CHAPTER 2

PRINCIPLES OF PLANNING FOR ECONOMISTS

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Introduction

The literature in economics and planning contains advice that hinges upon the distinctions between planning and market approaches to public policy. In these distinctions, the planning approach is often characterized as stiffly regulatory while the market approach is characterized as more flexible and thus usually preferable. This distinction, we argue, is false both in its positive formulation and in its normative implication that the market approach is always superior. Instead, we assert planning is not about market failures and regulatory remedies but can be better understood by several other economic principles. These include the Coasian notion of transaction costs, the problem of optimization over time, and the problem of non-cooperative games in which the public sector is but one of many players. We argue plans and planning make sense in ~~both~~ situations where single or multiple actors think before acting, using limited information. When viewed in these frameworks, research by planners and economists are much stronger complements than they are substitutes.

Economists are fond of the contrast between outcomes brought about by a social planner and those brought about through the interactions among individual agents. The conclusions of these arguments are usually that Pareto optimality can be achieved through an invisible hand guided by self-interest,[1] rather than a scheming

1. Self-interest is not the only motivation of a "rational" being. Adam Smith wrote *The Theory of Moral Sentiments* before he published *The Wealth of Nations*.

and purposeful planner guided by benevolent intentions. Abetted by the Cold War nomenclature of planned and market economies, such distinctions have been emphasized over time and have become the orthodoxy in many fields, including urban economics and urban planning. Planners and economists have come to accept the dichotomy between planning and markets as fundamental, and planning to be an exclusive function of the State (Klosterman 1985). In this chapter, we argue that regulation—not planning—is the exclusive function of the police power of the State. Planning, alternatively, has nothing, in particular, to do with governments.[2]

In our formulation, planning is merely considering an action in light of other prior and subsequent actions. Planning considers these sets of actions in the context of the actions of the planner and those of others. It also considers them in the context of multiple and unpredictable circumstances because the efficacy of actions is different in these different circumstances. From this working definition of planning, it follows that planning is second-order action—*thinking before acting*[3]—undertaken by agents whether or not they have police power. It also follows that plans are useful whether or not there is interaction among agents. All that is required for planning is an intentional agent who can, albeit imperfectly, think beyond the present. Firms as well as governments are such intentional agents.

We can trace much of our thinking to the work of Hopkins (2001), who identifies interdependence, irreversibility, indivisibility and uncertainty as fundamental to planning. Of these, interdependence and uncertainty are most important because the other two are merely restrictions on the types of actions that an actor can undertake. Several mathematical and economic models are available for modeling various combinations of strategic and non-strategic interdependence and uncertainty (table 2.1). For a single actor, if future decisions condition current decisions, considering them as a whole is planning, and optimal control is one of the tools available. If the interdependence is strategic, as in the case of a multi-actor situation, then game theory, in both its dynamic and its static versions, is immensely useful for planners. Under some assumptions about the nature of uncertainty, stochastic optimal control and stochastic games are useful to deal with uncertainty and linked decisions. If plans are to be useful in a range of circumstances, not in just the average circumstance, then robust control mechanisms are useful frameworks.

Table 2.1 Some Economic Techniques for Planning

	Interdependence	Uncertainty
Single actor	Mathematical programming (or) optimal control	Stochastic optimal control (or) robust control
Multiple actors	Dynamic and static games	Stochastic games

2. It is a historical accident of language that governments tended to have departments with "planning" in their titles and the planning within private organizations is subsumed under "management" (Alexander 1992).

3. This term is a variation on Pollock (2006).

A choice of an optimal route between two nodes, given a network, can be specified by a plan (i.e., the plan may fully specify the sequence of links that need to be traversed). On the other hand, a plan can also specify a rule set (e.g., Dijkstra's rules) that postpones the choices of the links to the future, but incompletely specify how to decide (through decision rules) at each decision node. The first case is a *fixed plan*, and the second case is a *contingent plan*. In general, the first kind of plan is easy to use, but the second one is more robust with regard to uncertainty. A fixed plan fully and completely specifies the sequences of decisions of agents over the planning horizon; a contingent plan considers various futures and provides direction in those futures. Even when the future does not occur, the plan may still be useful to make and have because the occurrence of the high-impact, low-probability future may otherwise necessitate myopic actions.

In subsequent sections, we describe various economic theories and concepts under which planning can be understood. We will consider the standard arguments of market failures and planning, but we will also consider other notions such as transaction costs, information regimes, commitment strategies, and non-cooperative games. In each case, we consider examples that can plausibly be examined using the tools usually available to economists and propose principles in each case. We draw these from a variety of strands of literature, including rational choice theory, communicative action, and management science.

Market Failure Theory of Planning

Market failures are often used as a justification for planning. Moore (1978), in his defense of planning based on economic concepts, suggests that among other things, providing public goods is the inherent role of government and, therefore, of planning. Furthermore, Klosterman (1985) argued that externalities can be corrected through Pigouvian taxation and planning should be used to deal with externalities because planning is a function of governments. In contrast, Richardson and Gordon (1993) argue that governments fail as well and, therefore, planning is not a panacea for correcting the inefficiencies in markets.

In our conceptualization, this debate not only is fundamentally misguided but also conflates two entirely different activities: regulation and planning. The first is the application of the police power (either by the state or by some other third party). The second is thinking about actions in relation to one another. Planning requires an intentional agent who is forward looking. Regulations require an institutional mechanism that permits an agent to compel other agents. Such institutional mechanisms are not unique to governments; collective groups may be equally coercive. There are other organizational structures, such as clubs and condominium associations with regulatory authority over certain activities of its members. Through administrative rules, private firms regulate the actions of their employees.

Nonetheless, each of these organizations can be forward looking, boundedly rational, and therefore can and do plan. Thus, planning versus markets is not a right distinction (Alexander 2001). As Coase (1937) and more recently Williamson (1975) point out, the institutional structure of a firm is alternative to that of a market. Planning is alternative to neither and in fact it is incommensurable to either. Since markets are merely networks of relationships through which transactions are conducted; markets, in and of themselves, cannot plan. In other words, a market is not an intentional agent and, thus, has no capacity to plan. However, the agents that participate in the markets can and do plan. Their capacity to plan does influence prices, presumably to which other agents react. Agents in a rational expectations framework are merely a reflection of planning within markets. A market failure theory of planning, thus, becomes a normative account of how states should act because agents cannot do so efficiently within other governance structures (namely, interfirm markets, intrafirm administration, or voluntary groups). Market failures are not justifications for planning but for alternative institutional arrangements to private property rights.

Perhaps the dominant justification for planning is the existence of externalities: the uncompensated benefit or harm imposed by one agent on another. Demsetz (1967) argued that the creation, existence, and perpetuation of property rights is contingent on the costs of internalizing the externalities and benefits of those rights.[4] Building upon Coase (1960), Demsetz shows when transaction costs are zero, Pigouvian taxation is not inherently superior to voluntary negotiations of rights exchange. The value of private property rights should be significantly more than the enforcement costs of such rights. In a similar vein, Barzel (1997) argued that instead of viewing property rights as absolute, they should be viewed as a bundle of rights that is partially separable (i.e., the bundle can be exchanged in pieces). More significantly, the bundle is not constituted *a priori*. Some rights are always left in the commons to allow for them to be internalized when they become valuable enough to warrant transformation into private property rights.

Zoning is merely a privatization of property rights that were left in the commons or reassignments of private rights back to the commons. It is a regulatory mechanism through which land uses are separated so that negative externalities are attenuated and positive ones are enhanced (Webster and Lai 2003). For example, in one situation, a zoning code might permit certain maximum-density thresholds, so as to preserve the neighborhood character, which may enhance property values of each of the property owners in the neighborhood. In another, it seeks to prohibit a business from locating in that neighborhood, based on the justification that such location choice is detrimental to the existing landowners (Fischel 1980).

4. In a trenchant critique, Demsetz argues that economists recognize an externality when they see a smokestack but do not see it in a military draft. A "let-him-buy-his-way-out," (in military draft) and a "buy-him-in" (in volunteer military) policies both result in the same levels of social welfare under certain conditions (Demsetz 1967, p. 348–349)

Zoning, however, is not planning.[5] While zoning and planning departments in municipalities and local governments are usually the same, their functions, mandates, and modes of operation are different. Zoning is the application of regulations and, thus, the application of the police power of the state. Planning, on the other hand, is thinking about actions beyond the present and, thus, is the application of the forward-looking property of the state. A plan may specify a future land-use map, but a zoning map clarifies and crystallizes those property rights. The future land-use map is useful not because it is a regulation but because it deals with interdependence of land uses.

Public goods are another case of an externality that cannot be easily internalized through assignment of private property rights. Because excludability for such goods requires fairly costly enforcement mechanism, coupled with the fact that consumption of these goods is nonrival, these collective goods are best provided by fairly inclusive but coercive clubs, such as sovereign states or condominium associations. The provision of these goods is paid for by the membership fees collected through the threat or application of police power (taxes). Once again, the provision of goods, whether rival or rival and whether excludable or nonexcludable, has little to do with planning. A public school can plan as a private school can plan. One can plan for a public park as well as a private park. Monopolies such as publicly regulated utilities, providers of private goods, also plan about where and how to expand capacity and how to set prices. A large development company can make plans that look quite similar to the plans of a municipal planning department.

Plans themselves can be public goods (Hopkins 2001). Since plans are merely information about intentions, a sanitary district plan about contingent extension of sewer services on realized residential densities in an area is potentially nonrival and nonexcludable. As such, these plans could be provided by the state. However, a plan of a private firm about its location choice of new manufacturing plant or closure of one is both rival and excludable. While this plan is useful to the firm, it may not be an appropriate good for a government to provide. This would be true even when this new manufacturing plant, or plans about it, has both positive (e.g., economies of scope) and negative externalities (e.g., environmental impacts).

In sum, the market failure theory of planning is not a theory of planning but a theory of public intervention and the merits of alternative institutional arrangements. It may be possible to address market failures with some combination of property rights reassignment, government incentives (usually mislabeled as market incentives), and other regulations. Though they are not the focus of this chapter, we reject the general superiority of any of these approaches. Instead, we suggest that the efficacy of any approach depends on the nature of the problem and the costs and benefits of alternative institutional mechanisms (Knaap 2008). Again, all

5. According to Fischel (2001), existing neighborhood groups actively and pervasively use political institutions, such as enforcement of zoning code, to protect their substantial investments to the detriment of future and potential residents. This is merely a form of rent seeking by the "homevoter."

these mechanisms have nothing to do with planning, except insofar as they are interdependent with other decisions and others' actions.

The preceding arguments beg the question on the very nature of planning and what tools are required to understand the various aspects of planning. Planning occurs when a single agent has to consider the effects of current decisions on future options. Planning occurs when an agent has to consider the effects of her decisions on other actors. Planning occurs when an agent has to consider the effects of the announcement of her plans on the actions of others. It occurs when multiple agents and organizations have to negotiate to come to an agreement about collective commitments to future actions. In all these cases and in many others, the underlying theme is thinking about sets of decisions before taking any one because each impacts the other. In all these cases, the planning agents can be states, firms, voluntary groups, households, and many other associations. Public welfare can be their explicit charter, or they can solely seek private profits. Only an omniscient agent with infinite computational capacity does not need to plan because she can instantaneously decide on the best possible course of action, while acting. The rest of us will have to make do with plans.

Dynamic Optimization

In the next few sections, we present the planning of abstract rational actors. While we are acutely aware of the behavioral critiques of the rational choice model (e.g. Sen 1977; Elster 1982), we merely argue that planning could be cast in the framework of the rational choice model without fully explaining it or justifying it.

The beginning of equations 2.2 must read

s.t. x'

(note: the s.t. stands for such that. So, we need s.t. and then a space before the x prime.)

Intriligator and Sheshinski (1986) characterized planning as a method of formulating a strategy that decides on the timing and quantity of action in relation to other future actions and perhaps under uncertainty. Planning can thus be formulated as a dynamic optimization problem that determines the optimal path of the control variable given a horizon. In this section, we provide an example of the standard tools in the repertoire of economists to analyze planning situations and formulate the notions of plans as time paths of control variables.

A standard optimal control problem is defined as,

$$\max\int_0^T U(t,x,c)dt \tag{2.1}$$

$$\cancel{\text{s.t.}}\,x'(t) = g(x,c,t); x(t) \geq 0; x(0) = x_0 \tag{2.2}$$

where U is a utility function. $c(t)$ is the control variable over which the decision maker has authority; it determines how the state variable, $\cancel{c}(t)$, evolves. Equation (2.1) could be considered a planning problem of finding the optimal path of $c^*(t)$ with a planning horizon of T. Usually fixed plans posit $c^*(t)$ be determined before

$t = 0$. The path of $c^*(t)$ is considered the plan, which the decision maker then follows between $[0, T]$. Under deterministic knowledge about how the system evolves and the impacts of the control variable on such evolution, Pontryagin's minimum principle (Pontryagin et al. 1962) or Bellman's dynamic programming (Bellman 1966) can determine the plan (or at least the first-order conditions). Excellent references in the context of economic control and management include Kamien and Schwartz (1991) and Stokey, Lucas, and Prescott (1989). Under uncertainty, stochastic optimal control may very well be used provided some regularity conditions hold (more in later sections).

Consider a simplified example to illustrate planning in both the public and private sector. Since the government can act like a firm to provide certain goods, such as sanitary service provision and fire protection, planning by governments and private firms acts analogously in the case of provision of services. Say $x(t)$ is the size of the city and $c(t)$ is the investment in sanitary service provision. Because such investments may constrain growth due to opportunity costs, we can formulate the problem with an equation of motion that governs the size of the city relative to the sanitary service. If, on the other hand, $x(t)$ is the level of a nonrenewable resource, then $c(t)$ is the amount of extraction activity, then this translates to the usual planning problem for a private firm. Such situations are analogous to each other. On the other hand, we could also formulate the plans about the extent of regulatory constraint, when $x(t)$ is the size of economic activity in a region and $c(t)$ is the amount of regulation (e.g., resources allocated to enforcing a regulation). Such plans may be unique to agents providing these regulatory frameworks.

Assume equation (2.2) controls the rate of growth in the city, where $\frac{\partial g}{\partial x} \le 0$ (i.e., the city is growing at a decreasing rate); $\frac{\partial g}{\partial c} \ge 0$ the investment in sanitary service has positive effect on the growth rate and in general, the city is growing (i.e., $g \ge 0$).

Consider a social welfare function is $W(x, c)$, where $\frac{\partial W}{\partial c} \le 0$ and $\frac{\partial W}{\partial x} \ge 0$ because it is costly to provide the service and assume there are increasing returns to scale with respect to the size of the city. If r is a discount rate, considering $U = e^{-rt}W$, the planning problem of the government for a fixed horizon T is

$$\max \int_0^T e^{-rt} W(x,c)dt \tag{2. 3}$$

subject to the equation of motion (equation (2.2)) ~~and $x(0) = x_0$~~ and $x(T)$ is free (i.e., the size of the city at the final time is left unconstrained). The solution is obtained by writing out the Hamiltonian

$$H(x,c,\lambda) \equiv e^{-rt} W(x,c) + \lambda(t) g(x,t,c)$$

and the first-order conditions are

$$\frac{\partial H}{\partial c} = 0 \rightarrow e^{-rt} W_c + \lambda g_c = 0 \quad (2.4)$$

$$\frac{\partial H}{\partial x} = -\lambda' \rightarrow e^{-rt} W_x + \lambda g_x = -\lambda' \quad (2.5)$$

$$\frac{\partial H}{\partial \lambda} = x' \rightarrow g = x' \quad (2.6)$$

It is also necessary that $H_{cc}(c^*, x^*, \lambda) \leq 0$ and if both W and g are concave then the necessary conditions are sufficient.

If the functional forms of W and g are known, it may be possible to derive a closed-form solution jointly for equations (2.4), (2.5), and (2.6). It may also be possible to derive numerical solution to obtain g^* and therefore c^*. The marginal values of current and future welfare should be equal (equation (2.4)). $-\lambda'$ is the loss that would be incurred by postponing action, and on the optimal path, the change in the shadow price should be equal to the marginal change in the Hamiltonian (equation (2.5)).

The solution path of c over time $[0, T]$ is, thus, the plan that determines the investment in sanitary service by the public sector. c^*, in turn, determines the growth path, $x^*(t)$. It is $c^*(t)$, not $x^*(t)$, that is the plan because plans are usually only about actions the planner can control.[6] However, a crucial distinction should be noted. The application of $c^*(t)$ would be the action about which the decision needs to be made, and the second-order action that arrives at the optimal path is the planning process. This action would be analogous to the application of the land-use controls to direct urban growth, or setting of prices in a monopoly or following a production schedule. Planning, on the other hand, is the task that is undertaken to arrive at these optimal land-use controls, or optimal prices in the case of a monopoly, or optimal production schedules in the case of a perfect competition. These are the cases of *fixed* plans, where plans are formulated before the beginning of the action set, are never modified, and are followed to the letter over the entire time horizon.

As Simon (1982) reminded us, optimization is a costly process; so is planning. Intriligator and Sheshinski (1986) take this cost into account when they formulate their planning theory. Under no uncertainty and costless planning, a fixed plan that is applicable for the entire planning horizon is adopted before the initial time and is never revised. The no-revision condition arises from the lack of uncertainty, and both costlessness and perfect information about the future contribute to the fixedness of the plan. Even when planning is costly and under no uncertainty, fixed plans work because the costs are constant and are incurred up front. However, if for at least some portion of the time horizon myopic action yields a better payoff

6. In later sections, we will consider situations where the planner plans for actions and futures she cannot control; nevertheless, the plans are about what she should do in response to those actions and futures. In other cases, a planner may be planning on behalf of others (i.e., telling others what they should do). Examples of such plans include the 1909 plan of Chicago by the Commercial Club. These kinds of advocacy plans are not the focus of this chapter.

than a planned action, then creating multiple plans at the beginning of various subintervals may be better.

Note that none of these situations require market failures. They merely require interdependen~~cy of~~ decisions ~~on one another (or at least dependency)~~. In the earlier examples, the choice of the level of $c(t)$ at any given time t is interdependent on the level of c between $[t + \varepsilon, T]$, even when the system is deterministic and completely known. Planning, therefore, is useful when considering decisions that span a time horizon. Whenever there is uncertainty about the future, the value of planning is enhanced.

Planning under Uncertainty

If the future is uncertain, then taking a moment to consider the various courses of action in different futures is planning. Dealing with uncertainty can manifest as choosing actions (or collections of them) that suit the future on "average" when the probability distribution of the futures is known. It can also manifest as choosing actions to minimize the worst possible future as in the case of robust control or minimax optimization. In any case, presence of uncertainty increases the value of planning because careful consideration of what futures are likely to happen requires thinking before acting. Even when there is no uncertainty, planning is useful. Under uncertainty, planning becomes much more relevant.

Let us turn to an investment problem of a sanitary district under uncertain urban growth patterns it cannot control or deterministically predict. Unlike in the earlier section, the sanitary district's actions do not necessarily control the patterns of growth. Assume for the moment that the urban growth, U_t, follows the following exogenous geometric Brownian motion, ignoring the spatial pattern of growth

$$dU/U = \alpha dt + \sigma dB \tag{2.7}$$

On average, over the long term, the city grows at rate α. However, instantaneous growth rate is determined by the relative difference between α and σ. This formulation does not assume urban growth is irreversible; growth and decline are equally probable, save for the trending term α. These assumptions can be easily modified to suit other conditions.

A sanitary district (a government agency) incurs a cost I for the new treatment plant. If this cost is the present value of the recurring maintenance costs and the initial costs, then I is incurred whenever the treatment plant is built. Assume the social welfare function of the treatment plant has increasing returns to scale and follows a Cobb-Douglas formulation of

$$W = \kappa U^{\gamma} \text{with } \gamma > 1$$

If there were no uncertainty (i.e., $\sigma = 0$), then it makes sense to build the plant, whenever W reaches the threshold I because there is no incentive to wait. Because there is uncertainty, and because W is not monotonic, it can hit the threshold I and go below it at the next instant. In such cases there is strong incentive to wait until W reaches a higher threshold. Stochastic optimization provides methods to figure out the higher threshold, when, on average, it makes sense to wait and when to stop waiting.

Since the investment I is irreversible, there is a strong incentive for the sanitary district to wait till the urban growth reaches a threshold level that accounts for uncertainty. Let $F(W)$ be the value of the new treatment plant

$$F(W) = \max E[(W_T - I)e^{-\rho T}] \tag{2.8}$$

where E is the expectation at $t = 0$, T is the time at which the new plant is built and ρ is the discount rate. If there were no irreversibility, then the sanitary district will invest whenever $W = I$ and recover I completely with no cost, whenever $W < I$. Clearly such switching is impractical; therefore, choosing to wait until W reaches a threshold level that accounts for uncertainty is desired.

Following Dixit and Pindyck (1994) and using the Bellman's principle of dynamic programming, the value at which the district is indifferent between incurring the cost or continuing to wait is

$$\rho F(W)dt = E[dF(W)] \tag{2.9}$$

The standard solution to the differential equations suggests that the sanitary district will follow the rule

$$W^* = \frac{\beta}{(\beta - 1)} I \Rightarrow U^* = \left(\frac{\beta}{\kappa(\beta - 1)} I \right)^{\frac{1}{\gamma}} \tag{2.10}$$

where β is the positive root of the fundamental quadratic

$$\frac{1}{2}\gamma^2\sigma^2\beta(\beta - 1) + (\gamma\alpha + \frac{1}{2}\gamma(\gamma - 1)\sigma^2)\beta - \rho = 0 \tag{2.11}$$

Because $\beta > 0$, $W^* > I$. Therefore, the sanitary district will invest not when the social welfare overtakes the investment costs but when it reaches a much higher threshold that depends on the uncertain growth of the city. Thus, the decision rule (hence the plan) is determined before $t = 0$ and accounts for the uncertainty involved and chooses the time of investment based on the realization of particular levels of growth.[7] This plan merely specifies rules of behavior between $[0, t^*)$ (do not build the sanitary plant) and $[t^*, \infty)$ (build and maintain the sanitary plant) without actually predicting when t^* happens. By continuous monitoring of urbanization

7. Under no uncertainty $\sigma = 0$, the investment problem is a standard dynamic optimization problem.

patterns, t^* is determined indirectly through the levels of urbanization. An example of this kind of planning is the (s,S) inventory plans that firms and militaries use, where the plans are triggered if and when the inventory falls below a threshold level, s, without predicting when this event might happen (Scarf 1959). These are cases of *contingent* plans.

The analogous problem of when to abandon the plant when there is persistent average urban decline can be explored in this framework. As can be expected, the city has to decline to a much higher threshold than in the case of myopic nonplanning action, before abandoning the plant. This can be explained without the recourse to "sunk costs" but with appeal to "uncertainty." Since switching between abandonment and starting is not costless, irreversibility demands careful consideration be accorded to uncertainty.

Notice even though they are contingent, the rules about contingencies are fixed ahead of time (i.e., at $t = 0$). One could also divide the planning horizon into intervals and formulate plans at the beginning of each interval, by leveraging the information known at the end of the previous interval. However, the optimal division of the planning horizon into intervals would require a second-order planning. Extending this mode of reasoning, we can arrive at other results by Intriligator and Sheshinski (1986). In the presence of uncertainty and costless planning, a continually adjusted plan is optimal because ~~the~~ better information is available over time, and because planning itself is not costly, it is suboptimal to not take advantage. In the case of both uncertainty and costly planning, event planning has a higher expected payoff. If plans can be revised and updated, it may be better to reevaluate a plan that is determined at $t = 0$ depending on an occurrence of an event. Planning at the beginning of prespecified time intervals will be suboptimal. The tradition of planning for particular horizons usually used in urban planning is, thus, problematic (Knaap and Hopkins 2001).

Games and Strategic Uncertainty

As we have argued earlier, planning is essentially thinking about the future before acting, and such futures may involve uncertainty. This uncertainty is not only about the values and utilities of the planner, though they are important, but also about the actions of other actors especially if there is strategic interdependence. When there is interdependence, each of these actors is planning before acting and choosing a plan before the action sequence commences.

Analyzing a situation through a game theoretic framework in which multiple agents are interacting is useful in recognizing planning under strategic interdependence. If the game has unique pure strategy equilibrium, then the plan is *fixed*. The fixed plan is the choice of strategies for each player such that no player has any incentive to deviate unilaterally. In cases of mixed strategy equilibria, opponents cannot deduce the play of each player in any given game, but the probabilities of choices are known and are not updated. Therefore, if the game has only mixed strategy equilibria, then the second-order plan that assigns probabilities to the pure strategies is fixed. In the situation of repeated games, players can have *contingent* plans. For example, in the well-known case of the repeated prisoner's dilemma game by Axelrod (1981), the player chooses to cooperate or defect based on the previous play of the other player.

Consider a simple single-point Stackelberg game, where a real estate developer has to choose a value for her investment u_d, her decision (control) variable. The government chooses a value for u_g, its decision variable, the level of infrastructure investment. The cost for each actor is given by c_d and c_g. Let the social welfare function be $W_g(u_d, u_g, c_g)$ and the developer profits be $P_d(u_d, u_g, c_d)$. Assume that the government moves first and chooses the value u_g. However, being a rational actor, the government should choose u_g in such a way that the developer's choice maximizes the social welfare function. Knowing this, the developer must choose her investment strategy in such a way to maximize her profits. The solution to this problem can be found using subgame perfection and backward induction in which the developer's control variable is solved first. The first-order conditions are:

$$\frac{\partial P_d}{\partial u_d} = 0 \Rightarrow u_d^* = S_d(u_g, c_d) \qquad (2.12)$$

Substituting the preceding into the first-order condition of the government

$$\frac{\partial W_g(u_g, S_d(u_g, c_d), c_g)}{\partial u_g} = 0 \qquad (2.13)$$

The equations (2.13) and (2.12) jointly and fully determine the equilibrium actions of the government and developer and should be considered the plans of the government and developer. Each of these players can determine plans of others independently through ratiocination, and if there is a pure strategy equilibrium, neither has any incentive to deviate. The recognition of the developer's plan by the government and the government's plan by the developer occurs in a completely noncommunicative environment, where only actions are observed. Thus, the equilibrium solution not only dictates one's own plan, but also essentially solves the *plan recognition* problem (i.e., recognizing and responding to the plans of others), when the plans themselves are not communicated but need to be inferred from observable actions. Plan recognition is a classic problem in artificial intelligence (Schmidt, Sridharan, and Goodson 1978), but by and large it has been ignored by urban planners (Kaza and Hopkins 2009).

In their arguments about whether or not plans matter, Knaap, Hopkins, and Donaghy (1998) model a situation between a developer and an infrastructure provider (government) as a Stackelberg game. They argue that plans are useful insofar as they condition the expectations of the followers, the developers. However, this is only a partial view of the planning process as it assumes that only the intents of the governments are specified in plans. As we have seen even in a Stackelberg game, both leaders and followers are planning at the same time. A more apt title would have been "Do Plans by *Governments* Matter?" Suppose the roles are reversed, say, in the case of a large firm with a monopoly on the employment at a particular location, and a local government is choosing its tax rebate rate to entice the firm to choose its employment level. The firm chooses its level of employment knowing that the local government will respond with some tax rebate incentives to hold down the unemployment rate, after it makes these choices. An equilibrium solution to this game simply the choices of right levels of employment and tax rebates given the utility and welfare functions and therefore determine the plans of the firms and governments. In all of these games, it is merely the information structure of the game that determines the plans of the firms and governments. The preceding interactions can easily be modified to suit a different information structure such as a Cournot game.

When does it make sense *not* to plan? We have already considered the cases when planning is costly enough, then myopic actions may be optimal. However, there are other cases when it makes sense not to plan—when there are multiple players with strategic interdependence. Consider a simple pursuit evasion game, which can be modeled as a Stackelberg game where the evader is the leader and the follower is the pursuer. If the leader follows a fixed plan, then the pursuer can formulate a strategy based on observing the evader for a specified time and deduce the plan and formulating the counterplan to render the leader's plan useless. It is therefore better for the leader not to have any plan (i.e., choose random strategy at any given instant). Since there is no plan, there is no plan recognition.

In each of the preceding cases, plans made by the planner are internal to the planner, and they may be deduced from observable actions. However, most of government planning is assumed to be in the public sphere; therefore, we should analyze whether plans can effectively be used as credible signals about commitment. These are the issues addressed in the next two sections.

Plans in Cheap Talk Games

It is assumed, often erroneously, that plans of governments are, and should be, widely known (Kaza and Hopkins 2009). And such plans should influence, if not direct, the actions of others. This is the case, for example, where a government proposes at $T = 0$, to build specific transit stations at time $T = \tau$ (≥ 0), and a household, based on that information, can decide to move or stay at a particular location at $T = 0$. Or, in another example, a firm plans to invest in a particular technology and makes a public commitment to it, in the hope that it becomes an industry-wide standard. In either case, the plans are made by particular agents to suit their interests. However, whether the real plans of the agents are communicated to the wider world or are noisily obfuscated depends on the usefulness of such communication to the planner. Even when the planners want to reveal and communicate their true plans, because talk is cheap their plans may not be believed. Akerlof (1970) argued that asymmetric information makes it difficult to distinguish useful information from cheap talk. Two interlocking questions arise: When would true plans be revealed publicly? And when would publicly announced plans be perceived as credible?

Knaap, Hopkins, and Donaghy (1998) describe a case where there is a government monopoly over provision of infrastructure services and there are a large number of developers who respond to the infrastructure provision as well as to the information in plans concerning the timing of infrastructure provision. The developers respond to the government's plans through an individual belief function that is reflective of the developer's belief about the credibility of the plans. Because the government is a leader and the developer is a follower, it can be modeled as a Stackelberg game, and because belief functions about the credibility of the plans exist, this situation can also be modeled as an information signaling game. The plans are signals about commitment.

The plan maker (e.g., a city) knows whether the announced intentions in her own plan are credible, and this information is unavailable to the others (e.g., developers and homeowners). These other players do not know whether or not to believe the commitments of the plan maker. They engage in the logic of a strategic signaling game. In a different example, as in the case of recovery planning efforts after Hurricane Katrina, each homeowner may be trying to fathom whether her neighbors will reinvest or abandon their property because such information conditions her own investment decisions. In each of these cases, if the communicating agent (sender) is widely known to be credible, then the public availability of the plans of the agent is useful information that directs the course of action of others.

Cheap talk games are those situations where the sender does not incur any costs in communicating with the receiver and this communication does not directly affect the payoffs. The sender has full knowledge about the truthfulness of the communication, while the receiver does not. The receiver decides her own actions based not only on the payoff matrix but also on the credibility of the communicator. Because sending information is costless, obfuscation of intents may be lucrative.

Table 2.2 Communicating Plans and Commitment

a) Payoff matrix that results in credible plans

	I	N
I	5, 5	−90, −5
N	−5, −90	0,0

b) Payoff matrix that results in non-credible plans

	I	N
I	11, 11	−90, 1
N	1, −90	0,0

I = invest; N = do not invest.

The efficacy of the plans made and published by local governments is widely questioned because they are seen to provide little useful information about future intentions of ~~the~~ governments. In other words, by announcing the plan of action, the government may indeed be subverting the plan, and thus, it has a strong incentive to mislead. However, if such an incentive exists and is known, others will ignore the information in the plan. One may conjecture that a tennis player obviates the effect of her own plan if she announces that she plans to play at the net. Announcing such a plan will have no effect on the other rational player's actions because the other player would not believe that the information is credible (Kaza 2006). When others do not believe the announced plans, the signal is noninformative.

Even when obfuscation is lucrative and does not directly impact the payoff matrix, the disbelief in communication may have a significant disadvantage to the truthful planner. Consider the simple case of a standard prisoner's dilemma game modified slightly to allow communication of intent by one player. Because the other player has no reason to believe the communication, the resulting Nash equilibrium is not Pareto optimal, and the plan, therefore, is noninformative. Lack of belief in the communication leads to lack of coordination. Moreover, if there is widespread disbelief, there is no incentive for any planner to be truthful about her intentions as in the case of Akerlof's lemons.

In their seminal paper, Crawford and Sobel (1982) showed that even with the incentive to lie, there can exist meaningful communication between two agents in cheap talk games under certain conditions. Extending their work, Baliga and Morris (2002) showed that cheap talk is credible when the speaker always likes his opponent to respond to such communication in the best possible way. Assuming for the moment that making plans and communicating them are cheap, we can begin to understand public plans as notions of credible commitment in a strategic environment. Baliga and Morris describe an example, which is illustrated in table 2.2 after suitable modification. Imagine a case of two firms trying to decide whether or not to invest in a particular area. If there are externalities to investment decisions, the payoff matrix might look like table 2.2a. When both invest, they receive a positive payoff of 5; when one invests and the other does not, the investor loses 90 while the noninvestor loses only 5; when neither invest, they both receive no payoff.

This noncommunicative game has two Nash equilibria, both investing and both not investing. In the presence of communication, say firm 1 announcing its plan to invest, the plan is self-fulfilling because firm 1 has no reason to default on its commitment. Such default is detrimental to its own actions. The equilibrium position of both players (both investing) is Pareto optimal, and the communication and the plan are credible.

If, on the other hand, the payoff matrix looks like table 2.2b, firm 1 would like firm 2 to invest irrespective of its own actions. Firm 1 announcing its commitment to invest is not necessarily credible. The announcement of the plan does not provide any information to ~~the~~ firm 2 and is not useful in making its decision to invest or not. This leads to the same equilibrium outcomes (one of which is not Pareto optimal) as when there was no communication. Similar situations about credibility of government plans about infrastructure decisions or private firms' plans about location decisions can be analyzed in this framework. In a recent controversial case, *Kelo v. New London*, 545 US 469 (2005), New London used eminent domain conditioned on the belief Pfizer would invest in a research facility. Pfizer after a few years consolidated its research operations in a nearby town. New London could have done well to analyze Pfizer's commitments in a cheap talk framework.

The fundamental premise of the cheap talk games is that such talk is not verifiable. However, in reality the plans can be verifiable, in that the actions that follow the public plans are observable, and whether or not they conform to the stated plans can be evaluated. Under partial verifiability in a repeated interaction game, Bloomfield and Kadiyali (2005) show that, once the credibility of the claims can be established after the initial interactions, there can be equilibria with both informative and noninformative signals (exaggerated claims are made). They show that the frequency of verification conditions an evolutionarily stable equilibrium. In other words, if plans are not considered credible statements about commitment, then actors will pay no heed to the information in the plan, even when verification is frequent. If, on the other hand, the verifiability of the plans is infrequent, then plans are likely not to convey information. This has potentially great implications for plan evaluation and for engaging in multiple and overlapping planning exercises with same groups of stakeholders.

Cheap talk can thus be used to explain, under strategic interdependence, why plans are believed and when they contain useful information for others. If plans are merely information, then the quality of the information (i.e., noise-to-signal ratio and context) is important in determining the usefulness of the public plans. It also helps us to identify the conditions under which plans are indeed public goods and when they are private goods and the motivation of each actor in providing the signals. It provides a basis for Kaza and Hopkins's (2009) contention that actors are strategic about sharing information as plans. The despair of cheap talk should be tempered by the hope of communicative planning.

Communicative Planning

However, talk is not always cheap. Plans modeled as statements of commitments not only are costly to produce but also, reneging on these commitments strikes at the core of the human agency. These are the claims of the communicative (critical) theorists such as Forester (1999), Healey (1997), and Innes and Booher (1999) in interpreting Habermas (1981) to apply to planning. This mode of thinking about planning situations is considered complementary (at times alternative) to instrumental action or rational choice. In this section, we briefly touch upon the interplay of communicative action and instrumental action and use the work of Johnson (1993) and Heath (2001) to point out the convergences and divergence of the two.

Instrumental action is considered action undertaken to satisfy ends. These ends could be utility maximization or satiation. On the other hand, speech acts are primarily geared toward inquiry. If there are multiple agents, interaction between both these types of actions generates purposive social action. These social actions can be either strategic or communicative actions depending on the different proportions of the two elementary types of actions. Agents engaged in these social actions face coordination problems, including generating a stable set of expectations. Equilibria in games are one such kind of stable set; coordination through means of language is another (Heath 2001).

Communicative action is a social action whose primary purpose is geared towards inquiry and understanding. Most communicative planning theorists argue that instrumental action, which characterizes much of economics and comprehensive rational model of decision making, is inadequate precisely because it ignores linguistic mediation. They argue that the rational model is insufficient because decisions within and among organizations are made through negotiations and understanding rather than the strategic calculus of pleasure and pain. They argue that plans thus reflect the shared commitment of actors engaged in planning.

If planning is indeed communicative action rather than strategic action, and plans are more than mere cheap signals, then traditional rational choice theory exemplified either by decision theory (when there is a single actor) or by game theory (when there is strategic interdependence between multiple actors) cannot fully explain planning. It means that the micropolitics of the organization making the plans are fundamental in dictating action. We have shown strategic intent can be ascribed to both the plans that are made and the processes that make them. What we have not shown is the sufficiency of the strategic model in explaining the existence and persistence of plans. We make no such claim. It is impossible to see planning as entirely a matter of reaching understanding among various constituents. As we have shown in earlier sections, plans, unlike communication, do not require multiplicity of actors; they require only forward-looking actors who can recognize interdependence. However, when there are multiple actors, communicative action may indeed explain some interaction and therefore help in formulating plans.

Myerson (1989), in his formulation of credible commitment through negotiation, points out game theoretic analysis is often insufficient to winnow out multiple equilibria to a single one, when agents are allowed to announce their intentions and when the intentions are understood, not merely responded to. Building upon this argument, Myerson argues that the speech acts cannot be adequately modeled as signaling games, be it non-cooperative or cooperative games. As Heath (2001) succinctly states:

> [In] order to establish the claim that game theory provides an adequate general theory of action, the rational choice theorist must show that linguistically mediated interaction can be modeled game theoretically and that these models once constructed, have solutions. When it comes to providing game theoretic account of communicative action, non-cooperative models fail on the former count, while the cooperative ones fail at the latter. (78)

If neither non-cooperative nor cooperative games provide satisfactory frameworks for explaining planning behavior, then it behooves us to understand the limitations of the rational choice theory as it is traditionally understood. As we have seen in earlier sections, game theory is immensely useful in providing a framework to a multitude of situations that planners encounter. Supplementing rational choice theory with other epistemological frameworks such as communicative action helps us frame other planning problems and multiagent interactions that are not sufficiently explained by game theory.

Both game theorists and communicative theorists assign either strategic competence or communicative competence to the players (Johnson 1993). Furthermore, cheap talk games assign linguistic competence to the players. If, indeed, the plans of firms and governments are completely instrumental (i.e., strictly for the purposes of achieving ends such as maximization of utility or welfare), the organizations still have to be competent to communicate these plans to their constituents in attempting to achieve coordination of actions. If plans are to function as credible commitments about future actions, then strategic action exemplified by cheap talk is insufficient (but not completely useless) in providing explanations. Planning cannot be completely understood as communicative action because strategic intent is ever present, and we ignore it at our own peril.

Alas, in the field of planning as elsewhere, the communication between communicative theorists and rational choice theorists has broken down. We do not believe that either one framework is sufficient for exploring inter- and intraorganizational planning behavior. Johnson (1993) puts it succinctly about the need for communication between the two theorists:

> Each theory identifies factors that disrupt [the binding force of cheap talk]. But while game theory provides no account of why cheap talk is to ever succeed [in explaining interpersonal interaction], critical theory identifies the mechanisms to explain how, within constraints, it might co-ordinate social and political interaction. If critical theorists have considerable work to do and have at hand only some of the conceptual resources necessary to the task, game theorists are at loss over where and how to begin. (82)

While plans cannot be viewed as merely cheap talk, neither can the planning process be viewed merely, as Habermas puts it, as *institutionally unbound* interactions. Linguistic mediation cannot be completely modeled as strategic interaction. In social and political interactions, strategic intent cannot be wished away either. Therefore, planning processes and resulting plans should be viewed in a kaleidoscope of multiple frameworks.

Conclusion

There will always be some disagreement about the optimum size and influence of the public sector, but that dialogue has little to do with planning. We have argued that the conventional contrast of planning versus markets is a false dichotomy. Such distinctions hampered the dialogue between planners and economists who do not appreciate each other's potential contributions. Planning, simply involves forward-looking decision making. When conceptualized in this way, it becomes clearer how economic theory can be useful to planners and how some of the planning principles can be grounded in the logic of economics. The following principles can be derived from our exposition:

- Planning is about intertemporal decision making in a social context, is commonly practiced in both public and private sectors, and has little to do with market failure. Market failures may be important for planners to understand, but in and of themselves, they do not provide justifications for planning.
- The idea of a social planner opposed to multiple utility-maximizing agents is a straw man. Each of these utility-maximizing agents is a planner, and their plans influence others' action and, therefore, the total welfare.
- Costs and benefits of planning in one period must be balanced against costs and benefits that accrue in other periods. Furthermore, the costs of planning have to be weighed against the benefits of counterfactual nonplanning (myopic actions) in evaluating the efficacy of plans.
- Uncertainty increases the costs of long-term commitments and thus leads to shorter planning periods and more frequent plan revisions. However, uncertainty also increases the benefits of planning because plans can be made for contingent circumstances. Because myopic actions in high-impact, low-probability situations may be costlier than planning for those situations, contingent plans are useful to make.
- When decisions are strategically interdependent, the costs and benefits of any decision must include the costs and benefits of reactions by others. Instantaneous decision making about large interconnected sets of decisions is hard; planning resolves some, but not all, of these interdependencies before acting.
- Plans may facilitate more efficient coordination by signaling the intentions of the planning agent. Plans and prices, therefore, have the same signaling function. Prices are signals about relative opportunity costs whereas public plans signal intentions.
- The ability of plans to facilitate coordination increase with the credibility of the planner. Therefore, understanding plans as cheap talk—unverifiable declaration of intentions—limits the usefulness of the plans and planner.
- Plans can affect the behavior of more agents, if many agents participate in the development of the plan. Whether or not collective intention of the group is shaped by the participation, it can provide information about individual intentions, which may or may not lead to optimal outcomes.
- Communicative planning principles help us go beyond the limits of economic analysis in understanding the role of communication in

planning. However, strategic action and ratiocination in planning cannot be wished away.

The examples presented in this chapter are stylized and do not capture the complexity of planning situations. Nevertheless, we have demonstrated analogous planning problems of firms, governments, and other agents and how they may be cast in a conventional economics framework. Economists who routinely think about both these single-agent and multiagent situations would do well to recognize the significance and pervasiveness of planning.

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