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Editorial

Decisions, plans, and cities



1. Introduction

Cities are collectives of numerous, interacting decisions that can be broadly classified into investments and activities. Investments include land development and facility construction, whereas all other decisions are activities. Organizations also consist of sets of interacting decisions. Both cities and organizations are organized anarchies (Cohen et al., 1972; Lai, 2006), their major differences being that the former has a much larger scale that tends to persist over time than the latter (West, 2017) and that location plays an important role in the dynamic adjustment of investments and activities. Cities are no doubt complex systems that defy traditional axiomatic expositions. Even the economy, a subsystem of the city, is now recognized as a complex system that is far from equilibrium and is difficult to pin down by neoclassical economic theory (Arthur, 2021).

Decisions and plans are the two sides of the same coin. They enhance each other. Decisions are said to be meaningless without the context of a plan (Pollock, 2006). The outcomes of these decisions can be identified as either gains or losses in relation to the decision maker's reference point, such as the status quo. Therefore, decisions in cities are binary in nature. The decision maker acts differently in the regimes of gains and losses. In particular, the decision maker tends to focus on uncertainties in the regime of gains, whereas he or she may be equally sensitive to both outcomes and uncertainties in the regime of losses (Lai & Huang, 2019).

By considering a sequence of decisions, or a plan, as the binary outcome of gains and losses, we view the plan as a framework within which decisions are made and actions are taken. Plans are thus ubiquitous in cities. According to this view, outcome utility is not constant, but varies depending on the frameworks within which the outcomes are considered.

Consider a decision maker facing a complex set of decisions, each of which is composed of a subset of actions as choices. How would the decision maker plan to cope with the complex system of decisions in order to make progress? A natural response is to independently prioritize these decisions before making the first move. When these decisions are related through the consequences of actions and budgetary limitations, prioritization of the decisions may not yield the best outcome. Simultaneous evaluation of related decisions before taking the first action is more effective (Hopkins, 2001). Lai (2018) provided analytical support for making plans for cities.

Most decision theories consider the situations where decisions are made, regardless of whether they are related (e.g., Keeney & Raiffa, 1976). There is little consideration of related decisions in sequence in most decision theory textbooks (e.g., Hammond et al., 1999). Therefore, normative guidance on how sets of related decisions should be considered, that is how plans should be made, is necessary for decision makers or planners in light of the interdependence of these decisions. This editorial addresses this question directly and conceptually based on the mathematics of decision theory. We set aside at present how the dynamics of decisions evolves, that is how decisions are made and related in time.

2. Actions, decisions, consequences, and plans

Before we proceed, some common terms need to be carefully defined. An action is a move to act or a commitment to a decision. Actions may or may not be related. Relatedness of actions is defined according to whether the initiation of one action affects the value of the consequences of another action. A decision is composed of a set of actions as choices. Decisions themselves may or may not be related depending on whether the actions making up two decisions are related. A consequence is the result of an action in combination with the effect of the complex system under consideration, or the collective result of enacting related decisions. A plan is a set of related decisions made in order to make progress, i. e., enacted collectively to obtain the desired consequences.

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3. Independent, dependent, and interdependent decisions

Regardless of the complexity of the system under consideration, the relatedness of decisions can best be described by binary relations. There are four types of decision relations—*independence*, *dependence*, *mutual independence*, and *mutual dependence*—of which the *dependence* relation is the fundamental one from which other relations are derived. Let X be a finite set of decisions; A a finite set of actions; S a finite set of consequences; and f a function mapping from X to S .

Definition 1. Decision dependence

Suppose x and $y \in X$ and are nonempty sets of actions; xRy if and only if the choice of actions in x depends on that in y .

Given $x, y \in X$, there are four relational possibilities:

1. xRy and not yRx (*dependence*, R);
2. not xRy and yRx (*converse of dependence*, C);
3. xRy and yRx (*mutual dependence or interdependence*, T); and
4. not xRy and not yRx (*mutual independence*, I).

In order to analytically prescribe how the decision maker should choose actions from the four relational structures, we first need to explore the characteristics associated with these structures. Following Fishburn (1972), there are five general categories of relational properties given a binary relation R on X .

1. *Reflexivity*: xRx .
2. *Irreflexivity*: not xRx
3. *Symmetry*: xRy implies yRx .
4. *Asymmetry*: xRy implies not yRx .
5. *Antisymmetry*: xRy and yRx imply $x = y$.
6. *Transitivity*: xRy and yRz imply xRz .
7. *Negative transitivity*: not xRy and not yRz imply not xRz ; equivalently, xRz implies xRy or yRz .
8. *Connectedness (completeness)*: xRy or yRx .
9. *Weak connectedness*: $x \neq y$ implies xRy or yRx .
10. xRy and zRw imply xRw or zRy .
11. xRy and yRz imply xRw or wRz .

It can be easily shown through games that the *dependence* relation is reflexive. That is, the choice of a decision depends on the consequences of the decision itself or xRx . The *dependence* relation is also transitive in that if xRy and yRz , then xRz . Therefore, R is a partial preorder. If R is denoted by \succ , we have the following properties of the preorder (Debreu, 1987). Let $x, y \in X$ and \leq (*dependence*) be a partial preorder on X .

1. By definition, $y \geq x$ means $x \leq y$.
2. $x \leq y$ and $y \leq x$ are written as $x \sim y$, meaning that x and y are mutually dependent or interdependent (*mutual dependence*).
3. $x \leq y$ and not $y \leq x$ are written as $x < y$ (or $y > x$), meaning that x is strictly dependent or one-way dependent on y (*converse of dependence*).
4. Relations of pairs other than the ones mentioned above are mutually independent (*mutual independence*).

It can be easily shown through games that the *independence* relation is irreflexive. That is, the fact that the choice of a decision depends on the decision itself or that xRx implies not xCx . It is also transitive in that if xCy and yCz , then xCz . Therefore, C is a strict partial order. According to Zorn's lemma, since C is a strict partial order, it is interesting to examine the properties of the extension structure. By similar argument, the *mutual dependence* relation and the *mutual independence* relation are partial preorder and strict partial order, respectively.

4. Identifying the scope and making plans

The scope of plan making is a transitive closure of C on X , where $= C \cup C \cup C \cup C \cup C \cup C \dots$ is a strict partial order because by definition not xCx implies not yCx , and therefore, not zCy . Any decision outside the scope is not worth considering in a plan because it can be evaluated independently of other decisions. We are only interested in dependent decisions, in particular the converse of dependent decisions, that is, decisions made by others that are dependent on the consequences of one's actions. Put differently, the scope of a plan should include one's consideration of the consequences of the expected actions of others and the effect of the consequences of one's planned actions on the actions of others.

Scope implies a set of possible plans, each of which is composed of a set of dependent decisions. A choice function Φ of the scope is to select the plan that yields the best outcome within the scope. The choice of scope and the choice of plan are thus confounded. We cannot expect to make an optimal plan in a complex system, but we can at least set up appropriate search strategies considering the scope and associated possible plans at the same time. Lai (2002) proved the optimal search strategy for planning in terms of information gathering

in a one-person organization. In particular, the planner should seek information structures that are degarbling and accurate in order to yield the best outcome. However, we focus here on interdependence between decisions.

Three structural distributions of dependent decisions can be distinguished: independent decisions, uniform distribution of dependent decisions, and clustered distribution of dependent decisions. In the distribution of independent decisions, all decisions in the finite set are independent of each other. There is no gain from making plans in this case. In the uniform distribution of dependent decisions, all the decisions are dependent of each other, and plan making implies that the plan must be complete in that all decisions constituting the plan are likely to gain. The question of how plans should be made in order to gain under such a distribution can be addressed directly in the proposed conceptual framework. Evidence shows that the distribution of interdependent decisions is likely to be hierarchical or complex in space and time (e.g., Simon, 1998; Wolfram, 2002), which implies that plan making should be a continuous activity.

5. Possible extension to urban planning

The analytical framework can be extended in three ways to urban planning. First, urban development processes can be characterized by at least four aspects—interdependence, irreversibility, indivisibility, and imperfect foresight (or the 4 Is; Hopkins, 2001). The focus of the proposed conceptual framework is interdependent decisions, and we have described to some extent what interdependence means. Irreversibility means decisions cannot be reversed without incurring some cost. Indivisibility means that decisions cannot be made at arbitrary scales. Imperfect foresight means that we cannot perfectly anticipate the consequences of actions from decisions. The proposed conceptual framework can incorporate the other three aspects incrementally in order to identify conditions under which plan making results in gains.

Second, automata theory is an extension of the current framework for considering the dynamics of interdependent decisions. For example, Cohen et al. (1972) viewed decisions, problems, choice opportunities, and solutions as separate, interacting elements in an organization; they ran a simulation of the decision process in relation to a garbage can as the model to investigate how organizational choice behavior was sensitive to externally controlled variables. This simulation was extended by Lai (1998; 2019) to explore the effects of plan making on the garbage can decision processes.

Finally, we have argued that decisions are likely to be related in hierarchical, complex structures. The implication is that decisions could be related to each other in a distribution where there are many clustered, mutually dependent decisions. Plan making is most likely to gain in such a distribution. This argument is reminiscent of complexity science where the emergence of self-organization of patterns in a complex system resulting from interacting agents is the rule, rather than the exception (e.g., Holland, 1998). In order to make our conceptual framework useful, it is necessary to provide evidence that the hierarchical and complex structure of dependent decisions is a condition that exists in all complex systems, including cities.

6. Conclusions

Cities consist of large sets of interdependent decisions that are binary in nature in that they yield either gains or losses to decision makers. There are four types of binary relations of decisions, namely, dependence, independence, mutual dependence, and mutual independence. Each relation constitutes an ordering with associated properties. Structural characteristics of the four types of relations can be investigated. We attempted to construct a decision-based conceptual model for cities and plans to which incremental complexity, such as time compression, plan making, and coalition formation, could be added to increase realism. However, planners lack useful analytical skills to cope with the complexity of many clustered mutually dependent decisions. Based on a conceptual framework of the mathematics of decision theory, this editorial focuses on how to make sense of such complexity by developing appropriate search processes for identifying the scope of plan making where useful plans are likely to be formulated. The insight thus gained into how to act in a web of related decisions supports the notion that plan making matters in complex systems.

References

- Arthur, W. B. (2021). Foundations of complexity economics. *Nature Review Physics*, 3, 136–145.
- Cohen, M. D., March, J. G., & Olsen, J. P. (1972). A garbage can model of organizational choice. *Administrative Science Quarterly*, 17, 1–25.
- Debreu, G. (1987). *Theory of value: An axiomatic analysis of economic equilibrium*. London: Yale University Press.
- Fishburn, P. C. (1972). *Mathematics of decision theory*. Paris: Mouton.
- Hammond, J. S., Keeney, R. L., & Raiffa, H. (1999). *Smart choices: A practical guide to making better decisions*. Boston, Massachusetts: Harvard Business School Press.
- Holland, J. H. (1998). *Emergence: From chaos to order*. Reading, Massachusetts: Helix Books.
- Hopkins, L. D. (2001). *Urban development: The logic of making plans*. New York: Island Press.
- Keeney, R. L., & Raiffa, H. (1976). *Decisions with multiple objectives: Preferences and value tradeoffs*. New York: John Wiley & Sons.
- Lai, S.-K. (1998). From organized anarchy to controlled structure: Effects of planning on the garbage-can decision processes. *Environment And Planning B*, 25, 85–102.
- Lai, S.-K. (2002). Information structures exploration as planning for a unitary organization. *The Planning and Market*, 5, 32–41.
- Lai, S.-K. (2006). A spatial garbage-can model. *Environment and Planning B: Planning and Design*, 33(1), 141–156.
- Lai, S.-K. (2018). Why plans matter for cities. *Cities*, 73, 91–95.
- Lai, S.-K. (2019). Planning as computational intelligence in complex socio-spatial systems. In X. Ye, & X. Liu (Eds.), *Cities as spatial and social networks*. Cham, Switzerland: Springer International Publishing AG.
- Lai, S.-K., & Huang, J.-Y. (2019). Differential effects of outcome and probability on risky decision. *Applied Economics Letters*, 26(21), 1790–1797.

- Pollock, J. L. (2006). *Thinking about acting: Logical foundations for rational decision making*. Oxford: Oxford University Press.
- Simon, H. A. (1998). *The sciences of the artificial*. Cambridge, Massachusetts: The MIT Press.
- West, G. B. (2017). *Scale: The universal laws of growth, innovation, sustainability, and the pace of life in organisms, cities, economies, and companies*. London: Penguin Press.
- Wolfram, S. (2002). *A new kind of science*. Champaign, Illinois: Wolfram Media, Inc.

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