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Using Discrete System Simulation to Model the Lane County Criminal Justice System

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Contents

• Background
• Literature Review
• Model Overview, Key Resources
• Selected Model Details
• Data Structure, Example, Groupings
• System Performance Indicators
• Model Testing, Test Scenarios
• Future: Data Collection, More Testing
• Future: Policy Testing
Background

• Project initiated and funded by Lane Council of Governments (LCOG)
• Goal: comprehensive simulation of the Lane County criminal justice system
  • From arrest to release from parole
• Determine bottlenecks of the system and how they effect the key outcomes
  – Public safety, time, cost, efficiency, etc.
Background (2)

• Use model to test scenarios that would be difficult to test in the actual system
  – That might interfere with the system operation
• Software package selected: ARENA
Literature Review

• First criminal justice system computer model
  – JUSSIM (Justice Simulation), Blumstein (1965)
    • Working with Law Enforcement and Administration of Justice
• JUSSIM dealt only with defendant flow
  – Lacked feedback mechanisms that might address recidivism
• JUSSIM II added this feedback
Literature Review (2)

• System Dynamics modeling technique by Bard (1977)
  – Emphasized the strength of feedback loops within the system
  – Defined key performance measures to evaluate the system.
Juvenile Justice Simulation Model (JJSM)

- Built as a discrete event flow model by Stewart (2004)

Focused on

- Final court outcomes
- Recidivism
  - Subsequent reappearance of young defendants within the juvenile justice system
- Simple cost comparisons between different policies and programs
Model: Overview

• Two main flows: Cases & Defendants
  – Case flow influences (provides data for) corresponding defendant flow

• Case flow includes: district attorney (DA), arraignment/grand jury, diversion, trial/sentencing

• Defendant flow includes: book-in, custody review, release or jail/custody, prison, released, …
Model: Key Resources

- DAs, City Attorneys, Federal prosecutors
- Book-in, CREF
- Grand Jury
- Trial (Circuit and Muni)
- Jail
Model: Jail Component

• Five components
  – Holding area
  – Housed pre-trial defendants
  – Housed post-trial defendants
  – Municipal Beds
  – Federal Beds

• Total number of beds is constrained
  – By space and available resources to support

System Science
Ph.D. Program
Model: DA Component

- The DA logic is challenging to model using the “standard” Arena modules
- DA spends time on each case depending on the workload and the priority of the cases
- There are two important time frames
  - Time for a case to move from one decision point to another (elapsed time)
  - Time for DA to process a case (process time)
Model: DA Component (2)

• Elapsed times
  – Arrest to filing (information)
  – Filing to arraignment or grand jury
  – Arraignment or grand jury to 35 day call
  – 35-day call to trial
  – Trial to sentencing

• Process times
  – Time required for DA to process the case to the next stage
Model: Search Component

- When case status is updated, information must be sent to the corresponding defendant
- Defendant must be “found” → search logic
Model: Search Algorithm

• Check all possible places where defendant might be
• To transmit information:
  – Send defendant a copy of the case  --or--
  – Bring defendant to the designated destination
• Implemented Using Arena’s Search, Remove, and Route modules
Data Structure

• Model decision logic keyed to offense type
  – E.g., a DUII defendant is more likely to be released than an armed robbery suspect

• The data has three levels of detail
  – Specific offense type (AIRS Charge Code)
  – Groups of offense types (Felony/Misdemeanor, A/B/C, Violent/Non-Violent, Unclassified, Violations)
  – The general, overall average for all offense types

• Model substitutes aggregate data when detail data is missing
Data Example: Groupings by Offense Type

- This type of grouping is necessary because there are many very similar offense types.

<table>
<thead>
<tr>
<th>Offense Description</th>
<th>Booking Percentage</th>
<th>Decide DA or MDA</th>
<th>Custody Release Percentage</th>
<th>FTA percentage after CREF</th>
<th>FTA percentage after CLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felony Non-violent B</td>
<td>90</td>
<td>100</td>
<td>15</td>
<td>65</td>
<td>25</td>
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<tr>
<td>Felony Non-violent C</td>
<td>85</td>
<td>100</td>
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<td>Misdemeanor Violent A</td>
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<td>Misdemeanor Violent B</td>
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<td>90</td>
<td>30</td>
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<td>Misdemeanor Non-violent B</td>
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<tr>
<td>Misdemeanor Non-violent C</td>
<td>50</td>
<td>70</td>
<td>50</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>Violations</td>
<td>10</td>
<td>65</td>
<td>55</td>
<td>20</td>
<td>25</td>
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<tr>
<td>Parole Violation</td>
<td>100</td>
<td>100</td>
<td>10</td>
<td>90</td>
<td>0</td>
</tr>
</tbody>
</table>
Other Possible Data Groupings

- Split by age
- Split by sex
- Split by other demographics
- The model can handle any type of grouping as long as the data is available
Future Data Collection

• Data regarding the DA both elapsed and process times
• Probation, post prison supervision and parole
  – Inter-arrival times of a specific type of violation
  – Revoke percentages
• Detailed data on sentencing results
  – How long a defendant is sentenced to jail, prison, probation and community service
System Performance Indicators

• Average matrix points of released defendants
• Proportion of sentenced time actually served
• Ratio of sentenced time served to pre-sentence time served
• Failure to appear (FTA) percentage
• Measure of overall system cost vs. outcome or per offender
• Measure of system “balance”
• Recidivism is also of key interest
  – Model is not currently intended to address this
Model Testing

• Is model behavior is similar to the real system?

• Verification phase is nearly complete
  – Correcting errors in programming and specification
    • E.g., verifying that a convicted felon is routed to prison (rather than jail) if their sentence exceeds one year

• Test Scenarios
  – Reproduce base case
  – Experiment with DA resources
Test Scenario: Base Case

- Model run for base year 2001
- Test dataset used with offenses grouped into 13 types

<table>
<thead>
<tr>
<th></th>
<th>Monthly CREF Interviews</th>
<th>Matrix Releases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>Actual Data</td>
<td>628</td>
<td>413</td>
</tr>
<tr>
<td>Model Results</td>
<td>703</td>
<td>468</td>
</tr>
</tbody>
</table>
Test Scenario: DA Resources

• Three scenarios
  – 30 units (interpreted as ~15 people)
  – 60 units (~30 people = current situation)
  – Essentially unlimited

• More DA resources should increase community safety
  – Measured by the average matrix points for released defendants
    • Lower is better
Test Scenario: DA Resources (2)

• Results:
  – At 30 units, the average is 828
  – At 60 units, the average is 393
  – With unlimited DA resources, the average is 333

• Interpretation
  – Model behaves plausibly--showing that changing DA resources would impact community safety
Next: Complete Model Testing

• Full model verification
  – visual and logical

• Testing the jail population composition
  – Number of Pre-trial vs. Post Trial

• Testing the distribution of defendants to other in custody places
  – Forest Work Camp
  – Community Corrections Center
Next: Conduct “Policy” Analysis

- Impact of Risk Assessment vs. Matrix points
- Impact of changing resources
  - DA
  - Public defenders (are these modeled?)
  - Jail space
  - Court resources (judges)
- Impact of FTA %
- Impact of lowering plea bargaining %
- Etc.
Future Work

• Modeling bargaining and negotiation between two sides (DA and Public Defenders)

• Improvements in post prison supervision (PPS)
  – key start to determine recidivism

• Recidivism (Feedback into the system from PPS to arrests)
References


• J. F. Bard, Criminal justice dynamics: A planning model, Winter Simulation Conference Proceedings of the 9th conference on Winter simulation - Volume 1, Gaitherburg, Maryland, United States p258 – 268, 1977