E * *

EFFECT .. WITHIN CELLS REGRESSION (CONT.)

DIMENSION REDUCTION ANALYSIS

ROOTS	WILKS LAMBDA	F	HYPOTHESIS D. F.	ERROR D. F.	SIGNIF. OF F
1 TO 9	.00067	1.36111	324.00000	337.57964	.00257
2 TO 9	[illegible]	1.17129	280.00000	354.41415	.03005
3 TO 9	.01308	1.05180	238.00000	370.19668	.33046
4 TO 9	.03610	.96369	198.00000	384.92159	.61213
5 TO 9	.07107	.88671	160.00000	398.58245	.81075
6 TO 9	.16114	.77773	124.00000	411.17193	.95229
7 TO 9	.29128	.72051	90.00000	422.68162	.97047
8 TO 9	.51295	.60138	58.00000	433.10186	.99078
9 TO 9	.77923	.46521	28.00000	442.42148	.99190

A) ASTON SAMPLE

EIGENVALUES AND CANONICAL CORRELATIONS

ROOT NO.	EIGENVALUE	PERCENTAGE	CUM. PCT.	CANON. CORR.	SQUARED CORR.
1	31.10292	40.01242	40.01242	.98430	.96885
2	20.26061	26.06430	66.07672	.97620	.95296
3	11.95786	15.38321	81.45993	.96064	.92283
4	5.78252	7.43894	88.89887	.92334	.85256
5	3.08140	3.96408	92.86294	.86890	.75499
6	2.46868	3.17583	96.03878	.84363	.71171
7	1.42286	1.83044	97.86922	.76633	.58726
8	1.00823	1.29704	99.16626	.70855	.50205
9	.64809	.83374	100.00000	.62709	.39324

CANVARS 26/01/83

* A N A L Y S I S O F V A R I A N C E * *

EFFECT .. WITHIN CELLS REGRESSION (CONT.)

DIMENSION REDUCTION ANALYSIS

ROOTS	WILKS LAMBDA	F	HYPOTHESIS D. F.	ERROR D. F.	SIGNIF. OF F
1 TO 9	.00000	1.30594	324.00000	83.91631	.07257
2 TO 9	.00000	1.11029	280.00000	101.15733	.27246
3 TO 9	.00010	.92501	238.00000	117.38054	.69418
4 TO 9	.00130	.76772	198.00000	132.58418	.95389
5 TO 9	.00881	.66461	160.00000	146.76625	.99416
6 TO 9	.03595	.60350	124.00000	159.92448	.99827
7 TO 9	.12470	.52072	90.00000	172.05631	.99964
8 TO 9	.30214	.47044	58.00000	183.15879	.99943
9 TO 9	.60676	.41314	28.00000	193.22859	.99643

APPENDIX 'D'

SUMMARY OF UNIVARIATE REGRESSION ANALYSIS FOR ORIGINAL STRUCTURAL VARIABLES

OVERALL CENTRALIZATION REGRESSED ON

OVERALL SPECIALIZATION
OVERALL STANDARDIZATION
OVERALL FORMALIZATION

A) ASTON SAMPLE

B) NATIONAL SAMPLE

(OUTPUT FROM SPSS-REGRESSION)

A) ASTON SAMPLE

MULTIPLE R	.60734	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES
R SQUARE	.36886	REGRESSION	3.	3482.09597
ADJUSTED R SQUARE	.32942	RESIDUAL	48.	5957.96172
STD DEVIATION	11.14110	COEFF OF VARIABILITY	8.3 PCT	

VARIABLES IN THE EQUATION

VARIABLE	B	STD ERROR B	F SIGNIFICANCE	BETA ELASTICITY
RSPEC	-.55838032	.11799156	22.395373 .000	-.9232926 -.15505
DOCUM	.80050437E-01	.27500812	.84729836E-01 .772	.0630807 .01429
STAND	.25002800	.15902284	2.4720559 .122	.4236718 .15539
(CONSTANT)	132.66455	7.2250132	337.15722 0.000	

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
RSPEC	-.55838032	.11799156	-4.7323750	-.79561827 , -.32114238
DOCUM	.80050437E-01	.27500812	.29108390	-.47289046 , .63299133
STAND	.25002800	.15902284	1.5722773	-.69708848E-01 , .56976485
CONSTANT	132.66455	7.2250132	18.361842	118.13768 , 147.19141

B) NATIONAL SAMPLE

MULTIPLE R	.52031	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES
R SQUARE	.27073	REGRESSION	3.	5241.78321
ADJUSTED R SQUARE	.24231	RESIDUAL	77.	14120.21679
STD DEVIATION	13.51177	COEFF OF VARIABILITY	13.9 PCT	

VARIABLES IN THE EQUATION

VARIABLE	B	STD ERROR B	F SIGNIFICANCE	BETA ELASTICITY
REPEC	-.70949035E-01	.11780182	.36273462 .549	-.0957021 -.02626
STAND	.89522932E-02	.67225180E-01	.17733916E-01 .894	.0173084 .00730
DOCUM	-.78072286	.24982776	9.7659032 .003	-.4560488 -.21166
(CONSTANT)	119.64394	5.3424451	501.53503 0.000	

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
REPEC	-.70949035E-01	.11780182	-.60227454	-.30552242 , .16862435
STAND	.89522932E-02	.67225180E-01	.13316875	-.12491014 , .14281473
DOCUM	-.78072286	.24982776	-3.1250445	-1.2781935 , -.28325224
CONSTANT	119.64394	5.3424451	22.394978	109.00577 , 130.28211

APPENDIX 'E'

SUMMARY OF UNIVARIATE REGRESSIONS OF TWO CANONICAL VARIATES * WITH CONTEXTUAL VARIABLES (SIZE AND TECHNOLOGY)

A) ASTON SAMPLE

B) NATIONAL SAMPLE

(OUTPUT OF SPSS-REGRESSION)

* 'CONTROL' and 'STRUCTURE', treating the former as the dependent var.

DEPENDENT VARIABLE.. CONTROL

MEAN RESPONSE -9.01373 STD. DEV. .99086

VARIABLE(S) ENTERED ON STEP NUMBER 1.. STRUCTR
LOGSIZE
WFINT

A) ASTON SAMPLE

MULTIPLE R	.96038	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES
R SQUARE	.92233	REGRESSION	3.	46.93203
ADJUSTED R SQUARE	.91748	RESIDUAL	48.	3.95202
STD DEVIATION	.28694	COEFF OF VARIABILITY	3.2 PCT	

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
STRUCTR	.94291606	.42369278E-01	495.27219 .000	.9677550 .29933
LOGSIZE	.26857630	.74078013E-01	13.144882 .001	.1517747 -.09388
WFINT	.11461824E-01	.10069651E-01	1.2956230 .261	.0488084 -.01228
(CONSTANT)	-7.2724517	.25546948	810.37056 .000	

B) NATIONAL SAMPLE

MULTIPLE R	.88114	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES
R SQUARE	.77650	REGRESSION	3.	56.02530
ADJUSTED R SQUARE	.73149	RESIDUAL	77.	20.43107
STD DEVIATION	.51511	COEFF OF VARIABILITY	9.5 PCT	

---------- VARIABLES IN THE EQUATION ----------

VARIABLE	B	STD ERROR B	F SIGNIFICANCE	BETA ELASTICITY
STREET	.80887082	.64196794E-01	158.67000 0.000	.8478917 -.46688
AFDC	.12356487E-01	.18036794E-01	.46032245 .495	.0408904 .02225
LOGSIZE	-.66330495E-01	.13052693	.27404942 .602	-.0356049 -.03010
(CONSTANT)	8.0400349	.3366907	570.27405 0.000	

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
STREET	.80887082	.64196794E-01	12.599746	.68083606 , .93690291
AFDC	.12356487E-01	.18036794E-01	.68501113	-.23559359E-01, .4827233E-
LOGSIZE	-.66330495E-01	.13052693	-.52349730	-.32824202 , .19150163
CONSTANT	8.0400349	.3366907	23.880412	7.3696212 , 8.7104486

APPENDIX 'F'

SUMMARY OF MULTIVARIATE REGRESSION ANALYSIS OF GREENWOOD AND HININGS DATA (176 PUBLIC BUREAUCRACIES)

FOUR CENTRALIZATION SUBSCALES CANONICALLY CORRELATED WITH FOUR STANDARDIZATION SUBSCALES

(OUTPUT FROM SPSS-CANCORR)

GREENWOOD & HININGS DATA (n = 176)

CORRELATION MATRIX -

	CEN1	CEN2	CEN3	CEN4	STAND1	STAND2	STAND3	STAND4
CEN1	1.00000	.11550	.06860	.06300	-.11070	-.34770	-.25760	-.16280
CEN2	.11550	1.00000	.06110	-.09510	-.06210	-.08390	-.04800	.08390
CEN3	.06860	.06110	1.00000	.26360	.15740	.33550	.19990	.22800
CEN4	.06300	-.09510	.26360	1.00000	.02180	.12000	.00980	.02330
STAND1	-.11070	-.06210	.15740	.02180	1.00000	.53240	.48590	.48500
STAND2	-.34770	-.08390	.33550	.12000	.53240	1.00000	.65500	.47610
STAND3	-.25760	-.04800	.19990	.00980	.48590	.65500	1.00000	.45020
STAND4	-.16280	.08390	.22800	.02330	.48500	.47610	.45020	1.00000

- -

HININGS CORREL

FILE [illegible] (CREATION DATE = 26/05/83)

- - - - - - - - - - - - - - - - - C A N O N I C A L C O R R E L A T I O N - - - - - - - - - - - - - -

NUMBER	EIGENVALUE	CANONICAL CORRELATION	WILK S LAMBDA	CHI-SQUARE	D.F.	SIGNIFICANCE
1	.26800	.51769	.70024	60.93271	16	.000
2	.02976	.17251	.95662	7.58394	9	.577
3	.00924	.09611	.98596	2.41754	4	.659
4	.00485	.06961	.99515	.83065	1	.362

APPENDIX 'G'

SUMMARY OF MULTIVARIATE REGRESSION ANALYSIS OF HOLDAWAY ET AL. SAMPLE OF 23 EDUCATIONAL ORGANIZATIONS

1) OUTPUT FROM SPSS-CANCORR BASED ON ASTON DATABANK (7 AUTONOMY ITEMS CANONICALLY CORRELATED WITH 16 'STRUCTURING' ITEMS)*

2) OUTPUT FROM CANONICAL CORRELATION PROGRAMME (WRITTEN BY AUTHOR IN APPLESOFT BASIC)
CORRELATIONS TAKEN FROM MATRIX PROVIDED IN ARTICLE IN PUGH AND HININGS(EDS) ORGANIZATIONAL STRUCTURE,(TABLE 8:3,p.124)

3) EXTRACT FROM ASTON DATABANK CODEBOOK,p.172

* As listed in the codebook extract for this study (3 above) -
autonomy items nos. 1,2,7,8,9,12,13
specialization items nos. 1-11
formalization items nos.1,2,3,5,7,8

(other items were rejected due to invariance leading to singularity of variance-covariance matrix)

HOLDAWAY STUDY - ASTON DATABANK (n = 23)

NUMBER	EIGENVALUE	CANONICAL CORRELATION	WILK S LAMBDA	CHI-SQUARE	D.F.	SIGNIFICANCE
1	1.00000	1.00000	0.00000	9999.00000	112	0.000
2	1.00000	1.00000	.00000	9999.00000	90	0.000
3	.95610	.97780	.00072	75.93530	70	.297
4	.81088	.90049	.01647	43.11453	52	.805
5	.72806	.85327	.08709	25.62810*	36	.900
6	.55058	.74201	.32027	11.95517	22	.958
7	.28737	.53607	.71263	3.55737	10	.965

(2) OUTPUT FROM AUTHOR'S CANONICAL CORRELATION PROGRAMME (2 x 2 matrix)

```
]RUN
TYPE IN THE NUMBER OF STRUCTRING VARIABLES
?2 (CENTRALIZATION AND AUTONOMY)
TYPE ROW1ONE COLUMN AT A TIME
?1.00
?.26
TYPE ROW2ONE COLUMN AT A TIME
?.26
?1

TYPE IN THE NUMBER OF VARIABLES IN MATRIX (B) (CONTROL VARS)
?2(FUNCTIONAL SPECIALIZATION AND FORMALIZATION)
TYPE ROW 1ONE COLUMN AT A TIME
?1.0
?-.85
TYPE ROW 2ONE COLUMN AT A TIME
?-.85
?1.00


TYPE IN MATRIX (C)

TYPE IN ROW 1ONE COLUMN AT A TIME
?-.200
?.14
TYPE IN ROW 2ONE COLUMN AT A TIME
?-.65
?.62

THE INVERSE OF MATRIX(A) IS AS FOLLOWS:

1.07250107        -.278850279

-.278850279       1.07250107


THE INVERSE OF MATIX (B) IS AS FOLLOWS-

3.60360361        3.06306307

3.06306307        3.60360361

THE VALUE OF THE FIRST CANCORR IS  .662648459
THE VALUE OF THE SECOND CANCORR IS .0979034778
WHAT IS NUMBER OF OBSERVATIONS
?23
THE DEGREES OF FREEDOM =  4
THE VALUE OF CHISQUARE = 11.4630609 (P < 0.05)
```

Miscellaneous - Data bank code 06 - study code 10

23 organizations

The data collected for this study is based on, but not comparable with, Full 0 and SKO.

Identification:

Columns	1,2	06 - data not comparable with other studies
	3,4	10 - code number of study
	5-8	respondent number (organization)
	9-11	card number - there are two cards.

Scale No.	Scale title and additional details	Card No.	Columns
11.01	Impersonality of Origin	1	12,13
-	Age: youngest 00 to oldest 09	1	14,15
-	Status	1	16,17
-	Ownership	1	18,19
13.01	Size	1	20-23
-	Outputs	1	24,25
16.01	Number of sites	1	26,27
51.02	Functional specialization	1	28,29
51.04		1	30,31
51.05		1	32,33
51.06		1	34,35
51.07		1	36,37
51.09		1	38,39
51.10		1	40,41
51.11		1	42,43
51.13		1	44,45
51.14		1	46,47
51.16		1	48,49
53.01	Formalization (as for SKO) item numbers 3-11	1	50,51 - 66,67
54.10	Autonomy (as for SKO) item numbers 1-6	1	68,69 - 78,79
	7-9	2	12,13 - 16,17
	14	2	18,19
	18, 19	2	20,21,22,23
	22	2	24,25
55.08	Chief Executive's span of control	2	26,27

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