



Continuous Improvement Associates

Calls for Service Dynamics and Community Policing

We often don't agree on what's going to happen & fail to foresee "side effects."

Here's an example of how systems thinking helps.



The Problem

This paper examines how officers respond to an increasing number of calls for service (CFS) with limited resources and it shows the effect of these responses on the system.* It's an example of the perversity of systems and how our "solutions" can cause our problems.

Reported and Actual Crimes?

Figure 1 shows that the model distinguishes between crimes and reports of crime. There are crimes, a fraction of which are actually reported, that result in calls for service. So CFS depends on "Population" and the rate at which people call. The actual crime rate is essentially unknowable. This is one advantage of modeling: we can examine the behavior of variables that cannot be accurately measured.

Calls for Service

Figure 2 shows that "dispatching calls" increases the number of "Outstanding Dispatched Calls." Calls are cleared as officer time is available.

Managing Time Pressure

When police have limited resources as "Population" and CFS increase, they are subject to increased "officer time pressure." In Figure 3 Loop B1, **Manage Time Pressure**, shows one response: officers can reduce "education &

What is systems thinking?

Seeking to understand system behavior by examining "the whole" ... instead of by analyzing the parts.

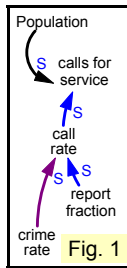


Fig. 1 Crimes & reports.

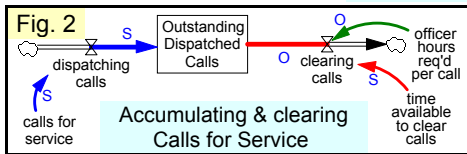


Fig. 2 Accumulating & clearing Calls for Service

Officer Time Pressure Effect on Educ & Prev Time

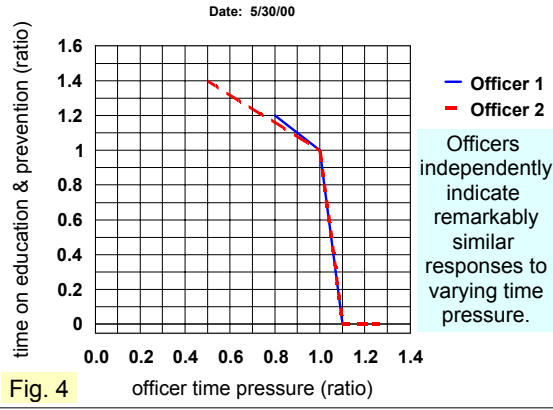


Fig. 4 Officers independently indicate remarkably similar responses to varying time pressure.

prevention time" to make more time for clearing calls. Figure 4 shows how two officers indicated their "education & prevention time" would change with changes in time pressure. Though they made independent estimates, their indicated responses were quite similar. The simulations use a graphical function that reflects this dependence.

What Happens to Calls for Service?

But when asked how increased "education & prevention time" affects CFS, one officer said calls would decline, while the other said calls would go up!

This is initially surprising, but makes sense.† The reasoning: while crimes go down in the long run (~48 weeks), in the short run (~12 weeks) increased community involvement results in an increased number of calls.

Figure 3 shows that police invest in "education & prevention" to increase the reporting of crimes (B2, **Public Involvement**) and reduce the number of crimes (R3, **Crime Prevention**).

Both officers independently estimated how crimes and crime reports would respond to changes in "education & prevention time." Again, their estimates (not shown) were similar; an approximate average response is used in the simulations.

An Expected Result

Figure 5 shows the result of the simulation. For the first 10 weeks, the model is in "steady state." This means the model simulates showing no changes in the values of variables; that is, the model is in equilibrium: the number of calls for service

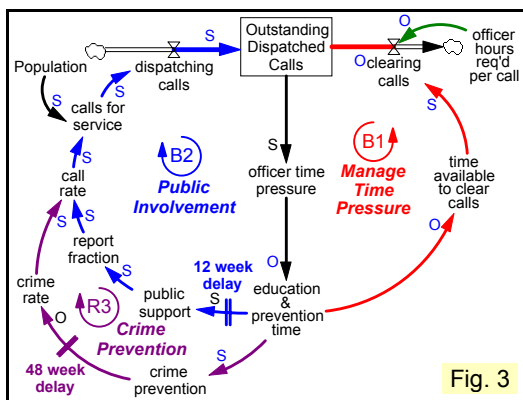
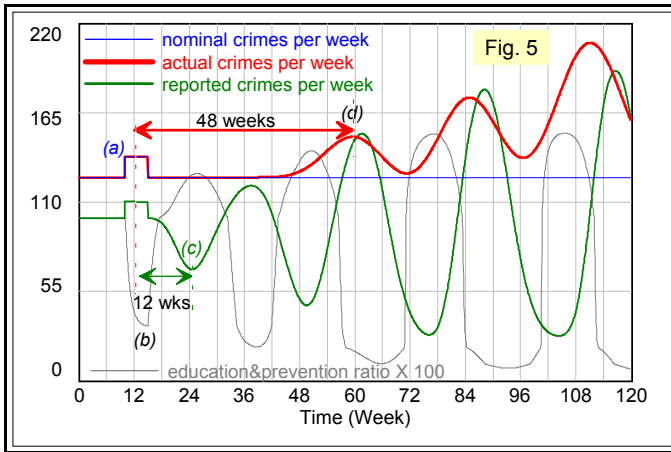
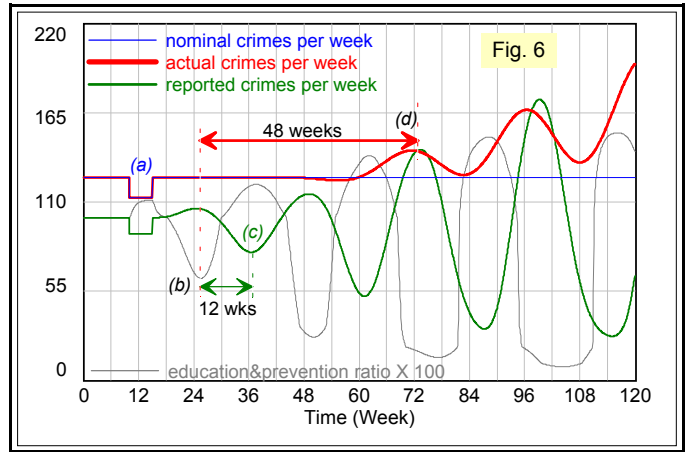


Fig. 3 B1 shows "education & prevention time" is varied in response to a changing level of outstanding calls. B2 and B3 show the effect investment in "education & prevention time" is to increase public support and reporting of crimes (B2) and to prevent crimes (R3). These loops create interesting dynamics.



A simulation from equilibrium with a 10% positive pulse in nominal number of crimes per week. Result: system out of control.



A simulation from equilibrium with a 10% negative pulse in nominal number of crimes per week. Result: system also out of control.

can *exactly* be handled with no excess or deficit of capacity. This allows perturbing the model to see how it responds without complicating initial transient behavior.

At 10 weeks the model is disturbed with a positive pulse in the crime rate for 5 weeks. The multiple overlapping simulation waveforms look complicated, but here's how it plays out:

- (a) A 10% pulse in the number of **actual crimes** produces a 10% pulse in **reported crimes**.
- (b) The increase in **reported crimes** above the capacity available to handle them causes a drop in "education & prevention time" because officers give priority to clearing calls.
- (c) Around 12 weeks later, **reported crimes** drop due to reduced "education & prevention time." This is because less time on community policing initially reduces the number of calls. Note that as the number of **reported crimes** drops, there is again more time for "education & prevention" ... both oscillate in opposite directions.
- (d) About 48 weeks after the minimum in "education & prevention time" the number of crime rate peaks.

All in all, this makes sense. When crime exceeds the capacity to handle it, even for a short time, the system oscillates out of control.

An Unexpected Result

Figure 6 shows results with a negative pulse. Surprisingly, *the system also goes out of control!* How can this be considering that overall there's more capacity than needed?

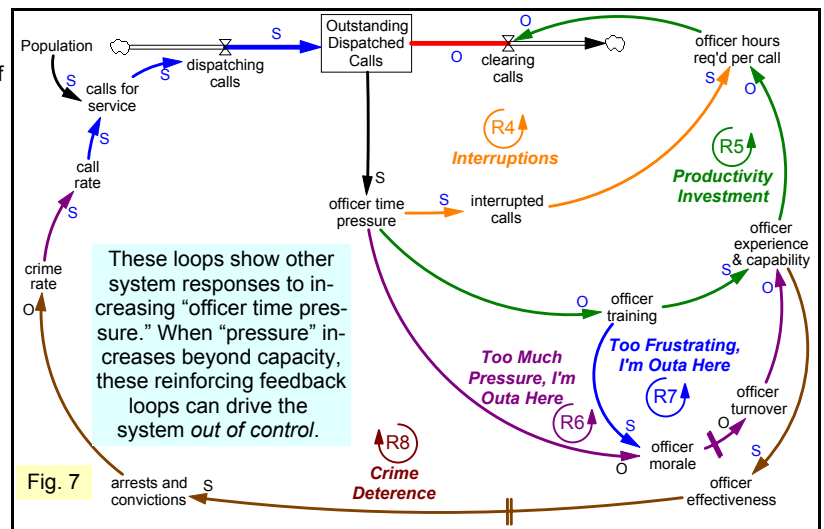
Here's how: A decrease in CFS allows more time for "education & prevention;" this results in a

greater percentage of crimes reported. After the negative pulse, as with a positive pulse, there are more calls than can be handled ... and this sets off oscillations.

Figure 7 shows other responses to increased "officer time pressure" that can have a negative effect on CFS.[†]

Conclusion

The lesson for community leaders: Systems are perverse ... our solutions cause our problems. Maintain excess policing capacity to avoid potentially ever-increasing waves of crime. *Don't get too close to equilibrium!*



Our "Solutions" Cause Our Troubles

"In many instances it emerges that the known policies describe a system which actually causes the observed troubles. In other words, the known and intended practices of the organization are sufficient to create the difficulties being experienced. Usually, problems are blamed on outside forces, but a dynamic analysis often shows how internal policies are causing the troubles. In fact, a downward spiral can develop in which the presumed solutions make the difficulties worse and thereby cause greater incentives to redouble the very actions that are the causes of trouble."

Jay Forrester, "Counterintuitive Behavior of Social Systems", 1995*

Workshop Benefits

An organization can:

- Understand the sources of, and resolve, conflicting points of view.
- Develop policies that designed to create the desired results.
- Develop measures to confirm the policies are working.

It's Not Whether to Use Models, but Which Model

"... models are simplifications of actual systems, but computer models can be far more comprehensive than the mental models that would otherwise be used. ... there is nothing new in the use of models to represent social systems. Each of us uses models constantly ... for decision making. The mental images in one's head about one's surroundings are models. ... The question is not to use or ignore models. The question is only a choice among alternative models."

Jay Forrester, "Counterintuitive Behavior of Social Systems", 1995*

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