A SIMULATION MODEL OF NEW YORK CITY POLICE DEPARTMENT'S RESPONSE SYSTEM

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Introduction

The urgency of studying police response systems was clearly demonstrated through the recent work done by the members of the Science and Technology Taskforce of the President's Commission on Law Enforcement and the Administration of Justice[1]. A study was conducted in Los Angeles observing the occurrence of incidents in two districts. The results showed that a decrease in police response time was correlated with increased probability of criminal apprehension.

The decrease in response time can be achieved by changes in the response system structure. This requires a thorough analysis of the response system. The resulting analytic models can be used to evaluate various alternative policies and resource levels related to response time.

The objective of the effort described here is to analyze the response system of an actual police department in a large urban area. New York City was chosen for this purpose.

In the context of this study, the system is defined as that phase of police operations and resources concerning the response to requests for police assistance. (Figure 1)

System Structure

The police response system can be viewed as three interrelated subsystems:

1. Input Processing
2. Resource Assignment and Dispatching
3. Field Response and Disposition

The first two subsystems are sometimes referred to as the command and control subsystem. (Figure 2)

Input Processing

The input to the response system is initiated by the incidents that require police assistance. These are reported by various media:

a. by the police-using radio or telephone
b. by the public-using radio or telephone
c. by alarm systems
d. by other departments - using telephone

The majority of the requests for police assistance and service consists of telephone calls received at the Police Communications Center. The requests for assistance cover felonies, misdemeanors, disturbances, ambulance calls and other calls. The pertinent data on the request (i. e. time received, location, request type) is recorded. This requires personnel that is accurate and efficient. The data is then relayed to the second subsystem.

Resource Assignment and Dispatching

On the basis of data recorded on the request, a decision is made concerning the assignment of field resources. In most cases a patrol car is sent. The selection of a particular unit to respond to the request depends on the deployment and availability of resource units in the field. The unit closest to the request location is asked to respond.

Field Response and Disposition

The assigned field unit travels to the requested location. The disposition of the case depends on the request characteristics. If the request concerns a felony, additional resources may be summoned, ambulances may be required; all these affect the disposition. If a suspected perpetrator is apprehended, an arrest is made which increases the disposition time considerably. On the other hand, unfounded calls, minor disturbances may only require a very short disposition time.

After completing the disposition of the case, the field unit notifies the dispatcher that the assignment is complete and that the unit is back in service.

New York City Police Response System Description

Input Processing:

All telephone calls for police assistance come into the Police Communications Center in Lower Manhattan. The incoming calls are answered by two groups of operators. (Group I and Group II Turret operators). Group I Turret operators process only those calls that require police assistance.

If a Group I Turret operator is available, he answers the call and determines whether it is an emergency or a non-emergency call. If it is an emergency call, he obtains the pertinent information on the request and records it on a CRD-7 form. A conveyor belt carries these forms to the dispatchers. If it is a non-emergency call (a call requesting information), he transfers it to the Group II Turret operators. Group II Turret operators answer all non-emergency calls and calls which found the Group I Turret operators busy. If both groups are busy, the call waits until a Group II Turret operator becomes available. All calls which find the Group I Turret operators busy are handled by the Group II Turret operators ahead of the Non-Emergency calls. (Figure 3)

Resource Assignment and Dispatching:

New York City is divided into police divisions each of which contains 4 to 6 contiguous precincts.

Each precinct is divided into 12 to 20 sectors to which various field resource units are assigned. At the Communications Center each division has a dispatcher and one radio frequency to communicate with the field units of that division. For efficiency and speed in communication a master dispatcher is assigned to a group of divisions. The master dispatchers receives the CRD-7 form on the conveyor belt and determines division, precinct and sector of the request and records it on the form. Then he hands the slip to the appropriate dispatcher.

The dispatcher has a large map of his division in front of him with lights indicating field units in service. The dispatcher attempts to reach the closest available field unit to the request location via radio and relays the pertinent information on the CRD-7 form to the police officer in the field unit. (Figure 4)

Field Response and Disposition:

This subsystem is the same as that described in the section on System Strucutre. (Figure 5)

Feedback Nature of the Police Response System

In the studying the Police Response System, there are certain systemic relationships which cause the response system to exhibit feedback. That is, certain system variables not only affect other system variables, but are, in turn, affected by them.

Figure 6 exhibits the four systemic relationships which produce feedback in the police response system:

1. Time to reach a field unit is a function of the field resources.
2. Travel time to the request location is a function of the utilization of the field resources.
3. Probability of arrest depends on response time.
4. Disposition time for arrest cases is much greater than the disposition time for non-arrest cases.

The feedback nature of the system can be more readily understood from the following example. Assume more cars are assigned to the field. This should reduce field resource utilization and reduce response time due to factors 1 and 2 above. As response time decreases, the arrest rate increases causing longer disposition times and greater utilization of field resources due to factor 3 and 4. At some point the entire system is in balance. Simulation can provide insight into the behavior of the system. The complexity of the response system makes a direct analytic approach infeasible.

Simulation Model

The model simulates the NYC Police Response System described in the previous sections. The objective of the model is to study the response time subject to various factors, policies and resources.

Some of the significant assumptions defining the scope of the model are:

1. The simulation is restricted to the borough of Manhattan.
2. Every call for police assistance initiates the dispatch of a single unit of field resource.
3. Different resources are dispatched depending on the type of call
4. Priority dispatching depends on the type of call and call characteristics.
5. There is no resource interchange between divisions.
6. Multiple resource dispatching is not provided for.

Model Input:

Distributions used in the model are either derived from a limited study of police data or "intelligent guesses" where data was not available.

The major input distributions used in the model are:

1. all borough calls coming into the communication center.
2. handling times for emergency and non-emergency calls at the communication center.
3. time to reach a field resource whose parameters are a function of resource utilization.
4. police response to ambulance calls.
5. time for resources to reach the scene whose parameters are a function of resource obligation.
6. disposition time whose parameters are a function of the call type characteristics i. e. (in progress, past, arrest, non-arrest, etc.).

Model Output:

In addition to the usual GPSS output on mean and maximum utilization of call processing, dispatches and field resources and various queue statistics, the following statistics are provided:

1. waiting times for information and assistance calls.
2. time to reach the dispatcher for assistance calls.
3. time until dispatch tabulated by division and priority type.
4. time until resource reaches scene by division and priority.
5. time until disposition completed by division and priority.
6. items 3, 4, 5, for all assistance calls.

Use of Model

The structure of the model has been designed to provide a tool to study a variety of problems. Some of these possible studies are:

1. Changes in resource levels and allocation.
2. New resources types and technology (radio-dispatching of foot patrolmen, radio scooters).
3. Policies concerning response to calls with different resource types (scooter response to ambulance calls, etc.).
4. Changes in incident rates, shifts in crime patterns.
5. Relationship of resource utilization to reduce response time and increased arrest rate.

References

(1) The Challenge of Crime In A Free Society, President's Commission On Law Enforcement And Administration of Justice. Washington, D.C., February 1967

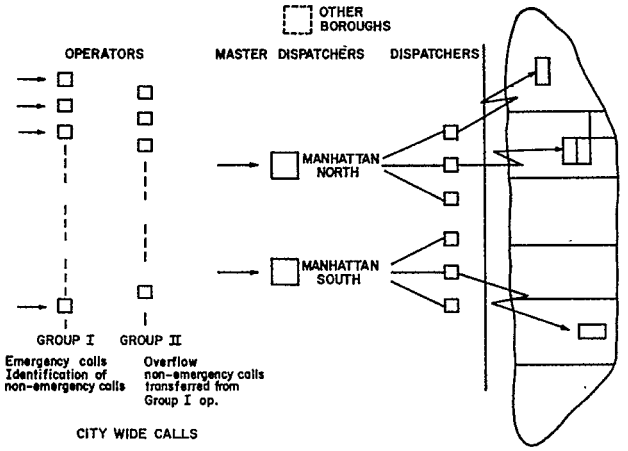

Figure 1

N.Y.C. POLICE RESPONSE SYSTEM

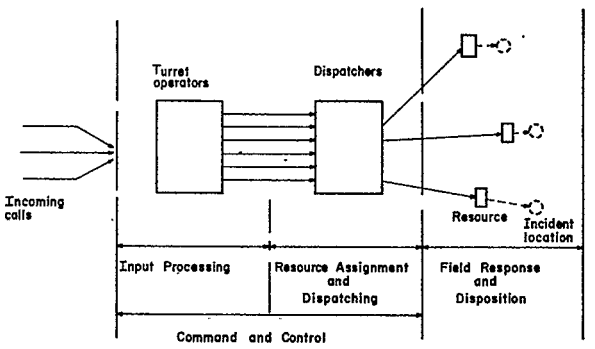

Figure 2

POLICE RESPONSE SYSTEM

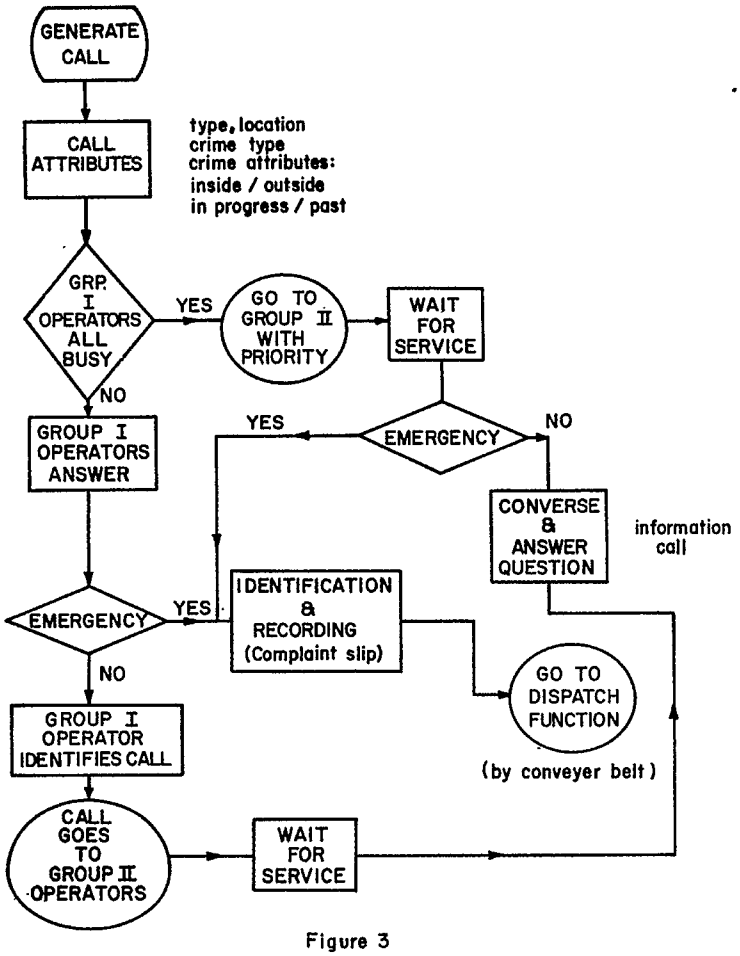

Figure 3

POLICE RESPONSE SYSTEM

INPUT PROCESSING

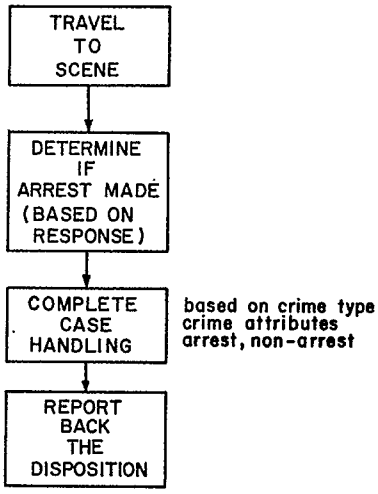

Figure 4

POLICE RESPONSE SYSTEM

FIELD RESPONSE AND DISPOSITION

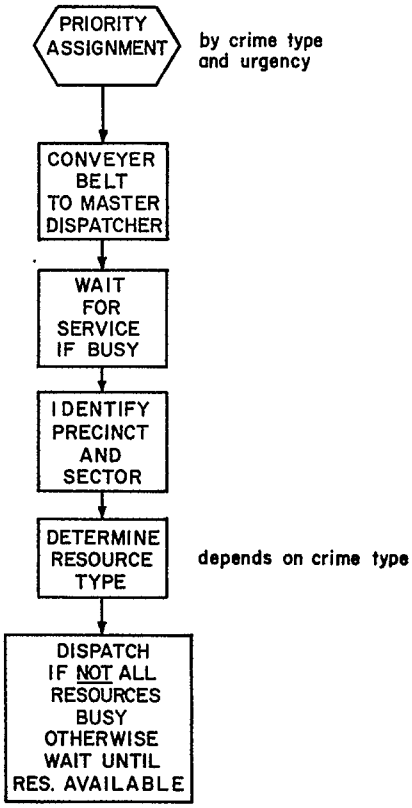

Figure 5

POLICE RESPONSE SYSTEM

RESOURCE ASSIGNMENT AND DISPATCHING

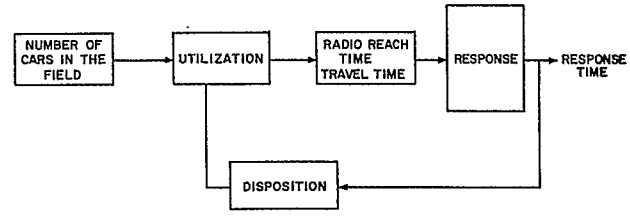

Figure 6

FEEDBACK NATURE OF THE POLICE RESPONSE SYSTEM