Planning Theory, Crime Prevention through Environmental Design (CPTED) and complexity: what planners can learn from COVID-19

Love, T.[1]*, Cozens, P.[1] & Cooper, T[2].

Affiliations

[1]Curtin University

[2]Edith Cowan University

*Corresponding author

ORCiD

Terence Love https://orcid.org/0000-0002-2436-7566

Paul Cozens https://orcid.org/0000-0002-5620-2416

Trudi Cooper http://orcid.org/0000-0002-4758-5881

Abstract

This paper focuses on planning as a mode of analysis and design based on simple linear 'causes' and argues this is not sufficient. The authors propose instead that planners address complex planning situations and phenomena with feedback loops, and this requires a different approach and different tools. We demonstrate this with a comparative case study of planning to address health and crime in Perth and Sydney during the recent COVID-19 pandemic. We contend that it is necessary to move away from thinking in terms of simple linear causes in most planning processes (as well as in health and crime) and that this challenges many existing theories in planning, public health, and crime prevention. A key issue is the approach taken by planning professionals. The systems researchers and others who create mathematical models of situations are aware of the role of feedback loops and include them in their models. Our findings suggest significant benefits can result from planners incorporating feedback loops into planning practices.

Keywords: planning; planning education; systems thinking; feedback loops; CPTED; COVID-19; wicked problems.

Background

Planners contribute to liveability of urban landscapes, and this includes ensuring that urban design minimises opportunities for crime and supports human health and well-being (Chang & Egbutah, 2015; Cozens, 2016; Duhl & Sanchez, 1999; Home Office, 2004; Northridge & Sclar, 2003; Shipway & Homel, 1999; WHO, 2020b). Megahed and Ghoneuim (2020) highlight how disease has always shaped the built environment. The bubonic plague and fire underpinned the renewal of renaissance cities in the 14th-17th centuries. The Great Plague in London occurred in 1665. The fire of London in 1666 is credited with more or less ending the plague and leading to increased planning control (restricting the use of wood in buildings) and changing urban design. Del Carmen and Robinson (2000) have argued the slum clearances during the industrial revolution, (for example, St. Giles, Saffron Hill, Old Nichol, in London) used crime prevention through environmental design (CPTED) strategies to reduce diseases such as tuberculosis and cholera as well as decreasing crime in dangerous crime hot spots, known as 'rookeries' (Beames, 1850). They suggest "efforts to control the spread of illness were achieved through CPTED strategies which preceded the academic writings of those considered to be the founders of CPTED" (Del Carmen & Robinson, 2000, p. 267). The rookeries developed because of multi-occupancy that came about because of the rapid growth of the urban population and the need to live close to where employment was. Urban growth was driven by poverty that came from the collapse in agriculture and decrease in infant mortality. Such sanitary reforms in the Victorian era in the UK sought to fight epidemics in cholera and typhoid and led to new planning regulations. Most recently, the Covid-19 global pandemic has had "a direct bearing on the very foundations of urban planning and architecture theory and practice" (Megahed & Ghoneim, 2020, p. 2). All of the above links between planning, health and crime prevention are echoed in the most recent definition of crime prevention in environmental design (CPTED) of ISO 22341:2021 (ISO, 2021, p. 1), based on Cozens (2016, p. 10), 'a process for analysing and assessing crime and security risks to guide development, site management and the use of the built environment in order to prevent and reduce crime and the fear of crime, and to promote and improve public health, quality of life and sustainability'.

There have frequently been calls for urban planning to consider new knowledge and to be more critical and some have argued that planning theory and research has adopted an analytical scope that is often limited and fails to critically analyse key assumptions within the discipline (e.g.,

Yiftachel & Huxley, 2000; Yiftachel, 2001). This paper considers knowledge outside planning to explore new ways forward.

Many contexts are complex, and in planning this is recognised in the literature of 'wicked problems' and planning complexity (see, for example, Briggs, 2012; Rittel, 1972a, 1972b, 1984; Rittel & Webber, 1974, 1984). Conventionally, planning assumes outcomes are based directly on simple linear causes. This paper suggests that planning research and practices will benefit from understanding the role of feedback loops and their implications for planning outcomes. It demonstrates this via a case study approach using two Australian cities, Perth, and Sydney as examples.

Feedback loops are processes that amplify causal relationships. For example, 'increased housing density' in an area causes 'increased availability of potential workers'. Or 'shortage of housing stock' causes 'increased house prices and rents' and 'greater homelessness'. Expressed symbolically, A causes B and C; where A is 'shortage of housing stock', B is 'increased house prices and rents' and C is 'greater homelessness'. This is simple causality. It can be more complicated yet remain 'simple causality' in the sense that A may cause changes to B and C which may in turn cause changes to other factors D, E, F and G.

Many difficult planning problems have complicated causal relationships and often when the complexity gets too great these kinds of situations are often, mistakenly, regarded as 'wicked problems'. It is mentally easier to predict outcomes in simple causal situations in which a factor, A, causes changes in factors B and C. It is more difficult, but still possible, to mentally predict outcomes of more complicated situations, usually with the help of some sketches such as those of Robert Horn (e.g., http://bobhorn.us/assets/uc-bigscreen-platformsforthought-what-is-3_reduced.pdf). The ability to predict outcomes in planning situations is a key issue and will be discussed later.

Planning situations involving feedback loops present a completely different kind of problem to those with simple or complicated causality. Using the same example and comparing a linear analysis with an analysis that uses feedback loops, the difference becomes apparent. A simple causality situation analysis is 'a shortage of housing stock' *causes* 'increased house prices and rents' and 'greater homelessness'. As described above, this is of the form: A *causes* changes in B and C.

Suppose, for example, in a working class suburb, the increased house prices and rents result in gentrification that makes local shopping more viable and in turn results in conversion of some residential properties to businesses and shops – reducing the housing stock and further increasing house prices and rents. Another example where inner city areas known for their vibrancy, musicians and artists etc. are perceived as attractive and then subject to gentrification, pushing out the people that gave the area its character. Both are examples of a situation with a first order feedback loop. It makes thinking through the process and predicting outcomes much more difficult than in simple causal situations.

For example, note the difference in difficulty in the feedback loop situation, compared to simple or complicated situations, in being able to accurately answer the question, 'How much will homelessness change and why?'

One possibility, gentrification leads to lower population density (fewer people living in a single space and less multi-generational households, shared houses and multi-key dwellings. What occurs depends upon a variety of social factors, such as whether there is cheaper housing and employment somewhere else, and the kinship networks people have. There are different possible outcomes. The first, is no effect on homelessness. People may move away and find housing and

work in cheaper locations. There is a shortage of workers in the gentrified neighbourhoods as people who used to work there move elsewhere and choose not to commute, thus making it difficult for the newly arrived to find cleaners or gardeners. Clearly, this may not result in a rise in homelessness. A second outcome is the location of homelessness may be displaced. Displacement of poorer families into fewer locations or at greater distances from employment may occur. This can result in increased travel distances to work for displaced people and in overcrowding in other locations increasing family stress. A third outcome is the temporary increase in homelessness which resolves over time. It may result in the loss of informal supports, make life more difficult for those remaining, who may gradually drift away to live elsewhere and eventually this becomes the same as the first outcome; no effect on homelessness. A fourth outcome is people may stay in the area sleeping in cars or couch surfing, or sleeping on the streets to be close to employment and social networks.

The additional difficulties in understanding and predicting outcomes stem from the structural differences in causality in the situations. Expressed in a symbolically similar manner to the previous examples the changes in A, cause changes in B and C, and these also result in changes in A which cause further changes in B and C which in turn cause changes in A and so on.

Of course, these are idealised examples in which one feedback loop of causality results in all the factors influencing each other and thus making prediction of outcomes difficult to understand. Real-world planning must contend with interactions of multiple factors. However, even simple examples of real planning situations with feedback loops present much more difficulty than the above when the actual feedback loops are taken into consideration. In what follows, the diagramming follows the conventions of systems dynamics causal loop diagrams and stocks and flows models (see, e.g., Binder, Vox, Belyazid, Haraldsson, & Svensson, 2004). Figure 1 below is an example of the relatively simple feedback loops of causality relating to planning public green space to help with clean air in a city.

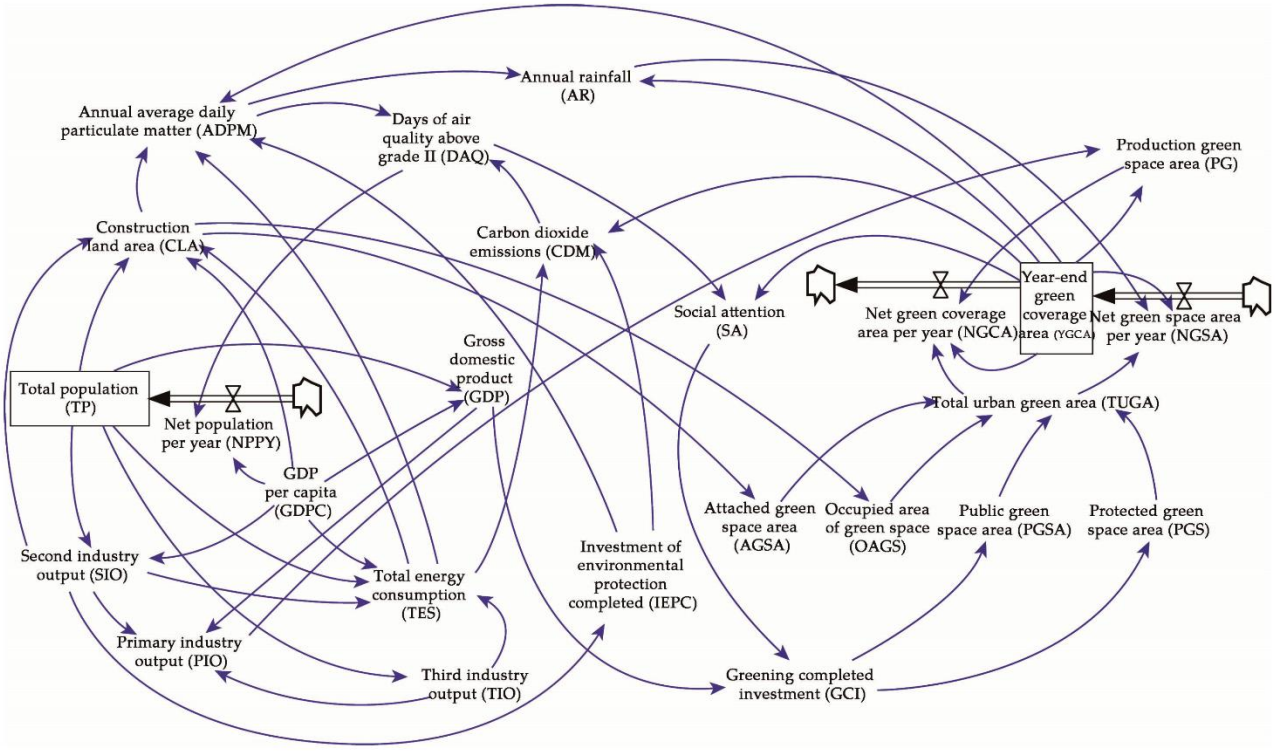

Figure 1: Li, Fangzheng, Yinan Sun, Xiong Li, Xinhua Hao, Wanyi Li, Yun Qian, Haimeng Liu, and Haiyan Sun. 2016. "Research on the Sustainable Development of Green-Space in Beijing Using the Dynamic Systems Model" Sustainability 8, no. 10: 965. https://doi.org/10

Figure 2 is another example of a real and relatively simple planning situation with feedback loops. In this case, the diagram shows the causal feedback loops of multiple factors influencing public health in relation to transport.

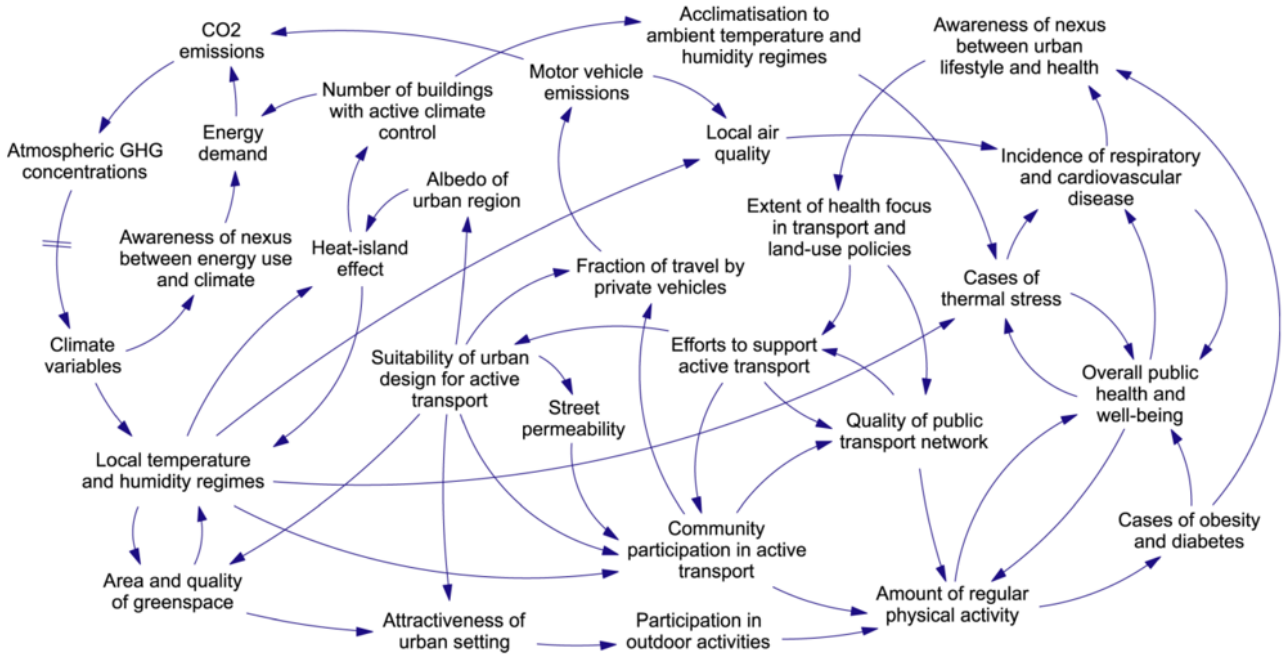

Figure 2: Proust, K.; Newell, B.; Brown, H.; Capon, A.; Browne, C.; Burton, A.; Dixon, J.; Mu, L.; Zarafu, M. Human Health and Climate Change: Leverage Points for Adaptation in Urban Environments. ***Int. J. Environ. Res. Public Health*** 2012**, *9*, 2134-2158. https://doi.org/10.3390/ijerph9062134**

One challenge for planners is to maximise the accuracy of their predictions about how planning recommendations will affect ‘overall public health and well-being' in the above.

Another key question for many planning proposals is, 'Will it produce unintended negative outcomes? A third question is 'How can the assumptions that inform planning be improved?’ (Sterman, 2002). Failure of prediction, and failure of planning is costly. The routine use of feedback loops in planning processes increases the likelihood that unintended consequences will be identified at the planning stage and before the project commences.

Another important question is why is the inclusion of feedback loops so important in planning? Firstly, it is important to be able to predict the future with some reliability. Reliable prediction of the future is the foundational and essential skill of any form of planning or design. If one cannot predict the future consequences of planning or design decisions reliably, then, although Planning (with a capital P) self-evidently exists, it just isn't doing planning (with a small P) as well as it could.

Secondly, the inclusion of feedback loops has wider implications for planning strategies when planners have difficulty to hold a mental model of a real situation that has feedback loops and to predict outcomes. Group problem solving, by stakeholder or public consultation, offers no benefits. The group simply consists of multiple people who all hold a mental model of how feedback loops may affect outcomes the situation. Therefore, in planning situations that involve feedback loops, stakeholder or community consultation, planning teams, multidisciplinary teams and the like may not improve decision-making. This has implications for decisions about when it is appropriate to apply guidelines, and which situations cannot be addressed through this means.

Third, situations with feedback loops typically have dynamic outcomes that change over time. Thus, planning strategies that aim to achieve 'an' outcome are inappropriate. Outcomes will dynamically change in scope, scale, and direction over time. In other words, linear planning

approaches cannot be relied upon achieve the intended outcome, as has been demonstrated by numerous historical planning failures.

Planning approaches to address feedback loop situations are different in form to those used for situations which are causally simple. A different suite of possible planning tools for feedback loop planning situations are not only possible they are also more effective. This paper will illustrate the above through a case study focusing on two topics: health intervention and crime prevention and the strategies used to address them in two cities: Perth and Sydney.

Health interventions and crime prevention are examples of planning realms with complex contexts. Health interventions for complex situations such as pandemics involve feedback loops between key factors. When the World Health Organisation (WHO) declared COVID-19 a pandemic on March 11, 2020, some governments imposed rapid and severe lockdown measures; others responded less. The health trajectories were dynamically different. A crucial difference was understanding that the COVID-19 phenomenon is *dynamic* and *complex* and includes feedback loops. Similarly, crime during COVID-19 and at other times has feedback loops that modify criminal behaviour (Drabek, 1986).

These are examples of planning practice, and this paper draws on these examples to propose planning theories and practices need to move beyond approaches associated with 'principles', policies and linear causal theories, and instead focus on approaches that centralise feedback loops in planning processes and decision-making, whether about urban form, crime prevention or pandemic control.

We note, however, that in spite of the above and the awareness of the significant roles of feedback loops in shaping outcomes, health intervention analyses and modelling of COVID-19 typically uses simple linear causality, for example following critical care pathways (e.g., the COVASim model reported in C. C. Kerr et al., 2020; Moss et al., n.d.). The linear critical care pathway used for the Doherty Institute model is shown below in Figure 3 and the COVASim flow model in Figure 4.

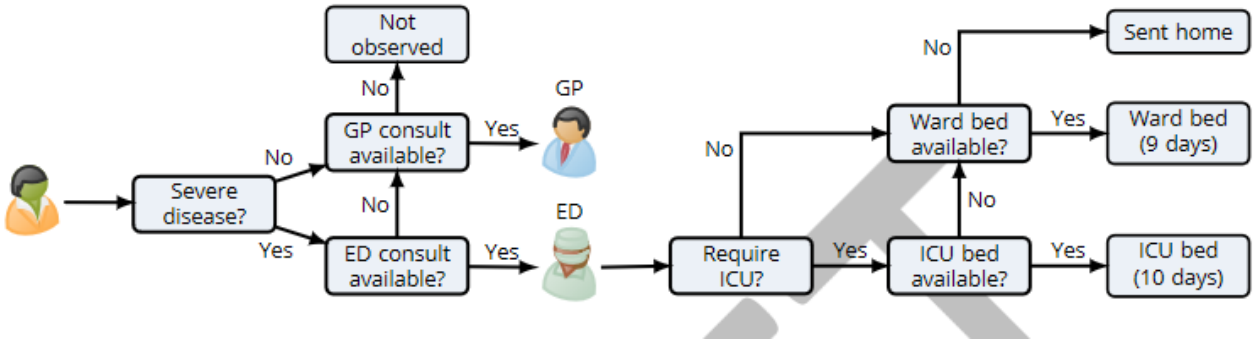

Figure 3: Critical care pathway COVID-19 model (Moss et al., n.d., p. 10)

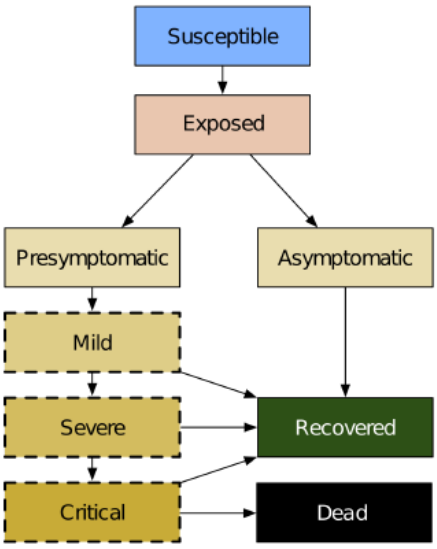

Figure 4: COVASIM model structure (C. C. Kerr et al., 2020 p. 4)

Conceptual Framework

Conceptually, the paper uses comparative analysis of two complex planning contexts and draws on theories and concepts from systems analysis and complexity theory, plus new systems and complexity theory and concepts developed over the last 2 decades by Love in collaboration with Cooper (Love, 2001, 2002; Love, 2007, 2008; Love, 2009; Love, 2010; Love & Cooper, 2008; Love & Cooper, 2007a, 2007b; Love & Cooper, 2011a, 2011b) and on criminological theories of CPTED and health of Cozens (Cozens, 2015a, 2015b, 2016; Cozens & Greive, 2009; Cozens & Love, 2009 ; Cozens, Neale, Whitaker, & Hillier, 2003; Cozens, Pascoe, & Hillier, 2004).

The approach echoes Rittel and Weber's boundary drawing in relation to what they called 'wicked problems' (Rittel & Webber, 1974, 1984; Rittel & Webber, 1972). Of special interest in this paper is the different effectiveness of planning approaches in planning situations with simple linear causality, in contrast to planning situations with complex feedback loops.

The authors' analytical approach contrasts with that of others analysing planning strategies who focus on linear causal methods, for example the R-based view of COVID-19 spread common to health services (e.g., C. C. Kerr et al., 2020; Moss et al., n.d.) and the crime prevention theory known as Routine Activity Theory (RAT) (e.g., Cohen & Felson, 1979; Felson & Clarke, 1998; Felson, Jiang, & Xu, 2020; Stickle & Felson, 2020) neither of which include feedback loops.

The authors undertake the above as an analogue for a type of common planning approach that are structurally similar, e.g., urban planning approaches focused on demographics, traffic flows, employment, or land uses.

We therefore seek to highlight the differences between planning situations with simple linear causality, and those which are more dynamic and focus on complex feedback loops. This research uses systems dynamics diagramming to explore, analyse and demonstrate the above via planning case studies of crime and the Covid-19 pandemic in Perth and Sydney. Appropriate methods for planning and crime prevention that require the least data are causal loop diagrams and system dynamics modelling.

Case Studies

The case studies are of Perth and Sydney in terms of the characteristics of their planning responses to the COVID-19 epidemic and related changes to crime and crime prevention.

Perth is the capital city of Western Australia (WA), the largest state in Australia by area, and economically, primarily acts to service the extractive, agricultural and tourism industries of WA. As a result, much of its local economy focuses on service industries, which service the population and businesses of Perth itself, but are funded by revenue derived from the industries outside Perth. WA provides positive economic support to all other states in Australia and to the Federal administration and government. In short, good planning in WA is important because wealth generated in WA largely funds the remainder of Australia, as well as for social benefit. The economic role of WA strongly influences planning strategies for Perth and throughout WA.

Sydney is the capital of New South Wales (NSW) and has an advanced market economy with the main contributors being financial and insurance services, manufacturing, and tourism. Sydney and is the Australian base for many major manufacturing and commercial businesses and has the headquarters of the commercial and public broadcasters. The governance of Sydney is distributed across 31 local government areas that make up the Sydney metropolis.

Responses to COVID-19 and related Crime and Crime Prevention strategies

Perth, WA and Sydney, NSW developed and utilised very different planning responses to COVID-19 and related crime and crime prevention situations. These to a large extent reflect their organisational differences and contexts.

In general, it appears at this point, that the Perth strategies were more successful. This is predicted on the fact that compared to Sydney, Perth has had:

- Much less lockdowns
- Less COVID-19 infection in the community
- Significantly increased domestic product and growth in Perth - compared to the significantly reduced financial activity and outcomes in Sydney (ABS, 2021)
- Expanded support for vulnerable citizens and groups
- Smaller changes in crime patterns
- Less civil disturbance

Below, we analyse these differences between Perth and Sydney in terms of the differences in the planning situation, specifically those structural difference relating to feedback loops and causality of effects of planning factors on each other.

Perth and Western Australia

The strategies developed by the WA government to control COVID-19 as soon as it was declared a pandemic in March 2020 were centralised, extensive, intense, and immediate and included an immediate declaration of a State of Emergency. The key elements were:

- Immediate closure of WA borders

- Division of WA into areas with no movement across the border of those areas and no access to Indigenous communities
- Public health advice to wash hands frequently
- Strategies based directly on professional public health advice
- Severe household lockdown with strictly limited allowances for movement outside the home to obtain food or restricted exercise - all with masks
- Police redirection of duties to enforce lockdown and mask wearing and manage potential for civil insurrection. Many police crime prevention activities such as drink driving testing were stopped
- Significant investment in COVID-19 testing and contact tracing
- Temporary housing was provided to homeless people
- Contact-tracing SAFEWA QR code app was developed in WA and quickly implemented along with alternative contact movement recording comprising attendance sheets for name, time, date and phone number in all cafes, shops and other establishments open to the public
- $5.5 billion WA recovery plan including funding for new social housing program, to support the construction industry and support for reduced fees on TAFE courses (https://www.wa.gov.au/government/wa-recovery).

After the immediate hard lockdown was completed, State borders remained closed to international and interstate travel and intrastate travel restrictions within WA and masking requirements were reduced.

Later, in 2021, two additional lockdowns were imposed each following the discovery of an infected person in the community due to (rare) failure of infection control in quarantine.

Functionally, the primary aims of the WA government COVID-19 strategies were:

- Protect people of WA, particularly the socio-economically disadvantaged, from the adverse effects of COVID-19
- Control the incidence of COVID-19 in the population
- Maintain the economic activity of the extractive and agricultural industries
- Avoid civil disturbance
- Minimise crime

Sydney and New South Wales

The strategies to control COVID-19 developed by the NSW government to control COVID-19 were philosophically, politically, and functionally fundamentally very different to those of the WA government. For the NSW government, the priority was to maintain business activity. The main characteristics of the NSW government response to the COVID-19 epidemic were;

- Slow responses
- Minimisation of lockdown, business and organisation temporary closures, and mask wearing

- Keeping open the borders internationally and interstate. International borders were eventually closed by Federal government rather than NSW State government
- Minimal investment in testing and contact tracing
- Minimal changes to policing priorities and activities
- Encouragement of use of the Federal COVIDSafe contact tracing app, which proved ineffective on many phones and was distrusted by many with privacy concerns (Department of Health, 2021)

Differences in COVID-19 outcomes

WA government COVID-19 strategies outcomes have been:

- Predominately zero cases of COVID-19 in the community
- Minimal cases in quarantine and hospitals - typically below 10 active cases on any day and approximately zero cases per day
- Total number of COVID-19 infections since March 2020 of around 950 at the time of writing with zero new cases per day (https://covidlive.com.au/wa).

The NSW government COVID-19 strategies outcomes (have been:

- Very high levels of COVID-19 active infections in the community with currently around 7,120 active cases
- Around 25 new active COVID-19 cases per day https://covidlive.com.au/wa) at the time of writing

Differences in Economic Outcomes

The WA government's COVID-19 strategies have resulted in the following economic outcomes:

- 1.4% positive growth in Gross State Product (2019-2020)
- 3% growth of GSP (Gross State Product) in March quarter 2021 (https://www.wa.gov.au/government/publications/highlights-of-the-wa-economy)
- Current (May 2021) unemployment rate of 4.7% (https://lmip.gov.au/default.aspx?LMIP/LFR_SAFOUR/LFR_UnemploymentRate)

The NSW government's COVID-19 strategies have resulted in the following economic outcomes:

- -0.7% reduction in Gross State Product (2019-2020). This is the worst since start of official statistics in early 1990s (https://www.treasury.nsw.gov.au/nsw-economy/about-nsw-economy/economic-outlook)
- Current (May 2021) unemployment rate of 5.1% (https://lmip.gov.au/default.aspx?LMIP/LFR_SAFOUR/LFR_UnemploymentRate)

Differences in Crime Outcomes

The WA government COVID-19 strategies have resulted in the following crime outcomes:

Year to date crime comparison

Summary Offence Categories	2018-19 YTD	2019-20 YTD	2020-21 YTD	5 year average (YTD)	% Change from 5 year average
Selected Offences Against the Person (excluding Family Related Offences)	17,465	17,948	18,557	17,529.6	**5.9%**
Family Related Offences (Assault and Threatening Behaviour)	16,813	18,626	20,885	17,572.4	**18.9%**
Selected Offences Against Property	116,498	119,617	78,929	122,454.4	**-35.5%**
Total Selected Offences Against Person or Property	150,776	156,191	118,371	157,556.4	**-24.9%**
Drug Offences	23,361	22,369	19,315	24,213.6	**-20.2%**

(https://www.police.wa.gov.au/Crime/CrimeStatistics#/)

The outcomes of the NSW government COVID-19 strategies have been (Kim & Leung, 2020):

In the 24 months to March 2021, two of the 17 major crime categories showed upward trends, ten trended downwards and the remaining five were stable.

The offences trending upward were sexual assault (up 14.4%) and domestic violence related assault (up 1.1%). The offences trending downwards were:

- Robbery without a weapon - Down 21.9%
- Robbery with a firearm - Down 35.2%
- Break and enter dwelling – Down 27.1%
- Break and enter non-dwelling – Down 32.6%
- Motor vehicle theft – Down 16.3%
- Steal from motor vehicle – Down 29.1%
- Steal from retail store – Down 29.0%
- Steal from dwelling – Down 13.8%
- Steal from person – Down 45.2%
- Fraud – Down 17.9%

The large decreases reported in many offences represent falls in crime associated with the response to the pandemic in 2020. Since April 2020 violent offending has returned to pre-pandemic levels, but many property offences, including car theft, break and enter and retail theft are still below pre-pandemic level.

Commenting on the findings, BOCSAR Executive Director, Jackie Fitzgerald, said the spike in reported sexual assault incidents was remarkable and preliminary April data suggests reports have

since come back down. "Typically, only around 10% or 15% of adult sexual assault victims report to police.

BOCSAR notes that the reported crime statistics do not reflect trends in unreported offences (Kim & Leung, 2020, p. 14).

The above analyses also reflect the initial analyses of criminologists with a focus on Routine Activity Theory who claimed a reduction in crime (as measured by police incident reports) demonstrated the validity of Routine Activity Theory and the RAT crime triangle (see, for example, Felson et al., 2020; Stickle & Felson, 2020)

Analysis

To recap, the focus of this paper is on the approaches and ways of thinking used in planning strategies and interventions. As described in the background, Planning processes that incorporate feedback loops have the capacity to improve forecast accuracy and to avoid costly mistakes. We use comparisons of planning decisions about COVID-19 strategies to demonstrate the differences in approaches and outcomes, and to suggest how learning from this might be applied in contemporary planning practices.

The planning and implementation of COVID-19 strategies differed considerably in WA and NSW and led to very different outcomes in COVID-19 infection terms and economic and employment terms. Crime statistical trends were broadly similar in that some crimes rates, particularly property crime rates went down, and some crimes went up. At first glance, this might appear to be expected from Routine Activity Theory in that in lockdown more people are at home and capable of defending against burglary and property offence. However, the circumstances (and by implication the routine activity changes) differed significantly in WA and NSW due to their differences in planning responses to COVID-19 and this should have been reflected in differences in crime rates between the states. This issue will be addressed later.

The planning analyses and the strategies to contain COVID-19, the modelling of outcomes and the communication of strategies to the public was essentially based on a view of the COVID-19 situation following the simple linear causal system model and causality sequences. These were described earlier in the background section and focused on returning to normal by using strategies to control the adverse consequences of COVID-19 in the community. A simplified representation of this is shown in Figure 5.

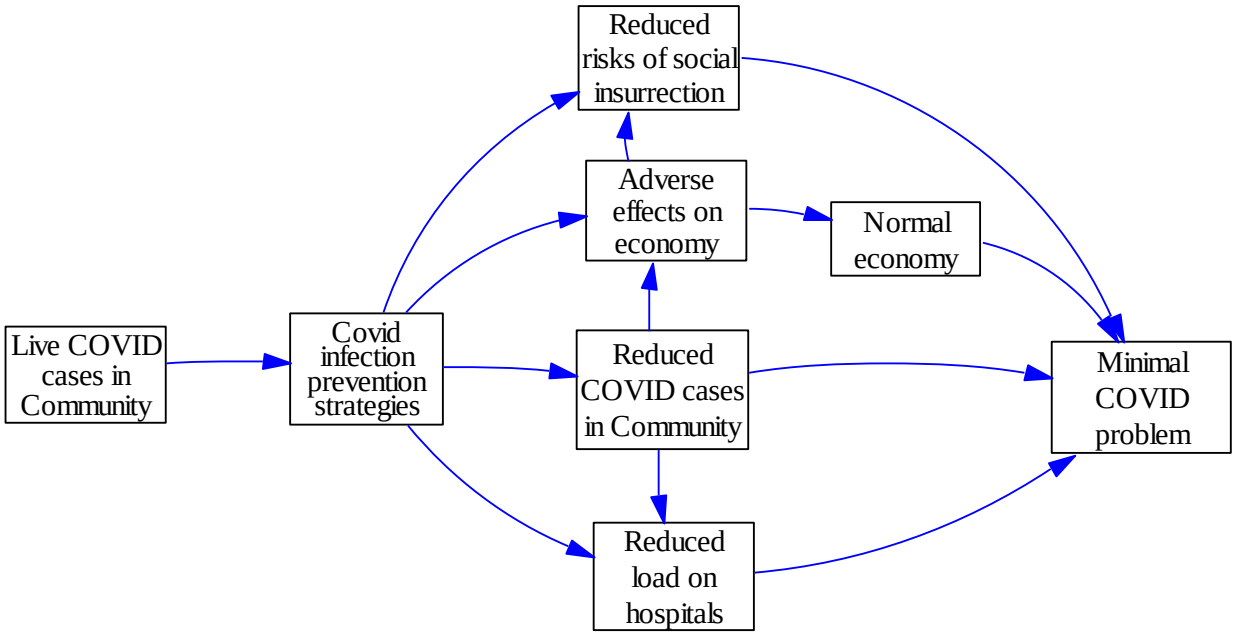

Figure 5: Overview of a linear planning approach concerning COVID-19 strategies

The use of such linear systems is found widely in the interpretation of what to do from the various COVID-19 infection and control models as catalogued, for example in Kerr et al (2021). Here, it is found in the use of the linear model using Latin Hypercube age and risk stratified transmission model of COVID-19 infection developed by the Doherty Institute used by Australian governments for planning strategies (see, for example https://www.doherty.edu.au/uploads/content_doc/McVernon_Modelling_COVID-19_07Apr1_with_appendix.pdf and the COVASIM agent-based modelling of IDM described by Kerr et al. (C. Kerr et al., 2021).

A planning approach using feedback loops to address COVID-19 could use more complex model such as that shown below in Figure 6.

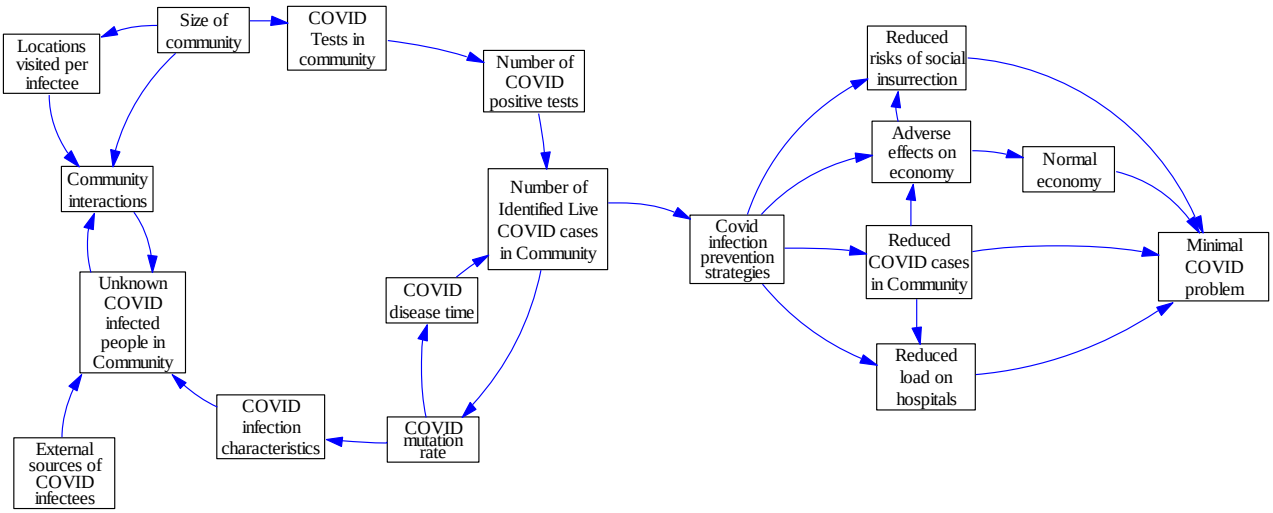

Figure 6: Feedback model of COVID planning

The feedback loops in the left-hand side of Figure 6 provide Planning with some indication of how the number of live COVID-19 cases might rapidly increase due to feedback, including feedback that also changes to the fundamental characteristics of the replication, transmissivity, virulence, and

infection time. All these can speed up the cycling through the feedback loops resulting in very rapid increases in identified cases in the community.

Approaches to urban planning that view the world through the perspective of feedback loops results in different kinds of strategies. Primarily, the focus is to stop the reinforcing actions of the feedback loops that result in runaway infections, increased numbers of virus mutations and the combination of high numbers of live cases in the community and adverse economic and social effects and community-wide problems with health infrastructure.

One way of minimising the feedback loop activity is to use lockdowns. Using traditional simple linear causal planning thinking the two planning aims of lockdowns are to reduce the rate of hidden community infection, and to provide time to undertake contact tracing to identify potential infectees for more extreme isolation. Planning that focuses on the roles of feedback loops also understand the role of ***time***. The effect of feedback loops on disease propagation and development rapidly increases over time.

Planning that focuses on understanding the role of feedback loops, therefore, places as much, or perhaps more emphasis on using the methods of minimising disease propagation as fast and as early as possible and using the most powerful approaches to stopping infection for as long as needed to ensure the disease transmission is as close to zero as possible. Second to this, is acting again as fast as possible with the necessary methods at even the slightest sign of disease re-emergence, i.e., a single new case. This difference in approach to planning is demonstrated by the differences in the approaches used to control COVID-19 by the WA and NSW governments.

At the declaration of COVID-19 as a pandemic on March 11th, 2020, the WA government very rapidly (15th March) put the state in severe lockdown and constrained movement tightly, including strict closure of WA's international and interstate borders and isolation of arrivals into quarantine onto Rottnest Island (Dawson, 2020). These WA restrictions predated Federal government restrictions. The result of planning such fast and extreme action that took into account the potential effects of feedback loops was COVID-19 was contained and life for WA's citizens has been significantly less affected by COVID-19. The health infrastructure was unchallenged and WA has had positive economic outcomes compared to other states.

In contrast, planning for COVID-19 intervention by the NSW government was deliberately delayed and followed the kind of simple linear causal planning thinking exemplified by Figure 5 above. The political and philosophical aim was to minimise lockdowns and other COVID-19 protection measures to avoid any adverse effect on business and to delay response to community infections. The result has been that the feedback loops shown in Figure 6 had the opportunity to take hold and exponentially increase the rate of feedback and subsequent number of live COVID-19 cases in the community and the numbers of potential contacts. The delays to the first lockdown to control COVID-19 meant that they lasted much longer than those of WA and currently, at the time of writing, 15 months after the declaration of COVID-19 as a pandemic, NSW has around 150 new COVID-19 cases identified each day and extensive long term stay at home (lockdown) restrictions and NSW citizens are restricted from travel across several state boundaries. For the 2019-2020 year of which COVID-19 occupied approximately a quarter, NSW Gross State Product fell by 0.7% (i.e., a fall of around 2.8% per annum). This compares with the positive outcome for WA over that period of 1.4% (equivalent of an increase in GSP per annum of around 5.6%).

Crime example

Planning of strategies to address COVID-19 has also included crime prevention. Again, there is a difference in perspective between planning intervention using the simple linear causal way of

thinking described earlier and understanding situations via feedback loops where they are present. Police statistics in WA and NSW show similar trends in reduced crime rates, particularly in property crimes (Freeman, 2020; Kim & Leung, 2020).

This similarity in crime rate trends between WA and NSW is surprising because the changes in routine activities from the COVID-19 protection strategies in WA and in NSW were dramatically different in terms of how much people stayed at home and how much the population's routines changed and when. Lockdowns and business closures in WA were intense and primarily limited to the first 3 weeks following the declaration of the COVID-19 as a pandemic and the institution of a State of Emergency in late March 2020. In contrast, the COVID-19 strategies of NSW were aimed at minimising the effects of COVID-19 whilst maintaining the NSW economy and avoiding the potential for civil reactions. In part this was likely because for NSW, the COVID-19 pandemic followed a serious bushfire and widespread flooding events.

As a reminder, the simple linear causal thinking on Planning for crime prevention would be expected to be similar to that of Figure 7 below.

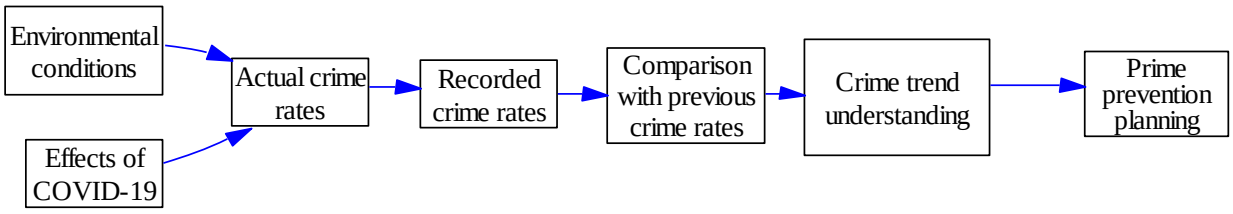

Figure 7: Simple Planning model of COVID-19 crime prevention thinking

An example of such planning thinking is the inferred understanding in WA and NSW of changes in domestic violence (DV) trends due to consequences of COVID-19 interventions.

In both WA and NSW, it has been claimed, based on Police reported incident statistics, that there has been negligible change in the incidence of domestic violence during COVID-19 in WA and NSW. In both cases, the police recorded incident data was supported by comparison with numbers of calls to domestic violence hotlines. The analysis and underlying thinking follow the above model which can be expressed more specifically for domestic violence as shown below in Figure 8.

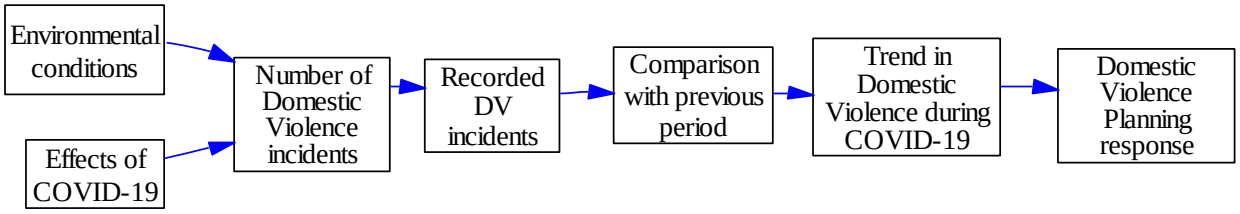

Figure 8: Simple linear causal domestic violence planning response

The conclusion from such planning thinking is there has been no change in domestic violence risk during COVID-19 and hence no need for any additional crime prevention or victim support response.

Other data contradicts this conclusion. Surveys of Australian women and alternative indicators of domestic violence indicate that domestic violence and associated crime risks has significantly increased during COVID-19 (e.g.,Boxall, Morgan, & Brown, 2020; Carrington et al., 2020; Neil, 2020; Richards & Nix, 2021). Similar outcomes have been found in research in other countries

(see, for example, Piquero, Jennings, Jemison, Kaukinen, & Knaul, 2021; Sharma & Borah, 2020; WHO, 2020a)

The reasons for the differences between the findings from research into women's experiences and the police statistics and planning responses can be found by thinking of the situation in terms of feedback loops that include the effects due to increase in abusers' levels of control of victims and influence of COVID-19 on police priorities as shown in Figure 9.

Understanding the causal effects of the feedback loops opens up the possibility of exploring why evidence from women themselves indicates much higher levels of domestic violence abuse during COVID-19 than the picture held by police. More importantly, perhaps, as described above for managing COVID-19 infections, the feedback loop approach offers insights into better planning strategies to reduce domestic violence abuse during the pandemic and provide better support for victims.

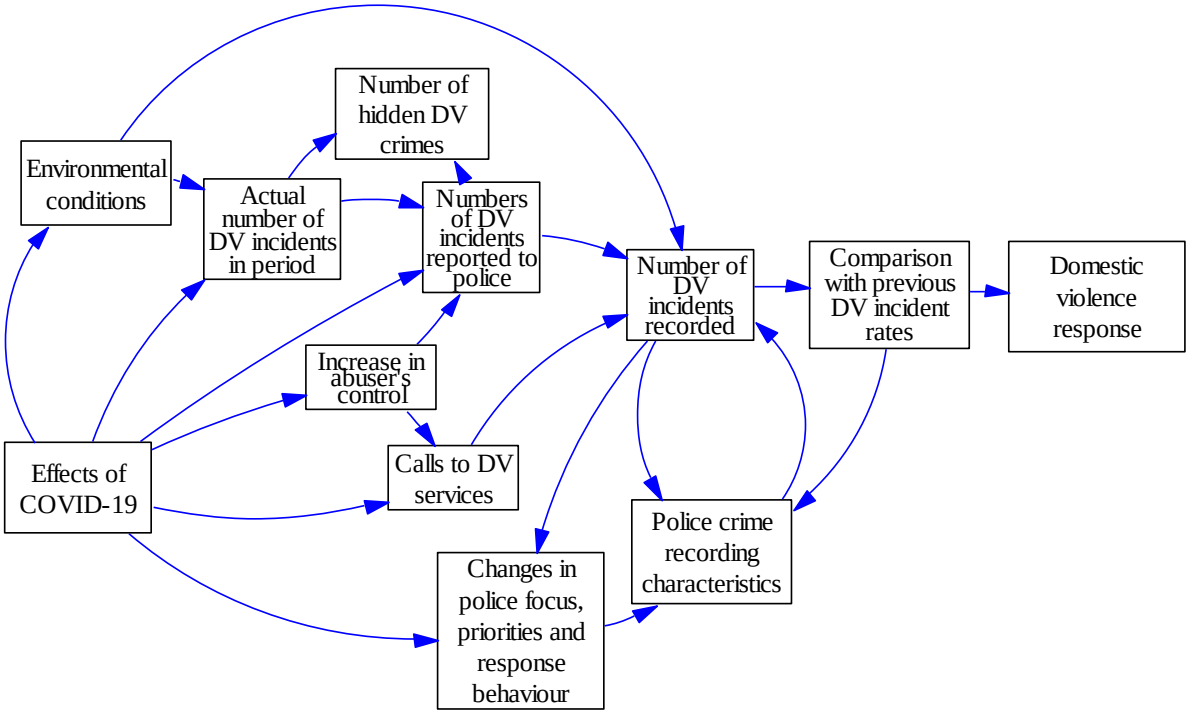

Figure 9: Feedback loop model of domestic violence

Understanding the changes in abusers' control of victims and changes to police and others' behaviours offers a way of viewing the above situation through the lens of routine activities and also through the different, though complementary lens of criminology's routine activity theory (RAT). This argues for a crime to take place, there must be the conjunction in time and space of a motivated offender, a crime target and the lack of a capable guardian (Cohen & Felson, 1979). Given the COVID-19 changes to routines activities associated with locking people down at home, the RAT approach therefore suggests an increase in DV abuse is likely. However, the feedback loop approach shown in the Feedback loop model of domestic violence in Figure 9: Feedback loop model of domestic violence offers advantages in explaining ***how*** and ***why*** such increases in DV abuse do not appear as increases in recorded crime incidents or increased calls to support services.

Summary and Conclusions

This paper has used case studies of planning responses to COVID-19 and associated crime prevention responses in two Australian States, to explore outcomes from different approaches to planning. The case studies focus on the differences in planning interventions based on simple linear causal thinking, and the alternative of including causal feedback loops. Causal Loop Diagrams are used to illustrate the differences between the two approaches in terms of planning responses to COVID-19 and crime prevention during the COVID-19 epidemic to date, as characterised by crimes of domestic violence and abuse.

The paper reviews the success or otherwise of the two ways of thinking in terms of the outcomes in each state.

The analyses in the paper demonstrate:

- Feedback loops are common in planning contexts
- Planning approaches often assume problems have a simple linear causal structure and plan responses on that basis
- Planning may result in faulty outcomes when problems are regarded in terms of simple linear causes rather than including causal feedback loops

We suggest, that planning as a field would benefit in its theories and practices to focus more on theories and tools that include feedback loops in understanding planning factors and outcomes in *all* planning contexts as well as crime prevention and pandemic control. This therefore responds to the calls for more critical inspection in urban planning (Yiftachel, 2001; Yiftachel & Huxley, 2000) and potentially helps to broaden the analytical scope of the discipline.

The analyses of this paper offer potential for significant improvement in planning outcomes, reduction in planning risks and improved confidence in planning as a profession. The analyses imply there are likely to be significant benefits in changes in planning education to emphasise the role of causal feedback loops and the tools for addressing them. Both have deep implications for planning practices, especially related to stakeholder involvement and community participation in planning.

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