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# Multiple Levels of Analysis: Prospects and Challenges for the Family Transformation and Social Cohesion Project

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**Multiple Levels of Analysis:  
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*“Social theory continues to be about the functioning of social system of behavior, but empirical research is often concerned with explaining individual behavior.”*

James S. Coleman

## **Introduction**

This paper aims at highlighting the need for multiple levels of analysis in the study of family transformation and societal cohesion. The recent changes within the family and the meaning of social cohesion are first explained. These are followed by a discussion of analytical frameworks that accommodate multiple levels of analysis. The need for community-level information in order to apply multi-level type of analysis on survey data collected by Statistics Canada is explained. The paper concludes with a discussion of statistical methodologies and available software. (In this paper “multiple” takes on the common meaning of “two or more” whereas “multi-level” is used in a technical sense of a “combined macro- and micro-level”)

## **Family Transformation and Family Cohesion**

Although demographic research has not explicitly addressed social cohesion, the study of the family transformations clearly impinges on the question of solidarity, societal order and continuity. The following is a brief description of changes in the family and its relation mainly to intra-family cohesion. Though these changes have occurred in other countries as well, most of the studies cited are mainly about Canada.

**Family Formation and Dissolution.** Concern for within family cohesion starts with its formation. The family’s beginning is no longer clear-cut with common-law union’s popularity on the rise (Marcil-Gratton and Le Bourdais, 1999, Marcil-Gratton, 1998, Ravanera, 1995). Cohabitation differentiates itself from marriage in that the bigger community is not involved in its launch. It is primarily a private arrangement, more readily dissolved if not a success. Although common-law unions formed are unstable, an increasing number of couples in these unions are opting to have children. The popularity of cohabitation together with high divorce and separation rates bring about changes in family structures with increases in the proportions of single-, step- and blended-families.

**Effects of Family Changes on Children.** Changes in family structures have great consequences for children. While some studies point to the resilience of children in the face of family breakdown (Haddad, 1998), several point to the adverse impacts of these changes not only in the short-term but in the long run as well. Analysis of the first wave of the National Survey of Children and Youth revealed that compared to children from intact families, a higher proportion living with lone parents have poorer outcomes in terms of health, behaviour, and school achievement (Lipman *et*

*al.* 1998, Ross *et al.* 1998)<sup>1</sup>. The effect of family instability stretches to adulthood. Le Bourdais and Marciel-Gratton (1998) find that parental separation and divorce increases the female children's chances of cohabiting and of early and pre-marital childbearing and the male children's experience of union dissolution. McLanahan and Sandefur (1994) document a lower achievement in high school and beyond of children in lone parent families in the U.S. and attribute this to diminished social capital.

**Home-Leaving of Children.** Another children-related issue is the delayed home-leaving and the frequent returns of young adults to parental homes. Children from disrupted families are more likely to leave home at an early age (Zhao *et al.*, 1995), more likely to leave because of strained parent-child relations (Mitchell, 1994), and less likely to return home after the initial home-leaving (Gee *et al.*, 1995). Mitchell (1994) thinks that home-leaving before age 18 has long-term adverse consequences such as dropping out of high school and narrowed employment and life opportunities. But the more general trend is the prolonged stay of today's youth in parental homes (Boyd and Norris, 1999, Ravanera *et al.*, 1998). One view about this delay is that today's young people have difficulties in making the successful transition to adult life. Côté and Allahar (1994) attribute this to the recent phase of industrial capitalism that no longer requires the labour of the youth, except in low-paying service industries. A family strategy of coping with labour market conditions is a longer stay in parental homes (Corak, 1998).

**Support and Care for the Elderly.** An inter-generation issue is the care and financial support for the elderly. For a while, there was a concern that women boomers have become a 'sandwich generation' burdened with responsibilities for the caring of their own children and for their aging parents. However, a study by Dumas and Belanger (1994) finds that only a small proportion of adults are the prime care providers for the elderly. Nevertheless, with the budget cuts for health and social services, there is a perception that families are being asked to carry an unfair load of caring responsibilities (Luxton, 1998). Another issue is the public funding for the elderly, which has given rise to a concern that there may be societal cleavage along age dimension (PRI, 1997). There is a perception that given the demographics and the pension system in place, working young adults are paying for old age pensions at a rate that they themselves may not get in their old age. The allocation of resources between those that heavily benefit the elderly (such as health service) and those that benefit the children and the young (such as education and children services) is also seen as a possible basis for age-based rifts. Complicating the issue is the question on measurement. Stone *et al.* (1998) argue that private exchanges between generations do rival or even exceed government transfers and that the flow favours the children.

**Household Division of Labour.** The changes (or the absence or slowness of change) in the division of labour among family members also have implications for family cohesion. Goldscheider and Waite (1991) point to two possible impacts: Many of the unmarried may avoid marriage, parenthood, or living in families if there are no changes in the division of domestic responsibilities. Among those already married, a weakened family relationship may arise as wives resent doing a double shift of employment and housework. A number of studies have shown

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<sup>1</sup>But the studies also point other factors such as family income, mother's education, type of parenting, and community support - directly or in interaction with family structure - that are crucial to the development of children.

that the traditional division of domestic tasks is changing but women still do more of the unpaid work at home (Le Bourdais and Sauriol, 1998, McQuillan and Belle, 1998). The issue is particularly important for child-care given the high participation of women with children in the labour force and the demands that child-caring responsibilities be broadly shared with businesses and governments by providing financial and other types of support (Luxton, 1998). Whether or not the movement toward more male involvement in domestic functions will continue and what the impact of egalitarian relationship will be on family cohesion are questions that need further study as the trends unfold. Bumpass (1993), for example, notes that it is companionate marriage involving greater gender equality that is associated with lower rates of parenting and with higher divorce rates.

**Changing Family Values.** Not only family-related behaviour but attitudes and values have changed as well. In a 1984 survey, Balakrishnan *et al.* (1993) found that cohabitation and divorce have become socially acceptable and children are no longer considered as the focal point of women's life or a basis of a couple's relationship. Young couples in the 1990s, particularly those who have experienced cohabitation, assign less importance to children and to living as a couple, and marriage is no longer seen as a primary source of happiness (Lapierre-Adamcyk *et al.* (1999). According to Nevitte (1996), two shifts happened in the 1980s: there is greater preference for more egalitarian spousal relations, and parent-child relationship has become less hierarchical. He contends that these two shifts are part of the general trend toward less deference to authority also manifested in politics and in the workplace and that decline in deference happened not only in Canada but also in the US and Western Europe. Based on findings about the changed values, the trends in the high rates of cohabitation and divorce, and the low rates of marriage and fertility are not likely to be reversed in the near future (Balakrishnan *et al.*, 1993, Lesthaeghe and Moors, 1995).

**Variations in Family Changes.** As with any social change, the family transformation has not occurred uniformly in Canada. The pace and level of change vary among groups differentiated by social status (indicated mainly by education, income, occupation, and work participation), culture (mother tongue, migration status, ethnicity, religion), and opportunity structures (province or region of residence). The observation about fertility that in more recent times variations by ascribed characteristics (such as language, ethnicity, and religion) have attenuated whereas differences by achieved status (such as education, income, work status) have persisted (Balakrishnan, *et al.*, 1993) may be true for other family transformations as well.

## **Social Cohesion Defined**

To relate the changes not only to family cohesion but to the bigger community's or society's cohesion requires a clearer understanding of the concept. Everyone seems to know what social cohesion is but finds it hard to define<sup>2</sup>. Jenson (1998) notes that the term is treated as if "it goes

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<sup>2</sup> In her paper "Mapping Social Cohesion: The State of Canadian Research", Jane Jenson (1998) found two definitions, one of which is that of PRI (quoted above) and the other is that of the working group of the Commissariat général du plan of the French government which states that "social cohesion is a set of social

without saying” and “usually mentioned when a set of problems is evoked.”<sup>3</sup>. The Canadian Policy Research Initiative Subcommittee on Social Cohesion (1997) came up with this definition that also seems to describe a goal: “the ongoing process of developing a community of shared values, shared challenges and equal opportunity within Canada, based on a sense of trust, hope and reciprocity among all Canadians.” A more general definition is that of S. Rosell (1995) which states that social cohesion “involves building shared values and communities of interpretation, reducing disparities in wealth and income, and generally enabling people to have a sense that they are engaged in a common enterprise, facing shared challenges and that they are members of the same community.”<sup>4</sup> Bernard (1999) points out that the main difference between the two is that the first definition waters down the idea of “reducing disparities in wealth and income” to that of “developing ... equal opportunity”.

The common points among the definitions are that social cohesion is a process, and it involves shared values, and sense of belonging to a community. But, these do not encompass other features of social cohesion. A round table discussion organized by the Canadian Policy Research Network, for example, came up with 5 dimensions of social cohesion (O’Connor,1998). These were subsequently put in theoretical contexts and discussed in relation to the various definitions of social cohesion by Jenson (1998). And, Bernard (1999) added one more dimension, equality/inequality, all of which can be categorized by character of relation and spheres of activity as follows:

Character of the relation/ Spheres of activity	Formal	Substantial
Economic	Inclusion/Exclusion	Equality/Inequality
Political	Legitimacy/Illegitimacy	Participation/Passivity
Socio-cultural	Recognition/Rejection	Belonging/Isolation

The *inclusion/exclusion* and *equality/inequality* dimensions are related to the market forces and bring up the questions of who have opportunities to participate or are marginalized from participation in the economy. *Legitimacy/illegitimacy* refers to how well institutions such as the government, political parties, and unions represent the people; and *participation/passivity* relates to people’s involvement in governance or in politics. *Recognition/rejection* acknowledges the virtue of pluralism; and *belonging/isolation* relates to shared values or sense of being part of a

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processes that help instill in individuals the sense of belonging to the same community and the feeling that they are recognised as members of that community.”

<sup>3</sup>Jenson (1998) also notes that it is just one of the many theoretical approaches to understanding social order. The two others that she mentions are the classical liberalism theory (“Social order results from private behaviour in private institutions such as markets”) and democracy theory (“Social order - and change - results from active democratic government guaranteeing a basic measure of economic equality and equity”).

<sup>4</sup> This is the same definition used by J. Maxwell (1996) and referred to by Bernard (1999).

community (Jenson, 1998). One challenge to the project is to find means to connect family transformations to these dimensions.

Another way by which the relationship between family changes and social cohesion may be explored is by looking at the types of social cohesion. Durkheim distinguishes between two types of solidarity: *mechanical* solidarity is based on likenesses while *organic* solidarity is based on division of labour. On the basis of multiplicity and intensity of attachments, mechanical solidarity is less strong than organic solidarity; and, as society becomes 'more civilized', likenesses diminish and solidarity based on division of labour increases (Durkheim, 1933, pp.148-150). Beaujot (2000) thinks that these forms of solidarity could be applied to the family realm as well: "As societies have been increasingly held together by organic interdependence, families are being held together by mechanical solidarity. (p.32)" He speculates that reduction in the sexual division of labour would enhance relationships based on common identity or emotional interdependence which is less durable. This may be further extended by looking at the relation between the family cohesion and that of the society's<sup>5</sup>. For example, could it be that commodification or the increasing assumption of family functions by the market structures (and hence, enhanced societal division of labour) facilitates attainment of egalitarian relationship in the households (and hence, the move towards mechanical solidarity within the family)? [It is also possible that the relation is the other way around, that is, the move toward household egalitarian relation increases the move towards greater commodification].

In the interest of finding indicators, Thomas (1999) enumerates three types of social cohesion based on grounds for trust and cooperation among actors who do not necessarily know each other. *Affective* cohesion is one in which trust and cooperation is based on similarity of traits or on feelings of attachment; *normative* cohesion is based on common values or beliefs; and in *instrumental* cohesion, cooperation is based on mutual business interests. Incidentally, similar expressions are also used in discussions of family cohesion. Alice Rossi (1985, cited by Beaujot, 2000) categorizes two types of love: *expressive* is mainly adopted by women and involves emotional closeness, affection, and open communication, whereas *instrumental* love favoured by men means working well together and providing resources. Clearly, there are commonalities between family and societal cohesion that could be useful in examining the relationships between them.

## Frameworks for Analysis

Given the family changes and the theoretical descriptions of social cohesion, the project

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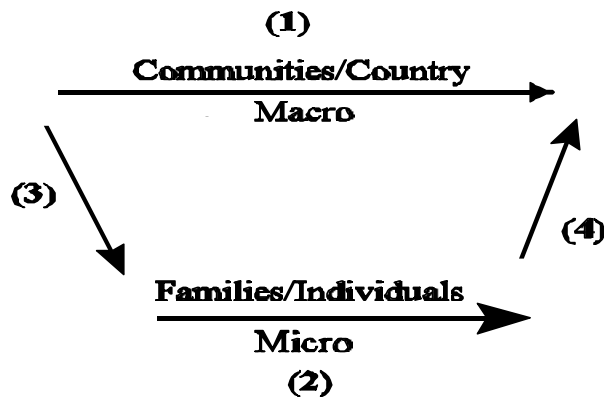
<sup>5</sup> Talcott Parsons' (1949) conception of a society as a system being made up of interdependent sub-systems is of relevance here. The family is one such sub-system or structure whose functions have been increasingly taken over by other structures in the society. Coleman (1990) has an updated version of the relation between the family and the larger society with his distinction between *primordial* structures based on derivatives from the family such as family, neighborhood, and religious groups; and *purposive* corporate structures consisting of economic organizations, single-purpose voluntary associations and governments. He too makes the point that many functions of primordial structures have been taken over by purposive structures.

proposal identified the following themes for research that could relate them together:

- |    |                                                                              |
|----|------------------------------------------------------------------------------|
| 1. | Changing Relationship Between Men and Women, and Social Cohesion             |
| 2. | Changing Relationship Between Parents and Children, and Social Cohesion      |
| 3. | Inter-generational Transmissions and Acquisition of Human and Social Capital |
| 4. | Family Type, Household Sharing and Social Capital                            |
| 5. | Family Related Values and Social Cohesion                                    |
| 6. | Measurement: Indicators of Family Change Relevant to Social Cohesion         |

These themes will be operationalized through the conduct of a number of studies, which may be located within any one of the following frameworks.

**Coleman’s Metatheory: Explanation in Social Science.** A useful framework in which to view family changes and social cohesion is the one proposed by James Coleman (1990). While pointing out that there is a widening gap between theory and research because: “(s)ocial theory continues to be about the functioning of social system of behavior, but empirical research is often concerned with explaining individual behavior” (p. 1), he proposes a mode of explaining the behaviour of a social system by examining the processes involving the units below the system, illustrated as follows:



An example that Coleman cites is the ‘frustration theory’ of revolution which attempts to explain why revolutions often seem to occur when conditions are generally improving (a macro-level proposition). Proponents of this theory argue that improving conditions create frustration among individual members leading to aggression (a micro-level relation) and on to revolution (by simple aggregation of individual aggression)<sup>6</sup>.

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<sup>6</sup>Though this is an example that seems to nicely fit the framework, Coleman points to its ill-defined micro-to-macro transition -- that is, revolution is more than just an aggregation of individual aggression as it



This macro-micro framework is relevant because social cohesion is a behaviour or attribute of a macro system (community or eventually, the country) and the families (and/or individuals) can be thought of as units comprising the system<sup>7</sup>.

Using this macro-micro framework, one can think of a proposition at the macro-level, for example, that increasing globalization weakens social cohesion in Canada, a proposition that seems to be implied in the theme of the SSHRC Strategic Grant: Exploring Social Cohesion in a Globalizing Era. One can then come up with a hypothesis on how globalization affects the families leading to behaviours that have impacts on social cohesion. As a simple example, one can think of globalization as leading to family economic insecurity that leads in turn to stressful life styles, and to low participation in community life. But globalization has many facets and social cohesion itself, as explained above, has several dimensions. On a broad level therefore, the challenges for the project are many: to define macro-level relations leading to societal cohesion, the macro-to-micro transitions that describe effects of, say, communities on family or individual behaviours, the micro-level relations explaining individual-level actions or outcomes, and finally, the micro-to-macro transitions that explain how individual actions relate to social cohesion. These would require hypotheses about the various relations and testing them with data that are available.

Realistically, all these relations may not be covered by one study, however, the framework can still be useful in classifying the various studies within the project, that is, by taking one “arrow” at a time (in reference to the illustration above) and using it as a tool for synthesizing and putting the various studies into a cohesive whole. The following types of studies are possible: (The names mentioned are co-investigators of the project.)

1. Macro-level studies (arrow 1) - One study, for example, is economic rationalization, social cohesion and the ecology of suicide and divorce in Canada, a study being done by D. Thomas with the hypothesis that “the growth of market individualism and economic rationalization can be disruptive of social integration”. The units of analysis are communities and will make use of vital statistics and census data at different points in time.
2. Micro-level studies (arrow 2) - This type is the most common using individuals as units of analysis and several studies within the project will be done using survey data - both longitudinal and cross-sectional. Some examples are Work Patterns and Quality of Family Life by E. Lappiere-Adamcyk, C. LeBourdais, and N. Marcil-Gratton, Division of Labour and Intra-Family Cohesion by K. McQuillan, Determinants of Lone Parenthood by P. Turcotte and C. LeBourdais, and Reproduction and Caring by R. Beaujot.
3. Macro-to-micro studies (arrow 3) - This would examine the community effects on individuals and presupposes that the environment (or the social context) affects individual

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involves organization and inter-play among the actors.

<sup>7</sup>By Coleman’s definition, we could also conceive of the family as a social system whose functioning can be explained by the functioning of individual family members but for the sake of simplicity, these two are taken as micro-level entities and communities (and country) as macro-level entities.

actions and outcomes. Among the theories that have been used to explain the way communities affect families and individuals, particularly children, are contagion, role model, relative deprivation, and competition theories, and the concept of social capital<sup>8</sup> (Boyle and Lipman, 1998, Kohen et al, 1998, Mitchell, 1994, McLanahan and Sandefur, 1996, Coleman, 1990). This type of analysis requires data on both the communities and on families or individuals and thus, whether or not this type of analysis can be done for the project is dependent on availability of data. (See discussion below)

4. Micro-to-macro studies (arrow 4) - The search for theories or explanations of how inter-related individual actions lead to community cohesion is a challenge that the project faces. Coleman points out that the micro-to-macro transition is not a mere aggregation of individuals' behaviours. One study that would touch on this micro-to-macro relation is that of Lesthaeghe and Moors who will examine family attitudes and values and how they relate to dimensions of social cohesion indicated, for example, by membership and involvement in voluntary organizations. They will use data from the World Values Surveys in 1981, 1990, and 1999 and their macro-level units will be countries in Europe, the United States and Canada.

A comprehensive framework such as that of Coleman allows viewing other frameworks of analysis in a broader perspective. For example, the framework used by the Applied Research Branch of HRDC in its call for research proposals (Appendix 1) may be seen as an expanded subset of Coleman's framework (HRDC, 1998). Essentially, the HRDC framework shows a micro-relation of children's development over time but it also points to the examination of macro-to-micro transition or the effects of contexts or external factors on children's development.

**Peters' Family Transactions Approach.** Another framework is that proposed by Suzanne Peters (1996) which uses the concept of transactions to examine family dynamics. One rationale behind the framework is that studies treating families as simple, cohesive units, rather than complex units consisting of inter-acting members, do not adequately capture family dynamics. She suggested that family transactions be viewed as having two aspects, "domains" and "dimensions". Domains classify family transactions into: (i) instrumental supports, (ii) transactions of finances or material goods, (iii) advice, management and assistance, (iv) socio-emotional supports, (v) biological functions. These family transactions are shaped by conditions or dimensions on three levels. *Individual* level dimensions are socio-demographic characteristics of individuals involved; *situational* level dimensions are the "circumstances under which transactions occur", and *systemic* level dimensions are the "external context in which the transaction takes place" (Peters,

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<sup>8</sup>Social capital is often referred to in discussions of social cohesion and in explanation of the effects of the environment or social context on individual behaviour or outcome. But, like 'social cohesion', the meaning of 'social capital' is not precise. For Robert Putnam (1995), for example, social capital is an attribute of a macro structure such as the community or even a country measured by such indicators as voter turnout, union membership, participation in parent-teacher organizations, and memberships in civic and fraternal organizations. But, for Nan Marie Astone *et al* (1999), social capital is an attribute of an individual with dimensions such as the number and strength of a person's relations, and the resources that can be made available by the relations. And, for others like McLanahan and Sandefur (1994) and Mitchell (1994), social capital belongs to families and is destroyed or made unavailable to children when families break up.

1996, pp. vii-ix) (Appendix 2)<sup>9</sup>.

A number of studies within the project would examine some of these domains, possibly using characteristics of the transactions as indicators of intra-family cohesion. Data on situational level dimensions are not available and thus, individual level dimensions will be the main explanatory variables. And, inclusion of systemic level conditions such as economic conditions and community characteristics necessarily calls for multi-level type of analysis and is dependent on whether community level variables can be obtained and appended to data sets available to the project.

**Practical Need for Multiple Levels of Analysis.** All the above discussions provide theoretical reasons for conducting multiple levels of analysis (macro, micro, and combined macro- micro). In addition, there is a practical purpose of helping form and support policies. Articulated needs of partners from governments and advocacy groups call for different levels of analysis. For example, the question “What are the situations of divorced and separated families in Canada?”(Department of Justice) requires a micro-level type of study. But, other questions from partners such as the following would require micro-macro types of analysis: (These questions are from letters of partners submitted with the project proposal.)

- What are the factors that contribute to family cohesion, and, in turn, to social cohesion within communities? (Canadian Policy Research Network)
- How and why do supportive community environments improve outcomes for young children and their families? (Canadian Policy Research Network)
- How do contemporary families promote inclusion, belonging, participation, and respect for others, and under what conditions do they fail to do so? (Department of Justice)
- What are the factors affecting parenting style and community mobilization? (Children’s Secretariat)

Having established the theoretical and practical grounds for doing multiple levels of analysis, the next concern is whether or not we have the data for multiple levels of analysis.

## **Data Requirement and Availability**

The following data sets will be used for the project:

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<sup>9</sup>One way of looking at this framework is to take the family as a social system whose behaviour may be explained by the processes among the individual members. However, inclusion of systemic level dimensions requires modification or perhaps expansion of the framework proposed by Coleman.

## A. Surveys

### 1. Longitudinal Surveys:

- (a) National Longitudinal Survey of Children and Youth, 1994 and 1996;
- (b) Survey of Labour and Income Dynamics.

### 2. National Cross-sectional Surveys:

- (a) General Social Surveys on Family and Friends, 1990 and 1995;
- (b) General Social Surveys on Time Use, 1986, 1992, and 1998;
- (c) General Social Surveys on Social and Community Support, 1990 and 1996;
- (d) National Survey of Giving, Volunteering and Participating, 1987 and 1997;
- (e) Work Accommodation Survey

### 3. World Values Survey, 1981, 1990, 1999;

### 4. Survey on Reproduction and Caring in London, Ontario

## B. Other Data

### 1. Census Data, 1986, 1991, 1996

### 2. Vital Registration Data on Suicide, Homicide, and Divorce, 1986, 1991, 1996

Data are readily available for the micro-level type of analysis as the survey respondents are individuals. In the case of a macro-level type where communities are the units of analysis, the data are from censuses and vital statistics and are also available.

The problem arises with multi-level analysis when one combines community characteristics with individual characteristics on a national level. A suggestion of Peters (1996) is that efforts be made to collect basic community characteristics through the census and other administrative systems. Given the need for information for policy-making purposes, the suggestion makes sense and is worth considering. Even in the absence of extensive community-level data, multi-level studies have been done in the United States and Canada. In the study about lone parenthood and its effects on children's achievement in the United States, for example, McLanahan and Sandefur (1994) made use of multi-level analysis with individual-level data from the Panel Study of Income Dynamics (PSID) and census tract characteristics (such as percent of families who are poor, percent of families who receive welfare, and percent of men not working) which were appended to each household record. A more recent multi-level study in the United States, is the assortative mating study of Lewis and Oppenheimer (2000) which made use of individual data from the National Longitudinal Survey of Young Men and Women to which were attached community descriptors aggregated from census micro-data.

In Canada, Corak and Heisz (1998) used the first 3 digits of the postal code to derive neighborhood characteristics from the income tax file to study income mobility of a young Canadian men and women<sup>10</sup>. And, two multi-level studies made use of the first wave of National

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<sup>10</sup>One study that matched census data with longitudinal administrative data was that of Knighton et al. (1998). The matching was done not for a multi-level study but to make use of individual level data in the censuses that were not available in the administrative source of data.

Survey of Children and Youth conducted in 1994-95, to which were attached 1996 census data<sup>11</sup> aggregated by enumeration areas (Kohen, *et al.*, 1998, Boyle and Lipman, 1998). This provided information about the places of residence (defined by the boundaries of the enumeration areas) and allowed the use of community variables such as proportion of families who are poor, mean household income, rate of unemployment, percent of total neighbourhood income from government transfer payments, and proportion of households headed by single females.

One concern about the use of administrative boundaries such as census enumeration areas is that they may not in fact correspond to the neighbourhoods or communities of the individuals. As Boyle and Lipman (1998, citing Moon, 1990) note, place is a geographical construct whereas a neighbourhood is a sociological construct defined by functions that space fulfils. But, it would be difficult, if not impossible, to define the actual neighbourhood of each respondent of a survey and to gather information about them on a national level. An advantage of using administrative boundaries of places is the large amount of socio-demographic data that can be made available for them (Boyle and Lipman, 1998).

Appending community descriptors from census data to individual records obtained from longitudinal surveys is facilitated by the information on the place of residence of the respondents, even though this place of residence may change from one wave to another. In contrast, cross-sectional surveys do not make follow-up surveys of the same respondents and therefore more specific information on the place of residence is not of high importance. However, the questionnaires of general social surveys include asking the address of the respondents: the street and number, the city, town or municipality and the province. It may thus be possible, with some effort and cost, to attach aggregated census data to cross-sectional survey individual-level data. Surveys such as the General Social Surveys on Social and Community Support, the National Survey of Giving, Volunteering and Participating, and possibly the General Social Survey on Time Use are particularly in need of data on communities as performance of these activities are most likely shaped or conditioned by situation in the communities.

If community descriptors based on aggregated data on census enumeration areas cannot be appended to individual records from surveys, or if the procedure will be too costly, the project may have to make do with what can be made available in the surveys themselves. The public use micro-data files of the surveys will be of no use for multi-level analysis because only the province of residence is made available. But, if other detailed information such as the CMAs/non-CMA (census metropolitan areas) and the urban/rural information, which are suppressed for the sake of protecting the respondents' privacy, are made available to the project there may still be a way of trying out multi-level type of studies. The National Survey on Giving, Volunteering and Participating, for example, shows a total of 71 CMAs. The rest of the respondents (about half of the total) live in non-CMAs and could be cross-classified by province and urban/rural categories for an additional 18 more "communities". ("Communities" in this case will be even more different from the actual neighbourhood of the respondents.) Thus, some 89 macro-level units may be used and "community-level" variables may be derived from the individual-level survey data (such as

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<sup>11</sup>Now that the second and third waves of the National Survey of Children and Youth have been conducted in 1996 and 1998, it may be more reasonable to match the 1996 census data with the 1996 NLSCY, and perhaps take the 1991 census data to match with the 1994 NLSCY.

proportion of households with income below \$20,000, proportion unemployed and proportion with university degree). This is not recommended as for some contexts, the number of respondents may not be large enough to obtain reliable estimates of community characteristics. It may therefore be worthwhile to obtain information from other sources, such as the census, and append them to the 89 macro-levels identified. Clearly, the small number of macro units make this less than an ideal way of doing a multi-level analysis and should only be used if attaching aggregated data from the census to cross-sectional survey data is not possible.

## Statistical Methodology and Software

The macro and micro level studies utilize well-known statistical techniques like ordinary least square regression, analysis of variance, and proportional hazards models. The multi-level analysis utilizes similar techniques but with formulations adopted for dealing with different levels (Goldstein, 1999; Hox, 1995). Assuming that data will be available, this section outlines some approaches to dealing with multilevel data with the software that are readily available to researchers..

**A. Macro Impacts on Individual Behaviour.** From the 1960s, suggestions for “contextual analysis” were proposed on the basis that human behaviour is affected also by social structures (Lazarsfeld and Menzel, 1961; Blau, 1960). Even in those times, analysts were aware of the fact that “the structure of a group differs from the aggregate of its members ... by those properties that cannot be used to describe individual members because they characterize relations or combinations of members and hence describe the group as a whole” (Blau, 1981, p. 9). Thus, the term “structure” stood, not simply for aggregates but for relationships between aggregates or *relative positions* between individuals and aggregates. The term “structure” was also used to denote the hierarchy of levels that somehow introduce stratification or differentiation in a society as well as inequality and heterogeneity resulting therefrom. The latter was implicit in the use of structures because individuals occupy a (relative) position in the structure and act and behave accordingly. Thus, the high rates of unemployment were not only the concern of the unemployed but also of the employed, since they affect both of them; high rates of unemployment make the employed also jittery about the security of their jobs. Our discussions on social (and family) cohesion in the earlier sections fall in line with this line of thinking that was introduced by Lazarsfeld and Blau.

The seminal ideas were there even in the 60s, but data were not. For lack of specific information on contexts and structures, analyses in the 70s and 80s were done as “contextual analysis” using the summary values derived from individual-level data (see for example Boyd and Iversen, 1979). Thus, for each context or group  $j$ , one explanatory variable  $X$  for each individual  $i$ , a straightforward regression model was suggested:

$$(1) \quad Y_{ij} = a_j + b_j X_{ij} + e_{ij}$$

The intercepts and the slopes were then examined whether or not they vary by group-level (derived) characteristics, that is, 0 :

$$(2) \quad a_j = a_0 + a_1 \bar{X}_j + e_j \quad \text{and} \quad b_j = b_0 + b_1 \bar{X}_j + d_j$$

These equations were referred to by Boyd and Iversen as separate equations, which when substituted into equation 1 yielded a single equation as follows:

$$(3) \quad Y_{ij} = a_0 + a_1 \bar{X} + b_0 X_{ij} + b_1 X_{ij} \bar{X} + (e_j + d_j X_{ij} + e_{ij})$$

The estimation technique proposed by Boyd and Iversen was the OLS with its usual assumptions. It should however be obvious to any reader that there is something “strange” in the error term that should be accounted for. More importantly, with expressions such as equation 3, other issues can be raised, one of them being the “correlated observations”. Because individuals in the same context share common experiences and are thus similar, the usual assumption of independent observations rarely hold in contextual analysis.

These problems in multilevel analysis were only recently addressed by formulating the regression equations in a different way. Starting from the traditional regression model  $Y_{ij} = a + bX_{ij} + e_{ij}$ , where the coefficients  $a$  and  $b$  are “fixed” effects [it is generally known that when a context is ignored, the standard error of the coefficient  $b$  is too low], we can include the context in the intercept term and rewrite the equation as

$$(4) \quad Y_{ij} = a_j + bX_{ij} + e_{ij}$$

In equation 4,  $a_j$  represents the variability from context to context, and hence is to be considered as “random” effect rather than fixed effect. This distinction is an important one underlying the techniques of multilevel analysis. Extending this to make the slope also vary for contexts, we get

$$(5) \quad Y_{ij} = a_j + b_j X_{ij} + e_{ij}$$

with two random effects that can be interpreted as “between contexts” effects. This equation, although identical to equation 1, is known as Random Coefficients Model. The OLS technique is not adequate to estimate the coefficients of this equation, although it can be used building separate equations for each context. The possibility of using “dummies” to represent the contexts also becomes inefficient since we generally have to deal with a large number of contexts. More importantly, formulating the equation as consisting of random effects calls for possible correlations between intercepts and slopes that is beyond the OLS technique.

To extend the above ideas more formally, we let  $a_j$  and  $b_j$  become random variables

$$(6) \quad a_j = a_0 + u_{0j} \quad \text{and} \quad b_j = b_0 + u_{1j}$$

with  $u$ 's having zero means and variances as  $F_{u_0}^2$  and  $F_{u_1}^2$ , and also possibly have a correlation of  $D_{u_0, u_1}$ . Substituting this in the original equation, we get

$$(7) \quad Y_{ij} = a_0 + b_0 X_{ij} + (u_{0j} + u_{1j} X_{ij} + e_{ij})$$

where  $Y$  is expressed as the sum of a fixed part and a random part that is within brackets. This differs from the standard regression model with the presence of more than one residual term. The estimation of the fixed part is no problem, but that of random parts needs special procedures

(compare this with equation 3 of Boyd and Iversen). Various estimation procedures are used such as IGLS, REML, EB/ML, EM, etc. Different procedures use different assumptions regarding the distributions of the random variables, and this invariably leads to a problem identical to that found in the literature on unobserved heterogeneity.

The above formulations have considered only two levels, one at individual level and the other at a contextual level. The extension is straightforward to any number of levels and for any number of explanatory variables and are referred to as hierarchical nested models. A practical question, however, is how many levels to introduce in a study? Although there is no theoretical restriction to the number of levels, most packages at disposal cannot handle more than three or four (which itself becomes cumbersome both technically and substantively).

Software packages differ in their capabilities as well as the type of analysis that they can do. The following packages are available to researchers for multilevel analysis: SAS has two procedures MIXED and VARCOMP (the latter, variance components analysis, is another way of looking at the multilevel effects, but falls short in bringing out the many details of a multilevel analysis), MLwiN can allow a maximum of 15 levels, HLM5 allows up to 3 levels, and VARCL (all these three can be bought for a price), and MIXREG or MIXOR that allows only 2 levels (free and downloadable at [www.uic.edu/~hedeker/](http://www.uic.edu/~hedeker/))

A simple illustration is given below for a 2-level analysis of SLID data on income for 1994 by making use of Hedeker's MIXREG program. [The analysis presented here is cross-sectional; one could also use two or three-waves information on income from SLID for a longitudinal analysis.] The following variables have been selected: Province, Education Level (1=secondary & below), Income94 ('000s), Intercept (=1 for all), Sex (0=male, 1=female), Full/Part-time work (0=Full, 1=Part), Work experience (yrs), and Age (only 40-44 yrs old in 1994). The adjacent table gives an insert from the data file for nine individuals. The constant column of 1s is needed for running MIXREG to specify the intercept estimate.

35	2	18.3	1	0	0	99	40
12	2	40.2	1	0	0	22	42
12	3	37.0	1	0	0	17	40
59	3	21.2	1	1	1	99	44
59	2	51.0	1	0	0	12	42
10	2	12.4	1	1	9	5	41
35	3	38.0	1	0	0	21	43
59	2	48.0	1	1	0	18	44
24	3	33.4	1	1	0	22	44

The variable Province is treated as a structural level variable. (This is in the absence of a variable such as a census enumeration area discussed above.) We present here a two-level analysis, one structural (Province) and all the other individual-level variables in a regression model. If data were available, it is possible to nest another structural variable within the Province, thus leading to three-level analysis but unfortunately the MIXREG allows only two levels<sup>12</sup>.

It is a good idea to first run the regression model without random effects (that is, as a multiple regression on any statistical package). MIXREG uses the maximum likelihood procedure instead

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<sup>12</sup>We have obtained the MLwiN package which allow more than 2 structural variables but we have not as yet tested it as it arrived only today, May 15.



of the OLS, but the results will not be very different). Using Sex, Work Type, and Work Experience, the results are given in Table 1. (We left out education as we initially planned on using it in another example but for the sake of brevity, we have confined ourselves to one example.) The model gives the expected results, women and part-timers having a lower income, and work experience increasing the income by about \$200 per year.

Table 1 : Regression without random effects				
Numbers of observations : Level 2 observations = 1508				
Level 1 observations = 1508				
Descriptive statistics for all variables				
Variable	Minimum	Maximum	Mean	Stand. Dev.
INCOME94	-15.3000	228.6000	35.56088	22.66921
Intercep	1.00000	1.00000	1.00000	0.00000
Sex	0.00000	1.00000	0.43435	0.49584
Worktype	0.00000	1.00000	0.12599	0.33195
Workexp	0.00000	30.00000	18.79244	6.46957
* Final Results - Maximum Marginal Likelihood (MML) Estimates *				
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EM	Iterations = 10			
Log Likelihood	= -6737.673			
Variable	Estimate	Stand. Error	Z	p-value
Intercep	37.33718	2.20650	16.92146	0.00000
Sex	-10.09196	1.24732	-8.09090	0.00000
Worktype	-12.51189	1.79216	-6.98145	0.00000
Workexp	0.22262	0.09710	2.29258	0.02187
Residual variance				
	444.97982	16.20521	27.45906	0.00000
note: p-values are 2-tailed except for variances which are 1-tailed				

Now, let us introduce Province as a context to examine whether differences among provinces are simply random differences due to sampling and not systematic structural differences. Using Province as level-2 variable, we get the results presented in Table 2. As seen in this table, the mixed effects model reduces the log-likelihood by about 2 units (6737-6735) giving a  $P^2$  value of 4 for 1 degree of freedom. The parameter estimates are quite stable and all significant. The intercept now has a variance equal to 73.68 which is highly significant, thus indicating that provinces do have their structural differences. What is more interesting in this table is the intra-cluster (here intra-province) correlation. The intra-class correlation (ICC) is used to express the fact that the observations in the same cluster are related and tend on the average to be more like each other than observations from different clusters. The larger the ICC, the more similar are the observations in the same cluster. If ICC is almost equal to zero, then the observations are independent of one another, which would mean that a multilevel analysis is not appropriate. Here we get  $ICC = 0.164$  which is considered to be moderate.

Table 2. Regression with mixed-effects - Province as cluster

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Numbers of observations
Level 2 observations = 1299 (Province)
Level 1 observations = 1508 (individual)

* Final Results - Maximum Marginal Likelihood (MML) Estimates *
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EM      Iterations = 10

Log Likelihood      =      -6735.307

Variable      Estimate      Stand. Error      Z      p-value
Intercep      37.19319      2.20358      16.87850      0.00000
Sex           -10.07201      1.24486      -8.09085      0.00000
Worktype     -12.17642      1.79205      -6.79470      0.00000
Workexp       0.22613      0.09686      2.33451      0.01957

Random-effect variance & covariance term(s)
Intercep      73.68643      29.16117      2.52687      0.00575

Residual variance
              375.00793      30.69210      12.21839      0.00000

note: p-values are 2-tailed except for variances which are 1-tailed

Calculation of the intracluster correlation
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residual variance = 375.008
cluster variance = 73.686

intracluster correlation = 73.686 / ( 73.686 + 375.008) = 0.164

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The above simple illustration shows that a structural (or a macro-level) variable, province, has a significant impact on income. Multiple-level analyses utilizing these recent procedures should not stop at this, that is, at finding whether or not the structural variable has a significant impact. This result is important in itself, however, we would normally want to know more than this. Once we identify the importance of a macro-level variable, we can select some important characteristics and use them in analytical procedures that meaningfully allow combination of individual and structural characteristics. We intend to explore the various software and find how the accepted procedures such as logistics regression and proportional hazards models have been modified by these recent formulations related to multi-level analysis.

## Conclusion

We have discussed the recent family transformations and the need for multiple levels of analysis to explore their relevance to our research on social cohesion. Theoretical frameworks provide guidelines on the possible substantive connections that can be posited, and information needed for policy formulations provides practical rationale for conducting multiple levels of analysis. Data and statistical procedures are available for the macro- and micro-level studies. For the combined

macro-micro analysis, the urgent need is to obtain community variables that can be attached to individual records from survey data, both longitudinal and cross-sectional. For longitudinal survey data such as from the SLID and NLSCY, appending community descriptors (from aggregated census enumeration area data) is possible and has already been done for the analysis of NLSCY's first wave. We propose that similar efforts be made for cross-sectional survey data, particularly for surveys where community characteristics have great impact on shaping individual behaviours (for example, the General Social Surveys on Social and Community Support, and the National Survey of Giving, Volunteering and Participating). Should data become available, there are recent developments in statistical methodologies supported by a number of software. We think that our project's prospects of conducting studies at several levels including a combined macro-micro levels are promising.

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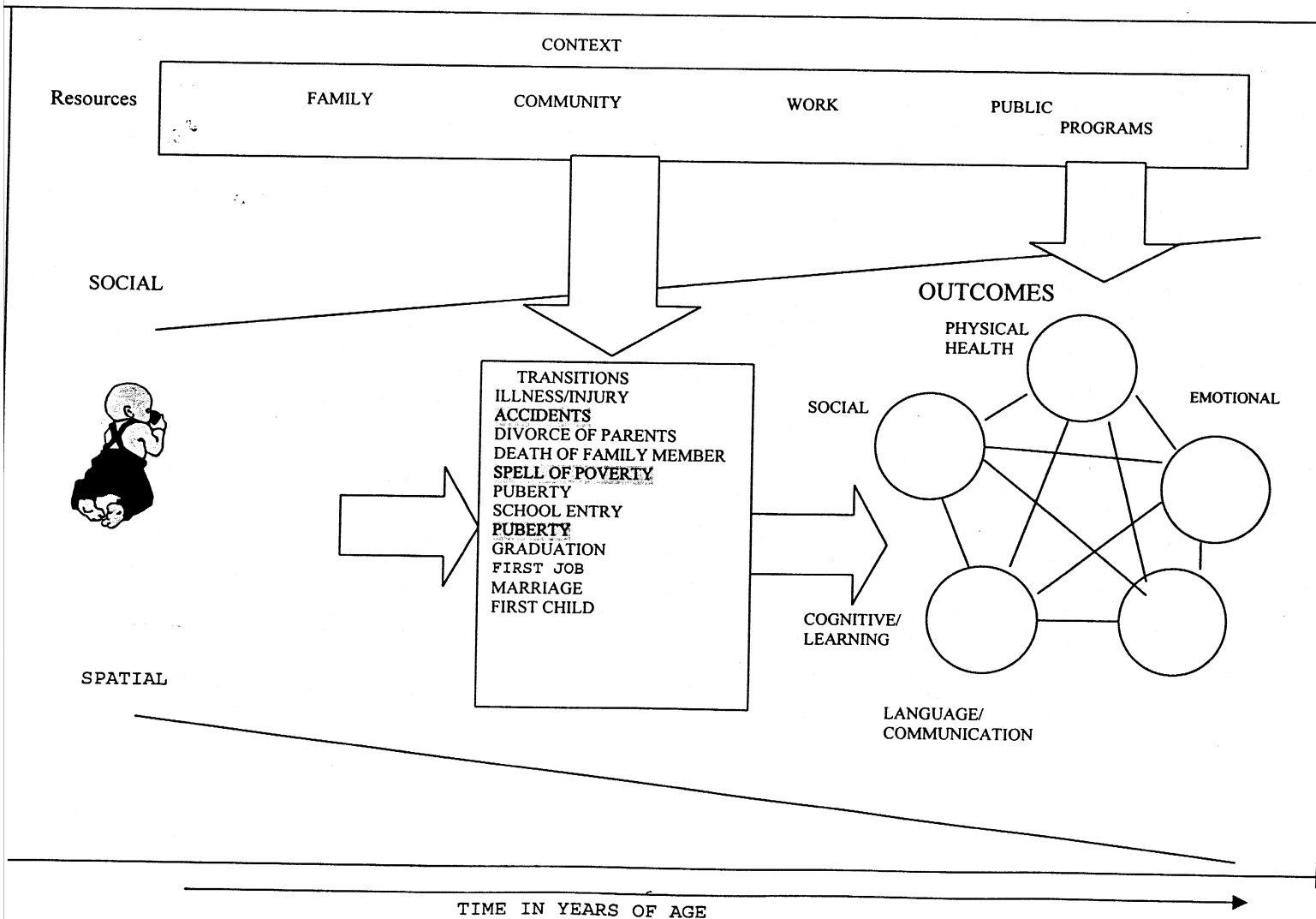
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Appendix 1  
 HRDC Applied Research Branch

LONGITUDINAL RESEARCH FRAMEWORK FOR POLICY



## Appendix 2

### Variables for Study at Three Levels of Analysis

Demographic Level Dimensions	Situational Level Dimensions	Systemic Level Dimensions
Gender Employment Hours Conditions Wages Status Income Age Education Race/ethnicity Religion Geographic Density	Relationship Genealogical Legal Former kin Quasi-fictive kin Temporal Frequency Periodicity Life course Locational Within household Across household Geographic distance Meaning Multiple or singular Personal value and beliefs Reputation and responsibility Legitimacy of excuses Process Explicit or implicit intent Mechanisms to balance Independence/dependence Direct repayment Indirect repayment To a third party Generalized Reciprocity	Policy and legal frameworks Cross-jurisdictional effects Economic conditions Commodifications Growth of non-standard jobs Level of unemployment Wage gaps Community characteristics

Peters, S. 1996. Examining the Concept of Transactions as the Basis for Studying the Social and Economic Dynamics of Families. Canadian Policy Research Network (CPRN) Working Paper No. F01. P.37.