

## I. Introduction to Part II

Part I surveyed theories of ethical conduct and the development of ethical dispositions. There was considerable disagreement about the principles that characterize ethical dispositions, but a broad agreement about the existence and influence of such dispositions. For example, Aristotle argues that investment in virtue and knowledge tend to produce a happier life, and that a virtuous character emerges as habits of thought and action are developed. These habits are partly products of education and partly of choices made during one's lifetime. Smith argues that moral sentiments are based on the pursuit of praise and feelings of praise-worthiness. One's praise worthiness and sense of duty emerges gradually from choice, experience, and education. Kant regards moral action to be the disinterested actions in accord with universal law. The will to undertake such actions is perfected by identifying such laws and dutifully following the laws identified. Mill returns to Aristotle's idea, but argues that virtuous actions all have the property that they tend to increase aggregate utility. The internalization of utilitarian aims again requires education, deliberation, and experience.

All the scholars reviewed in Part I agree that ethical dispositions exist, can be strengthened through conscious effort. All agree that once acquired, such dispositions broadly affect behavior. All also agree that some rules of conduct are important because they tend to reduce conflict within communities, although they do not agree about whether all such rules have a moral character. For example, international trade according to Kant tends to promote peaceful relationships, although trade itself, being largely to advance self interest, cannot be a moral activity according to his theory. It can be praiseworthy without being in the domain of moral conduct.

Part II shifts the mode of analysis from philosophy to social science. It develops a series of rational choice models that can be used to analyze how internalized rules of conduct affect behavior and how it can improve life in communities and extend the domain of commerce. To do so, modest extensions of the standard rational choice models from game theory and economics are employed. These models allow us to

abstract from the myriad of concerns that individuals confront in their lives, which allows the manner in which ethical dispositions affect behavior to be analyzed.

A series of problematic choice settings in communities (chapter 6) and markets (chapters 7 and 8) are examined. Together, they demonstrate that the social harmony supposed by Bastiat is not automatic, but require ethical and legal support. A wide variety of conflicts and social dilemmas exist that can make life in communities difficult or impossible and also gains from trade and specialization difficult or impossible to realize. Many of these problems can be reduced or eliminated through appropriate internalized rules of conduct and norms for behavior. Dispositions to follow such rules and norms would be regarded as virtues by most of the philosophers covered in part I.

The same extended rational choice models can also be used to analyze the extent to which various ethical dispositions are developed in a given community. This allows various possible interactions between commerce and ethical conduct to be explored. It turns out that commerce tends to reinforce a subset of virtues, by rewarding persons who have them with higher incomes and authority. For virtues outside that subset, commerce often creates tradeoffs between virtue and short term financial advantage. Part II focuses the most part on dispositions that tend to support commercial activities, although others are discussed as well.

Chapter 6 uses elementary game theory to analyze how internalized ethical dispositions can solve or reduce the severity of a variety of social dilemmas in communities. Chapters 7 and 8 analyze dilemmas that have to be overcome for markets to flourish. In the absence of a relatively safe and stable patterns of property rights, opportunities for exchange and production are very limited. In the absence of reasonably hard-working and trustworthy persons, most market transactions are problematic and market networks tend to be small and inefficient.

## II. On the Possibility of Communities: the State of Nature and the Hobbesian Dilemma

Thomas Hobbes' (1651) analyzed relationships among narrowly self-interested persons and used them to develop a contract-based foundation for government and civil society. This chapter demonstrates that there is another escape from the Hobbesian dilemma, namely the evolution of codes of conduct that tend to reduce conflict among residents of a particular territory.

The point of departure for both Hobbes' and our analysis is a state of nature in which there are neither formal nor informal rules of conduct. The result, Hobbes argues, tends to be unconstrained conflict over resources.

Whatsoever therefore is consequent to a time of War, where every man is Enemy to every man; **the same is consequent to the time, wherein men live without other security, than what their own strength,** and their own invention shall furnish them withal. **In such condition, there is no place for Industry; because the fruit thereof is uncertain; and consequently no Culture of the Earth; no Navigation, nor use of the commodities that may be imported by Sea; no commodious Building; no Instruments of moving, and removing such things as require much force; no Knowledge of the face of the Earth; no account of Time; no Arts; no Letters; no Society;** and which is worst of all, continual Fear, and danger of violent death; **And the life of man, solitary, poor, nasty, brutish, and short.** (*Leviathan*, pp. 70-71).

In the absence of ethical or legal constraints, conflict over scarce resources tends to escalate to the point where a good life is impossible. Everyone would be reduced to bare subsistence, and life would be both highly unpleasant and short.

Hobbes proposes what would later be called the contractarian solution. He argues that people would recognize their dilemma, and agree to create a strong central government--a Leviathan or commonwealth--to escape from the problems associated with anarchy. That government would create and enforce laws to protect life and property, which would improve life for all--even if the government itself could not be easily restrained.

Hobbes was not the first to link prosperity to law and order, but his clear statement of the problem associated with self-interest in a state of anarchy and his proposed solution to its associated problems were new and had significant influence on political theory, both during and after the enlightenment.<sup>1</sup> Subsequent enlightenment scholars did not all agree with the Hobbes' bleak assessment of the "natural state," nor of the impossibility of constraining government once created, but most regarded the problem characterized by Hobbes to be serious and fundamental.<sup>2</sup>

John Locke (1689), for example, also uses a natural state and social contract to explain the emergence of legitimate government, but he paints a more pleasant picture of the natural state than Hobbes, partly because of the experience of the English colonies of North America. Nonetheless, he agrees with Hobbes that life in the natural state can be improved through formal and informal agreements that delegate law creating and enforcing powers to a single organization, a government. He also agrees with Hobbes that all persons would unanimously agree to form such governments.

The reason that Locke's characterization of anarchy is less bleak than Hobbes is that he does not assume a society of narrowly self-interested

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<sup>1</sup> The *Leviathan* was written by Hobbes in the relative security of Paris during the English civil war, a war that may have inspired his idea of the war of every man against every other. The details of Hobbes' social contract and its associated theory of legitimate state action are beyond the scope of this book. What is most relevant for the purposes of this book is his demonstration that human interests are not inherently harmonious.

<sup>2</sup> Contemporary archeologists have argued that the Hobbesian jungle was a reasonably accurate depiction of society from the dawn of agriculture through the iron age. Although the warfare was not literally man against every man, but band against band or tribe against every tribe, life was poor, nasty, and short. See, for example, Keeley (1997).

persons, but one in which most persons have internalized ethical dispositions (natural law) that reduce conflict.

**The state of nature has a law of nature to govern it, which obliges every one: and reason, which is that law, teaches all mankind, who will but consult it, that being all equal and independent, no one ought to harm another in his life, health, liberty, or possessions: for men being all the workmanship of one omnipotent, and infinitely wise maker.** (*Two Treatises on Government*, KL: 3286).

Locke, nonetheless, acknowledges that some persons will violate natural law, and therefore some external law enforcing organization, a government, can improve life in a community for all.<sup>3</sup>

### III. Ethics, Game Theory, and the Hobbesian Dilemma

Although game theory was not available to Hobbes and Locke, it can be used to illustrate both Hobbes' and Locke's characterization of the natural state. Elementary game theory demonstrates that narrowly self-interested choices in a setting without civil law can lead to Hobbesian anarchy. It also can be used to show why communities of persons that have internalized dispositions to respect the life, health, liberty and possessions of others in the community may at least partially escape from the Hobbesian dilemma, as in Locke's characterization of the natural state. Whether such a community needs an external law enforcing organization or not depends on the nature and strength of those dispositions.

Locke suggests that ethical dispositions are not sufficiently strong to eliminate all risks to life and property and so government is necessary. In contrast, Herbert Spencer (1851, ch. 4) once argued that the evolution of such norms can solve all the problems associated with life in a community without the need for government and its associated police

and court systems. This too can be shown to be possible. What matters is the strength and nature of the ethical dispositions internalized.

Two archetypal social dilemmas are focused on in this chapter: the prisoner's dilemma game and the coordination game. A third problematic choice setting is examined in the next chapter, assurance games.<sup>4</sup>

#### A. The War of Every Man as a Nash Equilibrium

The natural place to begin our analysis of the role of ethics in society is with the Hobbesian dilemma. The essential features of this choice setting can be characterized with a 2x2 game matrix.

**Table 6.1: The Hobbesian Dilemma**

		Thomas	
		Don't	Attack /Steal
John	Don't	(J , T) (10,10)	(J , T) (0, 14)
	Attack /Steal	(14,0)	(2,2)

Two persons are assumed to have equal abilities and resources, and be unconstrained by internalized ethics or external legal sanctions. Each is assumed to initially control their own labor and a small stock of useful items such as food, clothing, water, and firewood. Labor (time) can be used to produce more of those goods from a natural resource freely available in the area, or it can be used to attack the other and attempt to capture their stocks of those goods. Warfare, however, destroys part of

<sup>3</sup> All persons according to Locke have a common understanding of natural law, evidently more or less as in Grotius' (1609) theory.

<sup>4</sup> Elementary game theory was rarely taught to philosophers or social scientists writing before W.W.II, although some of its tools had been developed. The classic textbooks for game theory are Von Neumann and Morgenstern (1944) and Luce and Raiffa (1957).

the stock being contested and takes time and other resources away from productive activities.

In this context, steal, attack, and defend can be regarded as equivalent strategies. The alternative (don't) is to employ one's time and the resources previously harvested for peaceful purposes. For the purposes of illustration, both persons are assumed to initially control 8 units of the good in question and be able to produce 2 more during the period of interest. Alternatively, they may attempt to steal the holdings of the other, the process of which spoils or consumes between 2 and 6 units of the good struggled over, depending on whether their attack is resisted or not.<sup>5</sup>

If the person attacked is not fully engaged in attack or defense, a less effective defense is undertaken to repel the attack, which imposes a cost on the attacker, but is not sufficient to nullify the attack. Poorly defended surprise attacks thus pay for the victor ( $14 > 10$ ). On the other hand, if both parties are fully engaged in military efforts their resources are largely consumed or spoiled by those efforts, with the result that both are poor and civil society impossible, although this outcome is still better than being the victim of a surprise attack ( $2 > 0$ ).

Given the payoffs associated with the four possible combinations of actions by the two players, consider the thought process that each of these individuals may go through. On the one hand, if Thomas believes that John will not attack, then he can also not attack in which case he get a payoff of 10; however, in that case if Thomas attacks John, he gets a payoff of 14. On the other hand, if Thomas believes that John will attack, then by not attacking Thomas will get a payoff of 0, whereas if he also attacks (or strenuously defends) he gets a payoff of 2. Thomas is better off in both cases if he attacks John ( $16 > 10$  and  $2 > 0$ ). So, logically, he should attack.

Since both persons go through the same reasoning, the result is a war against every other and the outcome is the bottom right-hand cell that characterizes the Hobbesian dilemma. This combination of strategies is a Nash equilibrium, because no person can increase their own payoff by changing their strategy, given the strategy chosen by the other.

Although, none can do better by changing their strategy, although both would be better off if they could agree not to attack one another ( $10 > 2$ ). There are thus potential gains from a social contract among John and Thomas. However, a mere agreement will not suffice because each can benefit from renegeing on their agreement. The upper left-hand corner is not a Nash equilibrium. The basic logic of this choice setting extends to ones where thousands of people are involved, to ones in which there is a continuum of strategies between the all out attack-steal strategy and the "mind my own business" productive strategy, and to many repeated game settings.<sup>6</sup> The Hobbesian war of every man against every other is stable, although it is not the most attractive society for any of the people involved.

It is the relative magnitudes of the payoffs rather than their absolute magnitudes that generate the Hobbesian dilemma. However, the magnitudes of the payoffs determine both the temptations involved and the possibilities for solutions.

Hobbes suggests that escape from the dilemma can be achieved through an agreement to establish a law-enforcement regime. A government can alter the payoffs of the game by punishing persons for attacking the other. When such a law-enforcing organization can be created at low cost relative to its advantages, and the expected penalties are sufficient to change the equilibrium from the lower right-hand cell to the upper left-hand cell, mutual advantages can be realized by agreeing to form such organizations. Without such an enforcer, the neither attack (10,10) cell is not an equilibrium among narrowly self-interested persons, because both John and Thomas have an

<sup>5</sup> Only the rank order of the payoffs matter for this and most of the other game matrices used in this and the following chapter. The numbers are used to illustrate various problems, temptations, and solutions.

<sup>6</sup> For richer and more complete analyzes of anarchistic societies, see Tullock (1972) or Garfinkel and Skaperdas (2008). A repeated version of the above game can be represented in extended form or in normal form. The matrix above can be used to shed light on repeated games if the payoffs are considered to be the expected present discounted values of the net benefits associated with the pure strategies of attack and don't attack. Such games often have sub-game perfect Nash equilibria of the sort depicted for the one-shot game.

incentive to renege on any agreement and pillage the other ( $16 > 10$ ). Such an organization will be costly to operate and may cause other problems, but as long as those costs are smaller than 6, both would be better off with such an organization.<sup>7</sup>

If an agreement to create and maintain such a law enforcing agency is reached, it implies that the organization created is productive and legitimate. It does not, however, imply that such organizations are necessary or that they solve all of the problems associated with living in communities.

### B. Civil Ethics and the Hobbesian Dilemma

An alternative solution is implied by Locke's characterization of the natural state. A wide variety of ethical systems support rules of conduct that forbid (most) attacks on fellow members of their community. Aristotle, Locke, Smith, and Kant disagreed about the grounding principles for ethical conduct, but agreed that rules that reduce unproductive conflict within communities made societies possible or at least more pleasant.

We next illustrate how ethical dispositions can solve the Hobbesian dilemma if a sufficient numbers of persons in a community have internalized appropriate codes of conduct. The process of internalization, in effect, changes the payoffs associated with the two strategies. Persons would feel better off (virtuous) when they follow their rules of conduct and worse off (guilty) whenever they violate the rules.

Consider for example a community of devout utilitarians. The payoffs in the above game can be thought of as physical resources, money, or as happiness (net benefits or utility). If one interprets the payoffs as utility levels for the two players, the numbers can be added together to create an exact measure of aggregate utility. The highest aggregate utility possible in the game is that associated with the (10,10) cell. This outcome yields a social utility of 20, which is greater than the aggregate utilities associated with the other outcomes (16 or 4).

If all the residents are pure utilitarians, they would act as if they received the total payoffs in the cells rather than their personal payoff and would always choose the productive strategy ( $20 > 16$  and  $16 > 4$ ). Devout utilitarians would thus make the choices necessary to assure that the (10,10) cell is realized. A society of devout utilitarians would thus not confront the Hobbesian dilemma.

Other ethical systems can also solve the problem and without requiring detailed information about the game as a whole or the welfare of others. Examples include various nonaggression ethics such as "defend, but never attack" or "respect other person's life and property," and various trust building ethics that require "reciprocity" or "promise keeping" among community members.

The effects of internalized rules of conduct can be modeled in several ways. They may be represented (i) as taking some strategies off the schedule of life's possibilities, (ii) as reductions in the perceived payoffs associated with the "attack" choices (because of guilty feelings associated with immoral choices, the failure to abide by universal law, or disapprobation from others), (iii) as increases in the perceived payoffs of the "virtuous choices" (because of increased self esteem, the satisfaction of doing one's duty, or praise from others), or (iv) combinations of the last two. The second characterization is adopted below. The third is used in other illustrations.

This approach also can be used to illustrate why the strength of internalized norms and the magnitude of the temptations both matter. Finite feelings of guilt reduce the subjective payoff to the forbidden, immoral, or wicked strategy by amount  $G$ , rather than eliminating such strategies from the choice set. Such reduction in the subjective reward (net benefits or utility) of a particular action are associated with a variety of ethical dispositions, but the magnitude of the guilt varies both with the ethical system grounding them and the strength of the disposition.

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<sup>7</sup> That this property is not immediately obvious to readers who are not familiar with game theory is evidence that you (the reader) have probably internalized a "keep your promises" ethic or norm. Such norms allows agreements to move from (2,2) to (10,10) to be relied upon, for reasons indicated by table 6.2.

The effect of relevant internalized norms are incorporated into the Hobbesian dilemma in table 6.2. Note that the dilemma is solved whenever the “ethical cost” (G) associated with violating the norm is greater than 4 for each person. In such cases, each person chooses the “don’t attack” strategy and the outcome is the upper lefthand cell of the game matrix.

**Table 6.2: Solving the Hobbesian Dilemma with Ethics**

		<b>Thomas</b>	
		Don't	Attack /Steal
<b>John</b>	Don't	(J , T)	(J , T)
	Attack /Steal	(14-G,0)	(2-G, 2-G)

The guilt associated with “bad” behavior serves the same role as penalties imposed by a well-functioning law-enforcement organization. Thus, such internalized codes of conduct can also provide greater security for life and property within the community.

It bears noting that not all ethical systems have this property. For example, dispositions that increase the payoffs from attacking or reduce them for not attacking would tend to perpetuate the Hobbesian Dilemma, rather than curtail it. They do so by increasing the rewards associated with the attack strategy, rather than reducing them. If V is the internalized payoff from following such rules, the payoffs of the aggressive choices become 2+V and 14+V. Both these are clearly larger than the payoffs associated with the passive choices, 0 and 10.<sup>8</sup>

Norms that tend to perpetuate the Hobbesian dilemma yield societies where lives are closer to the margin of survival than communities whose norms reduce counterproductive conflict rather than encourage it.<sup>9</sup> It bears noting, however, that such Spartans might be sufficiently proud of their military virtues (bravery, toughness, guile, resilience) that they prefer their own society to a more prosperous but to them less virtuous alternatives.<sup>10</sup>

It also bears noting that the greater the temptation, the greater the feeling of guilt or virtue required to overcome the temptation to attack and

<sup>8</sup> Norms are often more context specific than a simple game matrix can capture, as for example reciprocity norms may be applied within a community and different norms (or none) to persons outside the community. The latter can be referred to as tribal norms as opposed to general or universal ethical theories. Both tribal and universal norms can solve many problems associated with life within communities, but without solving problems that occur among communities or nations.

<sup>9</sup> Such militant societies may conquer pacifist ones and take their wealth, if they favor both a military ethos and material comforts. Such instances reintroduce the Hobbesian dilemma for communities. A community may solve its own Hobbesian dilemma by refraining from attacking each other, but not avoid the Hobbesian dilemma produced by other groups that lack such norms. To do so, pacifist ethical systems might be refined to allow both self- and community defense. Keeley (1997) notes that pre-literate communities that evidently lacked a strong government, nonetheless, often under took a variety of defensive measures, including the construction of defensive walls and ditches and attempting to repel invaders when under attack.

<sup>10</sup> Montesquieu (1748) argues that communities and states emerge as methods for escaping from Hobbes’ war of every man against every other, and that such communities each have their own formal and informal codes of conduct. Inter-community relations remain problematic, however, except insofar as international law (which tends to be a collection of informal rules rather than formally enforced ones) tends to promote peaceful relations among communities. Keeler (1997) provides an overview of archeological evidence that implies that preliterate tribal norms solved a variety of problems within their communities, but also supported both aggressive and defensive warfare between communities.

take from others. Only relatively strong internalized dispositions (large G) will avoid all possible Hobbesian dilemmas.

In cases in which internalized dispositions are not sufficiently strong for all persons or all temptations, a law-enforcing organization would again be necessary to escape from dilemma--although its penalties can be milder than would have been required in the absence of norms supporting production over attack or theft. Contrariwise, in the case in which ethical theories support the attack or theft choice, penalties would have to be even stronger than in a community of narrowly self-interested persons.

### C. Ethics and the Law

Most of the philosophers that we surveyed in Part I argued that ethics and formal law differ although they often encourage or discourage the same conduct. The appropriate degree of overlap between ethic rules and formal law varied somewhat among philosophical theories. Kantian favored both behavior and formal legislation that is compatible with universal law. Theists often support a very high degree of overlap between divine rules of conduct and formal laws. Aristotle supported laws encourage virtuous actions by penalizing vice. Utilitarians would support laws that increase aggregate happiness of their communities, and oppose ones that do not, including ones that cost more to enforce than they generate in benefits. The analysis above implies that utilitarians would favor laws and formal penalties only when informal penalties (guilt, blame, loss of self esteem) are insufficient to solve the problem of interest. Smith's favored a system of natural liberty with relatively few formal laws because the pursuit of praise and praise worthiness tended to broadly induce virtuous behavior.

That relatively few people in prosperous communities routinely engage in violence or theft implies that the combination of external and internal supports in such communities must be sufficient to overcome the temptation to kill, enslave, or rob their fellow residents. In terms of the above illustration, if the payoff of the cooperative upper left-hand solution be C and the payoff associated with the attack strategy below it to be T. The strength of internalized norms (G) and expected formal

penalties (P) together (G+P) must be sufficient to deter the temptation to attack (T-C) for most people in most circumstances ( $G+P > T-C$ ).

Insofar as G varies within a community, the choice of P implies different crime rates. The lower P is, the higher crime rates tend to be for a given distribution of internalized ethics and temptations. For persons with relatively low values of G, G+P will be less than some temptations to steal, kill, etc., and those persons will rationally engage in crimes in those circumstances.

It bears noting that formal systems of punishment tend to be less certain than ones associated with ethical dispositions. An individual knows what he or she has done and so more or less automatically self-imposes guilt. A law enforcement system has to detect crimes and determine the identity of criminals in order to impose penalties. Each step in this process is costly and mistakes can be made at every step. (It is the risk associated with mistakenly imposing penalties on the wrong persons that tends to limit the penalties that persons in a community are willing to impose.) Internalized ethical systems thus have advantages over external law enforcement. The guilt associated with violating an internalized norm cannot be avoided, and variations in feelings of guilt with the extent of the violation can be more fine-grained than a uniform legal system can be. The guilty are always punished (by themselves), although the punishment varies with the strength of their ethical dispositions.

Because of differences in the norms internalized and the strength of that internalization, ethical dispositions are rarely sufficient to reduce crimes to levels consistent with peace and prosperity. As Thomas Paine (1776) once wrote:

**Here then is the origin and rise of government; namely, a mode rendered necessary by the inability of moral virtue to govern the world;** here too is the design and end of government, viz. freedom and security. (*Common Sense*, KL: 97-99).

Social contract-based governments exist to solve problems that internalized norms do not. However, ethical dispositions reduce the

magnitude of the problems confronted by such law-enforcing organizations, which tends to make their required law enforcing efforts and penalties smaller and less costly than they would otherwise have been.

#### IV. Beyond Law and Order: The Provision of Public Services

As the war of every man becomes less all consuming among persons living in a community and among communities in a given region, resources are freed for productive purposes. After some degree of peace and protection for life and property is established, a civil society may emerge. However, other useful services, both relatively important ones and minor ones, may be initially under-provided from the perspective of most members of a community. There are a variety of free-rider problems that community members confront.

Table 6.3 illustrates the nature of “free-rider” problems associated with producing services that advance shared interests within a community, but which cannot be easily “priced” and sold to individual consumers. Such services include law and order, community defense, the maintenance of dikes and passage ways, fire control, and many others.

Suppose that there is a service that can be provided at a cost of 10 that provides benefits of 8 to each person in the community. Because the benefits are shared, it is often mutually advantageous to share the cost of such services. Assume that the cost is shared equally among those who decide to contribute to the service. To simply the illustration, the community is assumed to be composed of two persons, Paul and Alfred, although the logic of the game matrix again applies to much larger communities as well. Payoffs are normalized so that if the service under consideration is not produced, the payoffs for both Paul and Alfred are both zero.

Individual net benefits for various combinations of decisions to voluntarily contribute to the provision of the community service or free ride are represented in the cells of table 6.3. Free riding is the dominant strategy. If Alfred believes that Paul will contribute, then he is better off free riding ( $8 > 3$ ). If Alfred believes that Paul will free ride, Alfred is again better off

free riding ( $0 > -2$ ). No matter what Paul does, free riding is Alfred’s best choice. The same logic applies to Paul’s decision making. The Nash equilibrium is the (0,0) outcome associated with mutual free riding.

**Table 6.3: The Public Goods Dilemma, Free Riding**

		Paul	
		Contribute	Free Ride
Alfred	Contribute	(A , P) (3, 3)	(A , P) (-2, 8)
	Free Ride	(8,-2)	(0, 0)

Each person would better off if everyone contributed to the provision of the public service ( $3 > 0$ ), but narrow self interest leads each to free ride. The service is not provided at this Nash equilibrium.<sup>11</sup>

It bears noting that free rider problems may be existential or trivial depending upon the service. For public services such as community defense or potable water, the free rider outcome could be as threatening to society as the original Hobbesian dilemma. In other cases, the result may simply be a society in which life is a bit more difficult or less satisfying for members of the community. The community may, for example, have fewer than the ideal number and variety of flowers planted along its cracked sidewalks or in its dilapidated window baskets. In all such cases, both Alfred and Paul would favor low cost steps to move from the (0,0) cell to the (3,3) cell where the service is provided and the cost is shared among all members of the community.

It is the relative size of the payoffs rather than their absolute values that generates the problem, although the magnitude of the payoffs are important

<sup>11</sup> As in the Hobbesian game, this game can also be represented in an infinitely repeated form. In such cases, the relative payoffs in the matrix should be considered present discounted values of the pure strategy choices, and the equilibrium depicted as a sub-game perfect Nash equilibrium.



for solutions. In the above case, a solution that costs more than 6 would not be undertaken.

The same government formed to solve the Hobbesian problem may be called on to solve this problem as well by requiring cost-share contributions (imposing taxes) and punishing free riders (fines for tax evasion).<sup>12</sup>

Of course, the problem may not be as severe as the game matrix indicates because all or most community residents may have internalized norms that reduce free rider problems. Contributing to the services of one's community may evoke a strong feeling of virtue. Free riding may evoke strong feelings of guilt. Either effect tends to reduce free rider problems.

The matrix above can be modified to illustrate the effects of internalized codes of conduct that reduce free riding. These can be represented either as an internal loss associated with not performing one's duty (G) or as an internal benefit from feelings of virtue or approbation associated with performing one's civic duty (V). Table 6.4 illustrates the case in which contributing to a community service is regarded by Paul and Alfred to be virtuous, praiseworthy, or a civic duty.

In the case illustrated, the benefits from the public service are nearly sufficient to justify private provision, so the "virtue benefit" does not have to be very large to solve the problem. Note that  $V > 2$  is sufficient to assure that the public service is provided, although it is not sufficient to assure that the costs are shared, which requires  $V > 5$ .

**Table 6.4: Solving the Public Goods Dilemma through Ethics or Social Norms for Virtue**

		Paul	
		Contribute	Free Ride
Alfred		(A, P)	(A, P)
	Contribute	(3+V, 3+V)	(-2+V, 8)
	Free Ride	(8, -2+V)	(0, 0)

The game matrix also illustrates that the extent to which norms can be relied upon to solve public goods problems varies with the cost of the service problem of interest. If the strength of civic duty is modest, as with  $V=2$ , public services costing up to 10 can be overcome via civic ethics, but not ones costing more than 10. The game matrix also demonstrates that internalized ethical dispositions need not be universal within a community to solve problems. In the case in which  $V=3$  for at least one person, the free riding problem (lack of provision) is solved, although there may still be free riders.

Contributions for especially beneficial and costly public services may also be supported by virtues that are only indirectly related to solving free-rider problems. Bravery may, for example, reduce the problem of village defense although it may be developed for other purposes. For example, bravery may be sought for the Aristotelian reason that it is regarded to be an important feature of a virtuous character and so enable

<sup>12</sup> If service that provides shared benefits is excludable, persons who do not contribute to its cost could be excluded from the service. In such cases, a voluntary organization could be founded to produce the missing service. A club or firm would recover the cost of the service provided by charging for it (or them), in which case no taxes (coerced payments) or formal penalties would be necessary. Such organizations also tend to have rules and some governing authority, but lack formal authority to impose costs on persons who fail to purchase the organization's services. Both private and club goods, however, have to be excludable to avoid the free rider problem. If club benefits are available to non-purchasers, free riding would again take place.

on to live a more satisfying life. Such private reasons to invest in developing an ethical disposition may be reinforced through public esteem and approbation, as with military parades, honors, and privileges.<sup>13</sup>

Sufficiently intense norms can induce Minutemen to grab their bows and arrows or guns and rush to the defense of their community at a moment's notice, to grab a bucket and put out a fire down the street, or to induce folks to sort through and separate their trash into designated recycle bins. As internalized ethics or praise diminish in strength or as the cost of the service of interest increases, governments or other similar organizations are likely to be a part of the solution to free-rider problems. When virtue and praise are insufficient to solve the free rider problems of interest, additional rewards or penalties may be provided by a community's government.

It may, for example, be feasible to solve problems associated with attacks on one's village from neighboring tribes through various combinations of civic virtues when only clubs or bows and arrows are required for defense. (Indeed, it is likely that only villages that encouraged the formation of such dispositions would survive in the long run.) However, it is less likely that residents of a contemporary nation states would independently purchase and drive their own tanks or missile launchers to their national borders to provide national defense. Similarly, individuals might be induced to bring buckets and participate in a bucket brigade to put out small fires that threaten their neighborhood or village, but not to provide fire trucks to control a major three alarm fire at a department store in a large city. Reliance on ethics and volunteers would have to be supplemented with tax-financed equipment and/or professional armies and fire departments in such cases.<sup>14</sup>

From a utilitarian perspective, a civil ethics solution is often superior to a tax-financed solution, because collecting tax revenues and organizing the provision of public services consumes resources that would no longer be available for other private or public services. Moreover, coercion itself may be regarded as cost of the tax system that reduces the net benefits of

community life. For utilitarians, all such costs must be charged against the net benefits of service provision.<sup>15</sup>

Of course, the moral solution also requires resources. However, moral and other normative training is routinely provided by families and schools in societies with a viable civic culture. It is arguably one of the activities that distinguish humans from most other creatures.

The logic of the above free-rider problem can be easily extended to communities with larger numbers in which the internalization of codes of conduct varies among residents. If the assumptions of the illustration are kept, the net benefits of sharing costs tends to increase as the number of persons in the community increases, because the costs of the service can be shared among more members of the community. The payoffs of the upper lefthand cell become  $(8-10/N)$ , which rises toward 8 as  $N$  increases. This increases the gains from solving the problem. However, the other payoffs and losses are unaffected.

In such larger communities the uniform ethics assumption is less likely to hold, but this can be an advantage for such communities. Large communities tend to exhibit a wider distribution of values for "G" and "V" and so be more likely to have extremely virtuous persons. The strongest norms tend to be stronger and the weakest weaker. This increase in variation, perhaps surprisingly, tends to reduce free-rider problems in large communities, although it also tends to increase crime. Individuals and small groups with higher than average propensities to resist free riding will often be able to provide public services, even if all others free ride.

In the above example, it is sufficient for at least one person to have a virtue payoff greater than 2 for the public good or service to be provided. If the strength of ethical dispositions for potential residents has a normal distribution with a mean well below 2, the probability that at least one

<sup>13</sup> There are often community norms for what norms should be passed on to children and students.

<sup>14</sup> It bears noting that these services have often been provided by volunteer organizations such as the "minute men" and volunteer fire departments, which implies that civic norms can be sufficient to solve even life-threatening free-rider problems.

<sup>15</sup> See Martinez-Vazquez and Winer (2014) for a recent analysis of the welfare effects of coercion within utilitarian and contractarian frameworks.

person in the community has virtue benefit greater than 2 increases with population.<sup>16</sup>

For services that increase in average cost as community size increases, the fraction of persons who have to contribute and the magnitude of contributions sufficient to solve the associated free-rider problems increase. Such services have free-rider problems that tend to increase with community size. Nonetheless, such services are often provided in large communities because a minority of persons have sufficiently strong ethical dispositions to contribute to those services. In large communities, charitable contributions have often funded public education, residences for the poor, libraries, museums, town meeting halls, medical research, and many other community services.

In cases in which ethical dispositions are not strong enough to solve the free rider problem for a particular service or community, internalized ethical dispositions tend to reduce the overall cost of governmental solutions. In the above game, it is the sum of benefits from virtue, praise, and subsidies that induce persons to provide the public service at issue. The higher the direct and indirect benefits of virtue the smaller subsidies need to be to induce the provision of the service of interest (and the tax payments to fund those subsidies).

In a setting in which guilt was associated with free riding, it would be the sum of the expected formal legal penalties, losses from disapprobation, and subjective losses associated with failures to perform one's civic duties that induce persons to avoid free riding. The stronger the sense of guilt and disapprobation, the smaller formal penalties would have to be to induce persons not to free ride.

The cost of tax systems tend to rise with the revenues raised (including both administrative costs and deadweight loss). Thus, a

community with relatively strong civic virtues tends to have a less burdensome government than one with weaker or no ethical sanctions against free riding, other things being equal.<sup>17</sup>

## V. On the Value of Conventions: Coordination Games

Beyond peace, essential public services, and public amenities, there are a variety of other problems that can be overcome to make life in a community easier, more pleasant, and productive. Among the simplest of these are norms (conventions) that solve coordination problems. Examples include, language, measures and weights, calendars, and many simple customs of day-to-day life such as the number of days in a week and greetings.

Coordination games have the property that all participants are better off when everyone chooses the same strategy, although no particular choice is better than another. This makes coordination problems quite different from those associated with prisoners dilemma (PD) games. Only one of the strategies of a PD-game necessarily yields better results when everyone adopts it. The desirable outcomes of coordination games are stable when they emerge, in contrast to the desirable outcomes of PD games, which are not.

Table 6.5 illustrates the payoff structure of a coordination game for the case of passing people on the left or right on a path or sidewalk. Note that in this case, a pattern of community behavior is likely to emerge that is stable and requires neither ethical nor legal support. Self-interest is sufficient to sustain it.

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<sup>16</sup> This is a property of sample size for normal distributions. If the distribution sampled has a maximum value, as in a uniform distribution, there are limits to this sampling effect. However, it is also possible that small groups of relatively virtuous persons may form clubs, and share costs in a manner that provide the service for themselves and their communities. Public service clubs often undertake such projects.

<sup>17</sup> It bears noting that relatively low expected penalties are sufficient to induce very high levels of tax compliance in the US and much of Western Europe. Although the penalties are not trivial, the probability of being punished is very low. That trustworthiness plays a role in tax payments has been demonstrated by Feld and Frey (2002) and by Feld and Tyran (2002). We return to these and other related issues in Part III.

**Table 6.5: Coordination Games: Walking on Community Paths and Sidewalks**

		Harold	
		Pass on Left	Pass on Right
Duncan		(D , H)	(D , H)
	Pass on Left	(1, 1)	(-1, -1)
	Pass on Right	(-1,-1)	(1, 1)

The above matrix and its associated solutions can be used to think about a wide variety of coordination problems. Persons in a given community may pass on the right when driving, walking, horseback riding, sailing, and so on. Persons in a given community may say: good morning, buenas dias, bonjour, guten tag, sabah alkhyr, ohayo gozaimusu, zaoshang hao, etc. but a random selection among these phrases would not be understood very often in most places.

Coordination problems are often repeated among different individuals in somewhat different settings. Although one could have a different convention for each pairing or place, in many cases one uniform rule will minimize the chance of the undesirable lower left-hand and upper-right hand cells being realized. It will not always be clear to which strategy to choose when they meet another person in another place. In such cases, normative rules of conduct may become internalized: one should always pass on the right (or left). One should always say hello rather than bongiorno.

When a convention becomes internalized, one of the strategies increases in value relative to the other. It becomes the “right thing to do” whereas the other becomes the “wrong thing to do.” In a society where there is an internalized disposition to drive on the right, driving on the left is uncomfortable, feels wrong, and is disorienting for its drivers. Similarly, a native speaker might feel uncomfortable with violations of his or her community’s rules for greetings, pronunciation, grammar, and expression. Not only would they tend to be unwilling to use slang, pronunciation, or

spellings from another region or dialect, they may be uncomfortable when they are used by others. An unconventional speaker may be dismissed as incoherent, an idiot, a barbarian.

As norms and habits of thought and behavior emerge, one of the possible equilibria in new circumstances becomes more likely to emerge than others as one confronts a sequence of similar coordination games.

**Table 6.6: Internalization of a Convention for Walking on Community Paths and Sidewalks**

		Harold	
		Pass on Left	Pass on Right
Duncan		(D , H)	(D , H)
	Pass on Left	(1+V, 1+V)	(-1+V, -1-G)
	Pass on Right	(-1-G,-1+V)	(1-G, 1-G)

Even a small nudge provided by an internalized normative principle is sufficient to induce the “right” strategy choice in unfamiliar circumstances within a given community. The combination of “pull” toward a community’s conventions and risk of losses from deviation only have to be sufficient to dominate the other possible equilibrium (or rebellion), as with  $(V+G)>2$ .

The role of ethics and other types of norms in coordination games is to shorten the period of disequilibria and reduce incentives to “be unconventional.” As conventions emerge, the unfavorable off-diagonal results occur with less frequency. That frequency tends to be larger in large communities than in small ones, other things being equal, because of mistakes made by their more numerous visitors (who may use different conventions at home) and because of the intentional choices of their more numerous nonconformists.

Conventions enrich community’s life by increasing the likelihood that one of the more rewarding equilibria emerges and is sustained. A normative

principle that extends easily to new circumstances helps assure that the beneficial equilibrium emerges quickly as minor changes in circumstances and persons change. Although, one could imagine different rules for coordinating on sidewalks, roads, stairs, and hallways, a uniform rule is easier to remember and easier to generalize to new situations.

Such conventions are often taught to children and foreigners. The simplest conventions may be taught in a moment, as children may be taught, for example, to always pass on the right of someone approaching them from the front (and on the left of any person they approach from the rear). Others are so complex that it takes a lifetime (or more) of practice to master, as arguably true of English grammar, the Chinese character set, etiquette, and mainstream religious doctrine.

Although conventions are often supported by strong norms, conventions are not always regarded to be matters of ethics. This is partly because many conventions are entirely arbitrary. For example, every convention satisfies the Kantian imperative and can be regarded to be a moral duty under his theory. Similarly, following conventions that solve coordination games can be regarded as a moral act by utilitarians. However, neither Kantian nor utilitarian theory provide guidance about which of the above two conventions should be followed.

Many conventions are beyond the domain of ethics from the perspective of Aristotle's or Smith's theories because one convention does not contribute to character development or praise worthiness more than another, or necessarily attract more approbation from an impartial spectator. People who drive on the left in England or Japan are not likely to have happier more complete lives than those who drive on the right in the United States or Germany. Both conventions qualify as universal laws under Kant's approach, but many such universal laws may serve equally well.

Nonetheless, violating conventions, as with a boy named Sue or poor spelling, are often associated with guilty reactions and disapprobation from fellow community members in much the same manner as other actions regarded to be unethical. It is this sense of guilt or virtue that allows us to represent the effects of internalized conventions on choices in the same manner used for ethical decisions.

Once established, following community norms may be supported by other higher level virtues that are unrelated to specific conventions such as prudence or a sense of duty to the law or one's community.<sup>18</sup> Some conventions are also supported by legal sanctions, although these are unnecessary under the logic of coordination games. Such laws can be supported on pragmatic or utilitarian grounds only if they help reduce periods of disequilibrium, or discourage irrational deviation from a convention after it emerges (rebellion).

There are a wide variety of conventions in contemporary societies: include methods for the writing of dates and fractions, systems of weights and measures, the units and nature of money, the sizes of doors, male and female names for children, the order of family and personal names, the voltage of electrical outlets, the width of railroad tracks, and many others.

It bears noting that there are usually more social conventions and uniformity norms than there are coordination problems to be solved. Examples from ancient and more recent history include sumptuary laws, dress codes, dietary restrictions, and state-sanctioned religious beliefs. In these cases, the benefits from eliminating uniformity norms and formal penalties for violating them were evidently larger than their long run costs, because they were not solutions to coordination problems. As a consequence they were unproductive restrictions on choice and occasionally generated Hobbesian conflict over which convention should be imposed.<sup>19</sup>

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<sup>18</sup> See Brennan and Pettit (2004) for an analysis of markets for esteem.

<sup>19</sup> This is not to say that there were no advantages associated with conventions that do not address coordination problems, the cost of clothing and cloth may be reduced by sumptuary laws. Printing costs may be reduced by monopoly religions. But the benefits from satisfying personal preferences in clothing and religious doctrines are forgone to achieve those cost savings, as are the potential benefits from innovations in fashion and religious doctrine. In addition, protecting monopoly churches can be bloody affairs as in Europe during the sixteenth and seventeenth

## VI. Ethics and the Internalization of Externalities

The rules of conduct that facilitate escape from the Hobbesian dilemma and which solve coordination problems are not sufficient to eliminate all sources of conflict within a community, although they reduce the extent and potential for conflict. A neighbor may create annoying noises on his or her property that affect others in the neighborhood. He or she may enjoy loud music or target practicing at 3:00 AM. He or she may warm his or her house or burn trash in a manner that sends smoke and smells to all his downwind or downstream neighbors. In economic terms, an individual's actions may impose externalities (spillover costs or benefits) on others in their community.

Rules that allow one to do anything that one wants with one's own property on one's own land do not eliminate externalities. Nor do rules that prevent anyone from doing anything without the permission of all of his or her neighbors. An externality occurs whenever one person's behavior imposes costs or benefits on others. Vetoing another's actions thus tends to generate externalities. Dealing with externalities requires more nuanced rules and procedures.

A game matrix can again be used to illustrate the nature of externality problems and possible ethical solutions. Suppose there are externalities associated with raising chickens in a village in the form of noise, smells, and pests. Suppose that urban farming is profitable for the persons of interest, but that their satisfaction with life in their community is diminished by the noises and smells associated with their surrounding fowl farms. (Urban farming, as it turns out, is presently an issue being discussed in many town councils in the US.)

Three farm sizes are used below to illustrate the common case in which externality problems are not of the all-or-nothing variety.

**Table 6.7: The Externality Problem**

		James		
		1 Chicken	10 Chickens	100 Chickens
Craig	1 Chicken	(C, J) (4, 4)	(C, J) (3, 6)	(C, J) (1, 8)
	10 Chickens	(6, 3)	(5, 5)	(2, 6)
	100 Chickens	(8, 1)	(6, 2)	(3, 3)

In the case illustrated, the Nash equilibrium is one with sizable household farms throughout the village. These provide benefits to the chicken owners, but impose significant costs on their neighbors. From a Utilitarian perspective, the result is the worst possible one on the table. Contractarians might note that both James and Craig would be better off if they agreed to reduce their flocks to size 10 each.

Community norms might emerge to support smaller equilibrium farms, as for example a norm that requires chicken farms with more than ten chickens to be undertaken out of town, where neighbors are more dispersed and so less affected by each other's poultry than in the village. Alternatively, the villagers may hold a town meeting to consider formal rules on chicken holdings in the village. Self-interest alone, as per the contractarian logic, implies that the community would agree to impose and enforce rules that limit flock sizes.

The philosophical writing of Aristotle, Locke, Smith, and Mill suggest that many externality problems are reduced through a subset of civic virtue, norms, and conventions. A virtuous person is often a public benefactor and an unethical persons a public malefactor. Heroes receive approbation because they are public benefactors, which is to say because their activities produce benefits for other members of their community. Villains receive

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centuries. Tolerance can be regarded as a civic virtue that reduces conflict by reducing the number and extent to which unusual behaviors are formally or informally discouraged by fellow residents of a community.

disapprobation because they are public malefactors, which is to say because their activities impose losses on other members of the community.

Both internalized ethical dispositions and informal support for dispositions that “internalize” externalities can reduce or solve a variety of externality problems. Several ethical principles require actors to take account of the effects of their actions on other persons (e.g. to internalize the externality). Reciprocity rules such as the “golden rule” (do unto others as you would have others do unto you) have this effect, as do ethical systems forbid actions that impose losses on others in one’s community. Utilitarian calculus also cause one to take full account of the costs and benefits that one’s actions impose on others.

Such normative principles have nothing to say about chicken farming itself, but do have general implications that include ones that are relevant for the activity of urban chicken farming. As in the previous cases, an internalized norm that associate guilt with activities that generate negative externalities (external costs) or virtue with activities that generate positive externalities will reduce or eliminate externality problems. Table 6 illustrates how such norms operate, when the consequences of an activity rather than the activity itself is the source of guilt.

**Table 6.8: Solving the Externality Problem**

		James		
		1 Chicken	10 Chickens	100 Chickens
Craig	1 Chicken	(C , J) (4, 4)	(C, J) (3,6- $G_{10}$ )	(C , J) (1, 8)
	10 Chickens	(6- $G_{10}$ ,3)	(5- $G_{10}$ , 5- $G_{10}$ )	(2- $G_{100}$ , 6- $G_{10}$ )
	100 Chickens	(8- $G_{100}$ ,1)	(6- $G_{100}$ , 2-- $G_{10}$ )	(3- $G_{100}$ , 3- $G_{100}$ )

In principle, guilt in such cases would increase with the external harm done, so  $G_{10} < G_{100}$ , which is to say that guilt is graduated. Several “guilt schedules” can solve this problem. For example  $G_{10} = 1$  and  $G_{100}=4$  would induce the central equilibrium, which utilitarians would regard to be the ideal outcome.  $G_{10} = 3$  and  $G_{100}=6$  would generate an equilibrium in the upper left-hand corner which might be regarded as optimal by persons with a “do no harm” ethos.

Addressing the problem with a town ordinance and a formal penalty essentially redefines the rights associated with ownership. The choice of chicken holdings beyond 10 may, for example, no longer part of the liberties associated with the ownership or occupation of a particular parcel of land in the village. The same could be said of regulations that ban loud noises after certain hours or requires that lawns be kept mowed or trash be stored in particular ways.

As Aristotle argued long ago, creating uniform ordinances in complex circumstances will rarely produce perfect solutions, because it is difficult for a general ordinance to take account of morally relevant variations in circumstances. When there is a continuum of possible choices and the best one is (arguably) among the middle ones, one cannot simply punish the activity per se with disapprobation, fines, or taxes. Rather a graduated system of punishment is necessary that takes account of the magnitude of the externalities at issue. An ideal ethical disposition with its associated feelings of virtue and guilt would serves as a Pigovian tax and subsidy schedule for the activities in question.<sup>20</sup>

Such cases also illustrate the challenge of ethical principles, which Aristotle also pointed out. When multiple intermediate cases exist and the best is not obvious, simple rules of conduct or maxims often provide little guidance. Practical wisdom is also required to appropriately apply the relevant principle(s).

<sup>20</sup> For those who are unfamiliar with Pigovian taxes, chapter 8 below provides a short overview. It is interesting to note that solutions induced by Pigovian taxes often cause persons to engage in different, rather than uniform, conduct.

## VII. Conclusions: Civic Norms Can Enhance Life in Communities

This chapter shows several ways in which life in communities can be made more attractive by a subset of ethical theories. Ethical dispositions can reduce conflict, solve coordination problems, and reduce externality problems. In the limit, as Spencer noted in 1851, normative dispositions could in principle “do it all,” and eliminate all the unnecessary conflicts and coordination problems associated with living in a community. In such cases, there would be no need for the centralized authority, no need for a government.<sup>21</sup>

The results need not be perfect to provide a foundation for a flourishing society. Ethical dispositions may diminish problems without fully solving them. All social evolution assures is that the combination of internally and externally enforced rules that emerge allow members of a community to escape from the Hobbesian dilemma and make life in the communities that emerge sufficiently attractive to be viable.

With respect to the role of ethics in a commercial society, ethical solutions for the problems of life in community are important because towns and cities are the places where commerce is most often central to life. As Hobbes pointed out, without security of life and property, industry and the arts would be unlikely to emerge.

Insofar as towns and urban centers become more pleasant places to live, commerce tends to expand. Life in cities requires commerce because less food is produced within cities boundaries than required to sustain their populations. To purchase food, those living in cities must produce goods and services valued by the persons that produce food and other raw materials. For this reason, urbanization, trade, and specialization tend to go hand and hand.

Nonetheless, towns and cities may exist without a flourishing commercial system. Meeting the necessities for food and shelter does not

require elaborate trading networks. A relatively small network of local producers and consumers is often sufficient to support a town or small city.

The next two chapters of Part I shift the focus of analysis from effects of ethics on the civil society to the effects of ethics on the extent of the commercial society. In the next two chapters, the effects of ethical dispositions on the size, scope, and effectiveness of markets are explored. Chapter 7 uses elementary game theory to do so. Chapter 8 uses elementary micro economic tools to do so.

Given the results of the present chapter, we might anticipate that as ethical supports for market activities increase in strength and sophistication, trading networks and production tend to expand, allowing greater specialization and larger commercial systems to be viable.

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<sup>21</sup> Remarks in Spencer’s autobiography (1904) suggest that at some point after 1851, he changed his mind about the feasibility of an evolutionary cultural equilibria, partly because he came to believe that society and human nature change more slowly than new problems emerge.



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## Appendix to Chapter 6: Some Introductory Notes on Non-Cooperative Games Theory

The use of game theory in political science began in the eighteenth century and in economics in the nineteenth century, but accelerated after World War II. The Cournot duopoly model was worked out in 1838, and provides an example of a non-cooperative game with a Nash equilibrium. Analysis of other forms of duopoly as with Stackelberg's model and models of monopolistic competition developed in the 1930s were also based on models and intuitions that would later be referred to as game theory. However, it was not until shortly after W.W.II. that game theory emerged as a separate field. The classic book that brought the field to the attention of persons outside the small group of applied mathematicians initially working on it is the *Theory of Games and Economic Behavior* by von Neumann and Morgenstern (1944). A second more accessible classic work is *Games and Decisions* by Luce and Raiffa (1957).

The application of game theory to economic problems continues to be the most active area of theory in contemporary economics and philosophy. A quick look at any economics journal published and many philosophy journals in the past three decades will reveal a large number of articles that rely upon elementary game theory to analyze economic behavior of theoretical and policy interest. Modern work on: the self-enforcing properties of contracts, credible commitments, the private production of public goods, externalities, time inconsistency problems, models of negotiation, and models of political and social activity have used game theoretic models as their engines of analysis.

Game theory can be used to model a wide variety of human behavior in small number and large number economic, political, and social settings. The choice settings in which economists most frequently apply game theory, however, are small number settings in which outcomes are jointly determined by the decisions of independent decision makers.

In "non-cooperative game theory" individuals are normally assumed to maximize their own utility without caring about the effects of their choices on other persons in the game. The individuals are pragmatists without internalized ethical dispositions.

- ◆ *The outcomes of the game are usually jointly determined by the strategies independently chosen by all players in the game.*
- ◆ *Consequently, each person's welfare depends, in part, on the decisions of other individuals "in the game."*

For example, in **Cournot duopoly**, each firm's profits depend upon its own output decision and that of the other firm in the market. In a setting where pure public goods are consumed, one's own consumption of the public good depends in part on one's own production level of the good, and, in part, on that of all others. After a snow fall, the amount of snow on neighborhood sidewalks depends partly on your own efforts at shoveling and partly that of all others in the neighborhood. In an election, each candidate's vote maximizing policy position depends in part on the positions of the other candidate(s).

Game theory models are less interesting in cases where there are no interdependencies among game players. For example, a social setting in which there is little or no interdependence is that of a producer and consumer in perfectly competitive market. A consumer (or firm) is able to buy (or sell) as much as they wish without affecting market prices. Game theory can still be used in such cases, but with little if any advantage over conventional tools.

The simplest game that allows one to model social interdependence is a two person game each of whom can independently choose between two strategies,  $S_1$  and  $S_2$ . There are four possible outcomes to the game:

- ◆ (1) both players may choose  $S_1$ ,
- ◆ (2) both may choose  $S_2$
- ◆ (3) player A may choose  $S_1$  and player B may choose  $S_2$ ,
- ◆ or (4) player A may choose  $S_2$  and player B may choose  $S_1$ .

The particular combination of strategies is the result of the independent decisions of the two players, A and B (Al and Bob). Such games allow a variety of interdependencies to be thought about systematically and, perhaps

surprisingly, also shed light on settings in which many strategies exist and many players, which normally generate very similar behavior.

A game is said to have a **Nash Equilibrium** when a strategy combination is "stable" in the sense that no player can change his strategy and increase his or her own payoff by doing so. There may be more than one Nash equilibrium. For example, the coordination game **has two equilibria**. Neither person can make themselves better off by changing their strategy (alone) given that of the other player(s) in the game.

A state of the world or game outcome is said to be **Pareto Optimal** or Pareto Efficient, if it is impossible to reach another state where at least one person is better off and no one is worse off. Note that the (Trade, Trade), equilibrium is Pareto optimal, but not of the other outcomes are.

The **Prisoners' Dilemma game** is probably the most widely used game in social science. What characterizes a PD game is that the "cooperate, cooperate" solution is preferred by each player to the "defect, defect" equilibrium. And also that the value generated by defecting is a bit higher than the cooperative solution regardless of whether the other player cooperates or not. Often the payoffs are represented ordinally with (3, 3) for the mutual cooperative solution and (2, 2) for the mutual defection result. The other payoffs are then (1,4) and (4,1) with the defector receiving 4 and the cooperator 1.

The PD payoffs can be represented algebraically with (abstract) payoffs. (C, C) and (D, D) are the payoffs of the mutual cooperation and mutual defection outcomes. And (S, T) and (T, S) for the "temptation" and "sucker's" payoffs when one person defects and the other is "played for a sucker." In a PD game,  $T > C > D > S$ .

The PD game's main limitations as a model of social dilemmas are its assumptions about the number of players (2), the number of strategies (2), the period of play (a 1-shot game), and the interests of the players (self-centered). However, most of these assumptions can be dropped without changing the basic conclusions of the analysis. Essentially the same conclusions follow for N-person games in which the players have

an infinite number of strategies (along a continuum) and play for any *finite* number of rounds, as we will see later in the course. However, if the players have internalized ethical dispositions many of the settings thought to have payoffs consistent with prisoner's dilemmas (including the money-based payoffs used in experiments) will not have a PD structure in overall utility terms, as demonstrated in this chapter.

The **mathematical requirements for completely specifying a game** are met in the Prisoner's Dilemma game. The possible strategies are completely enumerated. The payoffs for each player are completely described for all possible combinations of strategies. The information set is (implicitly) characterized. (A player is said to have perfect information if he knows all details of the game. A perfectly informed player knows the payoffs for each party, the range of strategies possible, and whether the other players are fully informed or not.)

In economics two-person models of exchange, the Edgeworth Box, is often used to illustrate the principle of exchange between two persons, although we know that exchange in the real world is much more complex. Game matrices can also be employed to model exchange, as in the next chapter. Such representations capture the essential features of exchange that are missing from the classic Edgeworth representation.

The Edgeworth box very nicely illustrates why the trade, and why trading equilibrium tends to be Pareto optimal, but not the risks associated with exchange in a setting in which information about the nature of the offers and products is imperfect.