

**John F. Kennedy School of Government
Harvard University
Faculty Research Working Papers Series**

Expressive Law: Framing or Equilibrium Selection?

Iris Bohnet and Robert Cooter

Nov 2003

RWP03-046

The views expressed in the KSG Faculty Research Working Paper Series are those of the author(s) and do not necessarily reflect those of the John F. Kennedy School of Government or Harvard University. All works posted here are owned and copyrighted by the author(s). Papers may be downloaded for personal use only.

EXPRESSIVE LAW: FRAMING OR EQUILIBRIUM SELECTION?

IRIS BOHNET* and ROBERT D. COOTER**

Abstract

Besides deterring people, laws may affect behavior by changing preferences or beliefs. A law may elicit intrinsic motivation by framing an act as wrong. Alternatively, it may coordinate the behavior of different people by changing their beliefs about what others will do. We investigate framing and coordination effects experimentally in prisoner's dilemma, "crowding" and coordination games. We simulate a law by imposing a probabilistic penalty on one of the choices. In the prisoner's dilemma and the crowding game, announcing the penalty had no effect. In the coordination game, announcing the penalty caused behavior to jump to the Pareto-superior equilibrium.

Keywords: Equilibrium selection, framing, expressive law, experiments, coordination, prisoner's dilemma.

JEL codes C72, C91, K42

* Corresponding author. Kennedy School of Government, Harvard University, 79 JFK Street, Cambridge, MA02138, phone: (617)495-5605, fax: (617)496-5747, email: Iris_Bohnet@Harvard.edu

** Boalt Law School, University of California at Berkeley, Berkeley, CA94720, email: rdc@law.berkeley.edu

I. INTRODUCTION

Making a law, conventionally defined as an obligation backed by a sanction, can affect behavior in at least three ways. First, fear of sanctions deters some people from breaking the law. The theory of deterrence explains law's effects on behavior by the probability and severity of sanctions and the elasticity of demand curves.¹ Second, framing an act as illegal can elicit intrinsic motivation to avoid it. Many citizens comply with law from respect, not fear. The theory of framing explains law's effects on behavior by the intensity and malleability of respect for law. Third, a law can coordinate the behavior of people by helping them to predict what others will do. The theory of coordination explains law's effects on behavior by the credibility of the equilibrium selection principle it offers.²

Our experiments test the strength of two of these effects: framing and coordination. We build on an extensive literature concerning whether changes in the representation of choices influence decisions in games (for a review, see Camerer 1995). In one famous framing experiment, Ross and Ward (1996: 108) found significantly more cooperation from labelling a two-person prisoner's dilemma (PD) as the "Community Game" rather than the "Wall Street Game." They concluded with this question:

"Further research will be required to determine exactly why the particular label attached to the game exerted so large an effect – that is, to what extent the label influenced subjects directly (i.e. determined the way subjects felt they ought to play) and to what extent it influenced them indirectly (i.e. by changing their expectations about how the other player would expect them to play)."

Our experimental design allows us to answer this question as applied to sanctions. To simulate a legal sanction, we tell subjects in our experimental group that one choice will result in a probabilistic "penalty" in dollars. We offset the probabilistic penalty by an increase in the certain payoff from doing the penalized act. Holding constant the behavior of others,

¹ For a review of the "imperative theory of law" in Anglo-American jurisprudence, see Raz (1980).

² For three effects of legal obligations on behavior, see Cooter (2000).

the expected monetary payoff from doing the penalized act remains unchanged.

Consequently, any effect of the penalty on the experimental group must occur because players change their subjective valuation of the dollar payoffs (e.g., guilt decreases the value of the penalized act), or because they change their beliefs about what others will do.

We wish to separate and compare the penalty's effect on preferences and beliefs. In a game with a unique Nash equilibrium, beliefs about others' behavior do not change the best strategy for a selfish player. Consequently, introducing a probabilistic penalty (and an offsetting increase in the certain payoff) can only affect behavior by changing preferences. Preferences change to the extent that a penalty elicits intrinsic motivation. We found that announcing a penalty in the prisoner's dilemma and "crowding" games, which have unique Nash equilibria, had no effect on behavior. Intrinsic motivation was too weak to overcome the dominant, self-interested strategy.

Next we experimented with coordination games having multiple Nash equilibria. In these games a penalty can help to select among equilibria. We found that announcing a penalty for the "wrong" choice caused behavior to jump to the "right" choice.

Our experimental results confirm our hypothesis about law in general: sanctions affect behavior more by changing beliefs than preferences. When navigating a world with cultural diversity, organized interest groups, and unreliable regulators, scepticism about the moral value of legal pronouncements preserves moral compass. While scepticism about law's morality inhibits intrinsic motivation, coordination effects can still operate.

While our experiments only concern coordination and framing, the results have significance for deterrence. Deterrence causes actors to adjust behavior to equate marginal benefits and costs, which involves small changes. In contrast, coordination causes behavior to jump from one equilibrium to another, which involves large changes. Consequently, our results suggest that coordination has larger effects than deterrence in law. Almost all of law

and economics focuses on deterrence and neglects coordination.³ Law and economics apparently concentrates on law's small effects and neglects its large effects.

The paper is organized as follows: Part II reviews the relevant scholarship on framing and equilibrium selection. Part III describes the experimental design. Part IV presents our results. The paper concludes with Part V.

II. REVIEW OF LITERATURE ON FRAMING AND EQUILIBRIUM SELECTION

A sanction lowers the payoff to the sanctioned act relative to unsanctioned acts. "Payoff" describes the sanction's effect in morally neutral language, whereas "penalty" implies that the act is wrong. In our experiments, we referred to a reduction in payoffs as a "penalty." We will review the literature on the question of how this change might affect preferences and beliefs.

A. Framing: Change of preferences

Introducing a probabilistic penalty and an offsetting increase in certain payoffs keeps material outcomes constant while changing their description.⁴ Subjective Expected Utility theory predicts no change in behavior from changing the description of payoffs. Changed behavior from changed descriptions violates the axiom of "descriptive invariance." A psychological theory of framing, however, predicts that changing descriptions might change behavior (Tversky and Kahneman 1986). First, "penalty" connotes wrongdoing, which might

³ To illustrate, textbooks in law and economics have almost nothing to say about law's coordination effects. See, e.g., Cooter and Ulen (1999) or Posner (1998). Recent exceptions to this generalization are McAdams (2000) and Hay and Shleifer (1998) who argue that the potentially most significant benefit of public laws in emerging economies is that they become the focal point and can coordinate expectations even with little enforcement.

⁴ Given the comparatively small stakes in experiments, we assume risk neutrality (Rabin 2000). Recent evidence suggests that this is probably also the most accurate assumption descriptively (Harbaugh et al. 2003). The results in Harbaugh et al. (2003) also suggest that it is unclear whether people overweight small probabilities as assumed by Prospect Theory in actual choice tasks.

incur psychological cost such as *guilt*. Second, “penalty” suggests a *loss* in dollar payoffs (even though an increase in the dollar value of certain payoffs offsets the probabilistic penalty). According to Prospect Theory (Kahneman and Tversky 1979), redescribing payoffs as a loss can cause loss averse individuals to change their behavior. In our experiments, loss averse individuals might avoid the “wrong” action in the experimental group and not in the control treatment.

The two possible framing effects of a penalty–guilt and loss aversion–operate in the same direction in all of our games. For our purposes, it does not matter whether framing operates through guilt or loss aversion. Instead of trying to separate these framing effects, we will discuss evidence about their magnitude.

Framing effects of the term “penalty” have not been investigated as yet. However, guilt induced by “harming others” has been studied. In public goods games, the non-cooperative choice can be described as “harming others,” which is a “guilt frame.” Alternatively, the cooperative choice can be described as “benefiting others,” which is a “warm-glow frame.” Guilt frames have been found to influence behavior less than warm-glow frames (Andreoni 1995, Cookson 2000, and Sonnemans et al 1998).⁵ People were more likely to cooperate when cooperation was framed as a positive externality than when defection was framed as a negative externality.

If players perceive positive complementarities and thus multiple equilibria in a public goods game, then they think of themselves as facing a coordination problem.⁶ Researchers were apparently more likely to find “framing effects” when their design created the

⁵ Andreoni (1995) and Cookson (2000) used standard linear public goods games while Sonnemans et al. (1998) used a step-level public goods game with multiple Pareto-ranked equilibria. Studies using hypothetical incentives have generally not found any effects of such framing (e.g. Fleishman et al. 1988, Messick et al 1993 and Rutte et al 1987). Brewer and Kramer (1986) found a “guilt” effect in a hypothetical common pool resource game.

perception of a game with multiple equilibria rather than a unique Nash equilibrium. We suggest that the experimenters were actually observing coordination effects, not preference changes. This reinterpretation of their results suggests that behavior changed from changed beliefs, not changed preferences.⁷

B. Equilibrium selection: Change of expectations

Announcing a probabilistic penalty that does not change the equilibrium (and is offset by an increase in the certain payoff) is “cheap talk.” Despite being cheap, some forms of talk have been found to affect behavior in prisoner’s dilemma and coordination games.⁸ Unlike most experiments on cheap talk, however, our subjects do not talk to each other (or to the experimenter). Rather, the small penalty is introduced by an “external authority” (the experimenter), and thus can be interpreted as a “common information assignment” to all subjects (Brandts and MacLeod 1995, Van Huyck et al. 1992, Wilson and Rhodes 1997).

Experimental evidence suggests that assigned information can serve as an equilibrium selection principle, provided that the assignment does not compete with another focal principle. Information assignments guiding the players to the Pareto-dominant equilibrium have been found to be particularly successful (Van Huyck et al. 1992). A penalty on the strategy leading to the Pareto-inferior equilibrium can guide people to the strategy leading to the Pareto-superior equilibrium if people want to avoid guilt and losses. Similar to Cachon

⁶ See Camerer (2003) who identifies “what game people think they are playing” as one of the “top ten open research questions.”

⁷ Farrell and Rabin (1996) made a similar point regarding two-person prisoner’s dilemma games. They argued that the results suggest that experimental participants perceived them as coordination games where psychological benefits of “both cooperating” induced the players to cooperate if the other did but not otherwise. While we are agnostic about the specific form of intrinsic motivation here, see for a survey of the theories and the empirical evidence on social preferences, Fehr and Schmidt (2001).

⁸ Higher cooperation rates are typically found for two-way, face-to-face communication rather than for one-way or anonymous communication in prisoner’s dilemma games (see, e.g., Bohnet and Frey 1999, Frohlich and Oppenheimer 1998, and for a meta-analysis, Sally 1995). In coordination games, two-way communication increases coordination rates in stag hunt games while one-way communication works better in the battle of the sexes game (see e.g. Charness 1998, Cooper et al. 1992 and for a survey, Camerer 2003).

and Camerer (1996), “loss and guilt-avoidance” can be used as focal principles to exclude strategies that may induce monetary and psychological cost.

Based on previous evidence, we expect a penalty to serve as an equilibrium selection principle in our coordination games but not to affect preferences in the prisoner’s dilemma or crowding games.

III. EXPERIMENTAL DESIGN

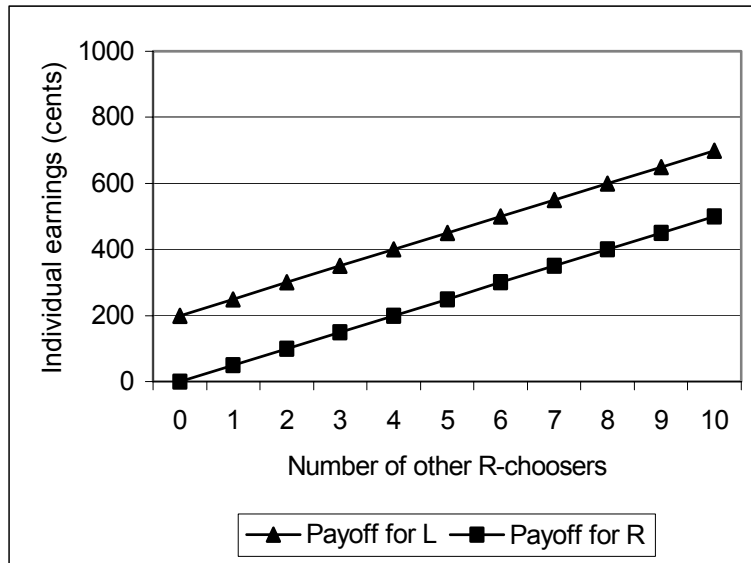
We run three different games with dichotomous choices called L and R. Each game had two treatment conditions. The control treatment had no penalty. We used behavior in the control version to see whether people’s perceptions of the game accord with objective material payoffs or not. The experimental treatment had a small penalty for choosing L. Specifically, the following description of a penalty was added to the instructions:

Choosing L will be punished. The penalty for choosing L instead of R is 200 cents. The penalty will be enforced with a probability of 0.1. After you have made your choice, we will determine whether the penalty will be enforced. There is a deck of 9 black and 1 red cards. An aide will pick a card. If the card is black, the penalty will not be enforced. If the card is red, the penalty will be enforced.

An increase of 20 cents in the certain payoff for choosing L offset the penalty. Thus the penalty did not change material payoffs for a player who is not averse to the risk of losing money. We applied the control and the experimental treatment to three games.

The first game is an n-person prisoner’s dilemma. In Game 1, the marginal cost of choosing R (cooperation) rather than L (defection) was \$2, independent of how many people chose to cooperate. Figure 1 presents the payoffs graphically.⁹

Figure 1: The 11-person prisoner's dilemma game¹⁰



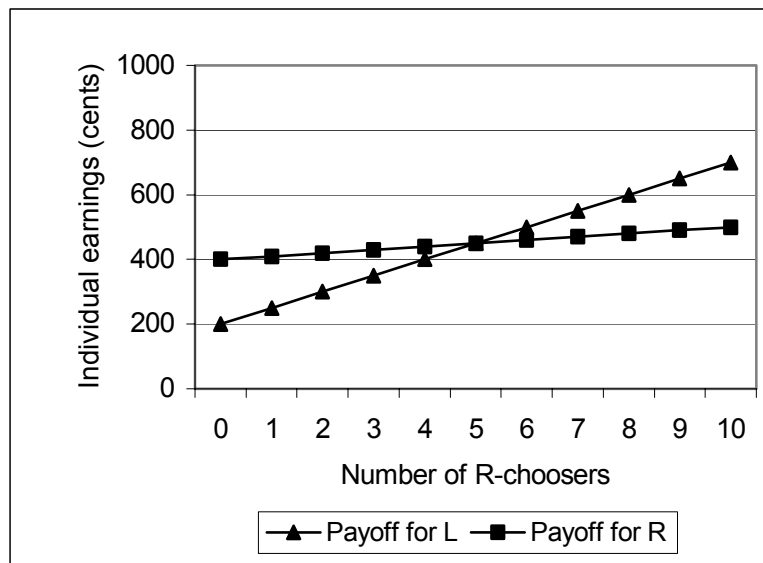
Game 2 is the crowding game with negative complementarities. Starting with 0 R-choosers, choosing R pays \$2 more than choosing L. Increasing the number of R-choosers produces negative externalities of 40 cents for all other R-choosers. Negative externalities accumulate as more players choose R until the sixth potential R-chooser is indifferent between choosing R and L. Beyond six R-choosers, a player does better to choose L. Subjects thus confront a payoff table in which choosing R pays when most people choose L, and choosing L pays when most people choose R. A unique, stable equilibrium occurs when the 6th player is indifferent between choosing L and R (see figure 2, and payoff table 2 in appendix A).¹¹

⁹ Table 1 (appendix A) shows the payoff table for an 11-person game as presented to experimental participants in the control treatment.

¹⁰ Figure 1 describes the payoffs as they present themselves to the marginal 11th player.

¹¹ While the payoffs for choosing L are the same as in the prisoner's dilemma game, the marginal cost for switching strategies is \$2 for the last R-chooser (or the last L-chooser) only.

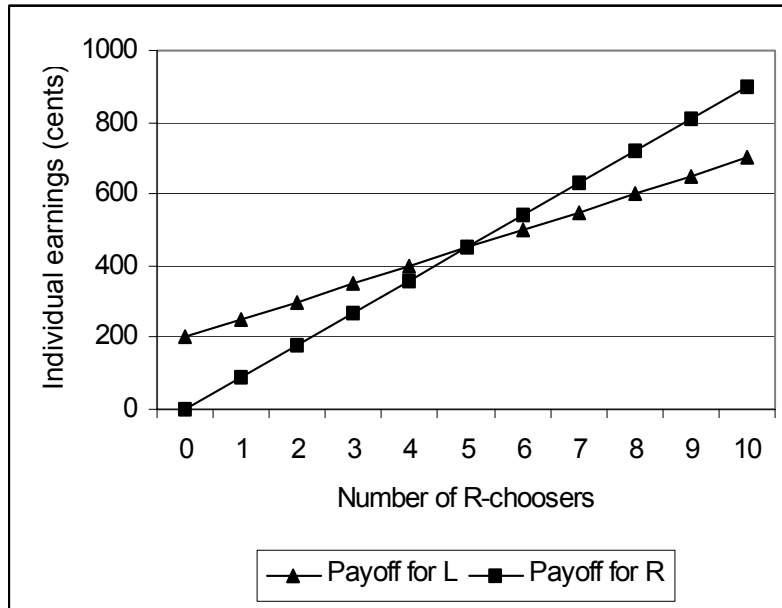
Figure 2: The 11-person crowding game



In Game 3, choosing R pays when most people choose R, and choosing L pays when most people choose L. This is a typical coordination game with positive complementarities. To contrast it with the crowding game, we call it an “affiliation game”. Game 3 has the same tipping point as Game 2: If 5 people choose R, the sixth player is indifferent between choosing R and L. Unlike Game 2, however, this equilibrium is unstable in Game 3. Every R-chooser produces positive externalities of 40 cents for every other R-chooser (see figure 3, and payoff table 3 in appendix A).¹² All-choose-L is a stable Pareto inferior equilibrium, and all-choose-R is a stable Pareto-dominant equilibrium.

¹² The payoffs for choosing L are again identical to the other two games and the difference between the payoffs of the two strategies is \$2 for the two corner solutions.

Figure 3: The 11-person affiliation game



We designed the affiliation game so that the tipping point occurs with six R-choosers, regardless of the total number of players in the game. Consequently, the *proportion* of R-choosers required to tip behavior to the Pareto-dominant equilibrium increases as group size decreases. To illustrate concretely, the tipping point requires 55% R-choices in a group of 11 players, 60% in a group of 10, 67% in a group of 9, 75% in a group of 8, and 86% in a group of 7. Given this design, we predict that coordinating on the Pareto-dominant equilibrium will be harder as group size decreases.

Table 4 summarizes the experimental design and each cell indicates the number of subjects, whose overall total equals 454 individuals.

Table 4: Experimental design (n=group size, N=number of participants)

Treatments	n=11	n=10	n=9	n=8	n=7
Game 1: Prisoner's dilemma					
Control			N=27	N=24	N=21
Sanction			N=27	N=32	N=21
Game 2: Crowding					
Control			N=27	N=24	N=21
Sanction			N=27	N=24	N=21
Game 3: Affiliation					
Control	N=33	N=30	N=27	N=24	N=28
Sanction			N=27	N=24	N=28

We had no prior belief about the particular percentage of R-choosers required to tip behavior to the Pareto-dominant equilibrium. We chose a range of group sizes hoping to identify situations where players in the game's control version would get stuck at the Pareto-inferior equilibrium, so we could test whether the subjects in the experimental group could get to the Pareto-dominant equilibrium. It turned out that groups with 11 or 10 participants (tipping points of 60 percent or lower) were able to coordinate on the Pareto-dominant equilibrium in the control version. These groups did not need the help of a penalty to coordinate their behavior. Consequently, we focused our experiments on groups with 9, 8 and 7 participants, where the control version coordinated imperfectly (or not at all) on the Pareto-dominant equilibrium.

Each game was repeated five times, which was common knowledge. Subjects were randomly allocated to new groups after each round. Due to our large group sizes, a true one-shot treatment was not possible. However, subjects did not know the code numbers of other group members at any time. The experiments were run double-blind, with neither the

experimenter nor other subjects being able to identify individual decisions.¹³ After the experimental instructions had been distributed, we also read them aloud to make sure that they were common knowledge. The experiments were run with students from various universities in the greater Boston area.¹⁴ They received a show-up fee of \$5 and earned approximately \$10 in the experiment. Their earnings in two randomly chosen rounds determined payment. The experiment took 45 minutes.

IV. RESULTS

We present our main findings in this section.

Observation 1: There is no evidence that announcing a penalty changes preferences.

Our results of Game 1 (prisoner's dilemma) support Observation 1. Figure 4 presents these results for groups of all sizes. Introducing a sanction did not increase the likelihood of choosing R, i.e. of cooperating. Indeed, cooperation in the early rounds is typically higher in the control treatment than in the penalty treatment. However, round-by-round comparisons¹⁵ do not reveal any significant differences between cooperation rates in the control and experimental groups but for round 3 in groups with 7 participants (significantly more subjects cooperated in the control than in the sanction treatment— $\chi^2=6.9$, $p<0.01$).¹⁶

¹³ The experimental procedure described in Bohnet and Frey (1999) was used. For the experimental instructions, see appendix B.

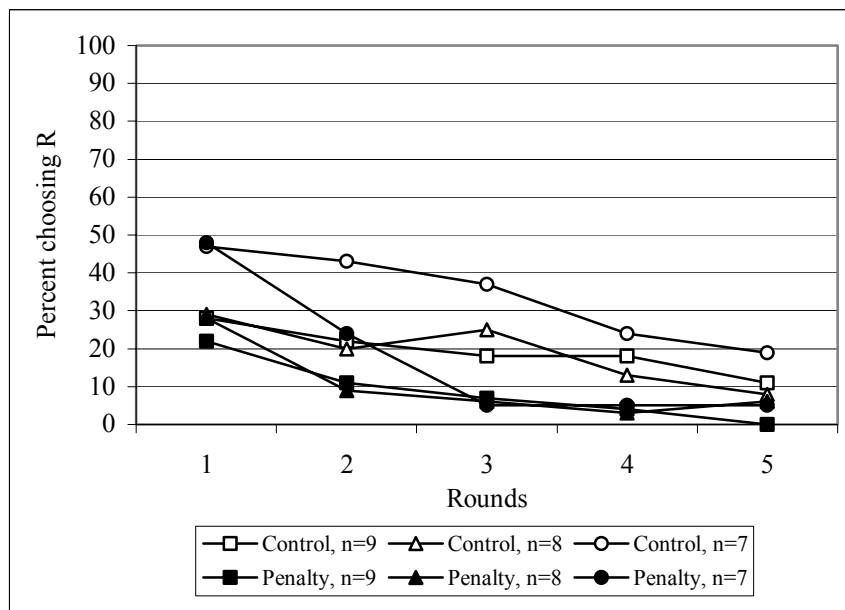
¹⁴ We thank the Harvard Business School for the recruitment of the participants. Subjects were recruited by announcements in student newspapers in various universities in the Boston area and signed up electronically for experiments.

¹⁵ We treat individual subjects as independent observations here but acknowledge that this is a second-best solution and that comparing group level data would be preferable. However, given our group sizes and our reluctance to aggregate over rounds, this would decrease our sample size most significantly, rendering any test meaningless.

¹⁶ While the differences are small, they are in line with the "crowding out" of voluntary cooperation induced by small fines found by Bohnet et al. (2001), Fehr and Gaechter (2000), Gneezy and Rustichini (2000), and more generally by Frey and Oberholzer-Gee (1997).

In the control and experimental groups, cooperation declines as players repeat the game, with cooperation approaching the equilibrium prediction. Our data looks very similar to standard repeated prisoner's dilemma games (see Ledyard 1995, Camerer 2003).

Figure 4: Percentage of R-choices in the prisoner's dilemma games

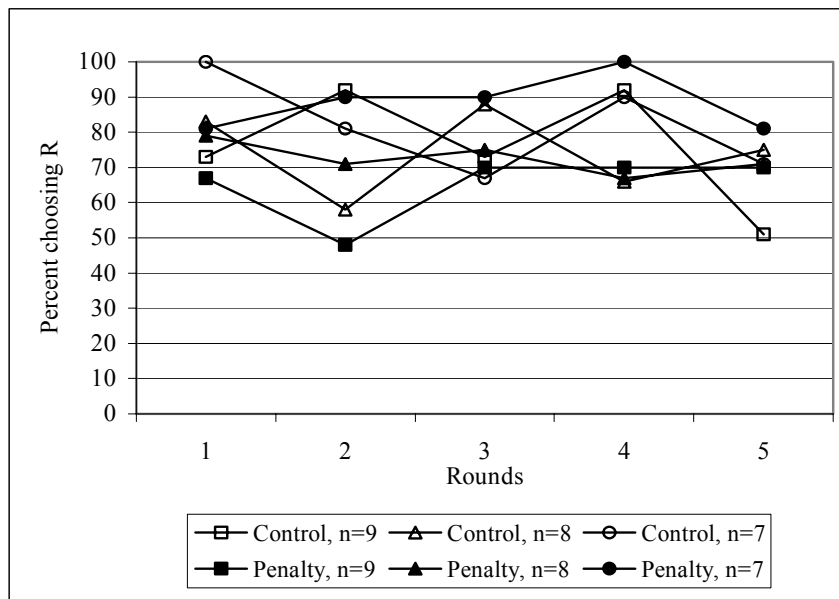


Now we turn to Game 2 (crowding), where the results also support Observation 1.

Figure 5 presents the results graphically for all groups. Announcing a small sanction does not affect aggregate behavior. Practically none of the differences are significant. (Round-by-round comparisons reveal one significant difference in round 2 of 9-person groups where more subjects choose R in the control than in the penalty treatment— $\chi^2=12.8$, $p<0.01$). All groups stay close to the equilibrium independent of the treatment and the round.¹⁷ No time trend can be observed.

¹⁷ In 9-person groups with an equilibrium point at 67% R-choices, 76% of the subjects choose R in the control and 65% in the penalty treatment on average. In 8-person groups, with the equilibrium point at 75% R-choices, 74% of the subjects choose R in the control and 73% in the penalty treatment on average. Finally, in 7-person

Figure 5: Percentage of R-choices in crowding games



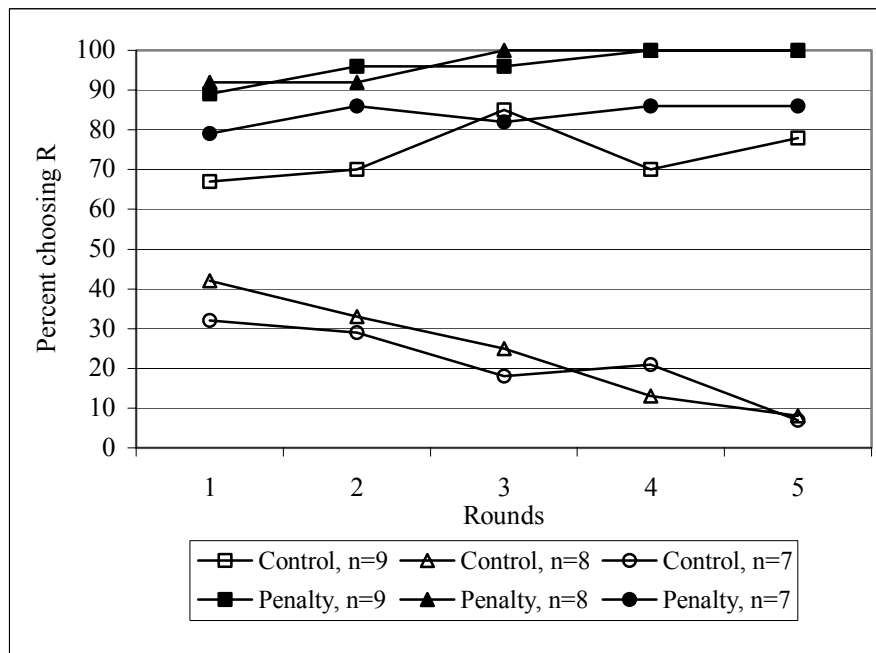
Observation 2: There is evidence that announcing a penalty changes beliefs.

Our results of Game 3 (affiliation) support Observation 2. Figure 6 presents the results for affiliation games of all group sizes. Introducing a sanction increased the likelihood of choosing R. For groups of size 7 or 8, round-by-round comparisons reveal a significantly higher likelihood of choosing R in all rounds in the sanction treatments than in the control sessions. In 7-person groups, the introduction of the sanction does not take the strategic uncertainty completely away. While the sanction significantly increases the likelihood of choosing R, there remain 4 people (out of 28) who keep choosing L in rounds 4 and 5. In 8-person groups, players coordinate on the Pareto-dominant equilibrium in the sanction treatment by round 3, while coordination fails in the control treatment. With N=9, the groups in the sanction treatment coordinate perfectly on the Pareto-dominant equilibrium by round 4, whereas the groups in the control treatment coordinate imperfectly even in rounds 4 and 5.

groups, with an equilibrium at 86% R-choices, R is chosen by 82% of the subjects in the control and by 88% in

With $N=9$, however, levels of R-choices are so high in both groups that differences between control and experimental treatments are only marginally significant (r.1: $p=0.05$, r.2: $p=0.10$, r.3: $p=0.16$, r.4: $p<0.01$, r.5: $p<0.01$).

Figure 6: Percentage of R-choices in coordination games



Observation 3: The probability of successful coordination increases as the percentage of actors required to tip behavior to the Pareto-dominant equilibrium decreases.

Recall that for groups of size 9, an interior equilibrium occurs at 67% R-choices. Round-by-round comparisons in the control treatments, as summarized in Table 5, reveal significant differences depending on whether or not the equilibrium point is above 67%. Groups with tipping points of 67% or below ($n=9$, $n=10$ or $n=11$) tend to coordinate on the Pareto-dominant equilibrium, and groups with tipping points above 67% ($n=7$ or $n=8$) tend to

the penalty treatment on average.

collapse to the Pareto-inferior equilibrium. By round 5, aggregate behavior has almost completely converged to one of the stable equilibria for all group sizes except $n=9$.

Table 5: Probability of choosing R in the coordination game (control groups)

Groups	R. 1	R. 2	R. 3	R. 4	R. 5
Size: $n=11$ - Interior equilibrium: 55%	76%	79%	82%	91%	94%
Size: $n=10$ - Interior equilibrium: 60%	77%	77%	83%	87%	97%
Size: $n=9$ - Interior equilibrium: 67%	67%	70%	85%	70%	78%
Size: $n=8$ - Interior equilibrium: 75%	42%	29%	25%	13%	8%
Size: $n=7$ - Interior equilibrium: 86%	32%	29%	18%	21%	7%

In our experiments, increasing group size makes coordination easier by decreasing the proportion of R-choosers required to tip to the Pareto-superior equilibrium. Players in our experiments correctly regard choosing R as a safer strategy when the group's size increases. But why can players coordinate merely by observing the payoffs, without a penalty or other communication? When multiple equilibria are Pareto-ranked, people may look for payoff-dominance to resolve strategic uncertainty (Harsanyi and Selten 1988, Schelling 1960).¹⁸ Experimenters have tested whether a uniquely Pareto-dominant equilibrium provides a sufficient focal point to coordinate behavior in a set of multiple equilibria. The evidence suggests that people can coordinate on the Pareto-dominant equilibrium in small groups. In larger groups (six or more members), however, coordination typically fails.¹⁹ Our

¹⁸ See for the empirical relevance of various selection criteria in coordination games, Cooper (1990) and Haruvy and Stahl (1998).

¹⁹ For the comparison between groups of 2 and 14 (or 16) members in weak-link coordination games, see Van Huyck et al. (1990), between groups of 3 and 6, Knez and Camerer (1994) and for groups of 9, Cachon and Camerer (1996). An exception to large-group coordination failures is reported by Weber (1998). He shows that when groups are started small and additional players are added slowly enough, even large groups with 12 members can avoid coordination failures.

experiments suggest that the percentage of players required for tipping determines the success or failure of coordination, not group size per se.²⁰

V. CONCLUSIONS

Predictions based on multiple equilibria are difficult to falsify, which makes coordination effects difficult to investigate in the field. Unlike field studies, our experimental design allows us to separate the effects of changes in preferences and beliefs. We compare games with unique Nash equilibria, where a sanction can only affect behavior by changing preferences, and games with multiple equilibria, where a sanction can help to select among them. In prisoner's dilemma and crowding games, which have unique Nash equilibria, we find that introducing a penalty does not measurably affect preferences. In affiliation games, which have multiple Nash equilibria, we find that such a penalty helps individuals coordinate on the Pareto-dominant equilibrium.²¹

Lawmakers often have to decide whether or not to make a law whose enforcement is ineffective. By "ineffective," we mean that the sanction's probability and severity are too low to deter wrongdoers. Instead of deterring, such laws express an evaluation. To illustrate, should the state impose a tax when the probability of enforcement is too low to deter rational people from evading it? Some studies indicate that variables other than differences in expected sanctions explain difference in tax compliance across jurisdictions.²² Specifically, the perceived likelihood that other people will pay taxes significantly affects individual

²⁰ There is a possible caveat to our interpretation: in our design, the payoff for the Pareto-dominant equilibrium increases with group size (from \$5.40 in 7-person groups to \$9.00 in 11-person groups). Compared to the constant payoff for the Pareto-inferior equilibrium of \$2.00, coordination becomes comparatively more attractive in larger groups. While the results for weak-link coordination games do not suggest that the payoff difference between the Pareto-dominant and the Pareto-inferior equilibrium matter (e.g. Van Huyck et al. 1990 versus Weber 1998), we cannot exclude the possibility that the higher payoffs in larger groups helped people coordinate on the Pareto-dominant equilibrium.

²¹ This result is corroborated by a recent study by Tyran and Feld (2002) who introduce small sanctions in a public goods game and find no increase in cooperation if the sanction is exogenously imposed.

compliance.²³ Coordination effects like those captured in our experiments may explain large differences in tax compliance from place to place.

Similarly, police seldom enforce laws against smoking in public buildings or littering in public places, yet most people obey these laws in some countries and not in others. Field studies suggest that people are less likely to litter in a clean environment where most others do not litter, again suggesting a coordination game (Cialdini et al. 1990). Similar arguments may apply to large differences in compliance with laws governing speeding on the highway, jaywalking, shop-lifting, or riding public transportation without paying.

Our experiments suggest an answer to the question of whether or not lawmakers should enact non-detering laws. Enacting a law with non-detering sanctions is most likely to change behavior when the underlying normative system has positive complementarities that cause multiple equilibria. In these circumstances, introducing a non-detering penalty can cause large jumps in behavior from one equilibrium to another. Without positive complementarities, non-detering laws have no lasting effects.

Whereas we have been discussing laws that coordinate *without* deterring, in the usual case laws coordinate *and* deter. To illustrate, based on the General Social Survey data from 1972-1994, Glaeser and Glendon (1998) find that strategic complementarity is one of the key causes of gun ownership. Violence and gang membership among youth depends on fear and the need for self-defence, i.e. on the likelihood of others being violent. Coordinating around a

²² See Andreoni (1998) for a survey of the literature on tax morale and a discussion and rejection of arguments that the expected fine or risk aversion can account for the observed tax compliance.

²³ See Gordon (1989) for a theoretical model in the spirit of Akerlof (1980), where the proportion of the population believed to consider evasion to be morally wrong determines the psychic cost of evasion, Pommerehne et al. (1994) for simulation results where tax compliance depends, among other things, on the likelihood that others have paid their taxes in the previous period, Posner (2000a) for the role of the social norm and compliance, and Sheffrin and Triest (1992) who analyze the 1987 Taxpayer Opinion Survey and find that perceiving other taxpayers as dishonest significantly decreases tax compliance. They argue: "Suppose, for example, that individuals who do not fully comply with the tax code experience more utility if aggregate noncompliance is higher. Perhaps this is because the guilt or stigma from noncompliance is eased when others are perceived to not comply as well. In this case, the relationship between individual and aggregate noncompliance can cause multiple equilibria." (p. 195)

lower level of gun ownership and violence thus requires a true belief that others will reduce gun ownership and violence. Recognizing this fact, researchers and public officials implemented a strategy in the "Boston Gun Project" consisting of more law enforcement, which deterred, and more public information about law enforcement, which coordinated. This prescription apparently created a true belief that others would have fewer guns and commit less violence, which created a new equilibrium (Piehl et al. 2000).

Our results bear on a disagreement among legal scholars about how law causes social change, such as the decrease in racial discrimination in the U.S. Some scholars argue that law has an “expressive function” that changes behavior,²⁴ whereas other scholars deny that law has much influence on such phenomena as racial discrimination.²⁵ Our research suggests that law changes society by changing beliefs more than preferences. According to this logic, laws imposing desegregation in the southern states may have changed behavior by changing beliefs about the willingness of others to integrate. Whereas beliefs changed relatively quickly, preferences probably changed relatively slowly.

When lawmakers create a new law, people sometimes coordinate around it and make large changes in behavior, which increases respect for law and the credibility of lawmakers. Lawmakers establish credibility and respect by enacting laws that cause people to change their true beliefs about the behavior of others. Sometimes, however, lawmakers create a new law and people quickly collapse back into their former behavior, which undermines respect for law and the credibility of lawmakers. Predicting whether or not people will coordinate around a new law requires information about non-marginal behavior, whereas deterrence only requires information about marginal behavior. Consequently, using law to coordinate requires lawmakers to understand citizens very well. To illustrate, tax administrators must

²⁴ See e.g. Cooter 1998, Ellickson 1996, McAdams 2000, Posner 2000b, Sunstein 1996.

²⁵ Rosenberg (1993) argues that, e.g. *Brown v. Board of Education*, failed to integrate southern schools. For other skeptical perspectives, see Adler (2000) and Anderson and Pildes (2000).

know whether people perceive taxation as a coordination game with multiple equilibria or a public goods game with a dominant strategy to defect. The effect of legal sanctions depends on the games people think they play.

Appendix A

Table 1: Payoff Table for the prisoner's dilemma game (n=11)

Number of Persons choosing L	Outcome for L (cents)	Number of Persons choosing R	Outcome for R (cents)
0	--	11	500
1	700	10	450
2	650	9	400
3	600	8	350
4	550	7	300
5	500	6	250
6	450	5	200
7	400	4	150
8	350	3	100
9	300	2	50
10	250	1	0
11	200	0	--

Table 2: Payoff table for the crowding game (n=11)

Number of Persons choosing L	Outcome for L (cents)	Number of Persons choosing R	Outcome for R (cents)
0	--	11	500
1	700	10	490
2	650	9	480
3	600	8	470
4	550	7	460
5	500	6	450
6	450	5	440
7	400	4	430
8	350	3	420
9	300	2	410
10	250	1	400
11	200	0	--

Table 3: Payoff table for the coordination game (n=11)

Number of Persons choosing L	Outcome for L (cents)	Number of Persons choosing R	Outcome for R (cents)
0	--	11	900
1	700	10	810
2	650	9	720
3	600	8	630
4	550	7	540
5	500	6	450
6	450	5	360
7	400	4	270
8	350	3	180
9	300	2	90
10	250	1	0
11	200	0	--

Appendix B

Sample instructions for the sanction treatment in an 8-person coordination game

Welcome to this research project!

You are participating in a study in which you have the opportunity to earn cash. The actual amount of cash you will earn depends on your choices and the choices of the other persons in the study. At the end of the study, two rounds will be randomly selected and the amount you earned in these rounds will be added to the show-up fee of \$5. In addition to these instructions, you receive an envelope containing

- a Code Number Form
- a Decision Form marked with your code number
- an envelope marked with your code number

What the study is about:

The study is on how people decide. You and 7 other persons have to choose between two alternatives, L and R. The payoff table tells you how much money you earn depending on what you choose and what the 7 other persons choose.

How the study is conducted:

The study is conducted anonymously and repeated five rounds. Participants are only identified by "code numbers". In order to guarantee privacy and anonymity, do not show anyone your code number! You are randomly matched with 7 persons present in this room in each round.

START

The table reads as follows:

If you and all other persons choose R, each of you earns 630 cents.

If 1 person chooses L and 7 persons R, choosing L earns 570 cents and choosing R 540 cents.

If 2 persons choose L and 6 persons R, choosing L earns 520 cents and choosing R 450 cents.

...

...

If 6 persons choose L and 2 persons R, choosing L earns 320 cents and choosing R 90 cents.

If 7 persons choose L and 1 person R, choosing L earns 270 and choosing R 0 cents.

If you and all other persons choose L, each of you earns 220 cents.

Payoff Table

Number of Persons choosing L	Outcome for L (cents)	Number of Persons choosing R	Outcome for R (cents)
0	--	8	630
1	570	7	540
2	520	6	450
3	470	5	360
4	420	4	270
5	370	3	180
6	320	2	90
7	270	1	0
8	220	0	--

Note: Choosing L will be punished. The penalty for choosing L instead of R is 200. This penalty will be enforced with a probability of 0.1.

Procedure:

The same procedure is repeated in all rounds.

Round 1:

Please carefully read the payoff table before making a choice. Indicate your choice for Round 1, L or R, on the decision form, put it back into the envelope and then into the box, which we will pass around.

We will now determine whether the penalty will be enforced or not. There is a deck of 9 black and 1 red card. An experimental aide will pick a card. If the card is black, the penalty will not be enforced. If the card is red, the penalty will be enforced. End of round 1.

We will now determine your earnings according to your choice and the choices of the other persons, and privately inform each of you how much money you earned in this round. For this purpose, we will again pass the box around. Please take the envelope marked with your code number out of the box. It contains the decision form now also indicating your earnings. Do not tell or show anybody else your result.

The following four rounds:

The exact same procedure as in Round 1 will be repeated in the following four rounds. You are randomly matched with 7 persons in this room. Please indicate your choice for 'Round 2' on the decision form, put it into the envelope and then into the box which we will pass around. We will then determine whether the penalty will be enforced or not. Your earnings will be computed again and you will be privately informed how much money you earned in this round.

At the end of the study, we will randomly decide which two rounds are relevant for your payment. You are informed on this. For your own records, please write down how much you earned in this study. Please put the decision form back into the envelope and then into the box. Keep your code number form!

END OF THIS STUDY. You are invited to collect your earnings right after the experiment by presenting your code number form. Your earnings will be in a sealed envelope marked with your code number.

If you have any questions, please address them to Iris_Bohnet@Harvard.edu

We thank you for participating in the study.

REFERENCES

- Adler, Matthew D. (2000). Expressive Theories of Law: A Skeptical Overview. 148 *University of Pennsylvania Law Review*: 1363-1431.
- Akerlof, George A. (1980). A theory of social custom of which unemployment may be one consequence. *Quarterly Journal of Economics* 94: 749-795.
- Anderson, Elizabeth and Richard H. Pildes (2000). Expressive Theories of Law: A General Restatement. 148 *University of Law Review*: 1503-1575.
- Andreoni, James (1995). Warm-glow versus cold-prickle: The effects of positive and negative framing on cooperation in experiments. *Quarterly Journal of Economics* CX(1): 1-21.
- Andreoni, James, Brian Erard and Jonathan Feinstein (1998). Tax Compliance. *Journal of Economic Literature* 36(June): 818-860.
- Bohnet, Iris and Bruno S. Frey (1999). The sound of silence in prisoner's dilemma and dictator games. *Journal of Economic Behavior and Organization* 38: 43-58.
- Bohnet, Iris, Bruno S. Frey and Steffen Huck (2001). More Order With Less Law: On Contract Enforcement, Trust and Crowding. *American Political Science Review* 95(1): 131-144.
- Brandts, Jordi and W. Bentley MacLeod (1995). Equilibrium Selection in Experimental Games with Recommended Play. *Games and Economic Behavior* 11: 36-63.
- Brewer, Marilyn B. and Roderick M. Kramer (1986). Choice Behavior in Social Dilemmas: Effects of Social Identity, Group Size and Decision Framing. *Journal of Personality and Social Psychology* L: 543-549.
- Cachon, Gerard P. and Colin F. Camerer (1996). Loss avoidance and forward induction in experimental coordination games. *Quarterly Journal of Economics* 111: 165-194.
- Camerer, Colin F. (1995). Individual Decision Making. In: John H. Kagel and Alvin Roth (eds.). *Handbook of Experimental Economics*. Princeton: Princeton University Press.
- Camerer, Colin F. (2003). *Behavioral Game Theory*. Russell Sage Foundation, New York, and Princeton, Princeton University Press.
- Charness, Gary (1998). Pre-Play Communication and Credibility: A Test of Aumann's Conjecture. Working paper. Universitat Pompeu Fabra.
- Cialdini, Robert B., Raymond R. Reno and Carl A. Kallgren (1990). A Focus Theory on Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places. *Journal of Personality and Social Psychology* 34: 907-914.
- Cooper, Russell W., Douglas V. DeJong, Robert Forsythe and Thomas W. Ross (1990). Selection Criteria in Coordination Games: Some Experimental Results. *American Economic Review* 80: 218-233.
- Cooper, Russell W., Douglas V. DeJong, Robert Forsythe and Thomas W. Ross (1992). Communication in Coordination Games. *Quarterly Journal of Economics* 53: 739-771.
- Cookson, R. (2000). Framing Effects in Public Goods Experiments. *Experimental Economics* 3(1): 55-79.
- Cooter, Robert D. (1998). Expressive Law and Economics. *Journal of Legal Studies* XXVII(2): 585-608.
- Cooter, Robert D. (2000). Do good laws make good citizens? An economic analysis of internalized norms. *Virginia Law Review* 86(8): 1577-1601.
- Cooter, Robert D. and Thomas Ulen (1999). *Law and Economics*. New York: Addison Wesley, 3rd edition.
- Ellickson, Robert (1996). Law and Economics Discovers Social Norms. *Journal of Legal Studies* 27: 537-552.

- Farrell, Joseph and Matthew Rabin (1996). Cheap Talk. *Journal of Economic Perspectives* 10: 103-118.
- Fehr, Ernst and Simon Gächter (2000). Do incentive contracts crowd out voluntary cooperation? Working paper. Institute for Empirical Economic Research, University of Zürich.
- Fehr, Ernst and Klaus Schmidt (2001). "Theories of Fairness and Reciprocity -- Evidence and Economic Applications." Institute for Empirical Research in Economics Working paper #75, 2001, University of Zürich.
- Fleishman, John A. (1988). The Effects of Decision Framing and Other's Behavior on Cooperation in a Social Dilemma. *Journal of Conflict Resolution* XXXII: 162-180.
- Frey, Bruno S. and Felix Oberholzer-Gee (1997). The Costs of Price Incentives: An Empirical Analysis of Motivation Crowding Out. *American Economic Review* 87(September): 747-755.
- Frohlich, Norman and Joe Oppenheimer (1998). Some consequences of e-mail vs. face-to-face communication in experiments. *Journal of Economic Behavior and Organization* 35: 389-403.
- Glaeser, Edward L. and Spencer Glendon (1998). Who Owns Guns? Criminals, Victims, and the Culture of Violence. *American Economic Review* 88(2): 458-463.
- Gneezy, Uri and Aldo Rustichini (2000). Pay Enough or Don't Pay at All. *Quarterly Journal of Economics* 115(August): 791-810.
- Gordon, James P.F. (1989). Individual Morality and Reputation Costs as Deterrents to Tax Evasion. *European Economic Review* 33(4): 797-805.
- Hay, Jonathan R. and Andrei Shleifer (1998). Private Enforcement of Public Laws: A Theory of Legal Reform. *American Economic Review* 88(2): 398-403.
- Harbaugh, William T., Kate Krause and Lise Vesterlund (2003). Prospect Theory in Choice and Pricing Tasks. Mimeo. University of Pittsburgh.
- Harsanyi, John and Reinhard Selten (1988). *A General Theory of Equilibrium Selection in Games*. Cambridge: MIT Press.
- Haruvy, Ernan and Dale O. Stahl (1998). An empirical model of equilibrium selection in symmetric normal-form games. University of Texas Department of Economics working paper.
- Kahneman, Daniel and Amos Tversky (1979). Prospect theory: An analysis of decision under risk. *Econometrica* 47: 263-291.
- Knez, Marc and Colin Camerer (1994). Creating expectational assets in the laboratory: Coordination in weakest-link games. *Strategic Management Journal* 15: 101-119.
- Ledyard, John O. (1995). Public Goods: A Survey of Experimental Research. In: John H. Kagel and Alvin Roth (eds.). *Handbook of Experimental Economics*. Princeton: Princeton University Press, 111-194.
- McAdams, Richard H. (2000). A Focal Point Theory of Expressive Law. *Virginia Law Review* 86: 1650-1729.
- Messick, David, S. Allison and C. Samuelson (1993). Framing and communication effects on group members' responses to environmental and social uncertainty. In Maital, S. and S.L. Maital (eds.). *Economics and Psychology*. Aldershot: Edward Elgar.
- Piehl, Anne Morrison, David M. Kennedy and Anthony Braga (2000). Problem Solving and Youth Violence: An Evaluation of the Boston Gun Project. *American Law and Economics Review* 2(1): 58-106.
- Pommerehne, Werner W., Albert Hart and Bruno S. Frey (1994). Tax Morale, Tax Evasion and the Choice of Policy Instruments in Different Political Systems. *Public Finance* 49(Supplement): 52-69.

- Posner, Richard A. (1998). *Economic analysis of law*. New York, Aspen Law & Business, 5th edition.
- Posner, Eric A. (2000a). Law and Social Norms: The Case of Tax Compliance. *Virginia Law Review* 86: 1781-1820.
- Posner, Eric A. (2000b). *Law and Social Norms*. Cambridge: Harvard University Press.
- Rabin, Matthew (2000). Risk-aversion for small stakes: A calibration theorem. *Econometrica* 68: 1281-1292.
- Raz, Joseph (1980). *The Concept of a Legal System*. Oxford: Clarendon University Press.
- Rosenberg, Gerald (1993). *The Hollow Hope: Can Courts Bring About Social Change?* Chicago: University of Chicago Press.
- Ross, Lee and Andrew Ward (1996). Naïve Realism in Everyday Life: Implications for Social Conflict and Misunderstanding. In: Brown, T., E. Reed and E. Turiel (eds.). *Values and Knowledge*. Hillsdale, NJ: Erlbaum: 103-135.
- Rutte, Christel G., H.A.M. Wilke and David M. Messick (1987). The Effects of Framing Social Dilemmas as Give-Some or Take-Some Games. *British Journal of Social Psychology* XXVI: 103-108.
- Sally, David (1995). Conversation and cooperation in social dilemmas. *Rationality and Society* 7(1): 58-92.
- Schelling, Thomas (1960). *The Strategy of Conflict*. Oxford: Oxford University Press.
- Sheffrin, Steven M. and Robert K. Triest (1992). Can Brute Deterrence Backfire? Perceptions and Attitudes in Taxpayer Compliance. In: Slemrod, Joel (ed.). *Why People Pay Taxes*. Ann Arbor: University of Michigan Press.
- Sonnemans, Joep, Arthur Schram and Theo Offerman (1998). Public good provision and public bad prevention: the effect of framing. *Journal of Economic Behavior and Organization* 34: 143-161.
- Sunstein, Cass (1996). On the Expressive Function of the Law. 144 *University of Pennsylvania Law Review*: 2021-2031.
- Tversky, Amos and Daniel Kahneman (1986). Rational choice and the framing of decisions. *Journal of Business* 59: S251-S278.
- Tyran, Jean-Robert and Lars P. Feld (2002). Why People Obey the Law: Experimental Evidence from the Provision of Public Goods. Working paper. University of St. Gallen.
- Van Huyck, John B., Raymond C. Battalio and Richard O. Beil (1990). Tacit Coordination Games, Strategic Uncertainty, and Coordination Failure. *American Economic Review* 80(1): 234-248.
- Van Huyck, John B., Ann B. Gillette and Raymond Battalio (1992). Credible Assignments in Coordination Games. *Games and Economic Behavior* 4: 606-626.
- Weber, Roberto (1998). Coordination problems in growing firms: Insights from experiments. Working paper. Carnegie Mellon University.
- Wilson, Rick K. and Carl M. Rhodes (1997). Leadership and Credibility in N-Person Coordination Games. *Journal of Conflict Resolution* 41(6): 767-791.