DELINQUENCY THEORIES: AN INTEGRATING SIMULATION MODEL

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ABSTRACT

Five theories of the origin of juvenile delinquency are incorporated into a DYNAMO language social system simulation. The model framework includes population, education and economic systems. The model also contains cultural or value factors which are partially linked to the model framework. The model demonstrates the possibility of multidimensional sociological theory models and the need for quantitative modeling in the social science area. The juvenile delinquency theory model has shown that changes in even a single social system variable can generate counterintuitive outcomes. The model is offered as a potential tool for theoretical, policy and instructional use.

INTRODUCTION

There are a number of sociological theories which have been found to be useful in illuminating the social origins of juvenile delinquency. Generally, these theories explain the occurance of delinquent behavior in terms of a limited number of causative social factors. They are each supported by some level of emperical evidence. However, there is no single delinquency theory so effective that it has acheived primacy among criminologists.

In this paper a simulation model is described which links five of the leading delinquency theories into an integrated, social systems model. This model is not intended, in its current form, to provide precise predictions of quantitative values. Rather, it is presented as a model with the potential for contributions on both the theoretical and policy levels, as well as a tool for teaching.

On the theoretical level, the simulation model approach employed here provides a framework for the integration of multiple insights into the origin of juvenile delinquency. This permits a model of behavior at a level of complexity more proximate to the reality being modeled than do the individual theory constructs.

On the policy level, Jay Forrester proposed in Urban Dynamics (4) that several of the programs designed to acheive desirable social goals for the urban environment, actually produced counterintuitive, negative effects in the long run. In the same way, the model described here has demonstrated the counterintuitive impact of changes proposed by policy makers on juvenile delinquency outcomes. For example, increased societal levels of education result, according to the model, in the long range increase in the number of delinquents. This outcome was not anticipated by any of the specific theories integrated into the model.

A variety of delinquency theories that have received some level of acceptance are generally discussed in series in a typical University level delinquency course text. This disjunctive presentation leads to some legitimate confusion in the minds of the students, since these theories have rather different starting points. This model is offered as a potentially valuable classroom framework for the integration of the current state of insight and understanding of the delinquency process.

A number of simulations have been developed during the past few years to model the operation of the criminal justice system (1,5). Among these, Willard Fry has developed a model using the DYNAMO simulation language. The Fry simulation was developed as a Criminal Justice Planner training tool.

Also using the DYNAMO language, Peter Delp has developed a model of the Juvenile Justice System (2). The model described in this paper was developed using the DYNAMO language. However, the focus of this model is not the processing of the juvenile thru the criminal justice service system, but rather, the origin of the delinquent in terms of the larger social system.

The procedure for developing the model was to select the five most widely accepted delinquency theories. These theories were abstracted to permit quantitative modeling. Then a social system model including the value structure, economic, education and population systems was developed as a framework fo the delinquency theories. Finally, the system was parameterized to permit a quantitative simulation. Segments of the system were validated. And, subseqently, sensitivity of the parameters were tested.

DELINQUENCY THEORIES AND MODELS

The five sociological delinquency theories selected for inclusion in the model were: Differential Association Theory, Differential Opportunity Theory, Anomie Theory, Deterence Theory and Labeling Theory. The main framework of the model is a population system model with three levels: child, juvenile and adult. The juvenile level is divided into three groups: non-criminal juveniles, criminal juveniles and delinquents. See figure 1.

Children are born and some years later they enter the juvenile population as non-criminal juveniles. They can spend the next several years as non-criminal juveniles and eventually become adults; or they can commit criminal acts, in which case, they enter the criminal juveniles group. Four of the theories incorporated into the model have to do with the transition from non-criminal to the criminal juvenile groups. Criminal juveniles can either move directly into the adult population upon reaching their majority; or they can be identified as criminal actors and be labeled delinquent. In this case they become part of the delinquent group until they become adults. Labeling theory deals with this transition process from criminal actor to delinquent.

The fact is that a crime is not generally identified as a juvenile crime, until the arrest/labeling process is completed. This has the effect of making the statistical measure of juvenile crime heavily dependent on the rate of transition from the criminal to the delinquent groups. One of the values of this model is that it forces the examination of the relationship of the actual level of juvenile crime to the societally labeled level of juvenile crime.

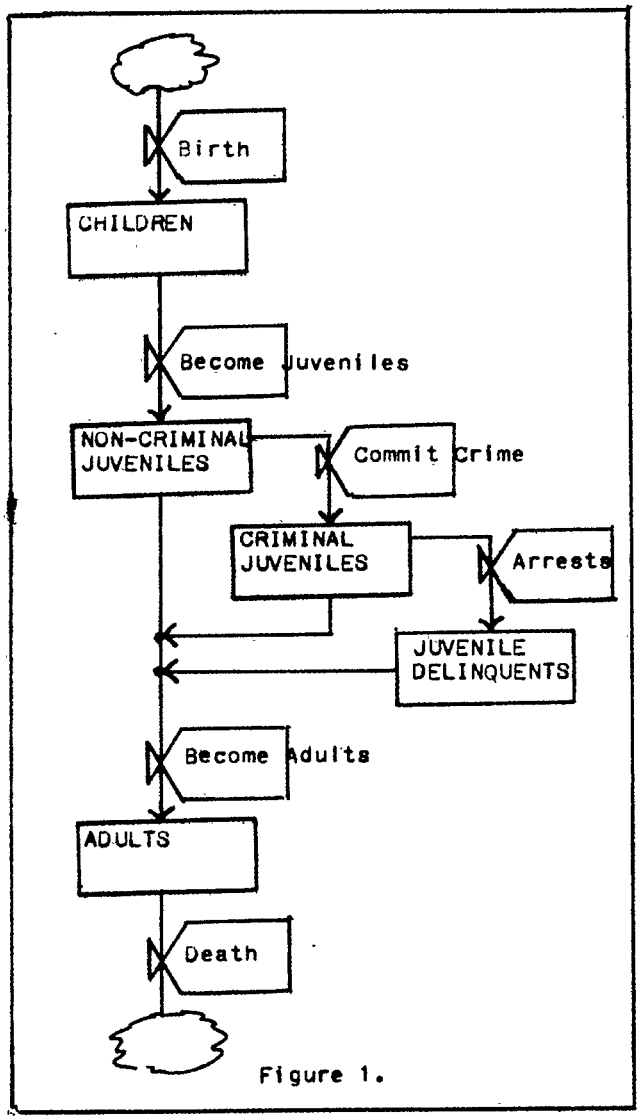

Figure 1.

1. DIFFERENTIAL ASSOCIATION THEORY

Differential association theory is based on the principle that all behavior is learned, deviant as well as appropriate. Juveniles are in a period of intense behavior learning and are extremely sensitive to their socializing associations. According to this theory, not only the frequency of the socializing association, but the significance of the socializing agent determines the strength of the influence.

To model this theory, it was assumed that the primary socialization to delinquent behavior is due to the associations of the individual with juveniles who are either criminal actors or labeled delinquents. The quantity of these delinquency socializing associations in a society is proportional to the ratio of criminal juveniles and delinquents to the total juvenile population.

Since the socialization model suggests that the main socializing agents of a juvenile are either the peer group or the family, the general societal strength of deviant socializing peer groups is modeled as the complement of the value that society places on the family, the degree of family-centeredness. The differential association theory can be represented as:

DAT = a1(TOTCJ?TOTJUV)(a2 - FAMVAL)

where
- a1 = a proportionality constant
- a2 = a constant representing the total socializing influence of the society
- TOTCJ = total of both delinquent and criminal juveniles
- TOTJUV = total number of juveniles in the society
- FAMVAL = an index of the level of family-centeredness in the society

2. DIFFERENTIAL OPPORTUNITY THEORY

Differential opportunity theory is based on the destinction between ends and means. According to this theory the individuals in a society are socialized to accept certain material goals. Both successfully adjusted juveniles and criminal juveniles, according to this theory, are socialized to a common set of goals. Society does not, however, provide a common level of means to attain these goals. As a result of this mismatch between goals and means, a portion of the population employee illegitimate means to obtain the legitimate goals. Simplified, this theory suggests that the level of crime is proportional to the distance between the societial goals and the societial means.

The goals of a society are modeled as dependent upon the historical economic situation, the level of materialistic values and the degree of integration of individuals into those goals. The means or opportunities to attain the goals are modeled as dependent on the current economic conditions, including both the current economic level and the degree of economic homogeneity, the measure of the distribution of the wealth. Differential opportunity theory is fomulated as:

DOT = a(ENDS - MEANS)/(ENDS)

where
- a = a proportionality constant
- ENDS = the material goals set by the society
- MEANS = the opportunity level for the attainment of the ends

The goals of the society are in turn formulated as:

ENDS = b(AVECON)(MATV)(INTEG)

where
- b = a constant
- AVECON = the general economic level during recent years
- MATV = the relative index of the degree of materialism in the society
- INTEG = the relative index of the degree of the integration of the society to common goals

The means are formulated as:

MEANS = c(ECON)(EHOMO)

where
- c = a constant
- ECON = the current economic level
- EHOMO = the relative index of the equality of distribution of the wealth in the society

3. ANOMIE THEORY

The theory of anomie is a third socialization theory. Where differential association is based on successful socialization into a criminal subculture; and differential opportunity theory is based on successful socialization into the goals of the society, without the structural opportunities to attain those ends; anomie theory is based on the breakdown of the social-

ization process itself. According to this theory, a juvenile, faced with conflicting socializing forces, or provided with only weak socializng influences in childhood years, can fail to internalize the behavioral values of the society. This failure results in a condition of normlessness or anomie.

The primary socializing influences in the child's early life is the family. As the value of the family decreases in a society, the effective early socialization will decrease. Also, as the general level of social integration of the society decreases, the effective socialization of juveniles will decrease. Anomie theory can be formulated as:

$$AT = a1 - a2(FAMVAL) - a3(INTEG)$$

where
- a1 = a constant representing the contintion of total normlessness
- a2 & a3 = constant/weighting factor
- FAMVAL = an index of the level of family centeredness of the society
- INTEG = a relative index of the degree of integration of the society

4. DETERENCE THEORY

While the differential association, differential opportunity and anomie theories all start with a premise of a neutral subject who is socialized into criminal actions, the deterence or control theory starts with the view that the individual juvenile is naturally inclined to deviant behavior. This model assumes that criminal behavior happens whenever there is a failure to apply negative reenforcement to deviant behavior.

The deterence theory includes the severity, swiftness and sureness of punishment in its considerations. Defenders of this theory argue that if every criminal act was met immediately with a swift, severe punishment, crime would cease to be attractive. For the model described here, the theory was simplified to consider only the sureness of punishment. This means that the effect due to deterence theory is modeled as proportional to the ratio of caught delinquent actors to the total number of criminal actors. Deterence theory can be formulated as:

$$DT = a(DELINQ)/(TOTCJ)$$

where
- a = a constant
- DELINQ = the number of "caught" criminal actors
- TOTCJ = the number of both "caught" and "uncaught" criminal actors

The integration of these four models is acheived in this model by assuming that the rate at which non-criminal juveniles commit criminal acts is proportional to the sum of the effects due to the differential association, differential opportunity, and anomie theories, less the effect due to the deterence theory.

5. LABELING THEORY

Conflict or labeling theory focuses on the process by which the power structure of the society selects certain individuals and behaviors to censure. Labeling theory points out that there is a large pool of juvenile criminal actors, but only some of them are actually labeled delinquent. Self reporting, emperical studies have supported this concept. Although the primary concern of labeling theory is the question of who is labeled, it does raise the issue of how many are labeled. It is that limited aspect of the theory that is incorporated into the present model in the form of an analytical model of the arrest process.

Ana analysis of the arrest process suggests that there are actually two components which compose the arrest operation. There is a component of the total arrests which is primarily dependent on the number of criminal actors and delinquents. Typical of this component of arrests is the case where several companions are implicated by a juvenile who is "caught"first. These "easy" arrests require only a certain minimal level of effort on the part of the criminal justice system to complete the arrest.

The second component of the arrest/labeling process is dependent on the level of effectiveness of the labeling system itself. Typical of this component is the arrest that occurs after several hours or days of investigative effort. This component is fairly independent of the number of criminal actors in the system.

The arrest/labeling process is formulated as the sum of these two components:

ARRESTS = POLEF + CLEVEF

where
POLEF = the component of juvenile arrests resulting from a substantial commitment of effort on the part of the criminal justice system
CLEVEF = the component of juvenile arrests which is independent of the level of effort extended by the criminal justice system

The "easy" component of arrests is proportional to the sum of the population at risk, those who have committed the offenses; plus the population of potential confessors, those already apprehended and labeled. The relationship is formulated as:

CLEVEF = SQUEEL x TOTCJ

where
TOTCJ = the sum of delinquent and criminal juveniles
SQUEEL = a constant, characteristic of the inefficency of the juvenile criminal

The second component of the juvenile arrest process is that portion dependent on the effectiveness of the criminal justice system. The effectiveness of that system depends on both the quality and quantity of the effort. This component was modeled as a Cobb-Douglas product of two factors: the level of financial resources and the level of professionalism characteristic of the system:

$$POLEF = a1 \times (BUDEFF)^{a2} \times (PROFAC)^{1-a2}$$

where
a1 = a constant
a2 = a constant less than one
BUDEFF = the relative level of the financial commitment to the juvenile arrest process
PROFAC = the relative level of the professionalism of the criminal justice system

The relative level of financial commitment to the juvenile arrest system is the ratio of the current budget to some baseline level. The current budget is determined by the available tax dollars and the way those tax dollars are allocated. The tax dollars available are dependent on the tax rate and the level of the economy. While it is assumed that the allocation of those dollars to the juvenile arrest effort is dependent on the perception of the juvenile crime problem on the part of the decision makers. Thus the relative level of financial commitment to juvenile arrests can be formulated:

BUDEFF = (ECON x TAX x ALLOC)/BDFM

where
ECON = level of the economy
TAX = the tax rate
ALLOC = the portion of tax dollars allocated to juvenile arrests
BDFM = the baseline allocation to juvenile arrests

The quality of the criminal justice arrest effort was modeled as a linear equation:

PROFAC = a1(POFM) + a2(EDUEFF) + a3(BUDEFF)

where
a1, a2 & a3 = constants
POFM = exogenous level of professionalism
EDUEFF = an education factor

Figure 2 summarizes this complex arrest/labeling process; and shows, as labeling theory would suggest, that the rate at which criminal juveniles are labeled delinquent depends on factors other than crime.

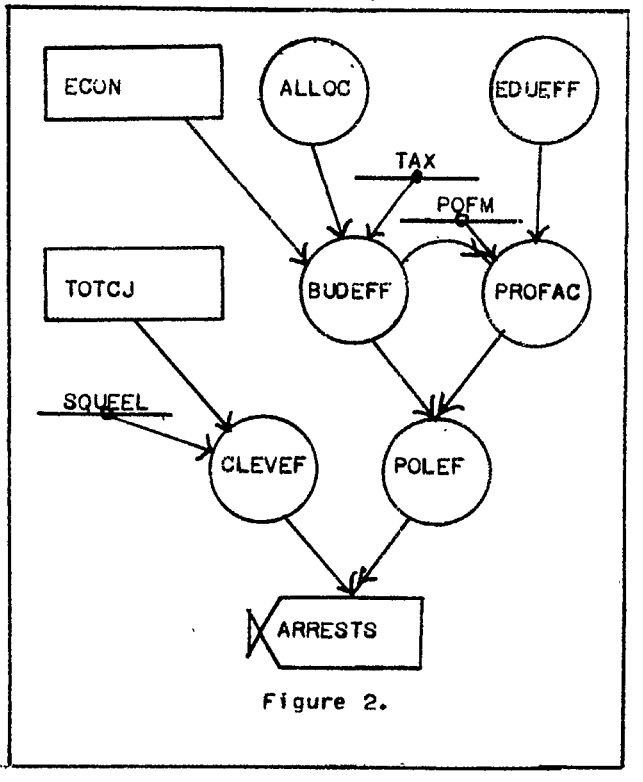

Figure 2.

SOCIAL SYSTEM FRAMEWORK

The five delinquency theories as described above, are dependent on the levels of certain variables in the general social system; the population group levels, the level of education, and the level of the economy.

The economy of an industrial society has been the object of extensive simulation modeling in its own right. However, for simplicity, in this model, it was assumed that the long term changes in economic productivity are able to be modeled as the result of the weighted sum of four independent factors: the quantity of persons in the labor force; the average education level of the society (reflecting both the level of skill training and the level of technology); the level of materialism (a value which puts a premium on productivity and the accumulation of wealth); and some exogenous growth rate reflecting other factors.

The change in education levels is partially dependent on the changes in the economy. In an improving economy the education level will increase. To model this, the change in education level was equated to the sum of an exogenous education change rate plus a factor dependent on the average changes in the economy during recent years.

The general framework of the population system was described above, but there are two additional behaviors of the population system which are important to the modeling of the delinquency theories: birth rates and population mobility.

The number of births in a society is dependent on the combined effects of the biological birth rate, the number of persons available to bear children and a cultural adjustment factor. The cultural adjustment factor was modeled as a variable dependent on the sum of the weighted effects of the economy, education and the relative degree of the centrality of the family in the value system of that society.

For simplicity of modeling, it was assumed that only adults die. To model the net changes in the population due to migration, it was also assumed that only adults migrate. Migration in or out of a given social system is obviously dependent on variables exogenous to that system. However, looking at the social system itself, migration is dependent on the performance of the economy, the space available, and the level of crime. For this model it was assumed that the rate of delinquency among juveniles is a measure of the degree of crime problem in the society.

The five delinquency theories and the economic, education and population levels of the system are conceptually dependent upon a set of variables which are qualitative characteristics of the social system rather than quantities: the degree of social integration, family centeredness, educational homogeneity economic homogeneity and materialism. These characteristics are difficult to model, not only because there is disagreement on their conceptual relationships, but because they have no appropriate unit of measure. In response to this problem, these system characteristics were modeled as index numbers with unity being equated to the starting value, a basepoint. In each case, the models of these characteristics were assumed to have a heavily weighted, exogenous cultural component and a small variable component dependent on variables endogenous to the social system model.

The degree of economic homogeneity is primarily dependent on the economic and political structure of the society. However, an economic depression in a given society, not only reduces the average wealth, but it produces a shift in the degree of economic homogeneity, by forcing a segment of the population completely out of work. The result is that a nonlinear shift in the relative homogeneity of the economy occurs.

The degree of educational homogeneity is largely determined by the history of education in a society and its level of technology. However, for this model the relative homogeneity of the distribution of education is assumed to be, in part, linearly dependent on the relative level of education. In statistical terms, the assumption is that the higher the mean educational level, the greater the variance of the distribution.

The integration of a society is likewise primarily the result of the cultural history of that society. On the other hand, changes can occur in the degree of integration as there are changes in the

ratio of value teachers to value learners; or as there is an increase in mobility, which reduces the influence of the value teachers. Also changes in the degree of economic and educational homogeneity can effect the degree of societal intergration. For the purposes of this model it was assumed that net migration is a measure of the total mobility of the society.

The degree of materialism is determined primarily by the historical experience of the particular social system. But, it is assumed that the level of the economy, the standard of living, has some determining effect on the level of the societal materialism. Also, it is assumed that increased levels of education would cause a reduction in the level of materialistic dependency.

The degree of family centeredness, primarily a cultural given, is also dependent on the educational level, the economic conditions and the current commitment of the society to family orientated life styles. This would mean that as the ratio of children in a society increases there is an increase in the reenforcement of family values by the society.

IMPLEMENTATION AND RESULTS

The conceptual relationships described in the theories and in the social system framework were combined in a series of DYNAMO language statements. However, simulation requires the specification of quantitative, as well as functional relationships. In fact one of the significant results of the modeling process itself is that it raises the question of quantifying the conceptual relationships. Typically the question might be asked, what does a 10% net migration do to the level of social intergration? Or, how much change in in police professionalism is caused by a 20% increase in the police budget? Where possible available research data was used to determine the values of the parameters of the system. In many cases arbitrary, but reasonable, values were slected. To facilitate this parameterization of the system characteristics of a specific social system were incorporated. It was assumed that the social system being modeled was a city of 500,000 persons. The starting point of the model was 1940 and the period of intrest was the fourty year span to 1988. Economic, education and population levels were specified in terms of this specific system. Certain system constants were selected initially to generate a steady state condition for the model. These values were then adjusted to weight and modify the related variables.

The model was executed on the Univac 1110 and the Univac 1106 using DYNAMO II/F, a Fortran based version of the language. The difference equation model was run with time increments of one year. Sensitivity analysis of the increment length showed no significant change for shorter increments.

As a preliminary attempt to derive some insights from the integrated delinquency theory model several runs were made in which only a single parameter or constant was changed. Most of these runs produced the anticipated changes in the levels of the non-criminal, criminal and delinquent populations. However, in a number of cases the long run results were a reduction in the total number of criminal juveniles and an increase in the number of delinquents. Since the number of delinquents is the public measure of the juvenile crime problem, the model outcome suggest that there "apparent" crime problem would be, in fact, opposite to the reality. This phenomena was observed when there was an increased rate of growth in either the level of the economy or the level of education. An attempt to model increased longevity by reduction of the death rate, also produced a rising level of delinquency and a lowering level of juvenile criminal activity. Finally, the same changes occured when the degree of materialism increased.

Two of the runs had to do with the arrest process. In the first case a 10% increase in the relative level of police professionalism resulted in a sharp rise in the number of delinquents. What was particularly counterintutitive about the outcome was not that the number of labeled delinquents increased, but that the total number of criminal juveniles also rose. The same pattern occured in the second case where a 20% increase in the allocation of funds to juvenile arrests was modeled. Again, as the allocation increased, the long run effect was that the total number of criminal juveniles and delinquents increased. This suggests that common sense policy decision might lead to negative results.

Additional analysis of the behavior of the model with changes to single, binary and multiple factors are underway. The objective is to model the changes in the social system so that they correspond to

to the historical changes in those variables. Such fine tuning of the model would allow it to be used as a quantitative, predictive tool.

CONCLUSION

In this paper a dynamic systems model of juvenile delinquency has been presented. Five theoretical criminology models have been incorporated into the system framework which included population, education, economic and social system characteristics components.

The model building process itself has demonstrated that the dynamic systems model can be a useful structure for integrating theoretical sociological models. Moreover, the process has focused attention on the failure of Sociology to evolve adequate mathematical theory models.

The runs that were made with this simulation model have demonstrated the counterintuitive behavior of the social system. Typically, simple solutions like increased police budgets resulted in higher, not lower levels of juvenile delinquency and juvenile crime.

The overall conclusion is that the development of a dynamic simulation of juvenile delinquency theory has raised a new set of questions.

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