

SIMULATION IN CRIMINAL JUSTICE:
A CASE STUDY OF THE JUVENILE COURT SYSTEM

Thomas Moranian
Nachum Finger
Nelson M. Fraiman

ABSTRACT

A simulation model using GPSS-V has been developed for determining flow rates through a juvenile court system linking four serial queues beginning with arrest, through a court review, court carry-order, and court probation. Observations of distributions of waiting times and processing times provide a basis for sensitivity analysis to consider trade-offs between court resources and gains in over-all flow time. The simulation runs with induced variations in court resources show the gains in over-all flow time expressed as reduced average waiting and processing times. The field data (1975) were collected from the juvenile court system of Morris County, New Jersey.

The purpose of this paper is to study the flow of delinquents through the juvenile court system in order to examine those elements which control the rate of flow. Many courts throughout the country are back-logged and according to expert criminal justice opinion the courts need to deal with juvenile offenders swiftly and justly in order to avoid the negative consequences of higher maintenance costs to the community and the anxiety-oriented pressures on delinquents stemming from slow developing court action. (5)(6)(9)(10)

In addition to describing the entire flow process, the study permits an analysis of those resources needed to bring about changes in flow rates. Hence, trade-offs between allocated court resources and gains in flow time can be evaluated. (2)

The juvenile court is perceived as a system of processing the flow of offenders from arrest, through court and, finally, to termination. (2) This process can be formulated (an approximation) as a sequence of serially linked queues where the output of one is the arrival rate of the very next queue.

To illustrate this concept the juvenile court system of Morris County, New Jersey, was selected for observation and as a source of real data. The observations show the flow beginning at the point of arrest then moving on to a waiting period to appear in court for adjudicatory hearing, then moving on to a waiting period again for disposition by the court and, finally, if placed on probation, moving on to a final waiting period for probationary services to begin (see Figure 1). This flow of offenders is typical of many court systems throughout the country. (7)

The entire flow process shows four different waiting periods. The first queue is a waiting time to appear in court. The next two queues emerge in the process just after the adjudicatory hearing when the judge does not decide the outcome and calls for an additional review and/or delay. Cases requiring a short period of time (several days) are postponed and reviewed again thus forming a review-oriented queue. The second type of cases is called carry-orders and they are delayed a longer period of time (several months) on a wait-and-see basis before final disposition. In some cases the final disposition is deferred a number of times after the first review or first carry-order. This deferral triggers a reprocessing through the review or carry-order queues until a decision is reached. In any event, after each review and carry-order the disposition mode for the court remains the same (dismissal, probation, review, carry-order). If an offender recidivates and the outcome is neither dismissal nor incarceration, his present probation is either continued or extended. The model in this study does not distinguish between these two types of probation.

The fourth queue arises when the offender is adjudicated a delinquent and is placed on probation and enters a waiting period for his first service session with the probation officer. The bottlenecks in the overall process are thus dependent on the arrest rate, the processing rate of judges on reviews and carry-orders, on second generation

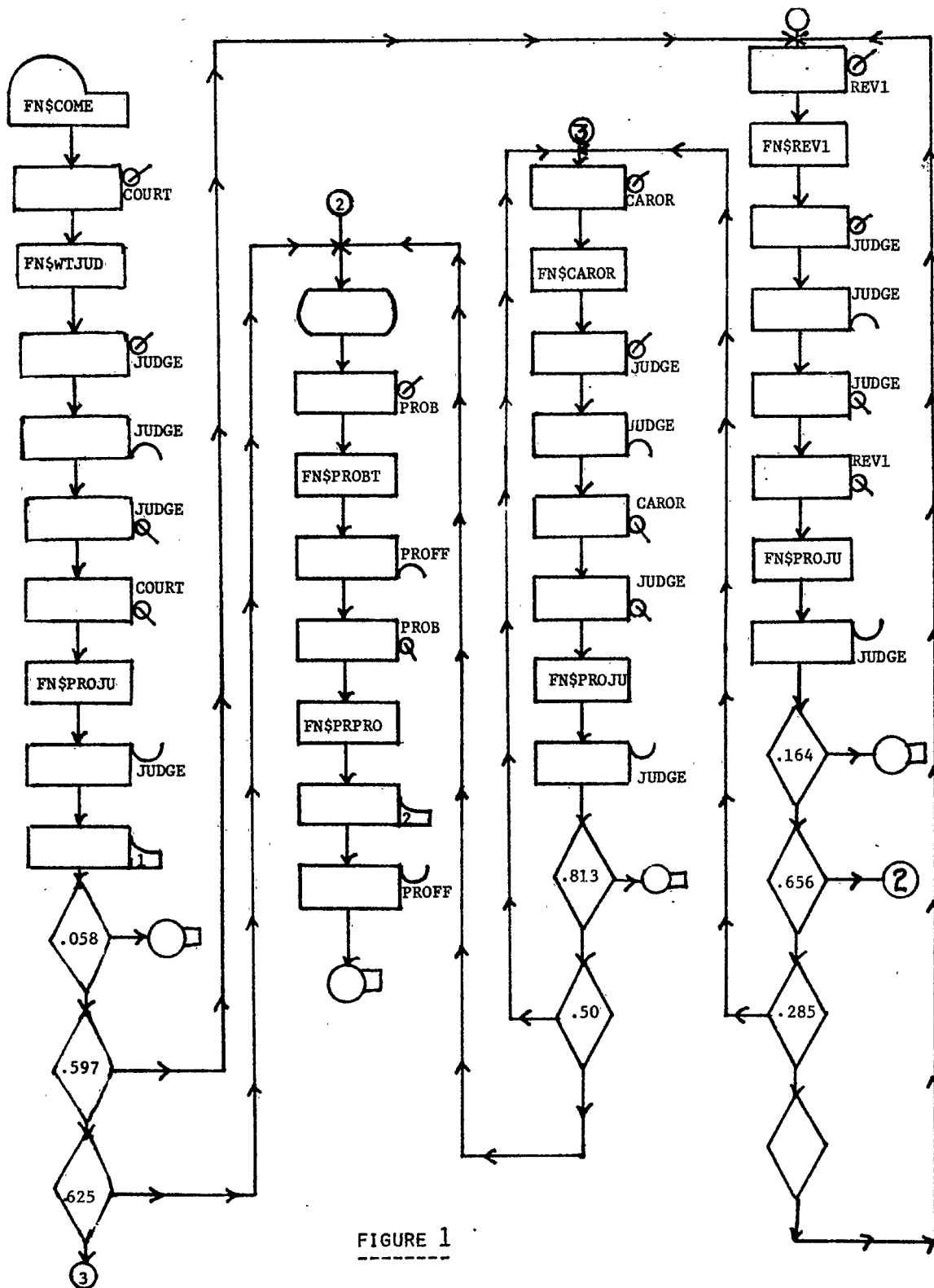


FIGURE 1

BLOCK DIAGRAM OF THE JUVENILE COURT SYSTEM OF MORRIS COUNTY, NEW JERSEY.

reviews and carry-orders, and the processing rate of probation officers. (7)

The flow of offenders processed through the juvenile court system is formulated in this paper as an ordered sequence of related queues. Given the observed distributions for arrest rate, waiting times for court appearance, reviews and carry-order waiting times, re-reviews and second generation carry-order waiting times, and probation waiting times, the composite flow of offenders through the juvenile court system is simulated using GPSSV language. (1)(4)(8) The simulation of flow of offenders throughout the entire juvenile court system is generated based on these distributions. Induced variations in the overall process flow-time or in parts of the total flow-time are produced by deliberate changes in the values of the tested variables controlling the flow. This is helpful in relating and equating shortened flow-times with corresponding induced changes (increases) in court resources allowing gains in reduction of flow-times expressed in terms of incremental resource allocations.

Several assumptions are made in the construction of the queuing model and need brief clarification in order to better understand the simulation. (3) The offenders in the juvenile court system are classified into four disposition categories: dismissal, probation, carry-order, and review. Since carry-order or review defers the final disposition decision (in a sense keeping the offender in "hold"), the final disposition is the outcome of recycling the offender through carry-order or review until the case is either dismissed or put on probation. The model in this study provides for recycling using two observed sets of distributions for flow rates: one set for those offenders going through the court for the first time around, and a second set for those flowing through a second time. The flow rates observed for the second time around are applied to all successive cycles until the offenders are either placed on probation or dismissed. Furthermore, the court processing time for recycled cases is considered the same as those being processed for the first time.

In observing the flow rates no special consideration is given to recidivism. If a youth is arrested two or more times, each arrest is considered a new case in the flow.

In simulating flow rates in a court system of two or more judges, the model assumes no significant difference between the average processing time per case per judge. Similarly, the average processing time amongst probation officers is the same. (7)

The condition and form of the available data required careful consideration and special handling to produce the necessary inputs needed to generate the simulation. (7) The processing rates and waiting times in the flow were expressed in time increments of days. The arrests occur at random but since the exact hour in the day per arrest was not available, the distribution of interarrival times was extracted from the average number of arrests per day recorded for 1975. From a sample of 150 cases terminated in 1975, the distribution of waiting times to appear in court was computed as the difference in days between the date of appearance in court and the date of arrest for each case. The distribution of waiting times to see the probation officer was also extracted from the same sample. The distribution of court processing times was taken from court minutes showing the daily number of reviews, carry-orders, and dismissals. Distributions of waiting times for cases making a second cycle through the court were extracted from the same sample of 150 cases whose results were used for all ensuing cycles. An estimate of processing times for probation officers was determined from data showing the average case load per officer and the average number of cases a probation officer handled daily.

In 1975, 1429 cases were processed by the court of which 5.8% were incarcerated or dismissed, 56.26% set for review, 13.9% carry-ordered, and 24.8% placed on probation. A sampling of the 56.26% recycled a second time through review showed 54.79% placed on probation, 16.4% incarcerated or dismissed, 20.55% set for another review, and 8.22% placed on carry-order. From 13.9% of the original carry-order group, 81.25% were dismissed, 9.38% placed on probation and the remaining 9.38% carry-ordered once again.

Using these actual proportions for the first and second cycles and the observed distributions for waiting times and processing times described above, the present court system of one judge and ten probation officers was compared to other alternative court systems to determine the effect that the number of judges, the number of probation officers, and the number of review and carry-order cases had on the flow rates.

Table I shows that under the present court system (one judge, ten probation officers) an offender waits an average of 49 days from date of arrest to appear in court and, if placed on probation, the offender waits an average of 63 days to first meet the probation officer. Simulations of waiting times in this Table were generated for 18 court systems (all possible

combinations of judges from 1 to 3 and probation officers from 10 to 15) and the results given in Table I. As expected, the average waiting times decrease as the number of judges and probation officers increase.

Table II is similar to Table I except that the proportion of cases in the review and carry-over categories was reduced by 50%. The reduced number of cases was diverted to probation and dismissal in a proportion equal to the initially observed ratio between those in probation and those dismissed. As expected, the average waiting time to appear in court is less and the average waiting to see the probation officer is greater (Table I versus Table II) when more cases were placed in probation. Also, as the number of judges and probation officers increases, the average waiting times decrease.

Table III presents the simulation results of three court systems showing the cumulative per cent of cases waiting to be processed through the court for court systems having one, two, and three judges. Note that the average waiting time to appear in court is three weeks for 18.1% of all cases in a one judge court, 59% in a two judge court, and 77.3% in a three judge court.

Table IV presents the simulation results of five court systems showing the cumulative per cent of cases waiting to see the probation officer for court systems having 10, 11, 12, 13, 14, and 15 probation officers. Note that as the number of probation officers increases, the percentage of cases processed increases for any given waiting time period.

Table I

Average Waiting Time to Appear in Court and see Probation Officer (in Days)

Present System Vs. Alternatives

| No. of Prob. Off. | | No. of Judges | | |
|-------------------|---|---------------|----------|----------|
| | | <u>1</u> | <u>2</u> | <u>3</u> |
| 10 | J | 44 | 19 | 12 |
| | P | 63 | 78 | 93 |
| 11 | J | 50 | 19 | 13 |
| | P | 52 | 60 | 65 |
| 12 | J | 49 | 19 | 13 |
| | P | 23 | 45 | 43 |
| 13 | J | 48 | 20 | 13 |
| | P | 19 | 29 | 28 |
| 14 | J | 52 | 18 | 12 |
| | P | 18 | 18 | 19 |
| 15 | J | 49 | 19 | 13 |
| | P | 16 | 19 | 18 |

J = Judge

P = Probation Officer

Table II

Average Waiting Time to Appear in Court
and see Probation Officer (in days)

Revised System: Reduce 50% Those
Going to Review and Carry Order

| # Prob. | Officer | No. of Judges | | |
|---------|---------|---------------|----------|----------|
| | | <u>1</u> | <u>2</u> | <u>3</u> |
| 10 | J | 37 | 19 | 12 |
| | P | 102 | 112 | 108 |
| 11 | J | 38 | 14 | 13 |
| | P | 74 | 73 | 75 |
| 12 | J | 38 | 19 | 13 |
| | P | 73 | 57 | 67 |
| 13 | J | 37 | 19 | 13 |
| | P | 45 | 56 | 49 |
| 14 | J | 37 | 17 | 13 |
| | P | 23 | 23 | 26 |
| 15 | J | 37 | 17 | 13 |
| | P | 19 | 19 | 18 |

Table III

Cumulative Percentage of Cases
Waiting to be Processed Through Court

(10 Probation Officers only)

| Average wait time (weeks) | No. of Judges | | |
|------------------------------|---------------|----------|----------|
| | <u>1</u> | <u>2</u> | <u>3</u> |
| 1 | 0 | 27.7 | 36.7 |
| 2 | 10.2 | 42.9 | 59.3 |
| 3 | 18.1 | 59.0 | 77.3 |
| 4 | 24.7 | 74.1 | 88.5 |
| 5 | 30.7 | 82.4 | 90.0 |
| 6 | 39.7 | 88.1 | |
| 7 | 50.1 | 93.4 | |
| 8 | 58.1 | | |
| 9 | 64.0 | | |
| 10 | 69.0 | | |
| 11 | 75.3 | | |
| 12 | 79.2 | | |
| 13 | 82.7 | | |
| 14 | 86.5 | | |
| 15 | 87.4 | | |

Table IV
Cumulative Percentage of Cases
Waiting to see Probation Officer
(1 Judge Only)

| Average Wait Time (weeks) | Number of Probation Officers | | | | | |
|------------------------------|------------------------------|------|------|------|------|------|
| | 10 | 11 | 12 | 13 | 14 | 15 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 1.1 | 2.8 | 3.2 | 3.2 | 3.8 | 4.1 |
| 3 | 16.4 | 33.1 | 30.9 | 42.5 | 47.7 | 45.8 |
| 4 | 30.1 | 51.2 | 61.7 | 64.3 | 71.4 | 72.3 |
| 5 | 52.4 | 73.4 | 82.8 | 84.4 | 89.3 | 88.7 |
| 6 | 70.3 | 86.7 | 93.5 | 94.2 | | |
| 7 | 81.0 | 92.4 | 94.9 | | | |
| 8 | 90.7 | 96.1 | | | | |
| 9 | 93.9 | | | | | |
| 10 | 96.1 | | | | | |

This study shows that simulation can be used to describe the flow through juvenile court systems and that meaningful comparisons between various alternatives can be made expressed in terms of allocated resources and benefits in reduced flow rates. The model applied does not attempt to minimize or maximize some objective function, but rather to measure the gains in reduced processing times versus added court resources needed to bring about the gains.

The simulation results show that an increase in the number of judges and a decrease in the number of review cases reduces the average waiting time to appear in court. But on the other hand, reducing the number of review cases increases the initial number of cases placed in probation which requires more probation officers to reduce the average waiting time in probation. Table II shows that increasing the number of probation officers from 10 to 11 drastically reduces the waiting time. However, as the number of probation officers increases, the rate of decrease in waiting time diminishes. The results show that for all alternative court systems the average waiting times converge to a minimum waiting time incorporated in the model to account for the time needed to implement the administrative requirements.

The objective of this study was to simulate the juvenile court section of the total court system. A future study involving a simulation of the total court system (juvenile plus adult sections) would require the classification and collection of additional waiting and processing time data including cost information to permit cost/benefit analyses.

The following is a list of definitions used in the flow diagram (see Figure I):

- FIN\$COME - arrival rate
- COURT - includes waiting to appear in court and be processed
- WTJUD - waiting time to appear in court
- PROJU - court processing time
- PROB - queue to see probation officer
- PROBT - waiting time for probation
- ARPRO - processing time of probation officer
- PROFF - number of probation officers
- CAROR - carry-order
- REVI - review

BIBLIOGRAPHY

1. Bobillier, P.A., Kaiaa, B.L., and Probst, A.R. Simulation With GPSS and GPSS-V Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1976.
2. Bohegian, E.H. The Foundations and Mathematical Models of Operations Research with Extensions to the Criminal Justice System. Yonkers, New York: The Gazette Press, Inc., 1971.
3. Chaiken, J., Crabill, T., Holliday, L., Jaquette, D., Lawless, M. and Quade, E. Criminal Justice Models: An Overview Santa Monica, California: Rand Corporation, 1975.
4. Gordon, Geoffrey, The Application of GPSS-V to Discrete Systems Simulation Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1975.
5. Juvenile Court Digest, "New Federal Juvenile Justice Act Summarized," Juvenile Court Digest, Vol. 6, 1974, pp. 294-296.
6. New Jersey State Law Planning Agency, Report on Juvenile Delinquency and Justice System, Trenton, New Jersey, 1975.

7. Saari, Rosemary, and Hasenfeld, Yeheskel, Brought to Justice? Juveniles, the Courts, and the Law. Ann Arbor, Michigan: University of Michigan, 1976.
8. Schriber, Thomas J. Simulation Using GPSS New York: J. Wiley, Inc., 1974.
9. Time. "The Crime Wave", Time Inc., Vol. 105, 1975, pp. 10-23.
10. Vintner, Robert D. Time Out. Ann Arbor, Michigan: University of Michigan, 1976.