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Beyond the Prisoner's Dilemma: Coordination, Game Theory, and the Law

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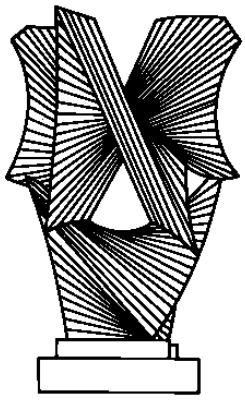

BEYOND THE PRISONERS' DILEMMA: COORDINATION, GAME THEORY AND THE LAW

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ESSAY

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INTRODUCTION

In reviewing a game theory text almost twenty years ago, Ian Ayres complained that "countless" law review articles "rearticulate the Prisoner's Dilemma, but few even proceed" to the simplest of other games.[1] Several years later, in still the most significant book treatment of game theory for law, Douglas Baird, Robert Gertner, and Randall Picker began by lamenting how legal scholars had neglected game theory up to that point "other than to invoke a simple game such as the prisoner's dilemma as a metaphor for a collective action problem."[2] All of these scholars asserted the great value of game theory to legal analysis and the hope that it would transform legal theory as it has transformed economic theory.

That transformation has not occurred, at least not in the law review literature. To the contrary, the diagnosis of Ayres, Baird, Gertner and Picker remains exactly true today: legal scholars are nearly obsessed with the Prisoners' Dilemma, mentioning the game in a staggering number of law review articles (over 3000), but virtually ignoring other equally simple games offering equally sharp insights into legal problems. One has to guess that the former obsession contributes to the latter neglect. Having learned one tool very well, legal scholars either shoehorn situations that are not Prisoners' Dilemmas into that framework or, recognizing that the problem is not a Prisoners' Dilemma, give up on game theory. For certain, this diagnosis does not apply to the formal modelers, many with Ph.D.'s in economics, who publish predominantly in peer reviewed law and economics journals. But, as I show below, the far more typical story for legal scholars is to use game theory only by using the Prisoners' Dilemma. And this outcome, I contend, is like only using mathematics when the problem involves odd numbers between twelve and two hundred.

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[1] Ian Ayres, *Playing Games with the Law*, 42 STAN. L. REV. 1291, 1295-96 (1990) (book review of ERIC RASMUSEN, GAMES AND INFORMATION: AN INTRODUCTION TO GAME THEORY (1989)) ("Law review articles continued to be mindlessly mired in the game theory 'technology' of the fifties.").

[2] DOUGLAS G. BAIRD, ROBERT H. GERTNER & RANDAL C. PICKER, GAME THEORY AND THE LAW 1 (1996).

Game theory contains many tools and insights beyond the Prisoners' Dilemma, too many to be the subject of an essay. No doubt the formal modelers would point out the greater realism of using games with continuous rather than discrete strategies,[3] sequential rather than simultaneous moves,[4] asymmetric information,[5] as well as models of evolutionary emergence of equilibrium.[6] Most contemporary game theory is not about games with pre-existing names like the Prisoners' Dilemma or the alternatives I discuss below, but concerns games the modeler constructs to fit the situation being studied. Yet this is the kind of complaint that Baird, Gertner, and Picker raised previously. I want to take a different, more practical path in criticizing the law professor's use of game theory, one that borrows from another applied field, political science. That work demonstrates that in situations just as basic as the Prisoners' Dilemma – with two players, two discrete strategies, complete information, and simultaneous moves – there is a world of value in games *other than* the Prisoners' Dilemma.[7] I focus on three such games, all involving problems of "coordination"[8] that do not arise in the Prisoners' Dilemma, and all having great value for legal theory.

Why would legal scholars focus on the Prisoners' Dilemma to the point where it obscures other insights of game theory? What is the game's allure? Two features that narrow the games' application also make it tempting to a legal scholar. When played just once, the Prisoners' Dilemma is one of the few games with a single "equilibrium." An equilibrium is central to game theory; it is an outcome where each

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[3] *See, e.g.*, ERIC RASMUSEN, GAMES AND INFORMATION 74-106 (4th ed. 2006).

[4] *See e.g.*, DREW FUDENBERG & JEAN TIROLE, GAME THEORY 65-206 (2002).

[5] *See, e.g.*, ERIC RASMUSEN, GAMES AND INFORMATION 169-369 (4th ed. 2006); DREW FUNDENBERG & JEAN TIROLE, GAME THEORY 207-434 (2002).

[6] *See, e.g.*, H. PEYTON YOUNG, STRATEGIC LEARNING AND ITS LIMITS (2004); DREW FUDENBERG & DAVID K. LEVINE, THE THEORY OF LEARNING IN GAMES (1998).

[7] At the same time, one must be aware of the limits to simple models, situations where omitting certain complexities to the game leads to the wrong conclusions. *See, e.g.*, DOUGLAS G. BAIRD, ROBERT H. GERTNER & RANDAL C. PICKER, GAME THEORY AND THE LAW 188-218 (1996)(chapter on "Collective Action and the Limits of Simple Models").

[8] Some essential works on coordination are THOMAS C. SCHELLING, THE STRATEGY OF CONFLICT (1960); DAVID LEWIS, CONVENTION (1969); EDNA ULLMANN-MARGALIT, THE EMERGENCE OF NORMS 74-133 (1977); ROBERT SUGDEN, THE ECONOMICS OF RIGHTS, COOPERATION, AND WELFARE 55-103 (1986); BRIAN SKYRMS, THE STAG HUNT AND THE EVOLUTION OF SOCIAL STRUCTURE (2004).

individual is playing her best response to what everyone else is doing. At such a point, no one wants to switch strategies.[9] Single equilibrium games provide a tidy and definitive prediction of the behavioral outcome. One can therefore ignore culture and history because, once factored into the payoffs, their influence is fully exhausted.[10] A second temptation of the Prisoners' Dilemma is a unique normative feature: *everyone* can be made better off by legal sanctions that "solve" the game. So if the problem is a Prisoners' Dilemma, the case for a legal solution is unusually strong.

By contrast, coordination games have *multiple* equilibria and therefore lack these allures. There being more than one equilibrium means that the payoffs alone do not determine the behavioral outcome. In this case, the economist concedes that history and culture (or other factors) may affect behavior independent of – in addition to – their effect on payoffs.[11] Prediction is messy. Second, games other than the Prisoners' Dilemma frequently present no opportunity for a solution making everyone better off. Instead, coordination games often present a choice between conflicting preferences of different individuals, which must be made on the basis of some complex and contestable normative theory.[12]

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[9] More precisely, an equilibrium refers to a "Nash equilibrium," which

> is the central solution concept in game theory. It is based on the principle that the combination of strategies that players are likely to choose is one in which no player could do better by choosing a different strategy given the ones the others choose. A pair of strategies will form a Nash equilibrium if each strategy is one that cannot be improved upon given the other strategy. We establish whether a particular strategy combination forms a Nash equilibrium by asking if either player has an incentive to deviate from it.

DOUGLAS G. BAIRD, ROBERT H. GERTNER & RANDAL C. PICKER, GAME THEORY AND THE LAW 310 (1996)(emphasis deleted).

[10] For example, if an individual gains some extra benefit from an outcome because of an emotional attachment to a particular cultural identity, the game theorist will accordingly raise the payoffs to that individual for that outcome. If there remains only one equilibrium, then the effect of culture is entirely limited to the way it affects payoffs.

[11] In contrast to the prior footnote, if the payoffs permit multiple equilibria, culture may not only affect the payoffs, but also affect the choice between the multiple equilibria. For example, if the payoffs don't determine a unique equilibrium, individuals with the same payoffs but different cultural identities may play the game differently. See the discussion of focal points and culture at infra text accompanying notes __-__.

[12] *See, e.g.*, LEWIS KAPLOW & STEVEN SHAVELL, FAIRNESS VS. WELFARE 15-37 (2002); JOHN RAWLS, JUSTICE AS FAIRNESS: A RESTATEMENT (2001); MARTHA C. NUSSBAUM, WOMEN AND HUMAN DEVELOPMENT: THE CAPABILITIES APPROACH (2000).

In short, there is a strong temptation to describe a situation as a Prisoners' Dilemma because it renders the problem amenable to an uncontroversial legal solution. This essay, however, describes the benefits of resisting this temptation, of opening one's eyes to more game theory than that one trick, however clever. Coordination problems are common and important to law, and there is much to be learned from using simple games to analyze them. Unlike the Prisoners' Dilemma, coordination games describe situations involving inequality, reveal how culture and history powerfully affect behavior, and demonstrate how law works expressively. These games provide unique insights into bargaining, constitutional law, democratic stability, international law, standard-setting, traffic regulation, property norms, gender roles, and social movements. Political scientists, economists, philosophers, and just a few legal scholars have begun exploring these matters. The theoretical insights already made, however, no doubt only scratch the surface for what is possible if *legal scholars* were to engage these alternative games as intensely as they have explored the Prisoners' Dilemma. The main purpose of this essay is to encourage legal scholars to exploit the potential of this sort of game theory and to correct the imbalance that currently overemphasizes the Prisoners' Dilemma.

I also explain how coordination games provide a bridge for intellectual exchange between two rival schools of thought that largely ignore each other: Law & Economics and Law & Society. Though the latter group mostly shuns game theory, it turns out that the social problems Law & Society scholars explore are overwhelming coordination problems, not Prisoners' Dilemmas. Each group might understand better the contributions of the other if legal scholars using game theory were to focus more attention on these alternative games.

Part I introduces the Prisoners' Dilemma and gives some measure of its enormous influence over legal scholarship. Part II introduces three simple games – Assurance, Hawk-Dove, and Battle of the Sexes – that are at least as common as the Prisoners' Dilemma, but that are virtually neglected by legal scholarship. In Part III, I describe some of the many ways these games illuminate legal problems, showing them to be at least as important to law as the Prisoners' Dilemma. Part IV discusses

opportunities for intellectual exchange between Law & Economics and Law & Society. Part V concludes.

I. ALL THE PRISONERS' DILEMMA ALL THE TIME

The problem of cooperation exemplified by the Prisoners' Dilemma ("PD") is one of the most dominant paradigms of recent theoretical work in economics, politics, and law. As Robert Axelrod puts it: "The two-person iterated Prisoner's Dilemma is the E. coli of the social sciences."[13] Legal scholars make great use of the concept, having mentioned it an astonishing number of law review publications – over 3000 according to my Westlaw search[14] – to explore topics ranging from contracts[15] and property,[16] to international law,[17] race discrimination,[18] feminism,[19] social norms,[20] the federal judiciary,[21] and, indeed, actual

[13] ROBERT AXELROD, THE COMPLEXITY OF COOPERATION ii (1997).

[14] I searched on August 12, 2008 in the JLS database for "prisoner's dilemma" or "prisoners dilemma" and the result was 3,051 documents. "Prisoners' dilemma" is not a valid search term because of the way Westlaw reads an apostrophe at the end of a word, but the search I ran picks up this usage anyway. If we add to the search the Prisoners' Dilemma's multi-party cousin the "Social Dilemma," the yield is 3376 documents, although some of these use the term in a non-strategic sense (as a synonym for the term "social problem").

[15] *See, e.g.*, Wayne Eastman, *How Coasean Bargaining Entails a Prisoners' Dilemma*, 72 NOTRE DAME L. REV. 89 (1996); Robert L. Birmingham, *The Duty to Disclose and the Prisoner's Dilemma: Laidlaw v. Organ*, 29 WM. & MARY L. REV. 249 (1988); Robert E. Scott, *Conflict and Cooperation in Long-Term Contracts*, 75 CAL. LAW REV. 2005 (1987).

[16] *See, e.g.*, ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION 23-38 (1990); Wendy J. Gordon, *Asymmetric Market Failure and Prisoner's Dilemma in Intellectual Property*, 17 U. DAYTON L. REV. 853 (1992).

[17] *See, e.g.*, George Norman & Joel P. Trachtman, *The Customary International Law Game*, 99 AMER. J. INT'L. LAW 541 (2005); John K. Setear, *Responses to Breach of a Treaty and Rationalist International Relations Theory*, 83 VA. L. REV. 1, 27-32 (1997)

[18] *See, e.g.*, Richard H. McAdams, *Cooperation and Conflict: The Economics of Group Status Production and Race Discrimination*, 108 Harv. L. Rev. 1003 (1995).

[19] *See, e.g.*, Carol M. Rose, *Women and Property: Gaining and Losing Ground*, 78 VA. L. REV. 421 (1992); H.E. Baber, *Tomboys, Femmes and Prisoner's Dilemmas*, 9 J. CONTEMP. LEGAL ISSUES 37 (1998).

[20] *See, e.g.*, ROBERT AXELROD, THE EVOLUTION OF COOPERATION (1984); ERIC A. POSNER, LAW AND SOCIAL NORMS (2000); Paul G. Mahoney & Chris W. Sanchirico, *Competing Norms and Social Evolution: Is the Fittest Norm Efficient?*, 149 U. PA. L. REV. 2027 (2001).

[21] *See, e.g.*, Thomas W. Merrill, *Pluralism, the Prisoner's Dilemma, and the Behavior of the Independent Judiciary*, 88 NW. U. L. REV. 396 (1993); David S. Law, *Appointing Federal Judges: The President, The Senate, and The Prisoner's Dilemma*, 26 CARDOZO LAW REV. 479 (2005).

prisoners.[22] Legal theorists use the PD to explain other major concepts in law – *e.g.*, the tragedy of the commons,[23] the public goods problem,[24] and trust,[25] all which are themselves relevant to many areas of law.

Given my thesis, the PD needs almost no introduction, yet it will help greatly to review the iconic narrative from which the game gets its name. A prosecutor suspects two prisoners of a felony, but can currently prove their involvement only in a misdemeanor. The prosecutor offers each prisoner the same inducement to confess to the felony, summarized below in Figure 1: "If you are the only one to confess, I will reward you by dropping all charges," which is represented in Figure 1 by the payoff of 0. "If you are the only one *not* to confess, I will use your confederate's testimony to convict you of the felony and obtain for you the maximum five years in prison (-5); if neither of you confesses, you each get one year for the misdemeanor (-1); if both confess, I will convict you both of the felony but give you an intermediate sentence of three years (-3)." In this context, to select the strategy of not confessing is to "cooperate" and to select the strategy of confessing is to "defect." Altruism can of course change the game, but the standard assumption is that the prisoners care only about their own punishment.

Prisoner 2

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[22] *See, e.g.*, Russell Dean Covey, *Beating the Prisoner at Prisoner's Dilemma: The Evidentiary Value of a Witness's Refusal to Testify*, 47 AM. U. L. REV. 105 (1997).

[23] *See*, Hanoch Dagan & Michael A. Heller, *The Liberal Commons*, 110 YALE L.J. 549, 555 (2001)("Most lawyers, economists, and other social scientists learn of the 'tragedy of the commons' in the first weeks of school, and all are taught that commons property is the axiomatic example of a prisoner's dilemma.").

[24] *See, e.g.*, Richard A. Epstein, *A Farewell to Pragmatism*, 71 U. CHI. L. REV. 675, 677 (2004) (referring to "the creation of public goods" as occurring "when state power blocks the degenerative outcomes of the standard prisoner's dilemma game."); Sean J. Griffith, *Spinning and Underpricing: Legal and Economic Analysis of the Preferential Allocation of Shares in Initial Public Offerings*, 69 BROOK. L. REV. 583, 610 n.91 (2004) ("The most familiar of these [social dilemmas] is the 'prisoner's dilemma,' but other terms are commonly applied to the same general problem, including 'social traps,' the 'tragedy of the commons,' and 'public goods/free riding problems.'").

[25] *See, e.g.*, Karen Eggleston, Eric A. Posner & Richard Zeckhauser, *The Design and Interpretation of Contracts: Why Complexity Matters*, 95 Nw. U. L. Rev. 91, 115 (2000) ("One useful model of trust treats it as an attribute of relationships in which two parties in a repeated prisoner's dilemma cooperate rather than risk retaliation.").

Prisoner 1	Cooperate	Defect
Cooperate	-1, -1	-5, 0
Defect	0, -5	-3, -3

Figure 1: The Classic Prisoners' Dilemma

With these payoffs, if Prisoner 2 cooperates, Player 1 is better off defecting (receiving a payoff of 0) than cooperating (-1).[26] If Player 2 defects, Player 1 is better off defecting (-3) than cooperating (-5). Therefore, Player 1 has a "dominant" strategy of defecting; it is her best move regardless of what Player 2 does. Because the payoffs shown are symmetric, Player 2 has the same dominant strategy. Thus, the only equilibrium is Defect/Defect. In Figure 1, and subsequent matrices, I indicate an equilibrium by underlining the payoffs. The game is termed a "dilemma" because this theoretically inevitable outcome is worse *for each prisoner* than another possible outcome, Cooperate/Cooperate.

A simple Westlaw search reveals a staggering 3000+ articles referring to the PD,[27] which contrasts with only trivial attention to coordination games of equal legal significance (as demonstrated below). One way to tell that legal scholars give excessive attention to the PD is to note how scholars misdescribe and misapply the game. First, scholars sometimes attempt to shoehorn a non-PD situation into the PD model they find so alluring. A simple example is a "run on a bank." Quite a few articles claim that "[b]ank runs represent a classic prisoner's dilemma."[28]

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[26] Notice that in Figure 1 as in every matrix the payoffs for Player 1 are on the left in each cell and the payoffs for Player 2 are on the right.

[27] *See supra* note __.

[28] *See* Mark E. Van Der Weide & Satish M. Kini, *Subordinated Debt: A Capital Markets Approach to Bank Regulation*, 41 B.C.L. Rev. 195, 204 (2000). *See also* R. Nicholas Rodelli, *The New Operating Standards for Section 20 Subsidiaries: The Federal Reserve Board's Prudent march Toward Financial Services Modernization*, 2 N.C. BANKING INST. 311, 315-16 (1998); Daniel R. Fischel, Andrew M. Rosenfield & Robert S. Stillman, *The Regulation of Banks and Bank Holding Companies*, 73 VA. L. REV. 301, 307-08 (1987); Jonathan R. Macey, *The Business of Banking: Before and After Gramm-Leach-Bliley*, 25 J. CORP. L. 691, 696 (2000). On August 12, 2008, my Westlaw search in the JLR database for "(run /3 bank) /p (prisoner /2 dilemma)" yielded ten documents. By contrast, a parallel search for articles involving the most apt coordination game ("stag hunt" or "assurance," explained below) to describe a bank run, the yield was zero. I thank Keith Hylton for suggesting this example.

On this view, "[d]epositors will be better off individually if they could beat their fellow depositors to the bank and reclaim their deposits whenever there is the slightest bit of uncertainty about the value of a bank's assets."[29] Yet a Prisoners' Dilemma is surely a poor model of a bank run. A better model would include both the equilibrium outcome where the bank is stable – as banks usually are – and also the equilibrium where there is a run. The Prisoners' Dilemma game can – at best – apply only *after* some uncertainty arises about the bank. By contrast, the simple game of Assurance, discussed below,[30] describes both the efficient "deposit" equilibrium and the inefficient "run" equilibrium and the way that uncertainty or a lack of "assurance" tips the situation from the former to the latter.

The Prisoners' Dilemma game is also a poor model of a bank run because, even after "the slightest bit of uncertainty" arises in a bank, it is not necessarily the best strategy for each depositor to "reclaim" her deposit. Depositors incur costs in removing deposits. If some uncertainty arises about person *A*'s bank, and yet others will not reclaim their deposits, then *A* will have no interest in incurring the costs of reclaiming hers. It is only when she expects others to withdraw their deposits that she wants to withdraw hers. The difference between wanting to take some action *no matter what the others do* and wanting to take some action *only if others also do the same* may seem small, but the Prisoners' Dilemma is strictly limited to the former case. As we shall see, the latter situation is about *coordinating* one's behavior with others.

Yet the distinction is often overlooked. Even when describing the original PD scenario, quite a few scholars posit payoffs *where the best outcome for a player – freedom from prison – occurs when neither party confesses*.[31] This is an error. By positing that mutual silence allows both

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[29] *See* Jonathan R. Macey, *The Business of Banking: Before and After Gramm-Leach-Bliley*, 25 J. CORP. L. 691, 696 (2000).

[30] *See infra* text accompanying notes __.

[31] Some smart scholars make this error. Robert Birmingham observes that Judge Easterbrook misdescribes a Prisoners' Dilemma in Page v. United States, 884 F.2d 300, 301 (7th Cir. 1989)(emphasis added), when he says:

> Two prisoners, unable to confer with one another, must decide whether to take the prosecutor's offer: confess, inculpate the other, and serve a year in jail, or keep silent and serve five years. If the prisoners could

prisoners to avoid any penalty, these scholars create a situation where each prisoner wants to confess *only if* the other confesses; each wants to remain silent if the other remains silent. As a result, there are two equilibria (Confess/Confess and Silence/Silence) and the situation is not a PD, but one of the coordination games discussed below. I suspect these scholars make this error despite knowing the game theory because, in trying quickly to recall the PD scenario from memory, they imagine a prosecutor/prisoner bargaining situation *that seems realistic and typical*, which is where mutual silence is best. It just turns out – surprise! – that many realistic and typical legal situations are not PDs. Below we see how a different game – Assurance – helps to understand these interactions.

> make a (binding) bargain with each other, *they would keep silent and both would go free*. But they can't communicate, and each fears that the other will talk. So both confess.

But if mutual silence equal mutual freedom, while a sole confessor serves one year (and a sole non-confessor gets five), then the best response to silence is silence. To create a PD, the prosecutor must ensure that either prisoner can obtain her best outcome – no prison – only if she is the sole confessor. So if both are silent, they must both serve some time, as for a minor crime the prosecutor can already prove. *See* Robert Birmingham, *Telling Alternative Stories: Heterodox Versions of the Prisoner's Dilemma, the Coase Theorem, and Supply-Demand Equilibrium*, 29 CONN. L. REV. 827, 842-45 (1997)(first making this criticism).

Lee Fennell catches the same error in her review of ROBIN PAUL MALLOY, LAW IN A MARKET CONTEXT: AN INTRODUCTION TO MARKET CONCEPTS IN LEGAL REASONING (2004). *See* Lee Anne Fennell, *Book Note*, 55 J. LEGAL ED. 295, 300-01 (2005). I have found five other examples just in the past three years: David McGowan, *Politics, Office Politics, and Legal Ethics: A Case Study in the Strategy of Judgment*, 20 GEO. J. LEGAL ETHICS 1057, 1072 (2007)("If they cooperate with one another by remaining silent, each receives no penalty (or a relatively light one)."); Jonathan T. Schmidt, Note, *Keeping U.S. Courts Open to Foreign Antitrust Plaintiffs: A Hybrid Approach to the Effective Deterrence of International Cartels*, 31 YALE J. INT'L L. 211, 234 (2006)(showing chart with outcome for mutual silence being no penalty, while the sole confessor gets a "light penalty" of "one year"); Glenn Harrison & Matthew Bell, *Recent Enhancements in Antitrust Criminal Enforcement: Bigger Sticks and Sweeter Carrots*, 6 HOUS. BUS. & TAX L. J. 207, 216 (2006) ("If neither prisoner confesses, both go free"); Geoffrey P. Miller, *The Legal Function of Ritual*, 80 CHI.-KENT L. REV. 1181, 1185 (2005)("If neither confesses, both will go free," while if only one confesses, the confessor "will serve only a short sentence (say, one year)"); Pamela H. Bucy, *Game Theory and the Civil False Claims Act: Iterated Games and Close-Knit Groups*, 35 LOY. U. CHI. L.J. 1021, 1028 n.46 (2004)("If both prisoners refuse to confess, they both go free. Otherwise, the prisoner who confesses first gets a short prison sentence ... ").

In any event, these examples are not alone.[32] Legal scholars seem to wear PD-colored lenses that trick them into seeing something that isn't there. Let us now consider what they are failing to see.

II. WHAT THE PRISONERS' DILEMMA OBSCURES: THREE SIMPLE GAMES OF COORDINATION

The Prisoners' Dilemma game is a brilliant way of illustrating the problem of cooperation. Where selfish pursuits lead individuals to outcomes that are worse for each than some other achievable outcome, they need to find how to cooperate to reach the better outcome. To be clear, I have no quarrel with the remarkable power of this analysis: PD problems are prevalent, their solution frequently offers an uncontroversial way to improve social welfare, and legal sanctions are often necessary and sufficient to solve such problems. But cooperation failures are not the only obstacles individuals face to achieving their ends. Game theory identifies another pervasive problem: the need to *coordinate*. Using games as simple as the PD, the theory demonstrates why society needs mechanisms for coordination as much as it needs mechanisms for cooperation. As we shall see, law serves the former function as much as the latter.

To illustrate a coordination problem, consider a simple variation on the canonical narrative of the PD. The prosecutor places in different interrogation rooms two prisoners who jointly committed some crime. Suppose, however, that the prosecutor's case is so weak that the prisoners could defeat the prosecutor and free themselves if, but only if, they can give a *consistent* alibi for their whereabouts at the time of the crime. It won't work for the prisoners to say they were each alone at the time; they each need someone to confirm their alibi and, because they are guilty,

[32] Bankruptcy is similar. When uncertainty arises, creditors can make a "run" on their debtor just as depositors make a run on a bank. Thomas Jackson describes this situation as a Prisoners' Dilemma, *see* Thomas H. Jackson, *Bankruptcy, Non-Bankruptcy Entitlements, and the Creditors' Bargain*, 91 YALE L.J. 857 (1982), but the same problems arise. First, the game describes the situation that exists only *after* the perception of insolvency arises, where a game discussed below (Assurance) also captures the original situation of perceived solvency. Second, because calling in a loan is costly, creditor A may not want to bear this cost if none of the other creditors call in their loan.

each knows that she can rely on no one except the other prisoner. But they did not agree on an alibi in advance. Each prisoner thinks of various possibilities: they were at one of their homes or the other, at the movies, out hunting, etc. The problem is that neither knows what alibi the other will choose. More generally, the problem of coordination arises because there is more than one path to some desired outcome, both want to choose compatible paths, but neither knows which path the other will take. Let us call the example the "Prisoners' (Pure) Coordination" game.[33]

Coordination is a pervasive concern of law. There are many coordination games, but I limit myself here to three classics: (1) the Assurance or Stag Hunt game, (2) the Hawk/Dove or Chicken game, and the (3) Battle of the Sexes. Unlike the PD, these games require an introduction because they are routinely ignored by the legal scholarship. In contrast to 3051 hits for PD,[34] a Westlaw search reveals 121 references to the Assurance or Stag Hunt game,[35] 101 references to the Hawk/Dove or Chicken game,[36] and 75 references of the Battle of the Sexes game.[37] In other words, these other games are mentioned, respectively, 4%, 3%, and 2.5% as often as the PD game. The number of articles mentioning *any* of these three games is 243, or 8% of the PD total.[38] So let us meet these neglected tools of legal analysis.

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[33] The game is a "pure" coordination game because there is no element of conflict. Each player is indifferent among the equilibria and cares only about coordinating. The classic example is the choice of driving on the left or the right side of the road.

[34] *See supra* text accompanying notes __.

[35] My search terms were: "stag hunt" or "assurance game." All the searches reported here were conducted on August 12, 2008 in the JLR database.

[36] My search terms were: "chicken game" or (hawk /s dove /s game).

[37] My search terms were: (battle /s sexes /s game).

[38] My search combined the above three searches, disjunctively. The combined search result of 243 yields fewer documents than adding the three individual game totals because some documents mention more than one of the games. Yet these games are the most likely coordination games to be mentioned. Indeed, my search for the generic term "coordination game" yielded only 238 documents. There is, however, some slight movement in the right direction. Limiting the prior searches to publications since 2002, I found 1048 articles referencing the PD and 104 referencing any one of the three coordination game, which is 10% of the PD total.

A. The Assurance or Stag Hunt Game

Figure 2 depicts what is known as a Stag Hunt or Assurance game.[39] Here, if Player 2 selects Strategy A, then Player 1 is better off selecting Strategy A and receiving 4 than selecting Strategy B and receiving 3. If Player 2 selects Strategy B, however, then Player A is better off selecting Strategy B (receiving 3 instead of 0). Because the payoffs are symmetric, Player 2 has the same preferences. Thus, the players want to match strategies and the game has two (pure strategy)[40] equilibria: A/A and B/B.

	Player 2	
Player 1	Strategy A	Strategy B
Strategy A	4, 4	0, 3
Strategy B	3, 0	3, 3

Figure 2: An Assurance or Stag Hunt Game

The players have the same preferences, each preferring A/A to B/B. This common interest might make it trivially easy to reach the mutually desired outcome. But the problem here is the riskiness of Strategy A. Selecting Strategy B guarantees a return of 3, while Strategy A will earn either 4 or 0. For this reason, both Players might select the less

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[39] *See, e.g.*, BRIAN SKYRMS, THE STAG HUNT AND THE EVOLUTION OF SOCIAL STRUCTURE (2004); DENNIS CHONG, COLLECTIVE ACTION AND THE CIVIL RIGHTS MOVEMENT 103-40 (1991); Gary Bornstein & Zohar Gilula, *Between-Group Communication and Conflict Resolution in Assurance and Chicken Games*, 47 J. CONFLICT RES. 326 (2003); Amartya Sen, *Isolation, Assurance, and the Social Rate of Discount*, 81 QUART. J. ECON. 112 (1967). For technical differences in "Assurance" and "Stag Hunt," which need not concern us here, *see* BAIRD, GERTNER & PICKER, *supra* note 16, at 301, 315.

[40] A "pure strategy" is one that selects (in a given circumstance) a certain "move" or behavior with certainty. This approach is contrasted with a "mixed strategy," which involves (in a given circumstance) selecting among at least two moves with some probabilities that sum to one. Concordantly, in a pure strategy equilibrium, "each player adopts a particular strategy with certainty," whereas in a mixed strategy equilibrium "one or more of the players adopts a strategy that randomizes among a number of pure strategies." *See* DOUGLAS G. BAIRD, ROBERT H. GERTNER & RANDAL C. PICKER, GAME THEORY AND THE LAW 313 (1996). To keep things simple, I focus on pure strategy equilibria.

risky Strategy B and wind up in equilibrium B/B despite the fact that each regards B/B as worse than A/A. The players thus face a problem of coordination.

The game draws one of its names – Assurance – from the fact that each needs to *assure* the other that she is going to play the riskier strategy – A – so the other should as well.[41] The name "Stag Hunt" comes from Rousseau's illustration[42] of the choice between hunting stag and hunting hare, where one succeeds in hunting stag only if the other hunter also hunts stag, where sharing a stag with the other hunter is the best outcome, but where hunting hare is safer because one can succeed on one's own.

One illustration of the game is the "bank run" discussed above, although that obviously involves more than two players.[43] Everyone wants to keep their money in the bank if everyone else does, but to remove their money if enough others are going to remove theirs. The efficient equilibrium is where depositors gain the advantage of pooling their resources, but the inefficient equilibrium results when everyone seeks to avoid the risk of pooling and go it alone. The game captures the fact that, in times of uncertainty, the depositors need to *assure* each other that they will not panic. Unlike the PD, if no one else will withdraw their deposit in fear, there is no reason for you to do so.

As another example of Assurance, consider again a prosecutor bargaining with prisoners. Suppose that, unlike the PD, the prosecutor has so little evidence that she cannot convict either prisoner of any crime if neither confesses. Unlike the above example, they need not even give an alibi to avoid punishment; they need merely remain silent to both walk free. Against this best outcome, the prosecutor offers a prison term of 7 years each if both confess, 1 year for being the sole confessor, and 12 years for being the sole non-confessor. If so, then each prisoner wants to assure the other that she will remain silent; neither wants to confess if

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[41] *See, e.g.*, DENNIS CHONG, COLLECTIVE ACTION AND THE CIVIL RIGHTS MOVEMENT 103-40 (1991); Amartya Sen, *Isolation, Assurance, and the Social Rate of Discount*, 81 QUART. J. ECON. 112 (1967).

[42] JEAN-JACQUES ROUSSEAU, A DISCOURSE ON INEQUALITY III (Trans. M. Cranston 1984).

[43] *See* text accompanying notes __.

they expect that the other will not confess.[44] The "Prisoners Assurance game" must be highly plausible because it is the set of facts by which some scholars misdescribe the PD.[45] Indeed, Christopher Leslie confirms that this result is common in anti-trust conspiracies: if the prosecutor can't prove the conspiracy, she can't prove any offense.[46]

B. The Battle of the Sexes Game

Figure 3 illustrates the Battle of the Sexes ("BOS") game, where the worst outcome for each player is the failure to match strategies, but where one player prefers matching at Strategy A and the other prefers matching at Strategy B.[47] Specifically, if Player 2 selects strategy A, Player 1 is better off selecting Strategy A (receiving 3 instead of 0). If Player 2 selects Strategy B, Player 1 is better off selecting Strategy B (receiving 1 instead of 0). Player 2's preferences are parallel, so there are two (pure strategy) equilibria: A/A and B/B. Unlike Assurance, there is conflict here because Player 1 prefers A/A and Player 2 prefers B/B. Like Assurance, the players agree on the need to avoid certain outcomes, B/A and A/B, each of which is worse for both players than either equilibrium.

Player 2

[44] One might challenge the example by saying that a prosecutor would always choose to make the game a PD by offering zero years if a defendant is the only one who confesses (instead of 1). In that case, it seems to be weakly dominant to confess, which is better for the prosecutor. Yet the reality is that most defendants will never regard an outcome of confessing and avoiding criminal sanctions as being as good as *not* confessing and avoiding criminal sanctions. First, confessing may force the confessor to stop engaging in profitable illegal activities, such as an ongoing price-fixing scheme. Second, there is a reputational cost to being a snitch. Third, the defendant may have some small altruism towards her criminal confederates. However small these effects are, the best outcome when the prosecutor can't convict either without a confession is mutual silence, in which case the game is Assurance and not PD.

[45] *See supra* note __.

[46] *See* Christopher R. Leslie, *Trust, Distrust, and Antitrust*, 82 TEX. L. REV. 515, 638-39 (2004) ("Yet in most criminal antitrust prosecutions, the authorities do not have solid evidence of a minor crime. . . . Without sufficient evidence of a minor crime, antitrust authorities need some leverage to convince cartelists to confess. Otherwise, there is no Prisoner's Dilemma.").

[47] See, e.g., Russell Cooper, et al., *Forward Induction in the Battle-of-the-Sexes Games* 83 Amer. Econ. Rev. 1303 (1993).

Player 1	Strategy A	Strategy B
Strategy A	3, 1	0, 0
Strategy B	0, 0	1, 3

Figure 3: A Battle of the Sexes Game

Although any game this simple will miss much nuance, the BOS is a useful model of bargaining. The game also models standard-setting, as where different firms or industries need to agree to certain technical standards to allow their products to interact. I explore these examples below.

We can also return to prosecutorial bargaining with prisoners. Suppose the prosecutor has enough information to charge both prisoners with a substantive offense *and* with a conspiracy to commit that offense. In response, A and B could each assert that a particular one of them committed the offense *alone*. If so, then neither prisoner can be convicted of the crime of conspiracy; the confessor will be convicted only of the substantive offense and the other prisoner will go free. The strategy obviously requires coordination because they will fail to be credible and fail to defeat the conspiracy charge if they each point the finger at the other or each point the finger at themselves. Being a BOS, each prefers a different equilibrium – the one where the *other* prisoner takes responsibility. Instead of a Prisoners' Dilemma, we have the "Prisoners' Battle of the Sexes" game.

C. The Hawk-Dove or Chicken Game

The Chicken or Hawk-Dove ("HD") poses a coordination problem but one with even greater conflict than the BOS.[48] Figure 4 illustrates. Given those payoffs, if Player 2 selects the strategy Dove, then Player 1's best response is Hawk (receiving 4 instead of 2 from playing Dove). If Player 2 selects Hawk, then Player 1's best response is Dove (receiving 0

[48] *See, e.g.*, ROBERT SUGDEN, THE ECONOMICS OF RIGHTS, COOPERATION, AND WELFARE 55-103 (1986); Gary Bornstein, David Budescu & Shmuel Zamir, *Cooperation in Intergroup, N-Person, and Two-Person Games of Chicken*, 41 J. CONFLICT RES. 384 (1997); Hugh Ward, *The Risks of a Reputation for Toughness: Strategy in Public Goods Provision Problems Modelled by Chicken Supergames*, 17 BRIT. J. POL. SCI. 23 (1987).

instead of -1 from playing Hawk). Because the payoffs are symmetric, the converse is true for Player 2, which means there are two (pure strategy) equilibria: Dove/Hawk and Hawk/Dove.

	Player 2	
Player 1	Dove	Hawk
Dove	2, 2	0, 4
Hawk	4, 0	-1,-1

Figure 4: A Hawk-Dove Game

Most obviously, there is conflict because each equilibrium has dramatically unequal payoffs, one favoring Player 1 and the other favoring Player 2. But there is also a problem of coordination because the players have a common interest in avoiding what each regards as the worst possible outcome – Hawk/Hawk. Even though that outcome is not an equilibrium (because at that point a player would prefer to unilaterally switch strategies), if both players "aim for" their preferred outcome by simultaneously playing Hawk, that is exactly what results.[49] Indeed, in the alternative name "Chicken" comes from a fictional game between teenagers who drive their cars directly at each other, where the one who swerves first loses face, but the failure of either to swerve is catastrophic.[50]

In the next part, I claim that disputes often have the structure of a HD game. For now, consider again the setting of prosecutorial bargaining. Suppose that the prosecutor has so *much* evidence that she can convict both prisoners of a serious offense without a confession. But imagine that either prisoner can, by "snitching," reveal evidence that the true perpetrator is a previously unsuspected person C, thereby exonerating both prisoners. The problem is that the prisoners each prefer

[49] The other non-equilibrium outcome is Dove/Dove. In Figure 4, the joint payoffs at this outcome (2 + 2 = 4) are the same as the joint outcome at the two equilibria (4 + 0 = 4). This is not necessary; the joint Dove/Dove payoffs could be less or more than the joint equilibria payoffs. If they are more, then we also have a cooperation problem in reaching this efficient outcome.

[50] *See Rebel Without a Cause* (Warner Brothers 1955).

that the other one act as a snitch because each knows that a snitch may suffer retaliation by *C* or other criminals. Each prisoner therefore regards the best outcome as to remain silent while the other snitches, but the worst outcome to be where neither snitches and both are imprisoned for a crime they did not commit.[51] But the only two (pure strategy) equilibria involve exactly one snitcher: Snitch/Be Silent and Be Silent/Snitch.[52] Instead of the PD, this is the "Prisoners' HD" game.

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In the PD, a prisoner always does better by confessing and does best by being the only one to confess. But in four other equally plausible cases of prosecutorial bargaining, that is not the case. In the Prisoners' (Pure) Coordination game, one does best by matching whatever alibi the other prisoner gives. In the Prisoners' Assurance game, a prisoner wants to reciprocate the other prisoner's decision and one does best by mutual silence. In the Prisoners' BOS game, one wants to cast all blame on whichever prisoner the other prisoner blames; one does best by mutually blaming the other prisoner. In the Prisoners' Chicken game, one wants to be silent if the other prisoner snitches on the third party who committed the crime but to snitch if the other prisoner is silent; one does best by having the other prisoner snitch.

This essay is not just about prosecutorial bargaining, as the next section demonstrates. But taking seriously the iconic scenario of the PD tells us something of the excessive influence of that game. Because the legal/game theory literature discusses prisoner/prosecutor bargaining only in terms of the PD, one might think that the PD is the standard situation that actual conspirators face, *i.e.*, that prosecutors always create a dilemma for them. But the conditions allowing the PD are specific and narrow. Collectively, the other four situations seem at least equally plausible, probably more so. No doubt, legal scholars recognize this empirical fact, but fail to imagine that game theory also nicely captures

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[51] Each would also prefer that both snitch to being the only snitch, because there is some safety in numbers.

[52] This kind of HD or Chicken game is sometimes called the "Volunteers' Dilemma," but it is not a PD (because it is *not* a dominant strategy to avoid volunteering). *See* WILLIAM POUNDSTONE: PRISONER'S DILEMMA: JOHN VON NEUMANN, GAME THEORY, AND THE PUZZLE OF THE BOMB 201-04 (1992).

the situations that are not PDs. In the next section, we see how the problem generalizes.

III. WHAT LEGAL SCHOLARSHIP NEGLECTS: THE IMPORTANCE OF COORDINATION PROBLEMS TO LAW

There is nothing exotic about the three coordination games introduced in the last part – Stag Hunt, Battle of the Sexes, and Hawk/Dove. They were identified and named decades ago, have been the subject of enormous theoretical and empirical work, and are thought by game theorists to typify many situations of social interaction. Indeed, I have chosen them because, among the games as simple as the PD, these three have the most obvious usefulness for law. Yet the degree to which legal scholarship uses these games is utterly trivial when compared to the attention (obsession?) given to the PD. No one of these games is mentioned in more than 4% of the number of articles that cite the PD game; collectively they receive 8% of the references as the PD.[53]

I can only imagine two possible justifications for this disparity: that one believes that the PD game is far more common than these three coordination games or that one believes that the coordination games are not relevant to the situations law addresses. As I show in this part, neither is true. Section A looks at the issue abstractly, identifying several reasons to believe that coordination problems are at least as pervasive as PDs. Section B explains three ways that coordination problems matter generally for law. Finally, Section C considers individually each of the three games (BOS, HD, and Assurance) and reviews some literature, published almost entirely outside of law reviews, that uses them to illuminate legal issues. The point here is not to be exhaustive – an impossible task in an essay – but to show something of the untapped potential for games other than the PD.

A. The Frequency of Coordination Games

[53] *See supra* text accompanying note __.

In the real world, coordination games occur no less frequently than PD games. In later sections, I argue for this proposition with concrete examples. Initially, however, consider three abstract observations. First, the PD represents only a small fraction of the possible games that arise in the simple two-by-two setting. Second, the payoff structure that gives rise to the PD game is trivially different from the structure that produces the HD and Assurance games, thus making it likely that all three games are equally common. Third, even within the iterated PD, there is frequently a strong element of coordination.

In its simple form, the PD game has two players, each of whom have two discrete actions they can take, where the decisions are made simultaneously. Long ago, game theorists mapped out all the possible games that have this two-by-two structure. If the players only make ordinal rankings and are never indifferent between outcomes, there are 78 "strategically distinct games."[54] The PD game represents *one* of these possibilities. According to political scientist Katherina Holzinger, three more cases are close variants on the PD.[55] By contrast to these four games, she counts five distinct cases of the Assurance (or Stag Hunt) game or variations she calls "degenerate coordination,"[56] one case of the Hawk-

[54] Anatol Rapoport and Melvin Guyer were the first to note that there are 78 strategically distinct two-by-two games (assuming strict ordinal rankings) of the 576 possible payoff combinations. *See* Anatol Rapoport & Melvin Guyer, *A Taxonomy of 2 X 2 Games*,11 GENERAL SYSTEMS: YEARBOOK OF THE SOC'Y FOR ADVANCEMENT OF GEN. SYSTEMS THEORY 203, 204 (1966). *See also* ANATOL RAPOPORT, MELVIN J. GUYER & DAVID G. GORDON, THE 2X2 GAME 17 (1976). Each player can ordinally rank the four outcomes in the two-by-two setting in 24 ways, which means the two players can rank the outcomes in 24 X 24 = 576 ways. But "[t]he game matrices are strategically equivalent whenever only the rows, the columns, both rows and columns, or, in symmetric games, the players are interchanged." *See* Katharina Holzinger, *The Problems of Collective Action: A New Approach*, Preprints aus der Max-Planck-Projektgruppe Recht der Gemeinschaftsguter 5 (2003), available at http://www.coll.mpg.de/pdf_dat/2003_2.pdf (last accessed 8/26/07). For example, if two players mutually prefer the outcome where both play "Strategy X," then the game where "Strategy X" is placed in the first row and first column is strategically equivalent to the game where "Strategy X" is placed in the second row and second column.

[55] *Id.* at 9, 14. The Asymmetric Dilemma differs from the PD in that only *one* of the two players has a dominant strategy to defect, while the other player's best move is to match whatever the first player does. But the result is still a Dilemma because, knowing that the first player will defect, the second player will also defect.

[56] In these games, there are multiple equilibria, where some favor one or the other player, but the efficient equilibrium has equal payoffs. Thus, the games should be easy to solve, but still require some assurance of how the other player is going to proceed.

Dove (or Chicken) game, and five distinct cases of the Battle of the Sexes game.[57] There is, therefore, nothing in the abstract nature of the PD game that makes it more likely to occur than these three coordination games. We don't know that nature produces payoffs randomly, but if it did, we would actually expect these three coordination games to occur almost three times as frequently as the PD game (given eleven occurrences of the coordination game variants, compared to four occurrences of the PD game variants).

Second, minor changes in the payoffs of a PD game can produce two of our coordination games: Assurance and HD. To illustrate, Figure 5 represents a generic two-by-two game, where specific payoffs are replaced by the variables *a*, *b*, *c*, and *d*. The particular game that exists in Figure 5 depends on the relationship between those variables. The PD arises if, for both players, $b > a > d > c$.[58] If $b > a$, each player wants to respond to Strategy A (which we can here call "Cooperation") with Strategy B ("Defection"). Because $d > c$, each player wants to respond to Defection with Defection. So each player will choose Defection and the sole equilibrium is Defect/Defect. Yet because $a > d$, each player regards this outcome as worse than the outcome Cooperate/Cooperate. That's what makes the game a Dilemma.

	Player 2	
Player 1	Strategy A	Strategy B
Strategy A	a, a	c, b
Strategy B	b, c	d, d

Figure 5: A Generic Symmetric 2X2 Game:

PD $b > a > d > c$
Assurance: $a > b > d > c$
HD: $b > a > c > d$

[57] *Id.* at 9, 14-15.

[58] If the game is repeated, another standard condition is that $b + c < 2a$. Otherwise, the expected value of taking turns playing defect against cooperate (alternating each round) would exceed the expected value of mutually cooperating each round.

Yet Figure 5 also represents the Assurance game if the payoffs take the form $a > b > d > c$. If $a > b$, then each player wants to respond to Strategy A with Strategy A. If $d > c$, then each player wants to respond to Strategy B with Strategy B. As a result, there are two equilibria: A/A and B/B, where both players prefer A/A (because $a > d$), but each regards Strategy B as safer (it necessarily avoids the worst outcome c). This is Assurance. Yet the difference from the PD is trivial; all that differs is the relative positions of payoffs a and b. If b is slightly greater than a, we have a PD; if a is slightly greater than b, we have Assurance.

Similarly, the HD Game arises if the payoffs take the form $b > a > c > d$. If $b > a$, then each player wants to respond to Strategy A with Strategy B. If $c > d$, then each player wants to respond to Strategy B with Strategy A. The two equilibria are A/B and B/A; each player prefers to play Strategy B against Strategy A (because b is the highest payoff), but if both play B they get the worst possible outcome (d is the lowest). This is Hawk-Dove. Again, the difference is trivial; all that is required to flip the PD game to HD is a change in the relative positions of payoff c and payoff d. If d is slightly greater than c, we have a PD; if c is slightly greater than d, we have HD.

Thus, if one takes the PD to be a pervasive feature of social life, then there is good reason to think that the Assurance and HD games are also a pervasive feature of social life, given how little the payoffs have to change to flip one game into the other. If cooperation is a common problem, so is coordination.

Coordination is pervasive for a final reason: the problem frequently arises *within* an iterated PD. In the real world, the PD is usually complicated by the fact that there is more than one plausible way for the parties to go about cooperating. If the parties attempt to cooperate using different understandings of cooperation, then it is likely that at some point a party will engage in behavior she believes is cooperative but that the other side views as non-cooperative. One side punishes what it views as defection, the other side views the punishment as unjustified defection requiring retaliatory defection. The resulting recriminations end cooperation. Thus, one step to solving the iterated PD game, almost

always neglected by existing legal literature, is *coordinating* on one particular means of cooperation.

The resulting game is now, I admit, slightly more complex than a two-by-two game. Instead of each player choosing one of two actions, there are three choices: Defect, Cooperate According to Plan A, or Cooperate According to Plan B. The result is a three-by-three game, as in Figure 6, adapted from Garrett and Weingast, the political scientists who first noted the legal significance of coordination within an iterated PD.[59]

	Player 2:		
Player 1:	Cooperate A	Cooperate B	Defect
Cooperate A	3, 2*	1, 1	0, 4
Cooperate B	1, 1	2, 3*	0, 4
Defect	4, 0	4, 0	1, 1

Figure 6: PD with Embedded BOS Game
** Equilibrium Possible Only With Iteration*

Figure 6 is a PD.[60] But if the game is repeated, the folk theorem says that it is possible to sustain cooperation; each party may cooperate to avoid the other side's future defection. But in Figure 6, there is no gain over mutual defection and no chance of sustaining cooperation unless they two players use the same *form* of cooperation, A or B. The need to match cooperative form is a matter of coordination. The type of coordination can vary, but the coordination problem *embedded* in Figure 6 is a BOS game. If iteration makes cooperation possible, then there are two cooperative equilibria: A/A and B/B. Each player prefers either equilibria

[59] *See* Geoffrey Garrett & Barry R. Weingast, *Ideas, Interests, and Institutions: Constructing the European Community's Internal Market*, *in* IDEAS AND FOREIGN POLICY: BELIEFS, INSTITUTIONS, AND POLITICAL CHANGE (J. Goldstein & R.O. Keohane, eds. 1993).

[60] Each player's dominant strategy is Defect. If Player 2 cooperates in either way, A or B, Player 1 gains more by defecting (4) than by either form of cooperation (3 or 1). If player 2 defects, then player 1 gains more by defecting (1) than either form of cooperating (0). Player 2 faces the same incentives so in the one-shot game, the only equilibrium is Defect/Defect.

to any other outcome, but Player 1 prefers cooperating at A/A, while Player 2 prefers B/B (each receives a payoff of 3 at her preferred equilibrium and 2 at the other equilibrium).

Garrett and Weingast use the embedded BOS game to model treaties.[61] Two nations, for example, may agree to limit their tariffs (against domestic interest groups that push for them) and sustain this agreement by threatening to breach if the other breaches. But the parties must define precisely what trading behavior constitutes "cooperation" for purposes of their conditionally cooperative strategies. If one nation eliminates its tariffs but enacts health or labor legislation that impedes imports from the other nation, is that "defection"? More precisely, under what circumstances is non-tariff legislation that impedes trade consistent with "cooperation"? Perhaps there is a single answer to this question, but if there are two or more ways to define acceptable non-tariff legislation and each nation prefers a different standard, they face a situation like Figure 6. Unless they first solve their BOS game by agreeing on Standard A or Standard B, they will eventually be in a position where one nation's effort to cooperate under Standard A is perceived by the other nation as a defection under Standard B. The latter nation retaliates by defecting and cooperation unravels.

The example generalizes because cooperation is rarely self-defining. Two neighboring farmer/ranchers may face a variety of cooperation problems, *e.g.*, the need for joint repair of border fences or conservation of a shared water source. But one neighbor wants to repair border fences annually and base water conservation measures on an assumption of average annual rainfall, while the other neighbor wants to repair fences every three months and save water for possible drought years. Unless they first coordinate on these matters, they will never sustain cooperation. Those using the PD usually simplify by ignoring these embedded coordination problems, but they may constitute the biggest obstacle to long-term cooperation.

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[61] *See* Geoffrey Garrett & Barry R. Weingast, *Ideas, Interests, and Institutions: Constructing the European Community's Internal Market*, *in* IDEAS AND FOREIGN POLICY: BELIEFS, INSTITUTIONS, AND POLITICAL CHANGE (J. Goldstein & R.O. Keohane, eds. 1993).

In sum, there is no reason to think that the PD is more common a problem than coordination.

B. Three Reasons Why Coordination Matters to Law

Coordination problems are not only pervasive, but important to the social conflict law addresses. I consider specific games in the next section, but there are three general features of these games that I explain first. Unlike the PD game, coordination games model situations of inequality, they make history and culture relevant, and they explain one way that law works expressively, independent of sanctions.

1. *Inequality*

Everyone gains from solving a PD. Yet it is obvious that law frequently deals with social conflict where one person or group gains only because another person or group loses. The concepts of social roles based on race, gender, or other factors usually arise in the context of social norms that impose unequal burdens on different groups. Correcting injustice usually means raising the wealth (or other privileges) of the victim by compensation that lowers the wealth of the wrongdoer. But the PD game does not capture these issues of distribution. If the problem is a PD, the solution makes everyone better off. There is no normative complexity and no controversy.

By contrast, coordination games frequently capture distributional conflict. Not always: there need be no inequality in the Assurance game. The two equilibria may involve equal payoffs between the two players. Yet the BOS and HD games do reflect distributional struggle. The two equilibria outcomes in each game necessarily have unequal payoffs where one player prefers one equilibrium and the other player prefers the other equilibrium. When discussing these games below, I point out some literature that uses the BOS game to model certain sexist norms in different parts of the world, such as those that require genital cutting.[62] I

[62] *See infra* text accompanying notes __.

have used the BOS and HD games to model discriminatory norms,[63] in ways I discuss below.[64]

2. *The Influence of History and Culture on Behavior*

A second implication of coordination games is the importance of history and culture. In a single equilibrium game, an economic model can claim to account for the influence of history and culture by making adjustments to the payoffs, which then uniquely determine how individuals will behave. But the surprising result of a coordination game, or any game with multiple equilibria, is that the payoffs, whatever they include, do *not* uniquely determine the behavior. Something else besides payoffs can and does influence how people act.

The game theory term for those other influences is a "focal point."[65] Decades ago, Nobel Laureate Thomas Schelling first observed that, in situations requiring coordination, anything that makes salient one behavioral means of coordinating tends to produce self-fulfilling expectations that this equilibrium will occur.[66] Schelling notes how, in many real world settings, something in the situation not captured by the formal mathematic structure draws the mutual attention of the individuals who need to coordinate.

The simplest examples involve pure coordination games. For example, Schelling asked people to name a place and time of day they would go to meet another person in New York City if they had planned a day to meet but had failed to pick a particular place or time. There are a very large number of choices; random selection should produce almost zero matches. But Schelling found that a majority identified Grand Central Station and almost everyone selected noon.[67] When he asked

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[63] *See* Richard H. McAdams, *Conformity to Inegalitarian Conventions and Norms: The Contribution of Coordination and Esteem*, 88 THE MONIST 238 (2005).

[64] *See infra* text accompanying notes __.

[65] See, e.g., Maarten C.W. Jaanssen, *Rationalizing Focal Points*, 50 THEORY & DECISION 119 (2001); Maarten C.W. Janssen, (1998), *Focal points*, in NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW (VOL. II) 150 (P. Newman, ed. 1998); Robert Sugden, *Towards a Theory of Focal Points,* 105 ECON. J. 533 (1995).

[66] THOMAS C. SCHELLING, THE STRATEGY OF CONFLICT 54-67 (1960).

[67] *Id.* at 55-56.

individuals to name a positive number named by another person who wanted to match the number they named, despite the infinity of equilibria, forty percent named the number one.[68] When he modified the problem to ask individuals to match a number on the (hypothetical) assumption that they would receive the number of dollars equal to the number on which they matched, twenty-nine percent selected not one but one million.[69] In each case, the players solve a difficult coordination problem by gravitating towards the prominent or conspicuous outcome. Schelling called the salient solution the "focal point."[70] Later research finds that individuals do not just thoughtlessly choose the salient solution, but reason about what is likely to be mutually salient.[71]

What makes a particular outcome focal? Among other things, Schelling mentions "precedent," "analogy," and "who the parties are and what they know about each other."[72] "Precedent" refers to history. What is focal depends on what the individuals in the situation believe about how they or others they know have solved the same or analogous situations in the past. If the youngest or the oldest present always bore some burden in the past, everyone is likely to expect that solution in the present. It is critical "who the parties are and what they know about each other" not only because different pairs of individuals share different experiences, but also because they may share different frames by which they judge past events as "analogous." Thus, focal points reflect culture. The only reason Schelling's respondents identified Grand Central Station as a meeting spot is that they lived in New Haven, Connecticut and such people frequently arrive in New York City at that location. That his respondents named one million as a quantity of money was entirely contingent on the salience of that quantity in American culture.

Economists thus discuss "culture," especially "corporate culture," as the conceptual tools – common language, beliefs, and frames – that

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[68] *Id.*

[69] *Id.*

[70] *Id.*

[71] *See* Judith Mehta, Chris Starmer & Robert Sugden. *The Nature of Salience: An Experimental Investigation of Pure Coordination Games*, 84 AMER. ECON. REV. 658 (1994); Judith Mehta, Chris Starmer & Robert Sugden, *Focal Points in Pure Coordination Games: An Experimental Investigation*, 36 THEORY AND DECISION 163 (1994).

[72] THOMAS C. SCHELLING, THE STRATEGY OF CONFLICT 57 (1960).

social groups have used to solve past coordination games and are therefore likely to use in attempting to solve future coordination games.[73] The political scientist Michael Chwe explains the function of social rituals as creating focal point solutions to coordination problems.[74] Indeed, one of the path-breaking early works on coordination was the philosopher David Lewis's effort to explain language as a conventional solution to a recurrent coordination game.[75] None of this is possible with the PD, where history and culture affect behavior only to the degree they affect payoffs.

3. *The Focal Point Power of Legal Expression*

Besides precedent and analogy, Schelling also identified communication as a means of creating a focal point. Even non-binding "cheap talk" can make the discussed solution salient.[76] Such communication may occur between the parties in the coordination game, but Schelling observed how a *third-party* – someone not in the coordination game – can use expression to construct a focal point.[77] The third party can recommend that the individuals coordinate in a particular

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[73] *See* AVNER GREIF, INSTITUTIONS AND THE PATH TO THE MODERN ECONOMY (2006); Avner Greif, *Cultural Beliefs and the Organization of Society: A Historical and Theoretical Reflection on Collectivist and Individualist Societies,* 102 J. POL. ECON. 912 (1994); Benjamin E. Hermalin, *Economics and Corporate Culture* in THE INTERNATIONAL HANDBOOK OF ORGANIZATIONAL CULTURE AND CLIMATE (S. Cartwright et al., eds., 2001); David M. Kreps, *Corporate Culture and Economic Theory*, in PERSPECTIVES ON POSITIVE POLITICAL ECONOMY (Alt & Shepsle, eds., 1990); Roberto A. Weber & Colin F. Camerer, *Cultural Conflict and Merger Failure: An Experimental Approach,* 49 Management Sci. 400 (2003).

[74] MICHAEL SUK-YOUNG CHWE, RATIONAL RITUAL: CULTURE, COORDINATION, AND COMMON KNOWLEDGE (2001).

[75] *See* DAVID LEWIS, CONVENTION (1969). *See also* Brian SKYRMS, THE STAG HUNT AND THE EVOLUTION OF SOCIAL STRUCTURE 49-81 (2004)(on the evolution of signaling and inference); BRIAN SKYRMS, EVOLUTION OF THE SOCIAL CONTRACT 80-104 (1996)(on the evolution of meaning).

[76] "Cheap talk" refers to statements that are "costless" to make, "nonbinding, and nonverifiable." BAIRD, GERTNER & PICKER, *supra* note 16, at 303. For the theory of how cheap talk can nonetheless influence behavior, *see* Joseph Farrell & Matthew Rabin, *Cheap Talk*, 10 J. ECON. PERSP. 103 (1996). For a review of the experimental literature, *see* Vincent Crawford, *A Survey of Experiments on Communication via Cheap Talk*, 78 J. ECON. THEORY 286 (1998).

[77] *See* THOMAS C. SCHELLING, THE STRATEGY OF CONFLICT 66 (1960)(department store sign for where lost parties should re-unite creates a focal point solution to their coordination problem).

way, and thereby create self-fulfilling expectations that the recommended behavior will occur. If the government in a new society (without a prior custom) announces that drivers will drive on the right side of the road, the salience of that solution is likely to cause that result, regardless of whether the government will use sanctions to enforce the announcement or whether the citizens feel a moral obligation to obey the law.

Of greatest significance to law, Schelling proposed that third-parties can create focal points in the more common mixed motive games that involve both coordination and conflict. Suppose, Schelling asks, that the traffic light fails at some busy intersection and a bystander – not a police officer – steps in to direct traffic.[78] As two drivers approach from different streets, each prefers to proceed ahead of the other, although each regards the worst outcome as a collision. Thus, the situation is like a HD or BOS game. Schelling conjectured that the bystander's hand signals would influence the drivers' behavior. If hand signal are in full view of both drivers, then the driver motioned to stop will now have stronger reason to expect that the other driver will proceed (and vice versa). Given that expectation, her best response is to stop, which is to comply with the third party's expression. By creating a focal point, the third party wields a purely expressive influence on behavior.[79]

Several theorists have noted that law can work in this manner, as legal rules are a form of third-party expression (of legislators, judges, or executive branch officials) making focal the form of behavior the law demands.[80] Like the bystander-in-the intersection, legal actors can influence behavior merely by creating self-fulfilling expectations that the legally obligatory behavior will occur. A number of experiments prove

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[78] *Id.* at 144.

[79] Nothing in the example requires that the bystander threaten non-compliance drivers with sanctions or possess what drivers consider to be legitimate authority. "[H]is directions have only the power of suggestion, but coordination requires the common acceptance of some source of suggestion." *Id.* at 144.

[80] *See* Richard H. McAdams, *A Focal Point Theory of Expressive Law*, 86 VA. LAW REV. 1649 (2000); Richard H. McAdams, *The Expressive Power of Adjudication*, 2005 U. ILL. LAW REV. 1043; Roger B. Myerson, *Justice, Institutions, and Multiple Equilibria*, 5 CHI. J. INT'L LAW 91 (2004); Robert Cooter, *Expressive Law and Economics*, 27 J. LEGAL STUD. 585 (1998); Robert B. Ahdieh, *Law's Signal: A Cueing Theory of Law in Market Transition*, 77 S. CAL. LAW REV. 215 (2004).

the point.[81] For example, Janice Nadler and I show that mere expression, even when selected randomly by a mechanical device, affects behavior in a HD game.[82]

For a real world example of law's focal point power, it helps to look to history, where some legal institutions lacked the power of sanctions. Consider medieval Iceland, which for several centuries had a robust legal culture, elaborate legal codes, and courts that generated substantial compliance,[83] all despite "the absence of any coercive state institutions."[84] There was "no state apparatus to pretend to monopolize the legitimate use of force," "no sheriff to issue a summons to a hostile party, to keep the peace in the court, or to execute the judgment."[85] Instead, "[i]t was up to the litigants to serve process on their opponents, maintain order in court, and enforce court judgments in their favor. Ultimately, the sanction behind legal judgment and arbitrated settlement was self-help, most often appearing in the guise of the bloodfeud."[86]

How did the law work without state enforcement? By making focal the outcome the court's judgment declared. Individual litigants could enforce or resist a judgment only by gathering the support of their kin. "[Power] meant having others *think* one had the ability to muster bodies to assist in the various procedures that made up a legal action."[87] The situation was not a PD, but a coordination game like HD, where neither wanted to back down but neither wanted the dispute to continue to the death. In this setting, it is easy to believe that a court could influence the behavior of the parties by providing a focal point. Once the

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[81] *See, e.g.*, Richard H. McAdams & Janice Nadler, *Coordinating in the Shadow of the Law: Two Contextualized Tests of the Focal Point Theory of Legal Compliance*, forthcoming in 42 LAW & SOCIETY REVIEW (2008); Jean-Robert Tyran & Lars P. Feld, *Achieving Compliance when Legal Sanctions are Non-Deterrent*, 108 SCAND. J. ECON. 135 (2006); Roberto Galbiati & Pietro Vertova, *Obligations and Cooperative Behavior in Public Goods Games*, 64 GAMES & ECON. BEHAV. 146 (2008).

[82] *See* Richard H. McAdams & Janice Nadler, *Testing the Focal Point Theory of Legal Compliance: The Effect of Third-Party Expression in an Experimental Hawk/Dove Game*, 2 J. EMP. LEGAL STUD. 87 (2005).

[83] *See* WILLIAM I. MILLER, BLOODTAKING AND PEACEMAKING: FEUD, LAW, AND SOCIETY IN SAGA ICELAND 222-57 (1990).

[84] *Id.* at 224.

[85] *Id.* at 232.

[86] *Id.* at 20-21.

[87] *Id.* at 245 (emphasis added).

court announced a winner, it appeared that the winner would fight and this expectation made it more difficult for the loser to gather or retain kin to fight on his behalf.[88]

C. Legal Applications of the Three Coordination Games

Now let us turn to our three coordination games and consider how each of them bears on various legal issues. The ultimate point is to ask whether the legal literature is justified in giving twenty times more attention to the PD than any one of these games.

1. *Battle of the Sexes*

The BOS game is useful for understanding bargaining, the creation of constitutions and treaties, standard setting, the harmonization of law, and gender roles.

Bargaining. Coordination is central to bargaining. Admittedly, when negotiations conclude, there may be a PD regarding compliance. If enforcement is insufficient, each party might have a dominant strategy not to uphold her end of the bargain. But in many situations, formal or informal sanctions make contractual compliance likely. If so, the important issue is whether the parties reach agreement. Given enforcement, whatever problem bargaining is, it is *not* a PD.[89] A bargain is possible only because two or more parties can mutually gain by some agreement. Where being the only one to defect in a PD is the best outcome, being the only one to withhold agreement in a bargaining situation is *not* the best outcome because it prevents the gain of the

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[88] For another historic example, *see* Andrea McDowell, *Real Property, Spontaneous Order, and Norms in the Gold Mines*, 29 LAW & SOCIAL INQ. 771 (2004)(finding that the focal point theory of adjudication explains third party resolution of frontier mining disputes). *See generally* Richard H. McAdams, *The Expressive Power of Adjudication*, 2005 ILL. LAW REV. 1043, 1101-03.

[89] Political scientist James Fearon makes this point in the context of treaty negotiations. *See* James Fearon, *Bargaining, Enforcement, and International Cooperation*, 52 INT'L ORG. 269 (1998). He says that after two states conclude an agreement, there is frequently an enforcement problem that takes the form of an iterated PD (because each side finds it cheaper in the short run not to comply regardless of what the other side does). But the initial stage of creating an agreement involves coordination.

bargain. Instead, the problem is one of coordination because there is more than one way to conclude agreement and each party shares the desire to avoid an impasse that may result when each party presses for its preferred distribution.[90]

Any two-by-two game will miss much of the problem of bargaining.[91] Nonetheless, because there is insight in simple models, one may reasonably ask what two-by-two game best models bargaining. The answer is the BOS game. We might think of BOS as capturing what both sides know is the last round of bargaining, where each side will make its final offer and there are just two unequal ways for the offers to match. If the two offers match, there is a contract and both parties gain. If there is no match, the bargaining ends without an agreement and both parties lose. But each prefers to match terms in a different way.

International Law. A large political science literature uses coordination games to explore international relations and international

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[90] Schelling discussed focal points in the context of bargaining based on the idea that a bargainer will try to identify or create focal points that draws her counterpart toward the bargaining outcome she seeks. That idea has generally been neglected in the bargaining literature, *but see* Maarten C.W. Janssen, *On the Strategic Use of Focal Points in Bargaining Situations*, 27 J. ECON. PSYCH. 622 (2006). In the legal literature, a few scholars have used focal points to explain the effect of non-binding rules or precedent on bargaining. See Robert Ahdeih, *The Strategy of Boilerplate*, 104 MICH. L.R. 1033, 1053-55 (2006)(using focal points to explain how boilerplate terms in contract forms influence bargaining); Russell Korobkin, *Inertia and Preference in Contract Negotiation: The Psychological Power of Default Rules and Form Terms*, 51 VAND. L. REV. 1583 (1998)(exploring similar effects for default contract rules). See also Richard H. McAdams & Janice Nadler, *Coordinating in the Shadow of the Law: Two Contextualized Tests of the Focal Point Theory of Legal Compliance*, forthcoming 42 LAW & SOC'Y REV. (2008)(finding contract default rules affect decisions in a BOS game).

[91] Such a simple game narrows the number of possible "moves" to two, where there are usually many ways one could reach agreement. Second, a simultaneous game ignores the back and forth nature of bargaining. Finally, simple games assume complete information, where bargaining usually occurs in the presence of asymmetric information. For this reason, game theorists have explored various complex models of bargaining. One approach is the Rubenstein alternating offers model. *See* Ariel Rubinstein, *Perfect Equilibrium in a Bargaining Model*, 50 ECONOMETRICA 1151 (1982); MARTIN OSBORNE & ARIEL RUBINSTEIN, BARGAINING AND MARKETS (1990). For discussions, *see* DOUGLAS G. BAIRD, ROBERT H. GERTNER & RANDAL C. PICKER, GAME THEORY AND THE LAW 219-41 (1996); ERIC RASMUSEN, GAMES AND INFORMATION 299-303 (3d ed. 2001). Another approach is the axiomatic bargaining model. *See* John Nash, *The Bargaining Problem*, 18 ECONOMETRICA 155 (1950). For discussions, *see* AVINASH DIXIT & SUSAN SKEATH, GAMES OF STRATEGY 521-49 (1999); RASMUSEN, *supra*, at 296-99.

law.[92] As noted above, Garrett & Weingast view international law as arising in an iterated PD game, but they make the "embedded coordination" point discussed above.[93] Because the nations must solve a BOS game in order to solve their PD, the nations must bargain. Cooperation is sustainable only if the states agree to a single understanding of cooperation. Garrett and Weingast propose that the treaty and subsequent judicial interpretations of it make focal one solution to the embedded BOS game, so each nation thereafter uses the agreed upon definitions to judge whether the other nation cooperated or defected in the prior round. With such a mutual understanding, the nations may then sustain cooperation (by threatening to respond to defection with future defection).

Standard Setting and Uniform Laws. When different firms or industries need to agree to certain technical standards to allow their products to interact (*e.g.*, automotive parts, computers and add-ons, hardware and software), they engage in standard-setting. The BOS game models standard setting because all parties wish to reach some standard, but disagree as to what standard is best. Each firm prefers the standard closest to the specifications of its current product, but everyone still wants their product to "match" everyone else's product. Unlike the PD, once everyone else starts to use a given technical standard, there is no incentive to "defect" but every incentive to conform.

There are some obvious legal examples of standard setting, such as treaties establishing standardized weights and measures, communications protocols for air traffic control, the international exchange of mailed and telephonic communications, and the exchange of

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[92] *See, e.g.*, Judith Goldstein & Robert O. Keohane, Ideas and Foreign Policy: An Analytical Framework, *in* IDEAS AND FOREIGN POLICY: BELIEFS, INSTITUTIONS, AND POLITICAL CHANGE 3, 17-20 (J. Goldstein & R.O. Keohane, eds. 1993); James D. Morrow, *Modeling the Forms of International Cooperation*, 48 INT'L. ORG. 387 (1994); Arthur Stein, *Coordination and Collaboration: Regimes in an Anarchic World*, 36 INT'L. ORG. 299 (1982); Duncan Snidal, *Coordination Versus Prisoners' Dilemma: Implications for International Cooperation and Regimes,* 79 AMER. POL. SCI. REV. 923 (1985). For legal discussions, *see* JACK L. GOLDSMITH & ERIC A. POSNER, THE LIMITS OF INTERNATIONAL LAW (2005).

[93] Geoffrey Garrett & Barry R. Weingast, *Ideas, Interests, and Institutions: Constructing the European Community's Internal Market*, *in* IDEAS AND FOREIGN POLICY: BELIEFS, INSTITUTIONS, AND POLITICAL CHANGE (J. Goldstein & R.O. Keohane, eds. 1993).

fingerprints by police departments.[94] In each case, the central issue is coordination; despite disagreement as to what standard is best, there is a strong incentive to match standards and no incentive to deviate from the standard everyone else adopts.

But standard setting is far more common and central to law than these examples suggest. Regarding private law, such as contracts, securities regulation, or arbitration, nation states are frequently interested in "harmonization"[95] or, as a lesser but even more common step, the convergence of different domestic legal regimes.[96] Within a federated nation state, the same desire exists for the unification of laws across jurisdictions, such as the adoption of the Uniform Commercial Code across American states.[97] The advantage of policy convergence and legal harmonization is that they save transaction costs when private firms seek to do business across borders. The greater the disparity in the laws of, say, contracts, securities, or antitrust, the more difficult it is to transact across borders. In other words, *legal rules themselves are "standards"* and

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[94] *See, e.g.*, Laurence R. Helfer, *Exiting Treaties*, 91 VA. L. REV. 1579, 1633-36 (2005)(using the BOS game to explore the issue of treaty exit). For coordinating air traffic control, the relevant treaty is the Convention on International Civil Aviation, Dec. 7, 1944, art. 37, 61 Stat. 1180, 1190, 15 U.N.T.S. 295, 320. For an explanation, *see* Michael Gerard Green, *Control of Air Pollutant Emissions from Aircraft Engines: Local Impacts of National Concern*, 5 ENVTL. LAW. 513 (1999) (authorizing the "governing body of the ICAO . . . to adopt international standards and practices" concerning "communications systems; airport characteristics; air traffic control practices; personnel licensing; aircraft airworthiness; aircraft registration; and other matters dealing with the 'safety, regularity and efficiency of air navigation.'"). *See also* Convention for the Establishment of an International Bureau of Weights and Measures, May 20, 1875, 20 Stat. 709.

[95] *See, e.g.*, Beth Simmons, *The International Politics of Harmonization: The Case of Capital Market Integration*, 55 INT'L ORG. 589 (2001); Francesco Parisi, *The Harmonization of Legal Warranties in European Sales Law: An Economic Analysis*, 52 AM. J. COMP. L. 403 (2004). The International Institute for the Unification of Private Law (UNIDROIT) works towards harmonization of private law. *See, e.g.*, Klaus Peter Berger, *International Arbitral Practice and the UNIDROIT Principles of International Commercial Contracts*, 46 AM. J. COMP. L. 129 (1998).

[96] *See* DANIEL W. DREZNER, ALL POLITICS IS GLOBAL: EXPLAINING INTERNATIONAL REGULATORY REGIMES 11 (2007)(distinguishing three nested levels of international coordination: "[r]egulatory coordination" is "codified adjustment of national standards in order to recognize or accommodate regulatory frameworks from other countries"; "policy convergence" is "the narrowing of gaps in national standards over time"; and "[h]armonization" is "policy convergence to a single regulatory standard.").

[97] *See, e.g.*, James J. Brudney, *The Uniform State Law Process: Will the UMA and RUAA be Adopted by the States?* 8 DISP. RESOL. MAG. 3 (Summer 2002).

there are costs savings to minimizing the differences between the standards. At the same time, because a state incurs costs in switching from one legal standard to another, each prefers that the *other* nations shift to its legal standard. The result is a BOS game.[98]

Constitutions. Political scientists have applied the above analysis of international law to constitutional law. First, the interaction of parties to a constitution frequently presents a game involving coordination. Second, a written arrangement or adjudication between those parties may influence their behavior by virtue of creating a focal point in a coordination game (and thereby creating self-fulfilling expectations of how to behave). Russell Hardin initiated this literature by claiming that constitutions arise out of, not the PD, but a BOS game.[99] Hardin imagines the constitution is the result of a bargain between powerful interest groups who are better off "matching" strategies, by agreeing to the same structure of government, than they are if they fail to agree and have no government.[100] But at the same time the situation is obviously not a pure coordination game because interest groups prefer different structures. Jon Elster, by contrast, views the constitution as solving an iterated PD game between

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[98] Drezner provides a slightly more complex "standards game" for just this situation. *See* DANIEL W. DREZNER, ALL POLITICS IS GLOBAL 51-55 (2007). His game uses variables that allow for the possibility that both parties are better off retaining their own national standard because the gains to either party from coordination are smaller than the costs of switching legal standards. But where the benefits of coordinating are high enough, the result is a BOS game. *See also* Anu Bradford, *International Antitrust Negotiations and the False Hope of the WTO*, 48 HARV. INT'L L.J.383 (2007)(using Drezner's approach to model international antitrust harmonization).

[99] Russell Hardin, *Why a Constitution?* in THE FEDERALIST PAPERS AND THE NEW INSTITUTIONALISM 100, 101, 105 (Bernard Grofman & Donald Wittman, eds., 1989). *See also* Russell Hardin, *Constitutionalism*, in HANDBOOK OF POLITICAL ECONOMY 289 (Donald Wittman & Barry Weingast, eds., 2006). Other political scientists, such as Peter Ordeshook, have explored the prescriptive implications of this theory for the creation of stable constitutions. *See* Peter C. Ordeshook, *Are 'Western' Constitutions Relevant to Anything Other than the Countries they Serve?*, 13 CONST'L POL. ECON. 3 (2002); Peter C. Ordeshook, *Constitutional Stability*, 3 CONST'L POL. ECON. 137 (1992).

[100] *See* Russell Hardin, *Why a Constitution?* in THE FEDERALIST PAPERS AND THE NEW INSTITUTIONALISM 100, 105 (Bernard Grofman & Donald Wittman, eds., 1989)(game 3). Note that instead of giving payoff numbers that represent utilities, where higher numbers are better, Hardin gives payoff ranks, where lower numbers mean higher ranks. Thus, Game 3 is BOS with the two equilibria being the payoff ranks (2,1) and (1,2), representing matches at I/I and II/II.

political parties, but (as Garrett and Weingast claim for international law), he describes a coordination problem embedded in the PD.[101]

Creating a constitution constructs a focal point. Writing down the allocation of power in a particular structure of government makes that allocation salient and creates self-fulfilling expectations that the various players will demand at least as much power as granted in the writing, forcing other players to cede that much power. One of the few constitutional scholars to examine the focal point theory, David Strauss, explains that it suggests giving great interpretive weight to constitutional textualism.[102] That focal points can alternatively be based on "precedent" (rather than communication) also explains the power of unwritten constitutional law, on customs that create strong expectations about how parties will coordinate.[103]

The focal point power also explains the judiciary's influence over the other branches of government in matters of constitutional conflict. The *ultimate* reason the executive and legislative branches defer to the judiciary cannot be that the judiciary will bring legal sanctions to bear, given that the judiciary depends on other branches of government for those sanctions. But the court may wield expressive influences by virtue of its power to make a particular resolution focal. The key is that the political branches or parties wish to coordinate to avoid a constitutional crisis or breakdown.[104] But the constitutional text and tradition leave open gaps and ambiguities, which allows disruptive disputes. Judicial judgments are followed merely because, like a driver in traffic, the losing

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[101] *See* Jon Elster, Unwritten Constitutional Norms (Oct. 2007 unpublished draft)(on file with author). Political parties expect to alternate control of government and thus find themselves in an iterated PD game where each party will benefit if both parties adhere to certain restraints of power when in office. But there are many ways to define governmental powers; many ways of defining the restraint required of each branch. To achieve cooperation in the iterated PD game, the parties must agree on the boundaries of governmental powers.

[102] David Strauss, *Common Law Constitutional Interpretation*, 144 CHI. LAW REV. 877, 910-19 (1996).

[103] *See, e.g.*, Ernest A. Young, *The Constitution Outside the Constitution*, 117 YALE L.J. 408 (2007); Jon Elster, Unwritten Constitutional Norms (Oct. 2007 unpublished draft)(on file with author).

[104] *Cf.* Matthew C. Stephenson, *"When the Devil Turns . . . ": The Political Foundations of Independent Judicial Review*, 32 J. LEGAL STUD. 59 (2003).

party expects the winning party to insist and views deferring as the only way to avoid the worst outcome.[105]

Gender Roles and Inequality. Other theorists use coordination games to explore how sex role norms arise and persist. In separate papers, the economist Gillian Hadfield and the political scientist Gerry Mackie point to the coordination that occurs within marriage. Hadfield explores why it is that, "[r]egardless of the level of economic development, it appears that almost all tasks in a society tend to be gendered, that is, to be easily identifiable as either women's work or man's work."[106] Biological explanations founder because "the majority of tasks divided along sex lines are not allocated uniformly to one sex worldwide."[107] Instead, it is common that a task gendered male in one society is gendered female in another.[108] Hadfield points to the need for individuals to coordinate their acquisition of human capital before marriage so as to bring to a marriage the skills that best compliment a future spouse's skill.[109] In a pre-industrial society, for example, if most men (women) know how to make leather products, but not baskets, then they will seek wives (husbands) who have the skill they lack – basket making. Once most men (women) in society do a certain kind of work, a woman (man) who has the same skill will be unattractive as a spouse. As with all conventions, the individual who deviates pays a cost.[110]

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[105] *See also* TOM GINSBURG, JUDICIAL REVIEW IN NEW DEMOCRACIES: CONSTITUTIONAL COURTS IN ASIAN CASES (2003).

[106] Gillian K. Hadfield, *A Coordination Model of the Sexual Division of Labor*, 40 J. ECON. BEHAV. & ORG.125, 125 (1999).

[107] *Id.* at 130.

[108] In one large study of 50 economic activities in 185 pre-industrial societies, the manufacturing of leather products, for example, was an exclusively male occupation in 35 societies and an exclusively female occupation in 29, while basket-making was exclusively male in 37 societies and exclusively female in 51. *Id.* at 127-28 (Table 1).

[109] *Id.* at 130 ("the coordination model provides a basis for understanding how economic conditions can give rise to norms, culture, ideology and so on which independently keep the sexual division of labor alive long after economic conditions have changed"). *See also* 143-48.

[110] *Id.* at 143 ("Trying to break out of these gendered categories . . . puts an individual at great risk of not finding a partner with whom he or she can combine skills so as to have bread to consume.).

Mackie identifies the same coordination dynamic in customs of female footbinding and genital cutting.[111] If the parents of girls in a village bind their daughters' feet and the parents of boys permit marriage only to females whose feet were bound, then individual deviations are costly. There is the risk that girls whose feet are not bound will be unmarriageable.[112] Mackie notes that the astonishingly quick demise of the custom of footbinding in China early in the 20th century took account of this coordination dynamic. What worked were agreements between parents within villages that those who had girls would not bind their feet and that those who had boys would not allow them to marry girls with bound feet.[113] Once enough parents expressed a willingness to follow this new behavior, everyone else wanted to follow it as well. Where individual deviation is costly, this collective action worked to unravel the norm.

Finally, inequality may arise because history and culture make the gender or race of individuals the focal point for coordination. If everyone expects the woman or a racial minority to "settle for less" in a bargaining situation, then a woman or minority member will find that if she refuses to "settle for less," she will be worse off. In BOS situations between a man and woman, if the man expects the woman to settle for her less favored outcome, then the man will play the strategy associated with his most preferred outcome. If the woman, counter to expectations, also attempts to claim the larger share, they will fail to coordinate and she will be worse off than if she did what was expected. A recent experiment is instructive.[114] The subjects were made aware of the sex of the subject against whom they were matched in an abstract BOS game with real

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[111] Gerry Mackie, *Ending Footbinding and Infibulation: A Convention Account*, 61 AMER. SOCIOL. REV. 999, 1005-07 (1996) (explaining how conventions are solutions to iterated coordination games).

[112] *See id*. at 1008 ("However the custom originated, as soon as women believed that men would not marry an unmutilated woman, and men believed that an unmutilated woman would not be a faithful partner in marriage, and so forth, expectations were mutually concordant and self-enforcing convention was locked in."). Mackie speculates that the practices first arose when wealthy men had multiples wives or consorts and sought to ensure paternity by making it harder for women to enjoy sex or to travel to meet men.

[113] *Id*. at 1011.

[114] *See* Hakan J. Holm, *Gender-Based Focal Points*, 32 GAMES & ECON. BEHAV. (2000). Two experiments were conducted in Sweden (306 subjects) and one in the United States (164 subjects).

monetary payoffs. When matched against a woman, the subjects were significantly more likely to play the strategy associated with his or her preferred equilibrium than when matched against a man.[115] In this way, gender facilitated coordination and mixed sex groups therefore earned more on average than unisex groups. Yet predictably men earned more than women.[116]

2. *Hawk/Dove*

The HD game is useful for understanding traffic regulation, low stakes disputes, the origin of property, and, again, conventions enforcing race- and sex-based social roles.

Traffic Regulation. Traffic regulation is mundane, but important – automobile accidents kill about 43,000 annually in the United States[117] and over a million worldwide.[118] Traffic is quintessentially a matter of coordination. Two drivers approach an intersection on perpendicular streets where each wishes to proceed first through the intersection; or two drivers in adjoining lanes merge into a single lane where each wishes to get ahead of the other; or two drivers stopped to make left turns across each other's path each wish to turn first. In each case, there is conflict because each wants to proceed ahead of the other. But there is also a common interest in coordinating to avoid a collision, which each regards as the worst possible outcome. The situation is certainly not a PD, but the HD game serves as an appropriate model.[119]

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[115] In the first Swedish experiment, subjects selected the more aggressive strategy 68% of the time when matched against a woman, but only 48% of the time when matched against a man. *Id.* at 299. For the Swedish replication, the numbers were 67% and 48%. *Id.* at 302. For the American study, the numbers were 50% and 38%. *Id.* at 304-05.

[116] In the first Swedish experiment, men earned 27% more than the women. In the Swedish replication, they earned 63% more. *Id.* at 303. In the American study, male subjects earned 28% more than female subjects. *Id.* at 305.

[117] *See* Traffic Safety Facts, National Highway Traffic Safety Administration Report (2006), at http://www-nrd.nhtsa.dot.gov/Pubs/810791.PDF.

[118] *See* World Report on Road Traffic Injury Prevent, WHO (2004), at http://www.who.int/violence_injury_prevention/publications/road_traffic/world_report/main_messages_en.pdf.

[119] It is likely that the two drivers also have a common interest in avoiding the outcome where both wait for the other to proceed. Not only does that waste time for both, but after

Given a strong element of coordination, there is every reason to think that the government exploits the focal point effect for its traffic rules. Those rules are relatively clear and the government publicizes them by requiring driver's tests and by the posting of traffic signs. Without denying the effect of sanctions and legitimacy, the focal effect is probably a significant cause of compliance with traffic laws, which is substantial despite obvious examples of violations (such as speeding). When a driver approaching a busy intersection observes a yield sign or stop light, she has a strong reason to comply independent of sanctions and legitimacy. Even if she has no fear of or respect for law, she fears an accident. Knowing that others expect her to comply, and that mis-coordination entails a serious risk of collision, her best choice is to comply. The effect is not likely to disappear merely because an individual does fear sanctions and respect law because we know that both incentives are highly imperfect.

Disputes. Many disputes have a structure like traffic, that is, like a HD game. Take property disputes. Two neighbors may disagree where the boundary of their property is; whether one has a right to walk or drive over her neighbor's property to access a public road; or whether there is any limit to how much water the upstream property owner can take from the stream before it flows into her downstream neighbor's land. In these disputes, each party clearly prefers to *insist* on her position while the other *defers*, thus getting her way at minimal cost. To be Hawk-Dove, each party has to also rank as the worst outcome the situation of unresolved conflict that occurs when both insist. That is a function of how much each party values the resource in dispute relative to the costs of unresolved conflict, which depends on what unresolved conflict entails.

One possibility is largely emotional – that the parties wind up in a heated shouting match, which is itself embarrassing and may end any social relationship the two parties previously enjoyed. Another possibility is violence. Even mature legal systems fail to deter all violence; much of the violence that remains occurs because individuals in a dispute engage

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each realizes that the other is waiting, they face the same situation again – deciding whether to proceed first or wait.

in a "self-help" remedy to enforce their perceived rights.[120] Thus, for many disputing parties, the insist/insist outcome is worse than giving in because the stakes at issue are low compared to (a) the embarrassment of a shouting match, (b) the loss of the social relationship with the other party, or (c) violence. In these cases, the resulting game is Hawk-Dove (or a close analogue).

If so, then there is room for a focal effect. If a well-publicized legal rule clearly identifies one neighbor as the property owner, then (like the bystander in the intersection), the rule creates expectations that this neighbor will insist (play Hawk) on the property claim. If so, then the other neighbor wants to defer (play Dove) to avoid the shouting match or violence that would otherwise result.

Property Norms. The economist Robert Sugden uses coordination games to imagine how the institution of property could arise from a state of nature, without any centralized enforcer like a state.[121] As with traffic interactions, resource disputes can be seen as an *iterated* HD game between randomly matched pairs of disputants.[122] In this setting, "Hawk" is the strategy of insisting on the disputed resource and "Dove" is the strategy of deferring to the other claimant. In the state of nature, the Hawk/Hawk result is a physical fight that could fatally injure either of the players. Each player would most prefer to insist while the other defers, but each regards the worst outcome as Hawk/Hawk because the expected benefit of fighting – a chance to gain or keep the resource – is outweighed by the expected cost of fighting – a chance of suffering a crippling injury or death.

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[120] *See* SALLY E. MERRY, URBAN DANGER: LIFE IN A NEIGHBORHOOD OF STRANGERS 175-86 (1981); RICHARD E. NISBETT, & DOV COHEN. CULTURE OF HONOR: THE PSYCHOLOGY OF VIOLENCE IN THE SOUTH (1996); Donald Black, *Crime as Social Control*, 48 AMER. SOC. REV. 34 (1983). I put "self-help" in quotations marks to indicate that I am referring to violence that falls outside of the legal entitlement to use force to defend one's rights. *See* Richard A. Epstein, *The Theory and Practice of Self-Help*, 1 J. LAW, ECON. & POLICY 1 (2005).

[121] *See* ROBERT SUGDEN, THE ECONOMICS OF RIGHTS, COOPERATION, AND WELFARE 55-103 (1986). *See also* JACK HIRSHLEIFER, ECONOMIC BEHAVIOUR IN ADVERSITY 223–34 (1987); Kenton K. Yee, *Ownership and Trade from Evolutionary Games,* 23 INT'L REV. LAW & ECON. 183, 187–94 (2003).

[122] The game does not have to be HD. If the value of the disputed resource were high enough relative to the costs of disputing, then the worst outcome is to defer when the other insists and the game is PD. But frequently the resource is not worth winning "at all costs."

Now suppose that the two individuals in a resource dispute observe which of them *possesses* the disputed resource. Because I am focusing on the simplest uses of game theory, I will not explore the evolutionary theory by which Sugden and others derive a particular equilibrium based on this observation. I merely note how a certain set of expectations could logically sustain a behavioral pattern that looks like the institution of property. Assume you expect *everyone else* to play the following strategy:

> *When I am the possessor, play Hawk, and when I am the non-possessor, play Dove.*

What is your best response? If everyone else plays Hawk when they are the possessor, your best reply is to play Dove when you are the non-possessor. If everyone else plays Dove when they are the non-possessor, your best reply is to play Hawk when you are the possessor. Thus, when all others play the above strategy, your best response is to do the same. Thus, there is an equilibrium where everyone plays this possession-based strategy. The result is the convention of property.[123] Sugden argues that the convention is not only possible but likely.[124]

So, as Hume first suggested,[125] conventions of property may slowly emerge from an iterated process that creates a pattern of expectations of how people will behave in resource disputes. Note also that the theory helps to explain the emergence of informal property rights not enforced by the state, such as the claim to return to parking spaces

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[123] For a more complete summary, *see* Richard H. McAdams, *Conformity to Inegalitarian Conventions and Norms: The Contribution of Coordination and Esteem*, 88 THE MONIST 238 (2005).

[124] *See* ROBERT SUGDEN, THE ECONOMICS OF RIGHTS, COOPERATION, AND WELFARE 89-91 (1986). The argument is that, on average, those who have put forth the effort to possess the property will value it more than those who do not possess it. As a result, possessors have more at stake and are therefore more likely to play Hawk, leading to the property convention. *See also* Jack Hirshleifer, *Privacy: Its Origin, Function, and Future*, 9 J. LEGAL STUD. 649, 657–58 (1980); Herbert Gintis, *The Evolution of Private Property*, 64 J. ECON. BEHAV. & ORG. 1 (2007).

[125] *See* DAVID HUME, A TREATISE OF HUMAN NATURE (L.A. Selby-Bigge ed., 2d ed. 1978) 1740, Book 3, Part 2, Section 2) (property "arises gradually and acquires force by a slow progression, and by our repeated experience of the inconvenience of transgressing it"); *see also* Peter Vanderschraaf, *The Informal Game Theory in Hume's Account of Convention*, 14 ECON. & PHIL. 215, 230–45 (1998).

from which one has shoveled out snow.[126] Similarly, Tom Ginsburg and I extended this analysis to territorial disputes between nations.[127] Sometimes those disputes involve territory that is so valuable to at least one side that it will try to "win at all costs." But frequently two nations dispute territory that is not worth the price of war. If so, they face a HD game where each would like the other to back down but each regards the worst outcome as the case where neither backs down. Given this problem, territorial treaties work by making one outcome focal. Once the parties have agreed to a territorial boundary, then there is far more reason to expect that either side will fight rather than relinquish what the treaty recognizes as its own territory. Ginsburg and I also found evidence that the International Court of Justice generates high compliance in territorial disputes, which we attribute to the Court's ability to make focal the outcomes it endorses.[128]

Gender Roles and Inequality. The same logic underlying Sugden's property analysis applies to other settings, as players select strategies based on observed facts other than possession. Again, I will not explain how particular strategies evolve, but merely illustrate a possible equilibrium. Assume that individuals contesting over resources in an iterated HD game observe not only the possession/non-possession distinction, but also a male/female distinction. Assume you expect all males to play this strategy:

> *If the other player is female, play Hawk; if the other player is male, play Hawk if possessor and Dove if non-possessor;*

and all females to play this strategy:

> *If the other player is male, play Dove; if the other player is female, play Hawk if possessor and Dove if non-possessor.*

What is your best response? Whether you are a male or female, if all other players play the strategy specified for their sex, your best response is to play the strategy specified for your sex. As with all conventions, once it

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[126] See Richard A. Epstein, *The Allocation of the Commons: Parking on Public Roads*, 31 J. Legal Stud. 515, 528-29 (2002).

[127] Tom Ginsburg & Richard H. McAdams, *Adjudicating in Anarchy: An Expressive Theory of International Dispute Resolution*, 45 WILLIAM & MARY LAW REV. 1229 (2004).

[128] *Id*.

arises, it will not pay for an individual to deviate. If a woman tries to play Hawk against men, who expect women to play Dove, she will simply endure the worst outcome (as do the men with whom she interacts). The result is a convention in which all property winds up in the hands of men. The same point can be made by using race roles instead of or in addition to sex roles, or any other immediately observable distinguishing traits.

3. *Assurance*

Previously I explained how the Assurance game models a bank run better than a PD. Now consider how the game also models democracy, social movements and counter-movements.

Democracy. Where Hardin and Elster focus on the bargaining between interest groups that produces any constitution, some political scientists have focused on *democratic* constitutions and the implicit bargain struck by citizens with each other. As Barry Weingast observes, the stability of democracy depends on "the people" being willing to challenge official action that transgresses democratic principles, as by purporting to stay in office after being defeated in a lawful election.[129] He models the problem as a complex game involving (in part) an Assurance game, where citizen groups can maintain democratic rule only by *jointly* challenging the official and thereby removing her from power.[130] Each group prefers to challenge the official if the other group does the same, but would rather acquiesce if the other group acquiesces, because unilateral action is ineffective and costly. The problem, therefore, is coordination. Different citizen groups have very different views about the appropriate limits to state power. If each group seeks to oust government

[129] Barry R. Weingast, *The Political Foundations of Democracy and the Rule of Law*, 91 AMER. POL. SCI. REV. 245, 246 (1997).

[130] *See id.* at 248 (figure 2) and 250 (figure 4), where the top node in each figure is, on inspection, an Assurance game for citizen groups A and B. For example, in the top node of Figure 2, there two equilibria are Acquiesce/Acquiesce and Challenge/Challenge. Mutual Challenge is best for A and B (payoff of 7), but riskier because their worst outcome comes from playing Challenge against Acquiesce (payoff of 1). Of course, in both cases the Assurance is embedded in a larger game, but Weingast's point is to show how that game requires coordination.

officials only when (and whenever) that group views the official as having overstepped her authority, the citizen response will never be sufficiently united to threaten authoritarian officials (but yet may cause constant turmoil).[131]

What is essential, then, is that the citizen groups coordinate their efforts to challenge government officials around a "social consensus" about what state actions are legitimate. Especially in a large diverse society, that consensus is unlikely to arise in a decentralized fashion. Some centralized mechanism is needed and that is what a constitution provides. "Policing the sovereign requires that citizens coordinate their reactions, which requires constructing a coordination device," such as a written constitution.[132]

Social Movements. Imagine a group seeks significant social and legal change. In the Jim Crow era of the American South, for example, blacks sought to topple segregation norms and to enact laws prohibiting private discrimination.[133] In many parts of the world, women seek to earn the right to be educated, to hold jobs, and to avoid various forms of oppressive treatment.[134] On a much smaller scale, in many communities today, non-smokers seek to ban public smoking.[135] In each case, for the group seeking social or legal change, reform is a public good because the enjoyment of the new rights by some individuals does not diminish the "consumption" of those rights by others and the group cannot exclude the benefits from those who did not contribute to creating them. Given that it is costly to participate in a social movement, it might appear that the problem is essentially one of cooperation. The correct model might be

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[131] *Id.* at 246, 251-52.

[132] *Id.* at 251.

[133] *See, e.g.*, MICHAEL J. KLARMAN, FROM JIM CROW TO CIVIL RIGHTS: THE SUPREME COURT AND THE STRUGGLE FOR RACIAL EQUALITY (2006); ALDON D. MORRIS, ORIGINS OF THE CIVIL RIGHTS MOVEMENT (1986).

[134] *See, e.g.*, MARTHA C. NUSSBAUM, WOMEN AND HUMAN DEVELOPMENT (2001); LISA BALDEZ, WHY WOMEN PROTEST: WOMEN'S MOVEMENTS IN CHILE (2002).

[135] *See, e.g.*, Thaddeus Mason Pope, *Balancing Public Health Against Individual Liberty: The Ethics of Smoking Regulations*, 61 U. PITT. L. REV. 419 (2000); Jessica Niezgoda, Note, *Kicking Ash(trays): Smoking Bans in Public Workplaces, Bars, and Restaurants: Current Laws, Constitutional Challenges, and Proposed Federal Regulation*, 33 J. LEGIS. 99 (2006).

a multi-party PD, where the dominant strategy for everyone is not to participate.[136]

Political scientist Dennis Chong offers a more sensible way of modeling social movements.[137] Focusing on the civil rights movement of the 1950s and 60s, Chong suggests that there were strong social incentives at work that would reward participation *if the movement event succeeded* but not otherwise. After a successful event – a boycott, march, registration drive, etc. – the group venerated those who helped it to succeed and sometimes shamed those who refused to participate. A failed movement event, by contrast, did not produce social distinction between participators and non-participators. Considering these additional social incentives, the payoff from participating when enough others participated to make the movement successful was plausibly higher than the payoff from not participating in the same circumstances. Yet because the social rewards of participating in an unsuccessful movement were far less, the payoffs from participating in a failed effort remained lower than not participating. The result, Chong observes, is an Assurance game, where individuals prefer contributing if enough others contribute, but prefer not contributing when enough others do not contribute.[138]

Chong's point generalizes. Several theorists claim that the desire for esteem provides a pervasive social incentive to engage in behavior

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[136] Another possibility trivially involves coordination. Suppose that social movement success is "lumpy" because low levels of participation (in marches, boycotts, monetary contributions, etc.) produce zero returns up to some threshold where participation produces the desired change. Take k to be the number of individuals who must participate for the social movement to succeed. If the benefits an individual receives from the movement's success exceed her own costs in participating, there is an equilibrium in which exactly k individuals participate. At that level, no participants withdraw because that would cause the movement to fail, but no one else participates because non-participants can free-ride on the movement's success. But just as with the PD, it is difficult to see how social movements ever succeed with this model. One starts at an equilibrium where the participation level is zero. My deciding to participate at this point makes sense only if I believe that that, suddenly, exactly $k - 1$ other individuals will participate.

[137] DENNIS CHONG, COLLECTIVE ACTION AND THE CIVIL RIGHTS MOVEMENT (1991) won the William Riker Prize given every two years by the Political Economy Section of the American Political Science Association.

[138] *Id.* at 103-40. *See also* Will H. Moore, *Rational Rebels: Overcoming the Free-Rider Problem*, 48 POL. RESEARCH QUART. 417 (1995).

that others approve or to avoid behavior that others disapprove.[139] If others contribute, and the individuals bring about the desired collective action, then there is likely to be strong disapproval for those who failed to contribute. Yet people are not as likely to approve those who contribute to failed causes. As a result, the incentive of esteem may frequently work contingently in the way Chong describes: when enough others contribute, the fear of disapproval can make contributing more beneficial than not contributing.

A second possibility is internal. Extensive experimental research provides powerful evidence that many people value reciprocation intrinsically.[140] "Homo reciprocans" may gain utility from reciprocating cooperation or lose utility from the guilt of exploiting another player by failing to reciprocate their cooperation.[141] The game for such individuals may be Assurance because they will get extra utility from participating when others participate and/or extra disutility from shirking when others participate.

With an internal or external motivation for reciprocity, situations that appear to be multi-party PDs[142] are actually multi-party Assurance Games. The two equilibria are Participate/Participate or Withhold/Withhold. The former equilibrium is mutually better, but the

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[139] *See, e.g.*, GEOFFREY BRENNAN & PHILIP PETTIT, THE ECONOMY OF ESTEEM (2004); Tyler Cowen, *The Esteem Theory of Norms*, 113 PUB. CHOICE 211, 221–22 (2002); Richard H. McAdams, *The Origin, Development and Regulations of Norms*, 96 MICH. L. REV. 338, 353–55 (1997).

[140] *See, e.g.*, Ernst Fehr et al., *Strong Reciprocity, Human Cooperation, and the Enforcement of Social Norms*, 13 HUM. NATURE 1 (2002); Joseph Henrich et al., *In Search of Homo Economicus: Behavioral Experiments in 15 Small-Scale Societies,* 91 AMER. ECON. REV. 73. (2001); Samuel Bowles & Herbert Gintis, *Behavioural Science: Homo Reciprocans*, 415 NATURE 125 (2002); Ernst Fehr & Simon Gachter, *Fairness and Retaliation: The Economics of Reciprocity*, 14 J. ECON. PERSPECTIVES 159, 162-63 (2000); James K. Rilling et al., *A Neural Basis for Social Cooperation*, 35 NEURON 395, 395 (2002); Thomas Dohmen, Armin Falk, David Huffman & Uwe Sunde, "Homo Reciprocans: Survey Evidence on Prevalence, Behavior and Success," IZA Discussion Papers 2205, Institute for the Study of Labor (IZA) (2006).

[141] *See* Dan M. Kahan, *The Logic of Reciprocity: Trust, Collective Action, and Law*, 102 MICH. L. REV. 71 (2003).

[142] Or public goods games with a highly improbable efficient equilibrium, where exactly *k* individuals contribute. *See supra* note __.

riskiness of participating may cause the players to prefer to withhold.[143] As Chong explains, the Assurance Games captures an important dynamic of social movements like the civil rights movement – the need for leaders to convince potential participants that there will be enough participation to succeed.[144] Given a baseline of non-participation in the absence of a social movement, charismatic leaders must communicate optimism. Such leaders must convince others of the inevitability of success (*e.g.*, "We Shall Overcome"[145]). They will select small easy steps to build up a track record of success, publicize even small successes, and perhaps exaggerate them as groups often exaggerate the number of protesters who participate in their events.[146] Thus, coordination games help us understand better the process of social and legal change.

Social Counter-movements. What Chong says about social movements can also be said about *opposition* to social and legal change. Here too, the problem is coordination. The resisting group may succeed in blocking change only if a sufficient number of people participate and also if they coordinate the manner of their participation.

Richard Brooks documents an interesting example – the resistance of white homeowners in Chicago to racial integration in the early and mid-20th century.[147] At one time, that resistance included legally enforceable restrictive covenants that forbade homeowners from selling

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[143] In contrast to the analysis at *supra* note __, with this new model, if *k* social movement participants are sufficient to produce the lumpy public good, we no longer have the odd equilibrium where exactly *k* individuals participate. Instead, if *k* individuals participate, the movement will succeed and so everyone with an internal or external incentive to reciprocate will want to participate. By failing to participate, one does not merely risk the remote possibility that, because exactly *k* - 1 others participate, one's failure to participate causes the movement to fail. One also risks the outcome where *k* or more others participate and the movement succeeds, in which case one is worse off for having failed to participate.

[144] *See* DENNIS CHONG, COLLECTIVE ACTION AND THE CIVIL RIGHTS MOVEMENT 73-90 (1991).

[145] *See, e.g.*, GUY CARAWAN, WE SHALL OVERCOME: SONGS OF THE SOUTHERN FREEDOM MOVEMENT (1963). The origin of this popular gospel song is in doubt. *See* the discussion at http://en.wikipedia.org/wiki/We_Shall_Overcome.

[146] *See* DENNIS CHONG, COLLECTIVE ACTION AND THE CIVIL RIGHTS MOVEMENT (1991). *See also* JACK KNIGHT, INSTITUTIONS AND SOCIAL CONFLICT 201 (1992)(describing union organization as an Assurance Game).

[147] Richard R.W. Brooks, Covenants & Conventions, unpublished manuscript (July 2005).

their land to non-whites.[148] *Shelley v. Kraemer*[149] ruled these restrictive covenants unenforceable. Brooks suggests that, at this point, white segregationist homeowners faced an Assurance game.[150] Here, the whites each wanted to sell to blacks if their neighbors did, but to "stay put" if their neighbors did. The mutually best outcome was for all to stay put, but staying put was risky because if the white homeowner's white neighbor sold to blacks, the property values would fall before the white homeowner could sell. Brooks goes on to explain how racially restrictive covenants, even though unenforceable after *Shelley*, continued to support and stabilize segregation.[151] His empirical analysis shows that these legally void covenants continued to work as a focal point, coordinating the actions of white homeowners, purchasers, real estate agents, and government agencies that preserved racial exclusivity.[152]

Social Conflict. Finally, note what happens when we combine the prior discussions of disputes and inequality (in the HD game) with the prior discussion of social movements and counter-movements (in the Assurance game). *We can now model much social conflict as a combination of two games:* HD and Assurance. First, the HD Game models the interaction *between* two individuals from the two different groups. *E.g.*, the conflict between a smoker and a non-smoker; in the era of Jim Crow segregation, the conflict between a black and white southerner; in many places and times, the conflict between a male and female over sex-role conventions. There emerges from this interaction one of the possible equilibria, which becomes a social convention, *e.g.*, non-smokers defer to smokers; blacks defer to whites; women defer to men.

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[148] Brooks observes that even these legal sanctions did not prove universally successful because many whites decided that it was cheaper to move to all-white suburbs where blacks were not trying to live than to enforce their restrictive covenants. *Id.* at 17. Indeed, the multiple neighbors who had standing to enforce the covenant faced a HD game. Each preferred that another bear the expense of litigation, though each considered the worst outcome to be where no one sued to enforce the covenant.

[149] 334 U.S. 1 (1948).

[150] *See* Richard R.W. Brooks, Covenants & Conventions, unpublished manuscript 18 (July 2005). He does not call the game Stag Hunt or Assurance, but an inspection of the matrix shows that it is, as the text above explains.

[151] *Id.* at 18-19.

[152] *Id.* at 20-35.

Second, the Assurance Game models the interaction among individual members *within* the same group. The group disadvantaged by the prevailing norm seeks to change it. If enough such individuals switch their strategies in the HD game against the other group members – playing Hawk instead of Dove – the resulting Hawk/Hawk conflict will be costly, but it may compel the other group's members to back down and start playing Dove. For individuals seeking social change, there is uncertainty whether enough of one's fellow group members will stand up and play Hawk long enough to make the other group's members back down. This makes joint action risky, even though it potentially produces the best outcome. The game between group members might be PD, if an individual prefers to free-ride off even when other group members succeed in creating a new norm. But where Chong's analysis applies, individuals prefer to contribute *if* the movement is successful. In this case, the game is Assurance. Given sufficient social identity or social solidarity, women or racial minorities are willing to sacrifice for social change when enough others will, and therefore seek to coordinate their actions with others. Those resisting change may have similar motives so that their interaction is also an Assurance game.

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Again, these are merely examples, not an exhaustive list. The world presents problems of coordination at least as often as the cooperation problem embodied in a PD game. And law is frequently called upon to resolve coordination problems. In the end, there is no justification for the disproportionate focus of legal scholarship on the PD compared to other equally simple games.

IV. INTELLECTUAL EXCHANGE BETWEEN LAW-AND-SOCIETY AND LAW-AND-ECONOMICS SCHOLARSHIP

The neglect of coordination contributes to unnecessary intellectual divisions. I refer to the divide between the two primary social science schools of legal thought in the United States: Law & Economics and Law

& Society. These scholarly camps are represented by the American Law and Economics Association[153] and the Law and Society Association.[154] Each group has its own peer-review journals, such as the *Journal of Law and Economics*, started in 1958, and the *Law and Society Review*, dating to 1966. Where some law faculties are heavily identified with law and economics, others are heavily represented by Law & Society scholars.[155] Like most scholarly divides, neither group seems particularly impressed with the other. Yet given how both groups use a social science approach to law, it is remarkable how little either engages the theory or empiricism of the other. Here, I briefly explain how a focus on the PD game magnifies the differences between Law & Economics and Law & Society.

On one of the rare occasions when a Law & Economics scholar addressed Law & Society, Robert Ellickson distinguished the "legal centralism" of Law & Economics from the "legal peripheralism" of Law & Society.[156] By the former, he meant that Law & Economics viewed law as the central mechanism of social control. Its scholarship commonly assumed that people know the law and that legal sanctions work. By contrast, Law & Society scholars are skeptical regarding the claim that law influences behavior and demand empirical evidence.[157] Much of their

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[153] The association began in 1991; its website is http://www.amlecon.org/.

[154] The association began in 1964; its website is http://www.lawandsociety.org/.

[155] As one of the few who regularly attends the annual meetings of both organizations, it is clear that the annual meetings of the Law & Society have greater attendance, though it is not clear which has more attendance by law professors. Law & Society draws many members from sociology, political science, psychology, history, and other fields, as well as law professors. Law professors dominate ALEA, which otherwise has members in economics departments and business schools.

[156] *See* ROBERT C. ELLICKSON, ORDER WITHOUT LAW 4-6, 147-48 (1991). The only other examples I know of are John J. Donohue III, *Law and Economics: The Road Not Taken*, 22 LAW & SOC'Y REV. 903 (1988); Kenneth G. Dau-Schmidt, *Economics and Sociology: The Prospects for an Interdisciplinary Discourse on Law*, 1997 WISC. L. REV. 389. Law & Society scholars have addressed Law & Economics more frequently. *See, e.g.*, Carol A. Heimer & Arthur L. Stinchcombe, *Elements of the Cooperative Solution: Law, Economics, and the other Social Sciences*, 1997 WISC. L. REV. 421; Lauren B. Edelman, *Presidential Address: Rivers of Law and Contested Terrain: A Law and Society Approach to Economic Rationality*, 38 LAW & SOC'Y REV. 181 (2004). For a comment on the last article, *see* Richard H. McAdams, *Cultural Contingency and Economic Function: Bridge-Building from the Law & Economics Side*, 38 LAW & SOC'Y REV. 221-228 (2004).

[157] ROBERT C. ELLICKSON, ORDER WITHOUT LAW 148 (1991).

scholarship finds serious gaps between "law-in-the-books" and "law-in-action."[158]

Today we must modify Ellickson's observation. Because he was so successful at persuading legal economists to incorporate social norms into their analysis, Law & Economics scholars are no longer legal centralists, even if they have greater faith in law than Law & Society scholars. But I think it fair to say that Law & Economics scholars remain "*sanctions* centralists" in that the key lesson they take from the power of social norms is that they must account for informal as well as formal sanctions. Informal sanctions are important because they also facilitate cooperation, "solving" the PD.

To this point, I want to add two more distinctions. First, where Law & Economics emphasizes efficiency, exchange, and mutual advantage, Law & Society emphasizes distribution, inequality, and social conflict. Law & Economics theorists look for means to avoid the waste of resources, *i.e.*, "dead weight" losses. Law & Society scholars look at struggles over resources and status, where one person's gain is another's loss. Second, among other methodological differences,[159] Law & Economics makes extensive use of game theory, while Law & Society, for the most part, shuns it. Law & Society methods vary because the group includes several disciplines, but it tends strongly to favor thick description of human actors over the reductive descriptions necessary for game theory.

Now consider the relationship between these three differences: (1) reductive game theory description vs. thick description; (2) legal centralism vs. legal peripheralism; and (3) efficiency vs. distribution. The

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[158] The idea originates in the legal realism of the early twentieth century. See Roscoe Pound, *Law in Books and Law in Action*, 44 AM. L. REV. 12 (1910). For contemporary gap studies, s*ee, e.g.*, KRISTIN BUMILLER, THE CIVIL RIGHTS SOCIETY: THE SOCIAL CONSTRUCTION OF VICTIMS (1988); WILLIAM K. MUIR, JR., PRAYER IN THE PUBLIC SCHOOLS: LAW AND ATTITUDE CHANGE (1967); GERALD N. ROSENBERG, THE HOLLOW HOPE: CAN COURTS BRING ABOUT SOCIAL CHANGE? (1991). Ellickson's *Order Without Law*, *supra*, is also a gap study because he found that Shasta County ranchers did not know the property law governing their disputes with neighbors; such disputes were instead resolved by local social norms.

[159] *See, e.g.*, Howard Erlanger, et al., *Is it Time for a New Legal Realism?*, 2005 WISC. L. REV. 335, 336 (noting "important differences in epistemology, methods, operating assumptions and overall goals" among the social sciences).

conventional account of the distinctions emphasizes method, that Law & Economics diverges from Law & Society not because of *what* it studies (law, legal institutions, legal change) but *how* it studies. On this view, the connection between the differences is that (1) the reductive tools of economics, including game theory, drive the economic theorist to embrace (2) sanctions centralism and (3) a focus on efficiency.

Yet we can now see why this is *not* the case. Although the methods differ, these two schools differ more profoundly because they study entirely different kinds of situations. The law review Law & Economics literature focuses on the PD game. Although Law & Society scholars do not use game theory, their work focuses on coordination games involving distribution issues. The PD is the wrong model for most of what Law & Society scholars study, so an emphasis on the PD makes game theory seem less relevant to their work than it actually is.

Although it is reductive, game theory need not lead legal scholars to care only about efficiency or to assume the centrality of sanctions. What produces these tendencies is the PD focus. First, the PD diverts attention from distributional issues because "solving" the game benefits *all* the players in the game. There is no problem of equity or distribution. Second, the PD focus makes sanctions central. If current payoffs permit only one equilibrium, then the only way to solve the game is to change the payoffs, as by sanctions. Or, if the game is repeated, but the players are stuck in the inefficient "all defect" equilibrium – their informal sanctions fail them – then formal sanctions for defection may be the only way to achieve cooperation. In these settings, the law's apparent ability to manipulate payoffs via sanctions makes it appear both necessary and sufficient for solving the problem. And given the absence of conflict, there is no reason for political opposition to solving a PD and every reason for unanimous support. So *in this case* there should be no gap between the law-on-the-books and the law-in-action. One uses law to change the payoffs so that the only equilibrium now is what the law requires: mutual cooperation. Law *is* central.

Coordination games, by contrast, lead to the Law & Society view. First, these games highlight distributional issues. In HD and the BOS game, the two equilibria involve no issue of efficiency – the sum of the

payoffs is the same – but solely a distributional choice. When one of these games is repeated, there is the possibility that a convention will emerge in which individuals in one social role – women, non-smokers, property non-possessors – will systematically receive less than those in another social role, which may lead to demands to change the distribution through law.

Second, if the correct model is a game of equity, then one side will favor change and the other will oppose it. Those disfavored by the status quo seek to use law to achieve what they perceive as justice. The social movement is met, however, by resistance. If those who benefit from the current distribution were, in the past, able to preserve the existing arrangement, they are likely to possess similar power today. Sometimes they will block any change. But even when resistors lack the ability to block all change, they may be able to minimize it in familiar ways: to narrow the new law's scope, to create procedural hurdles, to limit remedies, to influence the enforcement authorities, to outspend plaintiffs in litigation, etc.

Legal reform often fails to make compliance the only equilibrium. Instead, there *remain* multiple equilibria, one being the status quo distribution – where potential defendants insist and potential plaintiffs defer – and the other being the new distribution that is the goal of the law – where potential plaintiffs insist on their new "rights" and potential defendants defer. Where this is true, then focal points and *not payoffs* determine the actual outcome. If the issue is the law's focal effect, we cannot merely assume its effectiveness (legal centralism) because the law's influence will depend on competing social precedent, whether direct or analogous, which is to say, law's effect depends on history and culture. If current behavior and patterns of thought are sufficiently focal, individuals will entirely ignore a new law that tries to change existing practice.[160]

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[160] Factors that seem irrelevant to conventional economic analysis can then come into play. As Law & Society scholars say, law will have a greater effect if it changes the "frame" or "schema" individuals use for understanding the conflict. *See* Robert D. Benford & David A. Snow, *Framing Processes and Social Movements: An Overview and Assessment*, 26 ANN. REV. SOC. 611 (2000). One of the most common rhetorical moves, made powerful by existing legal focal points, is to claim some outcome as a "right." In a coordination game,

Thus, if the game is not PD, but BOS or Hawk-Dove, then we may follow Law & Society scholars in studying law and legal change in the much broader context of social movements and counter-movements and we may readily predict a gap between the law-in-action and law-on-the-books. A focus on coordination games lessens the differences between Law & Economics and Law & Society and provides some basis for intellectual exchange. Most obviously, coordination games direct attention away from the Law & Economics concerns of efficiency, exchange, and mutual advantage and towards the Law & Society issues of distribution, inequality, and social conflict. The excessive attention to the PD makes these conclusions seem foreign to game theory, when they are really well modeled if one starts with the right games.

CONCLUSION

Legal scholars have learned the lessons of the Prisoners' Dilemma too well, to the point where they obscure other insights of game theory. Because a Prisoners' Dilemma framing renders a problem amenable to an uncontroversial legal solution, there is a strong temptation to over-describe problems as a Prisoners' Dilemma and to value game theory only for this one insight. This essay, however, describes the benefits of resisting this temptation. Coordination problems are common and important to law. Unlike the Prisoners' Dilemma, they describe situations involving inequality, where culture and history affect behavior (independent of payoffs), and where law can work expressively.

Game theory includes many complex tools not discussed here, including techniques for constructing new games without pre-existing names that best fit the situation being studied. While some game theorists understandably push for greater use of these advanced tools, I have taken a different tack, criticizing the existing legal literature by focusing on two-by-two games as simple and rudimentary as the Prisoners' Dilemma. There is much to be learned from elemental coordination games, such as Battle of the Sexes, Hawk-Dove, and Assurance, which collectively model

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even a purely symbolic legal recognition of rights may influence how people expect others to behave, and therefore how they behave themselves.

bargaining, constitutional law, democratic stability, international law, standard-setting, low-stakes disputes, traffic, property, gender roles, social movements, and even the interaction of prosecutors and their prisoners. Anyone who thinks there is value in using the Prisoners' Dilemma game to understand legal problems should want to explore the usefulness of these three coordination games. Although many non-legal scholars have made some progress in understanding the importance of coordination legal issues, the main purpose of this essay is to encourage more work of this sort by legal scholars, to exploit the potential of this sort of game theory, and to correct the imbalance that unjustifiably elevates cooperation problems over coordination problems.

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