Wording and gender effects in a Game of Chicken. An explorative experimental study

Marie-Laure Cabon-Dhersin, Nathalie Etchart-Vincent

Wording and gender effects in a Game of Chicken
An explorative experimental study

Marie-Laure Cabon-Dhersin[1] Nathalie Etchart-Vincent[2]

Abstract:
In this short paper, we run an experiment to investigate the influence of a very basic change in the labelling of the strategies on cooperative behaviour in a *standard* Game of Chicken. Our between-subject experimental design involves two treatments. The only difference between them is that we introduce either a socially-oriented wording ('I cooperate'/'I do not cooperate') or colours (Red/Blue) to designate strategies. Our study replicates the findings obtained in a previous experimental study based on a Game of Chicken framework with incomplete information and a within-subject design: the level of cooperation appears to be higher in the socially-oriented context, due to a change in women behaviour only.

JEL classification: C72, C92

Keywords: social dilemma, Game of Chicken, cooperation, label framing effects, wording effects, gender effects

[1] CREAM & UFR Droit, Sciences Economiques et Gestion - Université de Rouen, 3 avenue Pasteur, 76100 Rouen.
[2] Centre National de la Recherche Scientifique (CNRS) & Centre d'économie de la Sorbonne (CES). Correspondence: Nathalie Etchart-Vincent, CES, Ecole Normale Supérieure de Cachan, 61, Avenue du Président Wilson, 94235 Cachan Cedex, France; Tel: (+33) 1 47 40 74 59; Email: nathalie.etchart-vincent@ens-cachan.fr

1. Introduction

The Game of Chicken (GC), also called the Hawk-Dove game, aims at capturing a kind of social dilemma that can be seen as more appropriate for investigating cooperative behaviour than the prisoner's dilemma game (PDG) (Thaler and Camerer, 2003). An archetypical GC situation is the car race with two drivers driving toward each other from opposite directions (see for instance Madani, 2010). Both drivers wish to avoid swerving, since the first one to swerve appears to be the "chicken" of the game. But death is even worse than shame, and the worst outcome is death for both drivers if none of them swerves and crash finally occurs.

To put it in more general words, the GC resembles the PDG in that it makes bilateral cooperation more profitable than bilateral defection, but differs from the PDG in that it makes bilateral (instead of unilateral) defection the worst outcome (see Boffa and Olarreaga, 2012 for instance). Moreover, while in a PDG it is never rational to cooperate (i.e. defection is the dominant strategy), in a GC a player has interest to cooperate if she expects her partner to defect (even though she will be declared the "chicken" of the game by doing so).

Many social, political and economic situations can be described using a GC payoff structure, such as military or political conflict (Snyder, 1971; Stone, 2001), environmental and climate negotiations (Carraro and Siniscalco, 1993; DeCanio and Fremstad, 2011; Ward, 1993), management of environmental resources (Madani, 2010), international trade agreements (Boffa and Olarreaga, 2012), interactions on the labour market (Cason and Sharma, 2007) and even parental investment (Kanazawa and Still, 2000). However, despite its interesting descriptive properties, GC-type choice situations have not been much investigated, be it theoretically or empirically, as compared to the PDG (see however Neugebauer *et al*., 2008 or Skyrm and Zollman, 2010 for recent analyses).

In this paper, we are interested in framing, and especially in 'label' framing, which refers to the manipulation of wording and labelling. In interactive settings, several characteristics of the choice situation allow frame manipulation in terms of wording and labelling, such as game's title, game's characterization, players' strategies and players' type. A quite general empirical result is that people tend to exhibit a more cooperative behaviour in the presence of socially-oriented wording/labelling (see Rege and Telle, 2004 and Zhong *et al*., 2007 for references). Moreover, this effect appears to be gender-dependent: most of the time, women seem to be more sensitive than men to the wording/labelling effect (e.g. Andreoni and Vesterlund, 2001; Eckel and Grossman, 1998; Harvey *et al*., 1997). So, the peculiar purpose of the present experimental research is to use a standard GC payoff structure to investigate whether, and in what direction, a very basic change in the labelling of the strategies is likely to affect cooperative behaviour, and whether such framing effect is gender-dependent or not.

In another paper (Cabon-Dhersin and Etchart-Vincent, 2013), we report a similar-in-spirit experimental study based on a one-shot GC under incomplete information (Cabon-Dhersin and Ramani, 2007) and a within-subject design. Thus, a major rationale for this explorative study is methodological and follows from the replicability principle on which experimental knowledge is based: investigate whether the gender-dependent framing effect that we observed previously is robust to the use of a more basic theoretical setting (a *standard* GC as described below) and change in the experimental design (use of a *between-subject* design).

As in our previous study, both a (baseline) context-free setting and a socially-oriented setting were introduced. The only difference between the two was a slight change in the labelling of strategies: in the context-free setting, strategies were labelled neutrally using

colours ("play red/play blue")[3], while in the socially-oriented setting, they were labelled with an explicit reference to cooperation (as "I cooperate/I do not cooperate"). Wording manipulation was deliberately circumscribed to the labelling of strategies, in order to capture and isolate the influence of the word 'cooperation' (which can be viewed as a socially and morally strongly connoted word, but is still only a single word) on cooperative behaviour, *all other things being equal*. Our results suggest that (i) subjects tend to cooperate more than theoretically predicted in both treatments (ii) the socially-oriented setting induces a slightly more cooperative behaviour than the context-free treatment; (iii) no gender effect seems to be at play in the neutral setting, while women appear to cooperate somewhat more than men in the socially-oriented setting.

2. The Game of Chicken

In the GC, the players have to choose (independently from each other) whether to cooperate (*c*) or to defect (*d*). With *X* the cooperative outcome (resulting from bilateral cooperation), *Y* the defection outcome (resulting from bilateral defection), *H* the free-riding payoff (the payoff of the defective partner in case of unilateral defection) and *L* the sucker payoff (the payoff of the "chicken" in case of unilateral cooperation) the usual conditions defining a game of chicken are $H > X > L > Y$ (Figure 1, left table).

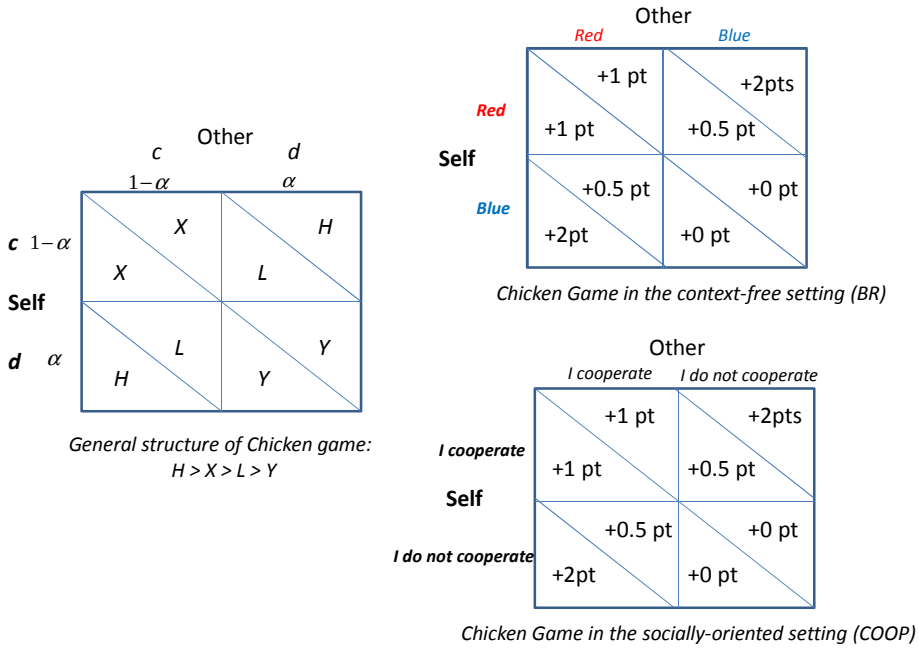

Figure 1: *The general GC payoff structure and the peculiar GC payoff structure used in the two treatments*

It is worth noticing that the payoff structure of the (one-shot) GC makes cooperation possible, while the payoff structure of the (one-shot) PDG prevents the emergence of cooperation by making defection the dominant strategy. GC displays two asymmetric pure-strategy Nash equilibria (*c*, *d*) and (*d*, *c*) and one mixed-strategy equilibrium in which each player mixes *c* and *d* with probability $(1 - \alpha)$ and α respectively. The expected payoff of

[3] We are fully aware that colours may be considered as non-neutral, even though we are not the first to use colours to label strategies (see for instance Chaudhuri *et al.*, 2002; Kotani et al., 2008; and the references in Zhong *et al.*, 2007). This point is discussed further in Cabon-Dhersin and Etchart-Vincent (2013).

cooperation is $(1 - \alpha)X + \alpha L$, while the expected payoff of defection is $(1 - \alpha)H + \alpha Y$. Hence, each player's optimum strategy is to cooperate if $(1 - \alpha)X + \alpha L > (1 - \alpha)H + \alpha Y$, i.e. if $\alpha > \frac{H - X}{(H - X) + (L - Y)}$.

If we define the best-reply correspondence $h(\alpha)$ of each player as the optimum probability of playing the defective strategy depending on α, then $h(\alpha)$ is given by:

$$h(\alpha) = \begin{cases} 1 \quad if \ \alpha < \dfrac{H - X}{(H - X) + (L - Y)} \\ (0;1) \quad if \ \alpha = \dfrac{H - X}{(H - X) + (L - Y)} \\ 0 \quad if \ \alpha > \dfrac{H - X}{(H - X) + (L - Y)} \end{cases}$$

A symmetric mixed-strategy equilibrium is given by a pair of probabilities (α^*, α^*) such that $\alpha^* \in h(\alpha^*)$. Only three equilibria are possible, namely (0,1), (1,0) and (α^*, α^*). Note that the mixed-strategy equilibrium can also be viewed as the result of the aggregation of individual *pure* strategies, with a proportion $(1 - \alpha^*)$ of players choosing *c* and a proportion α^* of players choosing *d* (Oechssler, 1997).

3. Experimental design

For our exploration study, two very simple questionnaires were built, involving a single interactive decision each, and displayed as a matrix of gains depending on each partner's choice. Both were based on a one-shot GC. The corresponding payoff matrices are given on Figure 1 (right tables, up and down). The only difference between the questionnaires is a slight change in the labelling of the (cooperative/defective) strategies, which were designated as 'red'/'blue' in the context-free (baseline) treatment (as in Chaudhuri *et al*., 2002), and as 'I cooperate'/'I do not cooperate' in the socially-oriented treatment. In the following, the context-free treatment will be denoted BR, while the socially-oriented treatment will be denoted COOP.

Note that, contrary to what is done in most experimental designs (including our former one), our choice situations did not involve monetary payoffs. We expected our subjects (young university students) to be more familiar with (and more sensitive to) grades than small amounts of money. So the payoffs in the matrices were given in terms of the extra-grade they could get in their final evaluation of the course during which the experiment was run, depending on their behaviour as well as on the behaviour of their partner in the game.

An obvious ethical impediment prevented us from implementing real payments. Nevertheless, before filling in the questionnaire, the subjects were asked to make their decision as if the choice situation was to be played for real, partnering another participant. We all the more expected the possibility for extra-grades to be vivid for the subjects, be they real of hypothetical, since the experiment was run in the same session as a graded test, and just before the test itself[4].

[4] The subjects' attitude during the experiment confirms that they were already under stress (due to the real test coming after the experimental session), and actually highly concerned with the possibility – be it real or hypothetical – of getting an extra grade. Moreover, a similar level of cooperation was observed as in previous experimental studies based on a GC framework with real monetary incentives (Butler *et al* 2011; Zizzo and Tan, 2007), which suggests that our experimental design succeeded in capturing *real* behaviour.

Facing the matrix of gains in COOP (resp. BR), each subject had to decide whether to cooperate (resp. play red) or not cooperate (resp. play blue), taking into account that her hypothetical fellow player had to make her own decision at the same time. She was made aware that (i) if both she and her partner cooperated (played red), both would get 1 extra point to their final grade; (ii) if both she and her partner did not cooperate (played blue), both would get no extra point to their final grade; (iii) if she cooperated (played red) while her fellow partner did not cooperate (played blue), she would get 0.5 extra point to her final grade, while her partner would get 2 extra points to her final grade; (iv) if she did not cooperate (played blue), while her fellow partner cooperated (played red), she would get 2 extra points to her final grade, while her partner would get 0.5 extra point to her final grade. The subjects were also reminded to consider that their hypothetical partner in the game was facing the same decision to make. Before answering the questionnaire, the subjects were given written and oral instructions, and invited to call upon the experimenter if they had any questions. Then, they were encouraged to make their decision at their own pace. Each subject/questionnaire was identified using a number, to ensure her anonymity.

The experiment was conducted in two different French institutions, namely a university (in Rouen) and a Grande Ecole (Ecole Normale Supérieure de Cachan, ENS Cachan in the following). A between-subject design was used: *in each location*, half subjects answered the BR (resp. COOP) questionnaire. Naturally, participants to the BR session did not have the possibility to communicate with those to the COOP session.

156 subjects participated in the experiment: 76 in Rouen (38 in each treatment BR and COOP) and 80 in Cachan (40 in each treatment). In Rouen, the sample included 38 males and 38 females; in Cachan, it included 40 males and 40 females. So, on the whole, our sample is both gender-balanced (with 78 males and 78 females) and treatment-balanced (with 78 subjects in BR and 78 subjects in COOP). All the subjects were graduate students in Economics; all of them were aware of game theory and decision theory, but they did not know the Game of Chicken at the time of the experiment. All were between 22 and 23 years old.

In each location, subjects were allocated to the BR or COOP session on a random basis, which ensured homogeneity across BR and COOP groups and allows us to consider that they were drawn from the same population. On the other hand, there might be significant heterogeneity *between* Rouen data and Cachan data, so we had to test for it before pooling the data. Even though some heterogeneity actually exists across locations[5], it never reaches statistical significance[6]. So the data were pooled for the purpose of statistical analysis.

4. Results

An overview of our experimental results is given in Table 1. In the following, we first compare the observed proportion of cooperative choices with the theoretically expected one (33%[7]), before turning to the comparison between behaviour in BR and behaviour in COOP among the whole population of subjects as well as among males and females separately.

[5] This point is discussed in Section 5.

[6] We tested for behavioural differences between Cachan and Rouen on the whole set of data as well as on subsets of data organized by either session BR/COOP or gender. Statistical results are available upon request.

[7] The theoretical proportion of cooperative choices $(1 - \alpha^*)$ is equal to $1 - \frac{H - X}{(H - X) + (L - Y)}$.

		Female N = 78	Male N = 78	Pooled N = 156	Female vs. Male
BR	N = 78	38	40	78	
	% Coop. choices	52.63%	37.50%	44.87%	
	BR vs. Theory (*p-value*)	**0.012**	0.576	**0.031**	
	BR (*p-value*)				0.175
COOP	N = 78	40	38	78	
	% Coop. choices	72.50%	47.36%	60.25%	
	COOP vs. Theory (*p-value*)	**<0.0001**	0.066	**<0.0001**	
	COOP (*p-value*)				**0.019**
BR vs. COOP (*p-value*)		0.064	0.376	**0.051**	

Table 1: *A synthetic overview of the experimental results*

4.1. Observed vs. predicted level of cooperation: a gender effect

The theoretically expected proportion of cooperative choices is 33%. A proportion test[8] shows that subjects cooperated more than predicted in BR (*p-value*: 0.031) and in COOP (*p-value* < 0.0001). Now, when looking at men' and women' data separately, it appears that men did not cooperate more than theoretically expected in BR (*p-value*: 0.576) while they tended to cooperate more than expected in COOP with a nearly significant difference between the two (*p-value*: 0.066), suggesting a slight indirect framing effect. By contrast, women appear to cooperate significantly more than theoretically expected both in BR (proportion test, *p-value*: 0.012) and COOP (*p-value* < 0.0001). This first set of results suggests that the observed tendency of our subject pool to cooperate more than theoretically predicted is actually mostly driven by women' behaviour.

4.2. Observed level of cooperation in BR vs. COOP: a gender-dependent framing effect

As expected, a framing effect seems to be at play on the whole set of data, with more cooperation in COOP than in BR, even though it does not fully reach significance (*p-value*: 0.051). Making the social background of the interactive choice situation explicit (through the use of the word 'cooperation') tends to promote cooperative behaviour as compared to a more neutral labelling.

Now, when comparing men' behaviour across treatments BR and COOP directly, no difference occurs (*p-value*: 0.376), while the difference in women' behaviour across treatments nearly reaches significance (*p-value*: 0.064). The slight gender-dependency of the observed framing effect is confirmed with even more strength when comparing men and women behaviour in BR and COOP separately: women did not cooperate more than men in

[8] Because similar results obtain using Fisher exact tests and Chi-Square tests, only proportion tests are reported in the paper. Other tests' results are available upon request.

BR (*p-value*: 0.175), while they significantly did in COOP (*p-value*: 0.019). This result suggests that women are sensitive to the use of the socially-connoted word 'cooperation', while men are not. Once again, this finding is not insignifiant from a methodological point of view: the fact that the seemingly general framing effect is actually entirely driven by women behaviour pleads for a systematic investigation of gender effects when investigating interactive behaviour.

5. Discussion and conclusion

Even though (deliberately) based a very simple experimental design as well as on a slight frame manipulation (that makes our test quite conservative), the present experimental study qualitatively replicates the flavour of the results that we obtained in a more sophisticated previous study (Cabon-Dhersin and Etchart-Vincent, 2013). First, subjects tend to cooperate more than theoretically predicted, and among them, women tend to be more prone to cooperation than men. Second, the 'word' cooperation appears to be powerful enough to enhance cooperative behaviour, but only among females. The robustness of these results to the change in most experimental features reassuringly suggests that they are not an experimental artefact, but rather genuine behavioural features.

The power of the word 'cooperation' may be due to its normative appeal (Biel and Thogersen, 2007): making the social background of strategic decisions explicit may have induced among the COOP subjects a 'perception shift' from payoff-maximizing considerations (those that arise spontaneously in interactive choice situations, i.e. those that occurred in the BR treatment) to social considerations. On the other hand, if we consider social frames as coordination devices between people (Ellingsen *et al*. 2012), the use of the word 'cooperation' may have affected subjects' beliefs and expectations as regards others' behaviour, which in turn may have influenced their own behaviour (Dufwenberg *et al*., 2011)[9].

Now, regarding gender differences in interactive behaviour in general, as well as the gender-dependent influence of labelling in particular, several explanations may be raised. First, gender differences in behaviour may be due to gender differences in terms of risk attitude. Indeed, women have generally been shown to be more risk averse than men. Since, in a Game of Chicken, cooperation is the safer choice (Butler *et al*., 2011)[10], women are expected to cooperate more than men. This prediction is actually supported by our data. Second, as regards our gender-dependent framing effect, it may be the case that women are more sensitive than men to the social/moral norm underlying cooperation, or, alternatively, that they have stronger expectations that other people will cooperate (Bicchieri, 2006).

Finally, we would like to underline a methodological point. In our study, we used two pools of subjects (from Ecole Normale Supérieure de Cachan on the one hand and Rouen University on the other hand). Since the difference in behaviour between subjects from Cachan and subjects from Rouen was statistically not significant (be it on the whole sample or in subsamples based on gender or treatment), the data were pooled for the purpose of statistical analysis. However, systematic qualitative differences actually arise between the pools. To put it in a nutshell, subjects from Cachan appear to be more prone to cooperation than subjects from Rouen, and men from Cachan appear to be more prone to cooperation than subjects from Rouen. We hypothesize that this difference in behaviour may be due to the

[9] As pointed out by Rege and Telle (2004), "*a person's beliefs about other people's strategies will influence his own strategy. […] If a framing makes a person more optimistic about other people's adherence to a norm for cooperation, then his dominant strategy may no longer be to defect.*" (p. 1631)

[10] This specification is important: in a PDG, the opposite pattern holds: the safer decision is to defect.

esprit de corps[11] that is known to arise in Grandes Ecoles (a French speciality) and may make subjects from ENS Cachan more prone to cooperation, and more sensitive to the appeal of the word 'cooperation', than subjects from a university[12]. In this respect, our Rouen pool might be seen as more representative of a randomly selected population (in which people do not have much information about each other), and the behavioural pattern we observe after pooling the data might actually be seen as the product of two quite different patterns. The first one, observed in Cachan, would (to some extent) describe interactive behaviour in close groups, in which members are able to draw normative and empirical expectations about each other's taste for cooperation. The second one, observed in Rouen, would rather describe the behavior of large and heterogeneous groups, in which members cannot easily speculate about others' intentions and/or have no normative incentive to cooperate. It would be worthwhile designing a specifically dedicated experimental study to investigate more thoroughly the influence of expectations, as well as its gender-dependency, on cooperative behaviour in a Game of Chicken.

[11] The influence of *esprit de corps* on cooperative behaviour is based on both a normative expectation (one should not betray a fellow) and an empirical expectation (one expects others to cooperate).
[12] In French universities, anonymity is more widespread than group spirit.

References

Andreoni, J. and L. Vesterlund (2001) "Which is the Fair Sex? Gender Differences in Altruism" *Quarterly Journal of Economics* **116**, 293-312.

Bicchieri, C. (2006) *The Grammar of Society*, New York: Cambridge University Press.

Biel, A. and J. Thogersen (2007) "Activation of Social Norms in Social Dilemmas: A Review of the Evidence and Reflections on the Implications for Environmental Behaviour" *Journal of Economic Psychology* **28**, 93-112.

Boffa, M. and M. Olarreaga (2012) "Protectionism during the crisis: Tit-for-tat or chicken games?" *Economics Letters* **117**, 746-749.

Butler, D. J., V. K. Burbank and J. S. Chisholm (2011) "The Frames behind the Games: Player's Perceptions of Prisoners Dilemma, Chicken, Dictator, and Ultimatum Games" *Journal of Socio-Economics* **40**, 103-114.

Cabon-Dhersin, M.-L. and N. Etchart-Vincent (2013) "Cooperation: The Power of a Single Word? Some Experimental Evidence on Wording and Gender Effects in a Game of Chicken" *Bulletin of Economic Research* **65**, 43-64.

Cabon-Dhersin, M.-L. and S. V. Ramani (2007) "Opportunism, Trust and Cooperation: A Game Theoretic Approach with Heterogeneous Agents" *Rationality and Society* **19**, 203-228.

Carraro, C. and D. D. Siniscalco (1993) "Strategies for the International Protection of the environment" *Journal of public Economics* **52**, 309-328.

Cason, T. N. and T. Sharma (2007) "Recommended Play and Correlated Equilibria: An Experimental Study" *Economic Theory* **33**, 11-27.

Chaudhuri, A., B. Sopher and P. Strand (2002) "Cooperation in Social Dilemmas, Trust and Reciprocity" *Journal of Economic Psychology* **23**, 213-249.

DeCanio, S. J. and A. Fremstad (2011) "Game Theory and Climate Diplomacy", *Ecological Economics*, in press.

Dufwenberg, M., S. Gächter and H. Hennig-Schmidt (2011) "The Framing of Games and the Psychology of Play" *Games and Economic Behavior* **73**, 459-478.

Eckel, C. C. and P. J. Grossman (1998) "Are Women Less Selfish than Men?: Evidence from Dictator Experiments" *The Economic Journal* **108**, 726-735.

Ellingsen, T., M. Johannesson, J. Mollerstrom and S. Munkhammar (2012) "Social Framing Effects: Preferences or Beliefs?" *Games and Economic Behavior* **76**, 117-130.

Harvey, O. J., E. J. Gore, H. Frank and A. R. Batres (1997) "Relationship of Shame and Guilt to Gender and Parenting Practices" *Personality and Individual Differences* **23**, 135-146.

Kanazawa, S. and M. C. Still (2000) "Parental Investment as a Game of Chicken" *Politics and the Life Sciences* **19(1)**, 17-26.

Kotani, K., S. Managi and K. Tanaka (2008) "Further Investigations of Framing Effects on Cooperative Choices in a Provision Point Mechanism" *Economics Bulletin* **3(51)**, 1-9.

Madani, K. (2010) "Game theory and water resources" *Journal of Hydrology* **381**, 225-238.

Neugebauer, T., Poulsen, A. and Schram, A. (2008) "Fairness and Reciprocity in the Hawk-Dove Game" *Journal of Economic Behavior and Organization* **66**, 243–250.

Oechssler, J. (1997) "An Evolutionary Interpretation of Mixed Strategy Equilibria" *Games and Economic Behavior* **21**, 203-237.

Rege, M. and K. Telle (2004) "The Impact of Social Approval and Framing on Cooperation in Public Good Situations" *Journal of Public Economics* **88**, 1625-1644.

Skyrm, B. and K. J. S. Zollman (2010) "Evolutionary considerations in the framing of social norms" *Politics Philosophy Economics* **9**, 265-273.

Snyder, G. H. (1971) "Prisoner's Dilemma and Chicken Models in International Politics" *International Studies Quarterly* **15**, 66-103.

Stone, R. W. (2001) “The Use and Abuse of Game Theory in International Relations: The Theory of Moves” *The Journal of Conflict Resolution* **45**, 216-244.

Thaler, R. H. and C. F. Camerer (2003) “In Honor of Matthew Rabin: Winner of the John Bates Clark Medal” *Journal of Economic Perspectives* **17**, 159-176.

Ward, H. (1993) “Game Theory and the Politics of the Global Commons” *The Journal of Conflict Resolution* **37**, 203-235.

Zizzo, D. J. and J. H. W. Tan (2007) “Perceived Harmony, Similarity and Cooperation in 2 x 2 Games: An Experimental Study” *Journal of Economic Psychology* **28(3)**, 365-386.

Zhong, C.-B., J. Loewenstein and J. K. Murnighan (2007) “Speaking the Same Language: The Cooperative Effects of Labelling in the Prisoner’s Dilemma” *Journal of Conflict Resolution* **51**, 431-456.