Group Decision-Making: An Economic Analysis of Social Influence and Individual Difference in Experimental Juries

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ABSTRACT

In a jury decision-making, individuals must compromise in order to reach a group consensus. If individuals compromise for non-rational reasons, such as a preference for conformity or due to erroneous information, then the final decision of the group may be biased. This paper presents original experimental data which shows that groups do have a significant tendency to compromise in jury-like settings. Econometric evidence also shows that features of groups, including the generosity of the group overall, will dictate the extent of compromise. The data also reveal that individual traits such as gender and capacity for empathy are associated with the extent of compromise in a jury-type setting. The implications are that interactions between individual and group characteristics limit the objectivity of decision-making.

Keywords: herding, social influence, legal decision-making, personality, behavioural economics

JEL codes: C92, D03, D72, D81

1.   Introduction

The integrity of the justice system is a vital component of a country's institutional structure: many economic transactions are facilitated by the existence of the legal and justice system, which acts as an external enforcer for contractual agreements. The jury decision-making process also has many similarities to group decision-making in economic settings, for example decisions by policy-making committees or groups of investment managers, and so insights into juries may be applicable to the study of decision-making in other groups.

A primary benefit of using a jury rather than a single judge has its basis in the "wisdom of crowds" (Suroweicki 2004) i.e. groups of randomly-selected, heterogenous people will bring a greater variety of personalities, perspectives and past experiences to a case, reducing *a priori* bias. A jury's *ex post* bias may also be smaller than a single judge's because the process of deliberation increases the likelihood that all the evidence and arguments for a case are remembered and considered before a decision is reached (Pritchard et al, 2002). Dawkins (2003) argues that this logic is flawed because the jurors' assessments are not independent; Goyal (2007) shows that the process of deliberation can introduce bias into the final decision when suggestible individuals' opinions are unduly swayed by the views of the others. By investigating whether a minority of individuals can unduly influence a jury's decision, and how and why they might do so, it may be possible to suggest changes to the justice system which would improve its efficacy.

In experimental work for this paper, participants were collected into small mock juries of five or six individuals. They were asked to read the evidence for a case and reach – firstly an individual verdict, and secondly – after deliberation, a unanimous group verdict. The purpose of the experiment was to investigate whether different juries examining the same case would come up with the same verdict and, if not, to identify some of the factors which caused them to diverge.

2.   Theoretical Background: Influences on Group Decision-Making

It has frequently been observed that people have a strong tendency to conform or cluster in their behaviour. Examples include evidence that opinion polls can influence voters to vote in the way that the opinion poll predicts, evidence that investors choosing assets are influenced by the choices of other investors, as seen in numerous asset bubbles, and the fashions and fads which frequently sweep through the markets for consumer goods. Although social influences on individuals' judgements are inevitable in juries, due to the requirement for a unanimous verdict, the same factors which cause convergence in judgements when it is justified may generate misplaced convergence when this is not justified. This is particularly true when some individuals are more susceptible to social influence than others and may translate into a greater propensity to compromise in a jury setting.

The justice system aims to treat all individuals fairly and equally, and therefore the hope is that a jury would reach the same verdict on a particular case, regardless of its composition. If two different juries can come to substantially different verdicts simply due to differences in their membership then the justice system is undermined, with repercussions for society and the economy. Although the presence of such inconsistencies would be extremely damaging, the identification of the causal factors behind this problem would help policymakers to make remedial changes to the justice system.

2.1   Informational Influences: Herding and Information Cascades

Communication between individuals generates copying and herding behaviours because it homogenises individuals' information. When there is a single optimal choice then convergence can occur if 'early individuals explain the benefits of alternatives to later ones' (Bikhchandani et al,

1992), a result predicted by Goyal (2007) with regard to networks. In a jury context, a unanimous verdict must be reached during the deliberation phase and so communication is clearly relevant to jury decision-making. During deliberation jurors review the evidence from the trial and discuss their personal viewpoints, helping to ensure that all the important information is remembered and that the reasoning behind a particular verdict is fully evaluated. This process may highlight gaps in people's memories or in their logic and so help the group converge on the right outcome. The assumption of one optimal outcome is defensible in this context because very clear decision-rules are outlined to the jurors by the judge and their decision is usually a simple guilty/not guilty verdict – based on identifying some underlying truth about an incident. Although there are no 'early individuals' in a jury setting and jurors will not be sure whether their verdict was optimal, in theory the pooling of information and viewpoints should still have potential to improve the group's chance of identifying the optimal outcome. On the other hand this theory assumes that communication is perfect, whereas in reality imperfections may exist which cause the group to converge on the wrong outcome. Bikhchandani et al (1992) and Banerjee (1992) show that, with Bayesian updating of information, a group may converge on a suboptimal choice. In Bayesian models, once a certain number of people have chosen the same option, it becomes privately optimal for all subsequent individuals to copy them, regardless of their private signal. This is because the information implicit in the previous actions outweighs the individuals' private information and triggers an information cascade. This can generate negative "herding" externalities in which groups of people make the wrong decision even though their private information would have allowed them to make the right decision. Unlike in a legal scenario, individuals in these models make their choices independently and sequentially, and they receive an individual payoff depending on their chosen option and the state of the world which arises after the choices have been made. Bayesian analysis may nonetheless be relevant to jury decision-making because it suggests conditions under which it would be optimal for individuals to copy those who have already indicated their preference, even if private information indicates a different option.

The results of these models have been supported by numerous experiments, including Anderson and Holt (1996, 1997); the sociology literature also analyses similar forces of normative influence, famously identified by Asch (see Bond and Smith 1996 for a meta-analysis). The Asch experiment was particularly striking because it showed that individuals often followed others despite unambiguous contrary private information. Subjects were asked to estimate the relative lengths of lines having heard, from confederates posing as other subjects, answers which contradicted the observable evidence. The results showed that 36.8% yielded to the judgement of the misleading majority and gave the wrong answer when, under ordinary circumstances, individuals gave the wrong answer less than 1% of the time (Asch, 1955). The results were interpreted as showing that apparent conformity reflected real information contained within other individuals' signals, rather than social pressure because similar results were found in experiments in which subjects did not interact face-to-face (Anderson & Holt, 1997; Deutsch et al., 1955). Shiller (1995) supports this informational interpretation, contending that it is rational for subjects, who are presented with conflicting social evidence, to reason that their own incompetence explains the inconsistency.

These results suggest potential problems for the integrity of jury decision-making for two primary reasons. Firstly they suggest that jurors might change their opinion without closely examining the evidence for each side. Though opinion convergence is obligatory in jury decision-making, the point of convergence is crucial and may be influenced by a majority to a greater extent than is publicly optimal, because of social influence. In approximately nine out of ten cases real life juries do eventually decide in the direction of the initial majority (Klevorick & Rothschild, 1979), which shows that the majority do have significant persuasive power. To some extent this persuasive power is

justified if the majority is more likely to be right than wrong, however there is a danger that strongly salient private information of those in the minority will be overlooked, causing the jury to make the wrong decision in those cases when the minority were correct.

The second implication is that speaking order may be an important determinant of a jury's final decision. To the extent that jurors take it in turns to express their opinions during deliberation, it may only take a few early speakers with a particular opinion to tip the balance in favour of a given verdict, despite evidence to the contrary. Though jurors do not receive information in an exogenously specified order, sequential elements may be observed in the way that the group discuss their viewpoints. Choice-order is endogenised in the 'waiting game' (Chamley, 2004), which is based on the basic information cascade model; individuals are able to delay their decision in order to gain more information about the state of nature by observing the actions of others, however this is costly because of temporal discounting. Chamley (2004) shows that, in the context of investment decisions, more optimistic agents will tend to act before more pessimistic agents, because they have a higher opportunity cost of delaying. Perhaps this argument can be extended to more confident jury members compared with less confident jury members: the more confident an individual is in their opinion, the higher the opportunity cost of delaying speaking, and so the earlier the individual is likely to speak. Theories of conversation analysis examine the underlying social organisation of face-to-face human interaction, for example the basic rule of 'turn-taking', and may be able to shed light on speaker order. In particular Goodwin (1990) discusses the theory that agreements are usually expressed more promptly and with more certainty than disagreements, which may be particularly relevant to jury deliberations. Analysis of speaker order may help explain why a jury has been persuaded to agree with a particular verdict.

Although information cascades have the potential to mislead a jury, Bikhchandani *et al.* (1992) show that cascades are extremely fragile and easily broken. Once a cascade has started, further adoptions are uninformative and therefore a violation of the cascade by a single individual or the arrival of new public information, perhaps analogous to the recall of a previously-forgotten piece of evidence, can cause the cascade to break. If juries spend sufficient time and energy remembering all the facts of a case then this may ensure that any potentially misleading information cascades are broken. Moreover the lack of strictly sequential information provision may be enough to make this theory redundant in a jury setting, particularly because jurors can speak more than once and so can argue against each other's points of view. To assess whether any information cascade effects are at work during deliberation, an experiment would have to be set up where speaker order was closely monitored or even loosely controlled.

2.2   Social influences

Chamley (2004) addresses the issue of expertise in the evolution of information cascades. He sets up a model where individuals are either experts or 'receivers', who choose their action based on a prediction of the future state of the world constructed using both their own information and the advice of the experts. He shows that the timing of the arrival of expert information is crucial to the outcome of the information cascade: when there are two experts the seniority rule, where the expert with the more precise signal speaks first, strictly dominates the anti-seniority rule in terms of producing an accurate prediction. It is probable that some jurors will have more experience of the law relevant to the case in question than others, for example if they have been involved in similar cases or have studied this law at some point. Chamley's results suggest that the number of jury members with extra information, and the order in which they impart that information, could affect the accuracy of the final decision made.

Akerlof and Kranton (2000) have emphasised the impact of identity in shaping economic outcomes, arguing that the social differences associated with people's identities explain not only their preferences but also the entrenchment of social norms, maladaptive behaviours and externalities (positive as well as negative). Identity will be important to group decision-making too. It will play a role if it sustains networks – promoting and protecting the communication channels essential to sustaining social relationships generated by business connections, ethnic affiliations, religious links, and so on (Rogers, 2003). For the experimental subjects recruited for this study, identification between subjects is likely to be strong, partly reflecting the fact that the participants were recruited from a relatively small pool and some were friends or acquaintances. Whilst this does not reflect the likely composition of real-world juries, it does provide a particular opportunity to investigate the effects of identity on group decision-making, and particularly individuals' propensity to compromise; in reality, jury members are unlikely to be friends but nonetheless will identify with some of the other jurors and not with others.

Identity may influence the effectiveness of communication between individuals. Baddeley (2010) suggests that the acquisition of information in a social setting is influenced by group forces and group motivations, 'reflecting not only imitation and conscious identification with the group but also group-centred goals and behaviour'. Rogers (2003) examines how differences in communication channels affect the ease with which information is transmitted between parties. He argues that communication is more effective when individuals are homophilous because less effort is required for effective communication and because the chance of cognitive dissonance, the discomfort that arises when individuals confront two contradictory hypotheses about the world, is reduced. When homophilous individuals communicate, feedback effects can occur. The very fact that communication is effective between people with similar identities reinforces their relationship, further increasing the effectiveness of future communication, which further reinforces the relationship, and so on. So people with similar identities will become more homophilous, increasing the effectiveness of their communication (Rogers, 2003). Friends are likely to be more homophilous than strangers both because friendships develop when individuals have common ground, for example shared interests, and because those who spend significant time together are likely to increase in similarity, as explained above. This suggests that jurors who become friends are likely to have more influence over one another than jurors who remain effective strangers to each another. It is possible to test this hypothesis using the experimental data. A key problem, however, is that it is unclear whether friends will tend to conform more or less than others. On one hand they may be more ready to compromise than others because they trust each other, and even strangers may feel pressure to conform towards a clique's consensus. Alternatively if people feel safe amongst friends then they may have more confidence in standing their ground and so will be less likely to adjust their opinion. If identity plays a role in establishing networks then these networks will help people to process information more accurately; when individuals have knowledge about others in their group then it will help them to decide more effectively the reliability of common knowledge and opinions within a network. Knowing that a friend is an unreliable source of information may help an individual discount their information more effectively than a stranger might, thereby increasing the accuracy of their judgements.

A model of the latter hypothesis is demonstrated by Goyal (2007). In his model some individuals are placed in a central clique, observed by all, whilst the rest are independent but can only observe a few others, as well as the clique. If the commonly-observed set all receive the same signal, and so choose the same action, then in the second period all the independent individuals will copy this action. This is because the central clique's actions will outweigh all the other information the independent individuals have, so that the posterior probabilities favour the core group's action. Goyal shows that the probability of everyone choosing an optimal action becomes arbitrarily close to 1 the

more locally independent individuals there are. In a jury individuals will not be as blinkered as in this model, however a tight, central network, such as a group of closely identified individuals, may act in an analogous fashion to the group in the above model, focussing their attention inwards. If other individuals are unduly influenced by this clique, then the group will herd towards the friends' consensus.

Persuasion bias (De Marzo *et al.* 2003) may produce similar results to this model, without relying on such strong assumptions. Persuasion bias exists when one individual believes the actions or opinions of others are based on independent sources of information, when really they are based on the same or similar sources. A clique of similar jurors may hold the same opinion simply because they are coming at the problem from similar perspectives; however naive jurors may not take this into account and so will fail to adjust for the repetition of information, biasing the group verdict towards the clique. Identification effects may be particularly complex in the context of group decision-making in a legal trial; there will be tensions between different social objectives because an individual is balancing a desire to belong to an in-group with which they identify against their duties to wider society. The incentive to do one's best as a juror reflects a desire to fulfil duties to society in sustaining justice, and this will depend upon the individual standing by their own principles rather than succumbing to social influence.

The imposition of social sanctions on deviants could cause individuals to copy others by raising the costs of deviation. Akerlof (1980) explains the persistence of some social customs, even when they are costly for the individual, because individuals lose reputation and therefore utility from breaking with such customs. This mechanism has a possible relevance to juries, in that the deliberation process will be more dragged out when the jury fail to reach a unanimous verdict, imposing a time penalty on those who refuse to compromise (as well as on all the other jurors). However since jurors are unlikely to encounter one another again after the trial finishes and are fully compensated for their time this effect is unlikely to be strong.

2.3   Psychological and cognitive influences: personality traits and cognitive ability

Individual differences may play an important role in group decision-making; such heterogeneities may operate as channels for herding and social influence because they will affect what information is divulged to the group, when it is imparted and how it is received. Differences in jurors' priorities and preferences can create information blockages that impede the transmission of useful information (Goyal, 2007), perhaps a cause of hung juries. Nocetti (2008) argues that communication can result in the 'wrong' final outcome because distortions in some individuals' memories may permeate the memories of others so that the bias disseminates through the group, magnifying the impacts of social influence.

Experimental work has suggested that personality traits may influence herd behaviour. Baddeley *et al.* (2010) have identified positive associations between a propensity to herd and both impulsivity and adventurousness, and a negative relationship with traits normally associated with sociability, such as extraversion and empathy. Traits such as empathy and generosity are particularly relevant to legal cases because jurors must put themselves in the shoes of others in order to understand a legal case. In terms of processing large quantities of information, the cognitive ability of an individual, including her intelligence and memory, could be important: individuals with lower cognitive ability may be restricted in their ability to make decisions using a Bayesian updating process, for example they may forget to account for some pieces of information.

One personal characteristic which will almost certainly have an impact is a preference for conformity. Shiller (1995) has suggested that an irrational, 'loyalty-induced psychological motivation' to copy others could explain much herd behaviour; Jones (1984) develops a model in which workers'

utility functions include a conformity preference term, which he suggests could arise from social pressures or a desire to be emulated. The Asch study provided some evidence that normative social influences exist: when face-to-face aspects of line judgement tasks was removed, the rate of conformity was slightly reduced (Deutsch, et al., 1955), suggesting that some people felt under less pressure to conform when they weren't being observed by their peers.

Conformity preference could alternatively emerge as a sensible heuristic or rule of thumb when individuals are choosing but lack the time or cognitive capacity to assess all the information available (Tversky & Kahneman, 1974). Conventional economic analysis relies on an assumption of substantive rationality, consistent with behaviour which is appropriate given the fundamental characteristics of the environment in which it takes place (Simon 1979, Baddeley 2006). For legal decision-making, substantive rationality may be unachievable. Substantively rational decision-making is not possible when contexts are complex, clouded by fundamental uncertainty, where an extensive quantity of information must be made readily available –including sets of alternatives, payoffs, preference orderings and probabilistic information (Simon, 1955). Even if such a rich information set were available, the computational demands of substantive rationality, including Bayesian-style information updating, may be beyond the actual capacity of the decision-maker, and this may reflect either cognitive limitations and/or time-constraints. Experimental work suggests that substantive rationality is violated in real-life decision-making of any complexity (Tversky & Kahneman 1974, 1981), and so given the large quantities of evidence shown to juries it seems probable that decision-making will be guided by procedural rationality rather than substantive rationality and, in this context, conformity preference may reflect a reasonable judgement that the majority is more likely to be right than wrong; in a complex situations, allowing oneself to be guided by social influences is arguably a sensible heuristic. Such a heuristic would conform to procedural rationality, defined as the outcome of appropriate deliberation, which may include the use of heuristics, norms or socio-psychological cues (Baddeley 2010; Baddeley *et al*. 2004).

Although conformity preference may be justifiable as a form of procedural rationality, it is extremely undesirable in a jury setting, where justice relies on individuals carefully considering the problem rather than compromising for the sake of compromising. Procedural rationality has been shown to produce systematic biases and rule violations (Rabin 1998) and these may undermine jurors' verdicts. In a jury setting, individuals with a greater conformity preference will be more ready to compromise than individuals who don't prefer conformity, perhaps leading the group to agree on the verdict preferred by the least conformist individuals, rather than the 'correct' verdict. This hypothesis does not rely on sequential imparting of information, as seen in the information cascade hypotheses of Banerjee (1992) and Bikhchandani *et al*. (1992), and therefore may be more readily applicable to the jury setting. On the other hand it suffers from the problem that measuring an individual's preference for conformity is difficult, not least because conformity preference may be a continuum rather than a discrete trait. Personal characteristics, such as impulsivity and empathy, may be good predictors of a tendency to conform because they suggest a tendency to resort to the easiest available solution and a greater concern for the opinions of others, respectively. Moreover an individual's relationships with those around him may contribute to a tendency to conform, for example he may be more ready to capitulate to those with whom he is most homophilous, or similar to in attributes such as social status, education, personal characteristics etc. (Rogers, 2003). If conformity preference does exist then identification of factors associated with conformity preference would aid the justice system administrators to select the most appropriate jury, and/or explicitly to instruct people against conforming.

3 Experimental Analysis

3.1 Hypotheses

The primary question to be addressed in the empirical analysis is whether systematic features of groups and individuals have an impact on individuals' tendency to compromise in a jury decision-making context. Variables which may affect an individual's tendency to conform (including personality traits, expertise and the sequence in which new information arrives) will be examined alongside specific features of the group decisions. The results of this analysis will help provide an answer to the question: to what extent might the jury deliberation process introduce bias into the final verdict?

For the econometric analysis of the experimental evidence, the specific hypotheses tested are:
H1: There will be a strong tendency for individuals to compromise i.e. to converge towards group judgments.
H2: The extent of compromise will be affected by characteristics of the group including shared identity (proxied by presence of friends versus strangers), the generosity of the group and the reliability of the group.
H3: The extent of compromise will be affected by individual characteristics including age, gender, area of expertise (subject of study), receptiveness to new ideas and personality traits, including empathy, impulsivity and venturesomeness.

These hypotheses will be captured via the estimation of the following empirical model:

$$C_i = G(z_i) \tag{1}$$

Where C is the extent of compromise and $G(z)$ is a link function with z given by:

$$z_i = \alpha + \sum \beta_k g_{k,i} + \sum \gamma_q h_{q,i} + \varepsilon_i \tag{2}$$

Where β_k and γ_q are vectors of fixed parameters on the sets of conditional variables g_k – group characteristics and h_q – individual characteristics; ε_i is the random error term.

As explained in the results section, this model will be estimated using both linear and non-linear link functions to test the above hypotheses against the nulls − $H_0 : \alpha = 0, \beta_k = 0$ as follows.

H1: retain (reject H_0) if $\alpha \neq 0$
H2: retain (reject H_0) if $\sum \beta_k \neq 0$
H3: retain (reject H_0) if $\sum \gamma_q \neq 0$

3.2. Experimental Subjects and Participant Incentives

The sample of experimental subjects included 63 students, mostly University of Cambridge undergraduates. Most were recruited via the Economics and Law faculties and through college networks. Subjects signed up to one of two sessions and were paid £15 for their participation in the experiment, to compensate them for time sacrificed. No payment conditional on the outcome of the experiment was made; every subject received the same show-up fee. This is justifiable for two reasons: first, payments to real-world juries are not conditional upon performance and second, given that experimental resources were not available to make generous payments to the experimental subjects, if the experimental subjects thought that their payments were unfairly small this might distort their intrinsic motivations. Following Gneezy and Rustichini (2000), it was assumed that motivation to achieve an appropriate verdict in a legal situation is most likely to be intrinsic, stemming from a desire to uphold a nation's justice system, and extrinsic rewards (e.g. a conditional monetary payment) can crowd out intrinsic motivations

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3.3. Task Structure

Pre-experiment briefing and testing

Before the experiment began, participants were given consent forms to sign, which outlined the structure of the experiment, and the subjects were also given detailed instructions about what they would be doing.[4] Then they completed an Eysenck Impulsivity, Venturesomeness and Empathy (IVE) questionnaire (Eysenck & Eysenck 1975, 1978). Before the experiment began, participants were informed that the purpose of the experiment was to get an indication of how people make decisions in a legal context, and that the experimental results would be used in research which might have real life implications.

Task Stage 1: Individual compensation offers

In the first stage of the task participants were asked to read a summary of a (real-life) case about an inheritance dispute and the evidence for each side before making an individual judgement on the case.[5] To prevent potential biases from the availability heuristic (recently remembered events are more salient than more distant events) half the subjects were presented with the plaintiff's case first; the other half were presented with the defendant's case first. The case regarded the distribution of the estate of a farmer who had died intestate. The plaintiff had been the deceased's partner for 30 years, during which time she worked part-time on the farm for little or no payment. The defendant was the sister of the deceased: she and her brother would each inherit half of the estate if the plaintiff was allocated nothing. Participants were asked to decide whether the deceased had encouraged an expectation in the plaintiff that she would inherit from the estate, and if so how much she should inherit to meet this expectation. The minimum amount participants could allocate to the defendant was nothing and the maximum was the entire estate: £800,000.

This case was chosen because it was based on a common real-life example of a legal dispute with which participants could easily identify, and turned on interpretation of the facts rather than any complicated legal considerations. Moreover, because the case required a numerical verdict ($0 < x < 800k$), it gave a more subtle insight into participants' behaviour than a simple 'guilty'/'not-guilty' verdict would do.

Task Stage 2: Group compensation verdicts

Having made their individual verdicts, participants were put into randomly allocated 'juries' of 5-6 people for a period of deliberation (15 minutes). At the end of which they had to reach a group verdict about fair compensation for the plaintiff.

Post-experiment questionnaire were conducted in order to get experimental feedback and subjects were asked a range of questions about their impression of their group, their own potential knowledge of the case (e.g. Had they heard of the case before? Had they been in a real-life jury and/or an experiment before?). They were also asked questions about their own motivation and results revealed that the vast majority of subjects described themselves as 'fairly' or 'very motivated' to reach a fair verdict.[6]

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4 For consent forms, experimental instructions and other material distributed to the experimental subjects, see Appendix 1.

5 Also see Appendix 1 for a summary of the case including plaintiff's and defendant's arguments, as distributed to the experimental subjects.

6 Again see Appendix 1 for the post-experiment questionnaire.

4   Results

The experimental data showed that the individuals, although presented with identical information, came up with very different pre-deliberation verdicts in the range £0 to £800,000 – see Figure 1.
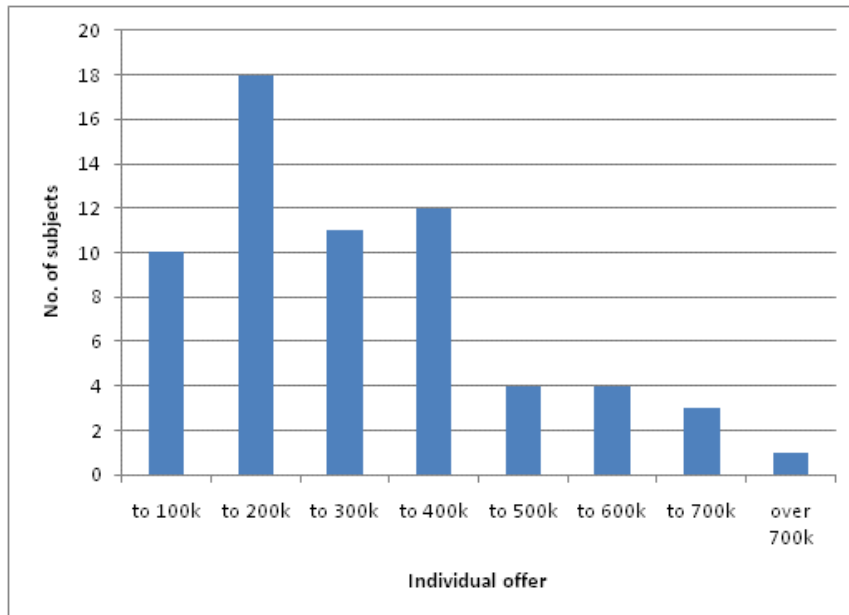
Fig. 1: Individual compensation offers

After deliberation too, there was a wide range of outcomes. The groups' compensation verdicts ranged between £0 and £600,000 and the extent of compromise, measured as the magnitude of the difference between an individual's initial verdict and the final group verdict, ranged from £0 to £500,000, as shown in Figure 2.
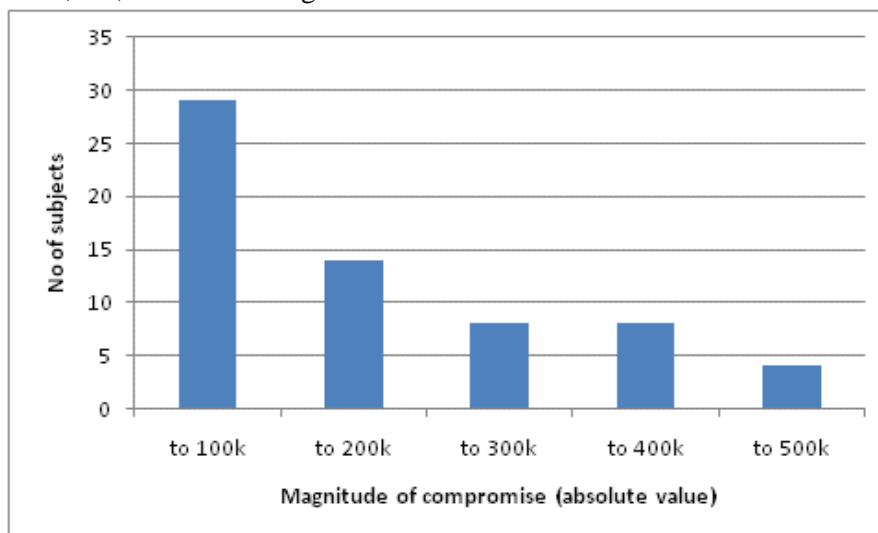
Fig. 2: Magnitude of compromise (individual verdict minus group verdict)

4.1.   Econometric analysis

In exploring econometrically the empirical hypotheses set-out in section 3.1, a variety of link functions were tested using the experimental data – all aiming to explain why different jurors compromised by different amounts, which in turn can explain the disparity in the verdicts reached. The dependent variable used in the econometric analysis was a "compromise" variable - measured as

the log of the absolute difference between an individual's initial verdict and the verdict agreed on by their group. Following from the hypotheses above, the explanatory variables were grouped into the two categories of group characteristics and individual characteristics. In identifying the restricted versions of the models, an encompassing approach was used, i.e. statistically insignificant variables (defined as those with p values greater than 10%) were deleted one-by-one. In terms of constructing the explanatory variables –age, gender and subject of study are self-explanatory. "Receptive to new views" is captured from the post-experiment questionnaire in which the subjects were asked if they learnt new perspectives from the deliberations. Group generosity and reliability are also captured in this way. The "bonded" variable captures the extent to which there were friendship connections within the groups, i.e. if there were no strangers in the group then the group members would identify with each other more strongly and this might affect the deliberations. As noted above the personality traits were assessed using an IVE questionnaire. The impulsivity and venturesomeness variables were not significant in early estimations so the results discussed here focus on the empathy trait.

The econometric analysis was conducted in two stages using STATA 10. First, as shown in Table 1 below, the models were estimated using Ordinary Least Squares (OLS) estimation techniques, alongside appropriate diagnostic tests for violations of Gauss Markov assumptions (*viz.* Breusch-Pagan test for heteroscedasticity – using fitted values of the dependent variable; and Ramsey's RESET test for model misspecification – again using fitted values of the dependent variable). The diagnostics revealed violations of the homoscedasticity assumption for all OLS estimations; therefore, t tests constructed using robust standard errors are reported alongside the standard t tests (calculated using uncorrected standard errors).

For the second stage of the econometric analysis the limitations of linear estimation were addressed explicitly. As can be seen from Figure 2, the distribution of the dependent variable is asymmetric suggesting a non-linear distribution (e.g. a Gamma distribution) could yield more powerful results. For this reason, the models were also estimated using a generalised linear model (GLM) with a Gamma distribution incorporating a log link function, see Table 2. This increased the power of the estimations whilst simultaneously confirming the results from the linear estimation: all variables that were statistically significant in the linear estimations were also significant in the GLM estimations and the power of hypothesis testing revealed additional significant variables in the GLM estimations – see Table 2.

Table 1:   LINEAR LEAST SQUARES ESTIMATION

Dependent variable: Absolute value of "Compromise" (logged)

Sample size: n=63

	Unrestricted			**Restricted**		
	Parameter Estimate	*t value*	*p value*	*Parameter estimate*	*t test*	*p value*
Individual characteristics						
Age	0.107	0.430	0.666	...	...	...
		(0.47)	(0.642)			
Gender	-0.765	-0.880	0.382	...	...	...
		(-0.97)	(0.338)			
Economics student	2.356**	2.440	0.018	1.820**	2.270	0.027
		(2.5)	(0.015)		(2.67)	(0.010)
Law student	0.625	0.470	0.638	...	...	...
		(0.39)	(0.699)			
Receptive to new views	-1.188	-1.370	0.176	...	...	...
		(-1.45)	(0.154)			
Empathy	-0.108	-0.820	0.416	...	...	...
		(-1.22)	(0.23)			
Group characteristics						
Reliable group	-1.157	-0.850	0.397	...	...	...
		(-0.58)	(0.563)			
Generous group	0.400**	2.410	0.019	0.370**	2.370	0.021
		(2.01)	(0.049)		(1.82)	(0.074)
Bonded group (no strangers)	-0.999	-0.650	0.520	...	...	...
		(-0.78)	(0.441)			
Constant	9.580*	1.790	0.079	8.014***	8.250	0.000
		(1.75)	(0.086)		(5.06)	(0.000)
(Heteroscedasticity robust t values and p values in brackets)						
R^2	0.2236			0.1496		
R^2 (adjusted)	0.0917			0.1212		
Diagnostic tests						
Heteroscedasticity	$\chi^2(1) = 33.54$ [p=0.000]			$\chi^2(1) =35.68$ [p=0.000]		
Ramsey RESET	$F(3, 50) = 4.64$ [p=0.006]			$F(3, 57) = 0.47$ [p=0.7014]		

*significant at 10%, ** significant at 5%, *** significant at 1% (t test of $H_0 : \beta = 0, H_1 : \beta \neq 0$)

Table 2: GLM ESTIMATION: Gamma distribution, log link function

Dependent variable: Absolute value of "Compromise"

Sample size: n=63

	Unrestricted			**Restricted**		
	Parameter Estimate	*t value*	*p value*	*Parameter estimate*	*t value*	*p value*
Indvidual characteristics						
Age	0.020	0.280	0.781	...	...	...
Gender	-0.693**	-2.480	0.013	-0.706***	-2.780	0.005
Economics student	0.517*	1.710	0.087	0.437*	1.860	0.063
Law student	0.209	0.550	0.585	...	...	...
Receptive to new views	0.197	0.700	0.485	...	...	...
Empathy	-0.080*	-1.940	0.053	-0.089**	-2.410	0.016
Group characteristics						
Reliable group	-0.694	-1.530	0.125	-0.753	-1.920	0.055*
Generous group	0.089	1.180	0.238	0.081	1.700	0.089*
Bonded group (no strangers)	0.114	0.220	0.825	...	...	...
Constant	12.726	7.610	0.000***	13.441	20.090	0.000***
Log likelihood	-806.833			-807.304		
AIC	25.963			25.819		
BIC	-177.759			-197.4		

* significant at 10% ** significant at 5% *** significant at 1% (t test of $H_0 : \beta = 0, H_1 : \beta \neq 0$)

5.   Discussion of results

The results of this experiment support the hypothesis that a range of factors, including group features as well as individual subjects' characteristics affect an individual's tendency to compromise. The constant term is highly significant in all estimations indicating that there is a strong and significant tendency for the experimental subjects to compromise with their group's verdict. More specifically, group characteristics and individual differences are also associated with the extent of compromise, as explained below.

5.1.   Group influences

Subjects are significantly more likely to compromise if they're in a generous group which might be explained by the fact that a social norm of generosity leads more subjects to compromise towards a more generous offer. Individuals are significantly less likely to compromise if they thought that their group was reliable, i.e. had remembered the facts of the case accurately; this could be explained by the fact that reliable groups' initial judgements were less widely dispersed and therefore the extent of possible compromise was limited. Overall these results suggest that people's judgements were not just affected by the objective elements of the case but also by the specific characteristics of the group context in which decisions are made.

5.2.   Individual differences

The other estimation results provide some evidence that individual characteristics are important: men are significantly less compromising and economics students significantly more likely to compromise. Whilst the latter finding may not fit well with stereotypes about economists, the discipline does focus on the balancing of costs and benefits and this may translate into an ability to weigh both sides of the argument by taking account of the information contained in others' viewpoints during deliberations. Measures of legal expertise (e.g. whether or not the subject is a law student) were found to be insignificant, perhaps because the case was easy to understand and so there was little informational advantage to having expertise in this area of law prior to the experiment. Personality traits also affect an individual's tendency to compromise. There was some evidence to suggest that empathy significantly reduced an individual's tendency to compromise and this confirmed results from previous experimental studies; in the context of financial decision-making Baddeley *et al.* 2007 and Baddeley *et al.* 2010 found that there was a significant, negative association between empathy and propensities to herd. For the current study of jury decision-making, the finding would be consistent with empathetic individuals caring more about the outcome and so being more persistent in their views.

6.   Implications and Conclusions

Overall the experimental evidence presented here suggests that a combination of individual and group characteristics affected the convergence to consensus for the mock juries studied. There is also evidence that individual heterogeneities, although uninformative and irrelevant to the task in hand, have a significant effect on an individual's tendency to conform. This is perturbing for the integrity of jury decision-making, because it suggests that verdicts may be dependent on the jury chosen for the trial, rather than solely on the evidence presented. Whilst this study has focussed on the independent impacts of the two sets of characteristics, further research could explore interactions between the two.

A significant problem with this analysis is that the estimations do not control for the factors which influence an individual's initial verdict: if an individual chooses an extreme initial verdict then

they will be an outlier in their group and so forced to compromise more, so factors which cause extreme initial verdicts will confound the results regarding compromise. It seems unlikely that the number of strangers in one's group would affect one's initial verdict, particularly because individuals were not allocated to groups until after they'd chosen their individual verdict. However this endogeneity problem is significant for the personality trait variables, which are much more likely to affect initial verdicts; for example empathetic individuals may be more likely to choose a generous initial verdict, so are more likely to be an outlier in their group and so are under more pressure to conform. More research into the effects of personality traits on individual verdicts is needed to address this problem, or alternatively a way of controlling for the extremity of one's initial verdict needs to be found.

Further research is needed to investigate the extent to which the findings are applicable in real-life juries. Even if there are inconsistencies between different juries' verdicts the use of juries may still be justified for other reasons, for example Cooter & Ulen (2004) argue that juries reduce the opportunity for corruption, as a larger group of decision-makers means that bribes and threats are less concentrated. These results may also have implications for group decision-making made in an economic setting, suggesting that network relationships and personality traits may prevent an individual remaining objective about a particular question. Future research could develop social influence and opinion convergence models which extend the analysis of the interaction between rational and social influences on such behaviour.

Notable differences between this experimental set-up and real juries include the time limitation imposed on deliberation, the smaller amount of evidence used and the small size of the juries used, all of which were adopted for practical purposes. Time limits may have prevented the mock juries from fully examining the evidence, but in reality all the juries (bar one jury – which was excluded from the statistical analysis for this reason) came to their conclusion before the end of the time period. This suggests that the time constraint did not pose any significant problems and so should not have adversely affected the reliability of the results. The small amount of evidence used would have, if anything, helped the jurors to accurately remember all the evidence; any difficulties in absorbing and recalling this information would only be amplified with more evidence, so it seems likely that results would be robust with more evidence. Although Klevorick et al (1979) show that the use of smaller juries does not substantially affect the final verdict reached, their model does not take into account any difference in deliberation between small and larger groups. Deliberation may be less effective with fewer individuals because the jury will have a smaller pool of extra information and opinions to work with, and also because each individual represents a greater proportion of the group and so certain individuals may be able to exert more influence. More work needs to be done using 12-person juries in order to find out whether the results found here apply with larger juries. Further research: interactions between individual versus group characteristics

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<u>Appendix 1:</u> EXPERIMENTAL INSTRUCTIONS AND RELATED MATERIAL

Consent Form

An Experiment on how People Make Decisions

The purpose of this study is to get an indication of how people make decisions in a legal context. In the study, you will be asked to complete a simple decision task as if you were a member of a jury. The experiment will begin with a briefing session (15 minutes long) in which you'll be given instructions about what to do during the course of the experiment. You will then be asked to complete a short pre-experiment questionnaire (10-15 mins). You will then be given a summary of a legal case and will be given about 10 minutes to read this. Then two brief sets of legal arguments will be presented to you in written form: one in favour of the plaintiff and the other against the plaintiff. You will be given 15 minutes to read and absorb each set of arguments after which you will be asked to reach an individual decision. You will then be asked to deliberate with the other members of the mock jury for about 20-30 minutes before the jury as a whole is asked to reach a collective decision. Once the jury decision has been made and recorded, you will then be asked to complete a feedback questionnaire (15 mins). Your participation in this study will take 120 mins at most. If you have any questions about the study, they will be answered for you.

For your participation in the study, you will receive a £15 show up fee. The show up fee will be sent to you at the address you've already specified to the researchers within the next 14 days. If you do not receive your payment during this time you can contact the researchers (see contact details below) who will endeavor to resolve the problem.

Your participation in this study is purely voluntary, and you may withdraw your participation or your data at any time without any penalty to you.

The data obtained during this study will be used for research by [experimenters' names], culminating in written work that may be published, on the topic of decision making in a legal context. If individual data is presented it will remain totally anonymous, without any means of identifying the individuals concerned. Your data will be kept **completely confidential** –it will not be used by anyone other than [experimenters' names]. Your personal information will **not** be stored with the data.

This project has received ethical approval from the Ethics Committee of the University of Cambridge. If you have any questions, you can contact:[Experimenters' names / contact details]

I have read the description of this study, my questions have been answered, I understand the payment system and I give my consent to participate.

Signature _____

Name (printed):_____

Date _____

Note: *Both the researcher and the participant should receive a signed copy of the consent form.*

INSTRUCTIONS

The purpose of this study is to get an indication of how people make decisions in a legal context.

In the study, you will be asked to complete a simple decision task, first on your own and then as if you were a member of a jury.

After this briefing you will have an opportunity to ask any questions you may have and then you will be asked to fill in a personal details form and short pre-experiment questionnaire. You will have 10 minutes in which to do this. All your personal details will be stored separately from the experimental data. Where individual data used in this study is published it will remain totally anonymous, without any means of identifying the individuals involved. All the data will be kept completely confidential and will not be used by anyone other than [experimenters' names]. If you have any questions about how the data will be used please do not hesitate to ask.

After the pre-experiment forms have been filled in you will be given a short summary of a case to read through. You will be given 5 minutes to read this sheet. You can keep this sheet throughout the rest of the experiment.

After this you will be presented with the evidence in favour of the plaintiff. You will have around 10 minutes to read this. Please read it carefully as after the time is up the sheets will be taken away and you will not be able to see them again.

Next you will be presented with the evidence in favour of the defendant. Again you will have around 10 minutes to read this and will not be able to see it again after the time is up.

After you have seen all the evidence you will be asked to make an individual judgment on this case.

You will then be split into small jury groups for a period of deliberation followed by a group judgment. Groups will be allocated at random and you will be given 20 minutes to discuss the case. Please use all the time available to evaluation the evidence and come to your conclusions.

At the end of the experiment everyone will return to this Auditorium to fill in a post-experiment questionnaire and a form regarding the payment system.

The total length of time for the experiment will be 120 minutes at most. During the experiment please do not communicate with other participants unless asked to.

Are there any questions?

Summary

The plaintiff in this action, Mary Brennan, was one of five children of a small farmer. She was born in 1960. At the age of 16 she left school without any qualifications at all and at 17 she began helping David Evans during the lambing season. He was then 42 years of age, unmarried and the owner of some 490 acres of land used for sheep farming.

Shortly after she began working for him a sexual relationship was commenced between the pair. This was to continue, it appears, for the rest of his life. Neither married nor formed any other similar relationship nor had children.

The plaintiff worked for many years in a factory until its closure, when she took a job as a cashier. She would help David on the farm in evenings and on weekends with tasks such as dosing the sheep, dipping them and helping with clipping. It is clear and uncontested that this assistance on the farm continued for some 30 years.

David Evans died on 12 January 2009 without making a Will – the default beneficiaries from his estate under the law were his brother and sister, as his only siblings. The two sold the farm and its surrounding land for £800,000. The plaintiff subsequently instigated the current legal proceedings, having been made aware of her rights under the law.

The plaintiff's case

Mary Brennan (the plaintiff, partner of the deceased)

The plaintiff claims that David Evans promised her that she would always have a roof over her head and a bit of ground. She therefore claims that the proceeds of the sale of the house and the land belong to her.

Mary describes herself as a hardworking and industrious woman. She claims that she did do considerable work about the deceased's farm, for which she was not adequately paid. Although her work for David was part time it was also regular. She acknowledges that the deceased would give her £20 or £30 from time to time and larger sums occasionally e.g. to pay for the insurance on her car.

Mary said that early on in the relationship, when she was still just a teenage girl, David asked her if she would always be there to look after him and she said she would. As part of the same conversation he assured her that she would always have a roof over her head and some land. The plaintiff said in evidence that she thought he meant "the home place" but she acknowledged that he never expressly said that, nor said which bit of land was intended.

Mary described David very much the centre of her social life. Inevitably that meant that she was not making herself available for other friendships with men, which might have led to relationships and marriage.

The relationship between Mary and David was never publicly acknowledged and was never discussed with his family.

Owen McCall (a friend of the deceased)

Owen was a long standing friend of the deceased. He denied that he was owed any money by the deceased. He was not friendly with the brother of the deceased.

He would often be up at his house for a drink or a game of cards and he said, "Mary would always be there, even when I left in the early hours of the morning." If he and David went to a sheep sale together, as they often did, and came back late Mary would be there with the fire going.

As David got older he suffered from health problems and so Owen urged him to sort his affairs out in case he should die suddenly. In answer to these urgings from Mr McCall the deceased said: "Mary Brennan will be looked after" and that he would sort out the matter next week. This was said more than once to the witness. He believed that people in the district assumed Mary would inherit the farm when David died.

Mr McCall knew both of the defendants (David's brother and sister) and believes that it was common knowledge that the relationship between the deceased and his brother was, for much of their lives, not a close one.

John Lucas (a friend of the deceased)

John was a fresh looking man of 77. He had shared a desk with the deceased at school and they had remained good friends for the rest of their lives. He considered the deceased and his family to be very good people.

He had known Mary for about 20 years. He first met her at the house of the deceased and knew she was helping him out, particularly after his hip operation. From time to time he went to sheep sales with the deceased and was at the house for card games on other occasions. Most times Mary was there - she provided the supper and the drinks. On one occasion when the deceased was not well she put the sheep in a lorry which John then drove to market. The deceased spoke of Mary's working capacities with praise saying that she was "as good as any two men".

He was reluctant to say anything about his dead friend which was adverse to him but when pressed he said that there were a lot of people around the parish who were talking about the relationship between the deceased and Mary. He would have guessed that there was a relationship between them.

John thought that David would have been careful with his money. He thought he had heard David say on several occasions, usually after they had been drinking together, that he had promised Mary that there would be a roof over her head. He had said that he would "see Mary alright".

He thought that Mary had looked after David pretty well for 30 years. "I thought she deserved some recompense."

The defendant's case

Alice Evans (the defendant, sister of the deceased)

Alice is David's sister and was an executive officer in the civil service until she retired in 1982. She is now 79. She says that she had a good relationship with her brother and that she came to visit him in his house twice a week. Despite owning 490 acres he did not own a washing machine and she would wash and mend his clothes in her own home.

She does not view Mary as a member of the family. She never saw the personal effects of the plaintiff about David's house when she went round to visit. When there were family weddings David went with Alice, in a suit bought for him by her, rather than with the plaintiff who shared his bed.

Alice contended that the plaintiff had told her, after the death of her brother, that she had been paid £150 per week by the deceased. (The plaintiff argues that this is a misunderstanding and that she never received such regular or substantial payment). Her brother had never discussed any promises to the plaintiff with her and in particular had never discussed who was to inherit the farm and farm land when he died. She had never suggested to her brother that he make a Will and believed that if she had he would not have answered her.

Peter Evans (brother of the deceased)

Peter is David's brother and owned a hardware shop until he retired. He is now 77. He says that he was not in close contact with his brother but that they saw each other at family gatherings once a year or so.

Peter was made aware David's relationship with Mary through local gossip but had never met her until David's death. He argued that David would have married her or written her into his Will had he wanted her to inherit anything. He pointed to the fact that she was not brought to family gatherings as evidence that the relationship was nothing more than a casual one. He acknowledged that local attitudes towards sexual relationships outside marriage are somewhat conservative but argued that this would have given the couple all the more incentive to marry had the relationship been that serious.

He argued that if David did promise Mary 'a roof over her head and some land' then this should not entitle her to the whole estate, but rather enough to buy a house suitable for a single woman and a few acres. He reiterated his argument that David had plenty of opportunities to make a Will and that given his health problems it was undoubtedly something he would have considered.

He contested the claim that Mary's work was largely unrewarded on the grounds that she spent a lot of time up at the farm and so David frequently provided her with food and shelter.

Individual verdict decision

Subject number: ....

Applying the Law

Under the law of proprietary estoppel it is possible for the court to award Mary Brennan a proportion of Mr Evans' estate.

The questions which you need to satisfy are:

1) Did the deceased create and encouraged an expectation by the plaintiff that she would inherit some of his estate in return for her care of, work for and relationship with him?

2) If so then how much of the estate?

3) Given your answers to the above questions, how much relief (i.e. money) would it be fair to give to Mary Brennan? As the house and land have been already been sold we know that the estate was worth £800,000. The maximum amount which can be awarded to Miss Brennan is the whole estate - £800,000. The minimum amount is £0.

Please record your answer to the third question only below:

I think Mary Brennan should be awarded £ .... out of the £800,000 estate.

Group verdict decision

Subject numbers of those in the group:

....

....

....

....

....

....

....

....

....

....

Applying the Law

Under the law of proprietary estoppel it is possible for the court to award Mary Brennan a proportion of Mr Evans' estate.

The questions which you need to satisfy are:

4) Did the deceased create and encouraged an expectation by the plaintiff that she would inherit some of his estate in return for her care of, work for and relationship with him?

5) If so then how much of the estate?

6) Given your answers to the above questions, how much relief (i.e. money) would it be fair to give to Mary Brennan? As the house and land have been already been sold we know that the estate was worth £800,000. The maximum amount which can be awarded to Miss Brennan is the whole estate - £800,000. The minimum amount is £0.

Please record the group's decision regarding the third question only below:

We think Mary Brennan should be awarded £   out of the £800,000 estate.

Post-experiment questionnaire

Subject Number: ....

Have you ever taken part in any experimental research on behaviour before?   Yes/No

If yes please give brief details of the relevant experiments participated in:

....

....

....

....

....

Do you think you've heard about this case before?   Yes/No

Have you ever been a member of a jury in real life?   Yes/No

Have you or a close friend or relative ever been involved in a similar case to that used in this experiment?   Yes/No

Have you studied this type of legal action in your academic studies?   Yes/No

Did you know any of the other participants in your experimental group?   Yes/No

How many of the other participants would you describe as the following (please do not count each individual in more than one category):

a) A good friend (e.g. someone you are close to)   ....

b) A friend (e.g. someone you know moderately well)   ....

c) An acquaintance (e.g. someone you recognise but have never really chatted to)
        ....

d) A stranger   ....

Do you think the following statements applied to your group's deliberations:

Everyone had a chance to express their opinion   True/False

Some people contributed more to the discussion than others   True/False

One or more individual(s) dominated the group's discussions   True/False

If you answered yes to the above question, how many people do you think dominated the discussions?   ....

Everyone's opinions were respected by the group   True/False

Your group looked at the case from a number of different angles   True/False

Your group remembered the facts of the case accurately   True/False

Your group remembered all the important facts of the case   True/False

The opinions of the members of your group were more influenced by the people they knew before the experiment than those they had just met   True/False

During your group's deliberations arguments were expressed which you hadn't thought of yourself

                                                                                                 True/False

Your opinion about the case was changed by the deliberation process   True/False

The deliberation process made you more confident in your final verdict   True/False

How motivated were you to find the 'correct' verdict:

    Not motivated   Only a little motivated   Fairly motivated   Very motivated

In your own words please describe why you were this motivated:

....

....

....

If you had been judging this case for real how motivated do you think you would have been to find the 'correct' verdict?

    Not motivated   Only a little motivated   Fairly motivated   Very motivated

If you have any other comments about the experimental procedure or the case used in this experiment, please record them here:

....

....

....

Thank you for taking part!