Conformity in the Lab

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Abstract. We use a revealed preference approach to disentangle conformity, an intrinsic taste to follow others, from information driven herding. We provide observations from a series of sequential decision making experiments in which subjects *choose* the type of information they observe before making their decision. Namely, subjects choose between observing a private (statistically informative) signal or the history of play of predecessors who *have not* chosen a private signal (i.e., a statistically uninformative word-of-mouth signal). In our setup, subjects choose the statistically uninformative social signal 34% of the time and, of those, 88% follow their observed predecessors' actions. When allowing for payoff externalities by paying subjects according to the collective action chosen by majority rule, the results amplify and the social signal is chosen in 51% of all cases, and 59% of those who pick the social signal follow the majority choice. The results from the majority treatment demonstrate that conformist behavior is not driven by inequality aversion, nor by strategic voting behavior in which voters balance others who are uninformed. Raising the stakes five-fold does not eliminate conformist behavior; in both treatments, the social signal is chosen nearly 50% of the time. Individual level analysis yields the identification of rules of thumb subjects use in making their decisions.

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1. INTRODUCTION

Understanding the formation of herds is relevant to a variety of economic environments, ranging from voting behavior to fashion fads to financial market investments. The literature on herd formation is split into two strands of work. The psychology literature (see initial studies of Sherif, 1937 and Asch, 1958) suggests a preference based explanation in which agents exhibit conformity, an intrinsic taste to follow others. In contrast, the economics literature (see Banerjee, 1992 and Bikhchandani, Hirshleifer, and Welch, 1992) has proposed an information based model in which agents opt to ignore private signals and follow their predecessors' choices when the latter provides a stronger statistical indication as to the best course of action. In such a setting, agents who appear to be blindly following their peers may simply be best responding.

The goal of the current paper is twofold. First, to disentangle conformity from information based decision-making and inequality aversion. Specifically, to determine whether conformity plays a significant role in economic environments. Second, to establish the effects of institutions on the prevalence of conformist behavior. In particular, we explore the impacts of payoff externalities and incentive magnitude on conformist behavior in the lab.

Our experimental design allows subjects to *choose* between observing a statistically informative signal and the history of choices of preceding players who themselves chose to observe the history of choices of predecessors who chose the history of choices, etc. That is, subjects choose between a statistically informative signal and a *pure word-of-mouth* signal. Within this framework, we study two aspects of subjects' decisions: whether they choose to observe the social word-of-mouth signal and whether, upon choosing such a signal, they follow the more popular action.

When subjects are paid according to their decision alone (a high amount when their choice matches the underlying uncertain state and a low amount otherwise), a significant fraction (34%) chooses to observe the word-of-mouth signal. Furthermore, subjects are significantly more inclined to turn down the statistical signal when they are located later in the sequence.

Finally, subjects that observe the social signal predominantly match the more prevalent action among those observed.

While the high percentage of agents turning down statistical information is both astounding and consistent with the notion of conformity, it could also be explained with a model of inequality aversion (e.g., Fehr and Schmidt, 1999). That is, if subjects have an intrinsic aversion to getting payoffs that are at the tails of the payoff distribution, others' previous choices may be useful in ascertaining their optimal actions. In about half of our experimental sessions, subjects in each group are paid identical amounts determined according to whether the *majority guess* matched the underlying state or not. As a result, subjects' payoffs are inherently equal within their group so inequality aversion cannot play a role. In these sessions, about 50% of the subjects turned down the informative signal.

There is another interesting layer to the majority choice treatment which pertains to the levels of sophistication and strategic behavior subjects exhibit. Indeed, if subjects realize that some of their peers are herding uninformed on one option, they may have an incentive to choose the *other* option in order to *balance* these "noise voters" and give the power of vote to informed subjects who choose the statistical signal. This is, in essence, the underlying intuition of the literature on strategic voting (see, e.g., Feddersen and Pesendorfer, 1996). In our treatment, a clear minority of those choosing to observe the history of choice behaved in a contrarian manner, voting against the option appearing to obtain the majority support. Consequently, there is great imbalance of choices amongst subjects who observe the word-of-mouth signal. In particular, we see very limited support for strategic behavior.

There are several experimental contributions to the literature on information cascades that tie directly to the current paper.[1] Our experimental design is similar in spirit to that used in Anderson and Holt (1997) and Hung and Plott (2001) in order to test experimentally the original informational cascade model of Bikchandani, Hirshleifer, and Welch (1992). Ultimately, both these papers illustrate the prevalence of cascades and their sensitivity to the institution used to aggregate group choices (in particular, under majority rule, Hung

[1]For general surveys of social learning, see Gale (1996), or Bikhchandani, Hirshleifer, and Welch (1998).

and Plott, 2001, illustrate that fewer cascades form).[2] A common denominator of all these papers is that both social and statistical information are always provided and are not objects of choice.

Our paper also relates to a few recent papers exploring information acquisition in the context of social learning. In Kübler and Weizsäcker (2004), subjects faced common uncertainty and were required to decide sequentially whether or not to make an investment whose return depended on the common realization of uncertainty. In addition to observing their predecessors, subjects had access to a costly information source. Experimental subjects invested excessively in information relative to equilibrium predictions. Interestingly, when we pose the choice in terms of information sources, subjects choose too little statistical information for payoff maximization. In a similar spirit, Çelen, Choi, and Hyndman (2005) studied information acquisition in the context of networks. Their subjects received a free signal on the underlying state, and could observe predecessors' actions for a fee. An agent who had access to only one other agent could gain nothing by observing that agent's first period choice (as it encompassed information from only one signal). Nonetheless, 25% of the subjects were reported to have paid the fee to observe their predecessor. These results are consistent with the observations reported in the current paper. In fact, we illustrate that even when predecessors' actions hold *no information* at all, agents are willing to forego statistical information in order to observe historical choices.

The paper is organized as follows. In Section 2 we describe our experimental design. Section 3 describes the theoretical hypotheses generated by our design. Section 4 provides the aggregate analysis of the results, while Section 5 provides the corresponding individual analysis. Section 6 concludes. An Appendix contains our experimental instructions.

[2]Hung and Plott also run a session in which subjects were directly given incentives to conform and indeed observe higher rates of cascades in the corresponding treatments. Drehmann, Oechssler, and Roider (2005a) replicate some of these results with a larger subject pool and introduce particular forms of network externalities in which agents' payoffs depend on the actions chosen by a subgroup of subjects. Interestingly, when decision values are endogenous, as in financial markets with flexible prices, Drehmann, Oechssler, and Roider (2005b) illustrate that herding may not play a very strong role.

2. Experimental Design

The underlying experimental design is as follows. There is a "red" jar and a "blue" jar: the red jar contains seven red and three blue balls and the blue jar contains seven blue and three red balls. At the start of each period, one of the jars is chosen by a toss of a fair coin. The goal of the subjects is to guess the jar that has been chosen.[3] Specifically, subjects make their guesses sequentially as follows:

Subjects 1-3 (history condition) each observes her predecessors' actions and no other information before making her guess.

Subjects 4 and on (choice condition) each gets to choose whether to observe *history*, the actions chosen by all agents who were in the *history* condition (by choice or by design), or a *private signal*, as manifested by a draw with replacement from the selected jar. The decisions of those that choose private signal are *not* recorded in *history*, which captures only the decisions of those that choose *history*.

Thus, starting from subject 4, each subject faces a choice between a (statistically uninformative) word-of-mouth signal and a (statistically informative) private signal. This process is repeated for 10 periods, in each of which subjects' locations in the sequence are randomly determined.

There are two treatments: *Individual Choice* and *Majority Choice*, which we now describe.

Individual Choice There are no payoff externalities between subjects' guesses. Each subject receives \$1 if she correctly guesses the chosen jar and \$0.10 otherwise.

Majority Choice We determine the jar that got a (simple) majority of guesses at the end of each period and give *all* subjects \$1 if the majority guess is correct and \$0.10 otherwise.

[3]Thus, the basic structure is reminiscent of the designs of Anderson and Holt (1997) and Hung and Plott (2001).

Treatment	Stakes	Number of Sessions	Number of Subjects
Individual	Low ($1, $0.1)	5	72=15+15+15+15+12
Individual	High ($5, $0.5)	3	45=14+15+16
Majority	Low ($1, $0.1)	4	58=15+15+15+13
Majority	High ($5, $0.5)	3	43=15+15+13

Table 1: Experimental Design

In order to examine the effects of incentive size, we also repeated our two treatments with stakes that were 5 times higher. That is, $5 for correct (individual or majority) guesses and $0.50 for incorrect ones.[4] In addition, subjects were paid $5 for showing up. To summarize, our experiments followed a 2×2 design, where the existence of payoff externalities (individual or majority choice) and the size of the stakes were varied.

Sessions were run at the California Social Science Experimental Laboratory (CASSEL) at UCLA, with a total of 218 subjects.[5] Table 1 summarizes the set of experimental sessions for each of the treatments (the number of subjects is described as a sum, where summand i corresponds to the number of subjects used in session i of the relevant treatment).

On average, subjects were paid $11.11 and $31.00 in the individual treatments under low and high stakes, respectively, and $12.48 and $32.29 in the majority treatments under low and high stakes, respectively.

3. PREDICTIONS

Of course, maximization of expected payoffs in the individual choice treatments would entail all agents choosing a statistically informative signal when having the option to do so, and following their signal with their guess. That is, choosing the red jar if a red ball was sampled, and choosing the blue jar otherwise. Consequently, our first hypothesis is:

[4]We note that the $1 - $0.10 stakes are actually of standard magnitude used in the social learning experimental literature in recent years (see, e.g., Celen and Kariv, 2004, Hung and Plot, 2001, etc.).

[5]We used the z-tree software (see Fishbacher, 2007) to program all of our experimental treatments. The slides used during the instruction phase of the experiments can be found in the Appendix.

Hypothesis 1 (Informational Herding) *The fraction of subjects choosing* history *in the individual treatment is zero.*

While in the individual choice treatments the optimal and dominant payoff maximizing behavior is to observe the statistical signal and follow it, more subtle strategic considerations arise in the majority treatments. Intuitively, conditional on choosing *history* under the majority treatment, strategic subjects aiming at maximizing their monetary payoffs should try to balance out the uninformed choices by going against the majority choice. This way, the informed subjects, who observe a private signal prior to voting, will have more voting power. Indeed, the intuition driving some of the underlying results in the strategic voting literature (see, e.g., Feddersen and Pesendorfer, 1996) suggests that sophisticated subjects who realize some of their peers select history of play and blindly follow the majority, may have an incentive to choose history of play and go *against* the majority.

Let n denote the odd number of voters. To glean some insight into the equilibria of this strategic game, suppose individuals 1 trough $n-2$ have chosen history of play and the vote lead for one of the options is 1.[6] The next-to-last voter can either select history to balance the vote count or vote on the basis of a private signal. In the former case, the final voter chooses a private signal and votes accordingly, and the probability with which the group is correct is equal to the signal precision $q = .7$. In the latter case, the final voter is indifferent between choosing history to balance the vote count of those that chose history or choosing a private signal and voting accordingly: either way the probability with which the group is correct is $q = .7$.[7] To summarize, there may be an even or odd number of voters choosing history but there will be at least one voter who votes according to a private signal. This example provides the intuition for the following characterization of informative equilibria,

[6] If the vote lead for either alternative is 3 or more after these $n-2$ votes, the majority is determined and the probability with which the group selects the correct alternative is only .5.

[7] When the final two voters choose private signals the chance that the group is correct is $\frac{1}{2}q^2 + \frac{1}{2}(q^2 + 2q(1-q)) = q$, where the first (second) term on the left side corresponds to the case where the (in)correct option has a vote lead of 1 among those that chose history.

i.e. equilibria in which some statistical information is utilized.[8]

Proposition (Equilibria Characterization) *In any informative equilibrium, at least one subject votes according to a private signal. Subjects choosing to observe history balance their votes such that neither option has a vote lead of more than 1.*

Clearly, the most efficient equilibrium entails at most one subject *choosing* to observe history in the majority treatment (recall that the first three subjects observe history by design). This holds even if subjects are inequality averse, unlike in the individual treatment. Consequently,

Hypothesis 2 (Efficiency) *At most one of the subjects succeeding the first three chooses history.*

Of course, subjects may not be following the most efficient equilibrium, but still behave in a sophisticated manner. The Proposition suggests that history profiles should be (almost) balanced in *any* equilibrium, so that the power of vote is given to those who are statistically informed. Thus, we can test for strategic sophistication through the following Hypothesis.

Hypothesis 3 (Strategic Voting) *In the Majority Choice treatment, history profiles are (almost) balanced, i.e., neither option has a vote lead of more than 1.*

4. Results - Aggregate Data

The focus of our study pertains to agents' choice of information. Since subjects $1-3$ were provided the history of actions and not given a choice regarding what information they desired, any choice of action by those subjects generated the same expected payoff. We therefore restrict most of the analysis that follows to the decisions taken by subjects 4 and on in the sequence. The final decisions in all periods of the individual choice treatments translate into 570 decisions with low stakes and 360 decisions with high stakes. In the

[8]In addition to the informative equilibria characterized by the proposition there also exist uninformative equilibria, e.g., everyone choosing a statistical signal and then voting blue.

majority treatments, there were 460 decisions in periods 4 and on of the low stakes sessions and 340 decisions in the corresponding periods of the high stakes sessions.

We start by analyzing choices of information. In particular, we study the effects of externalities on information choices, as well as rule out explanations such as inequality aversion for the apparent conformist behavior observed in the lab. We then investigate behavior of subjects choosing to observe the uninformative actions of others. This allows us to identify the extent of sophisticated game theoretic behavior in the voting context.

4.1. Information Choices. The upper panel of Table 2 summarizes the results from the individual choice treatments. As can be seen, 34% of the subjects in the low stakes sessions and 50% of the subjects in the high stakes sessions chose to observe history, and both these figures are significant at any reasonable level. Restricting the data to the last four periods in all sessions does not produce significantly different levels of history choices, suggesting our results are not driven by confusion nor are they significantly mitigated by learning. In fact, we were particularly concerned about subjects' confusion. At the end of each session, we asked subjects to explain in their own words the strategies used in the experiment. We then employed a research assistant to try and ascertain which subjects appeared confused. Note that subjects have self-protection motives to justify leaving money on the table (see below), and thus any confusion measure based on unpaid self reports is most probably an over-estimate. Nonetheless, using a harsh criterion of classifying a subject as confused if *anything* in his or her description is inaccurate, history choices remain above 15% across all sessions and significantly greater than 0. We therefore reject Hypothesis 1.

There are several points to note. First, subjects incurred significant monetary losses by selecting to observe history. Indeed, the per period average loss relative to potential per period returns (achieved if subjects were to observe statistical signals and follow them) was 10¢ in the low stakes treatment and \$1 in the high stakes treatment. Particularly in the high stakes sessions, these losses translate into subjects forgoing a significant portion of their experimental wage.

Treatment	Stakes	Fraction of History Choices		Average Profit	Potential Profit
		Periods 1-10	Periods 7-10	per Period	per Period
	Low ($1, $0.1)	0.34	0.32	$0.61	$0.72
		(0.02)	(0.03)	(0.02)	(0.02)
Individual		t= 17.14	t=10.24		
	High ($5, $0.5)	0.5	0.44	$2.65	$3.65
		(0.03)	(0.04)	(0.12)	(0.12)
		t=19.23	t=10.55		
	Low ($1, $0.1)	0.51	0.48	$0.75	$0.98
		(0.02)	(0.04)	(0.02)	(0.004)
Majority		t=21.71	t=13.09		
	High ($5, $0.5)	0.43	0.41	$2.72	$4.40
		(0.03)	(0.04)	(0.12)	(0.08)
		t=16.38	t=9.72		

Numbers in parentheses correspond to standard errors

Table 2: Aggregate Statistics

Second, and somewhat puzzling to us, is the fact that conformist behavior is more frequent in the high-stakes treatment (although the difference is not significant at the 5% level using a Wilcoxon two-sample test). This is intriguing in view of the amount of money left on the table in both treatments and reminiscent of the type of payoff insensitivity observed in other social learning experiments.[9]

We note that of the subjects who choose to observe the statistical signal subjects behave nearly optimally. Indeed, 91% (92%) follow the guess corresponding to the observed signal in the low (high) stakes treatment.

While the data observed from the individual choice treatments is consistent with subjects acting on conformist motives, i.e. an intrinsic taste to follow others, they are also consistent with some form of *inequality aversion.* That is, if subjects are averse to receiving either higher or lower payoffs than some function of the moments of the experimental distribution (Fehr and Schmidt, 1999), they may indeed be willing to forego statistically useful information

[9]Anderson (2001) systematically varies the payoff scale in social learning experiments similar to ours (in her experiment all subjects receive a statistical signal by design). She finds no systematic effects of changing payoff magnitudes unless the incentive payments are removed entirely.

as in our data. The majority treatments offer a clean control for any form of inequality aversion as, by definition, all subjects within a specific session received the same exact payoff. The bottom panel of Table 2 contains the aggregate statistics pertaining to the majority treatment.

Clearly, the number of history choices among those who had a choice was significantly more than 1 for both the low stakes and the high stakes sessions, at any reasonable confidence levels. In the low stakes sessions, 51% of the decisions entailed the observation of history, while for the high stakes sessions, the analogous figure is 43% (both of the same order of magnitude as observed in the high stakes individual treatments). As before, these observations are robust to restricting the data to the last four periods within each session. Furthermore, both the mean and the median number of history choices per group decision was 9 in the low stakes sessions and 8 in the high stakes sessions (see top panel of Table 3 below). Thus, Hypothesis 2 is rejected. Upon choosing to observe a statistical signal, agents follow the signal with high percentages: 96% in the low stakes condition and 91% in the high stakes condition. Thus, the deviation from equilibrium behavior cannot be explained by the choices made by subjects who observe the statistical signals. In particular, our results cannot be explained by an inequality aversion model, nor do the subjects seem to be playing the most efficient equilibrium.

It is worth noting that within each group, subjects had the potential for significant collective information (with 15 subjects there are 12 signals of accuracy $q = .7$). In particular, the gap between the average per period payoff and the potential per period payoff that would have been generated had subjects collectively followed the most efficient equilibrium strategies, is even starker than in the individual treatments. In the low stakes treatments this gap was 23¢, while in the high stakes treatment, the gap was \$1.68 per period!

Order	Individual Treatment		Majority Treatment	
	Low Stakes	High Stakes	Low Stakes	High Stakes
Second in sequence	0.72	0.5	0.48	0.57
	(0.06)	(0.09)	(0.08)	(0.09)
	t1=3.46, t2= 11.34,	t1=0, t2=5.48	t1=0.32, t2=6.02	t1=0.74, t2=6.26
Third in sequence	0.58	0.8	0.47	0.59
	(0.08)	(0.10)	(0.11)	(0.11)
	t2=1.01, t2=7.10	t1=2.90, t2=7.75	t1=0.23, t2=4.14	t1=0.74, t2=4.92
Four and on	0.88	0.84	0.59	0.70
	(0.02)	(0.03)	(0.04)	(0.04)
	t1=15.71, t2=36.67	t1=12.37, t2=30.39	t1=2.64, t2=17.13	t1=5.04, t2=17.75

Numbers in parentheses correspond to standard errors
t1 and t2 are t-statistics regarding differences from 0.5 and 0, respectively

Table 3: Frequencies of Followers within History

4.2. Behavior within History Condition. The previous section attested to subjects having some taste for observing others' actions. This can stem from a variety of underlying reasons – it may be a manifestation of curiosity, of a sensible rule of thumb, etc. We now inspect more carefully subjects' choices within the history condition.[10] Table 3 reports frequencies of subjects who have observed the social signal and chose the prevalent action among observed predecessors (i.e., the action that a strict majority of prior subjects who observed the social signal had chosen), when such an action existed.

The top panel of the table describes the behavior of the second and third subjects in the sequence. These were subjects who were forced into the so called history condition. They received no statistical information, but observed their predecessors' actions. Table 3 illustrates the probability that the second subject chose an action coinciding with the first's, as well as the probability that the third subject chose an action coinciding with the actions of the first two players, when those were identical.

[10]Note that while curiosity-type theories may help explain the *choice* of social information, they do not generally imply anything about choices *conditioned* on having observed the social signal.

It is important to keep in mind that under the individual treatment, absent any statistical information, following predecessors or not generates the identical expected values. Interestingly, subjects follow others with a probability that is significantly different than 50%, that would be generated by random choice (the reported $t1$ is the t-statistic corresponding to the difference between observed behavior and random choice). In the majority treatments, subjects potentially have an efficiency incentive to balance out predecessors' votes. While in these treatments probabilities of conforming with predecessors are not significantly different from those generated by random choice, they are certainly significantly different from 0, which would be derived if subjects were engaged in "balancing out" preceding subjects (the reported $t2$ is the t-statistic corresponding to the difference between observed behavior and contrarian behavior, i.e., going against the prevalent observed action).

The bottom panel of Table 3 reports the frequencies of following the prevalent action within history for subjects who *chose* the social signal. While the behavior is similar qualitatively to that of the second and third subjects in the sequence, the levels of following are greater. Indeed, in the individual treatments, subjects followed the more common action with $84\% - 88\%$. Within the majority treatments, these probabilities are lower. Nonetheless, subjects follow others with probability that is significantly greater than 50% and certainly do not behave in a fully contrarian manner as the informative equilibria suggest.[11]

Table 4 contains more information on the distribution of history lengths in each treatment. The lower panels in each of the segments of Table 4 summarize the results regarding the frequency of all possible differences between choices of Red and Blue. In the individual treatments, under the low stakes, only one history was balanced, and 3 out of 50 profiles had an imbalance of one vote. Under the high stakes, no history profile was balanced, and 3 of 30 profiled has an imbalance of only one vote.

[11] Corrazzini and Greiner (2007) note similar comparative statics regarding the tendency to follow other uninformed subjects as it depends on location within the sequence.

Stakes	Individual - Number of Subjects Choosing History														
	0	1	2	3	4	5	6	7	8	9	10	11	12		Mean
Low ($1, $0.1)	4	2	4	9	14	5	8	4	0	0	0	0	0		3.88
High ($5, $0.5)	0	0	1	4	4	7	1	4	3	3	3	0	0		6
	Individual - Absolute Difference between Choices within History														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	Mean
Low ($1, $0.1)	1	3	5	9	6	9	2	8	4	1	2	0	0	0	4.76
High ($5, $0.5)	0	3	4	3	2	0	7	1	3	2	0	1	2	2	6

Stakes	Majority - Number of Subjects Choosing History													
	0	1	2	3	4	5	6	7	8	9	10	11	12	Mean
Low ($1, $0.1)	0	0	0	0	1	3	3	2	6	9	7	5	4	8.8
High ($5, $0.5)	0	0	0	0	0	1	3	6	10	8	2	0	0	7.9
	Majority - Absolute Difference between Choices within History													
	0	1	2	3	4	5	6	7	8	9	10	11	12	Mean
Low ($1, $0.1)	0	7	3	2	5	6	7	2	2	1	4	1	0	5.0
High ($5, $0.5)	1	5	6	1	5	5	1	4	2	0	0	-	-	3.8

Table 4: Characteristics of History Profiles

Similarly, in the majority treatments, under the low stakes treatment, no history profile was balanced and only 7 out of 40 had an imbalance of one vote. Under the high stakes treatment, 1 out of 30 profiles ended up being balanced and 5 out of 30 had an imbalance of precisely one vote. In fact, the mean absolute difference between the two possible guesses under the low stakes treatment was 5, while under the high stakes treatment it was 3.8. On the individual level, these are consistent with the observations reported in Table 3 regarding contrarian behavior within history. In summary, Hypothesis 3 is rejected.

The extent to which there is imbalance within the history profile is certainly related to the length of history. For one, this difference is bounded by the number of subjects choosing to observe history overall. Figure 1 illustrates the link between the observed imbalance and the length of history profiles. In particular, for any number of subjects choosing to observe history, the figure illustrates the average imbalance of votes within the history profile. One can see that longer histories are characterized by lower rates of "almost balanced" histories.[12]

[12]This is consistent with the original conformity experiments reported in Asch (1958) in which the number of confederate subjects reporting a wrong answer affected positively the propensity of the real subjects to follow suit.

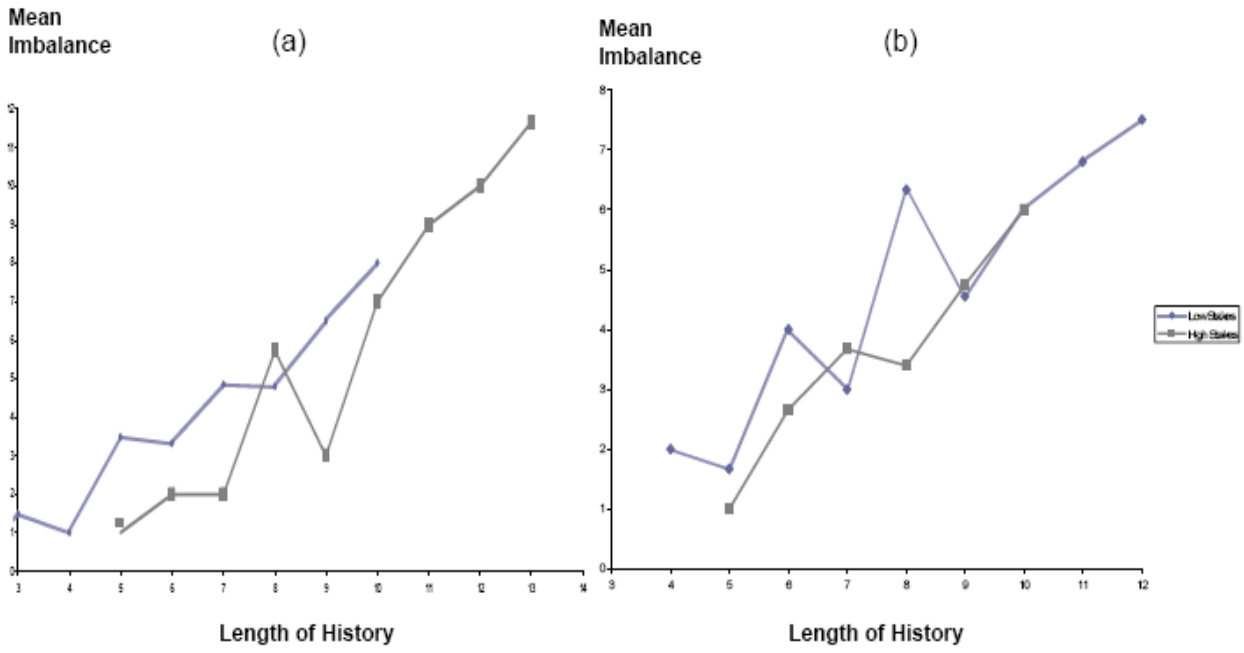


Figure 1: Mean Imbalance as a Function of the Number of Subjects Choosing History (panels (a) and (b) corresponding to individual and majority treatments, resepctively)

5. Individual Analysis

We now turn to the individual analysis of our data. Figure 2 depicts the distribution of individual frequencies pooled from all treatments. As can be seen, there are significant masses of subjects at the extremes, choosing either to observe the statistical signals or the uninformed historical choices nearly always. The distributions corresponding to the different treatments are similar in shape. For instance, in the low stakes sessions, under the individual treatments, 35 of 72 subjects chose to observe the social history no more than 25% of the time, while 10 of 72 subjects chose to observe the social history no less than 75% of the time. Under the majority treatments, 20 of 58 subjects chose to observe the social history no more than 25% of the time, and 20 of 58 chose to observe the social history no less than 75% of the time.[13]

[13]It is worth noting that neither gender nor academic major had significant explanatory power regarding individual choices.

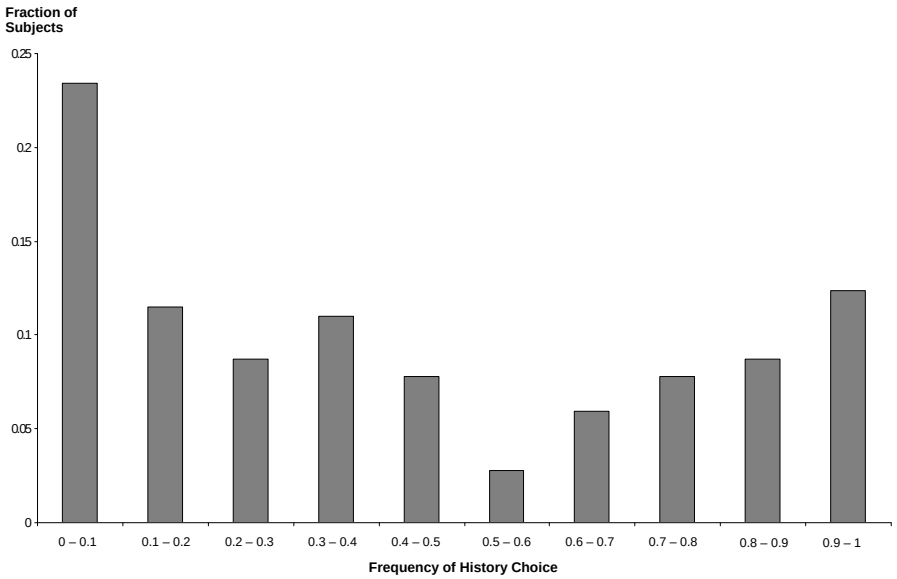


Figure 2: Distribution of Individuals According to Frequency of History Choices

One simple heuristic that seems to be used by our subjects relates to their location within the sequence. Indeed, subjects appear to be more prone to observe the word-of-mouth uninformative signal the further they are in the sequence. Figure 3 depicts the frequency of history choices as a function of the location of subjects within the treatments, as well as the estimated line corresponding to the pooled data from all treatment (of slope 0.031 ± 0.003).

The correlation between history choices and the location within the sequence of decision makers does not differ significantly across treatments and sessions.[14] The upward trend apparent in Figure 3 provides further evidence for conformist behavior. If agents possess an intrinsic taste to follow others and, say, care about the action taken by a majority of their peers, the value of looking up the social history of actions indeed increases later in the sequence of play.

[14]Linear or probit regressions yield similar confirming results. Consider the low stakes sessions. In the Individual Choice treatment, regressing a choice dummy (1 when history was chosen, 0 when a private signal was chosen) on location yields a coefficient of 0.033 ± 0.006 while in the Majority Choice treatment this coefficient is: 0.034 ± 0.007. Similarly, for the high stakes treatments the corresponding coefficients are 0.025 ± 0.007 for the Individual Choice treatment and 0.027 ± 0.008 for the Majority Choice treatment.

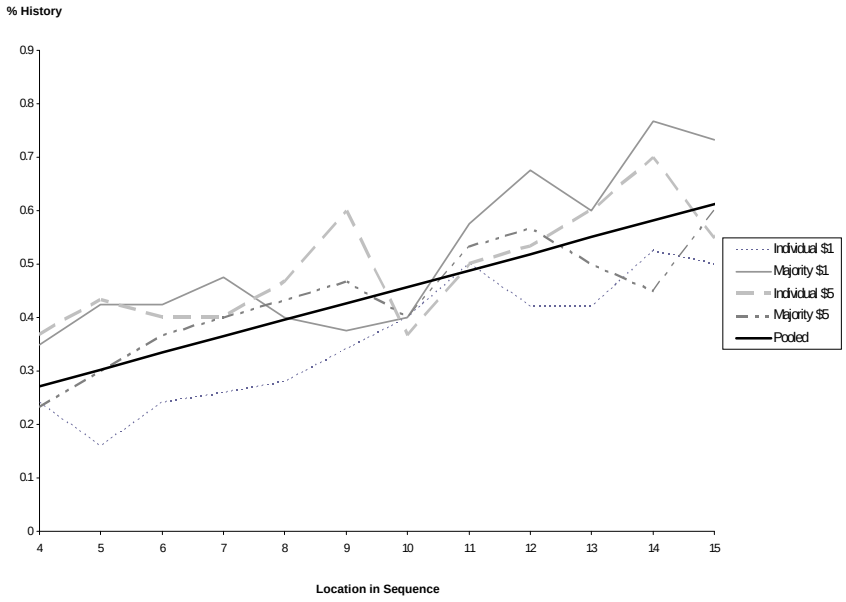


Figure 3: Fraction of Individuals Choosing History as a Function of Location in the Sequence

6. Conclusions

We report results from several simple experiments disentangling information-based herding from an intrinsic taste to follow others. Using a revealed preference approach, we allowed subjects to *choose* between social information void of any relevant statistical information regarding the problem at hand and an informative statistical signal. A significant percentage of subjects choose to observe the social information. Upon observing the social information, a significant majority of subjects choose the prevalent action observed. Externalities, learning, or increased stakes do not mitigate the results. In particular, the motives to "conform" appear to outweigh both individual and strategic voting motives.

Following others may be a very sensible rule of thumb in many contexts of real life and so may make sense as a decision making short-cut in various circumstances. Nonetheless, in many situations, this rule of thumb may be rather costly in terms of individual payoffs (as when considering stock market investments) or collective welfare (as in common-value elections), and suggests a potential new read of some of the germane empirical literature.

References

[1] Anderson, L. (2001) "Payoff Effects in Information Cascade Experiments," *Economic Inquiry*, Volume 39(4), pages 609-615.

[2] Anderson, L. R. and C. A. Holt (1997), "Information Cascades in the Laboratory," *American Economic Review*, Volume 87(5), pages 847-862.

[3] Asch, S. E. (1958), "Effects of Group Pressure upon the Modification and Distortion of Judgements," in E. E. Maccoby, T. M. Newcomb, and E. L. Hartley, eds., *Readings in Social Psychology*. New York: Holt, Rinehart, and Winston, pages 174-183.

[4] Banerjee, A. V. (1992), "A Simple Model of Herd Behavior," *Quarterly Journal of Economics*, Volume 107(3), pages 797-817.

[5] Bikhchandani, S., D. Hirshleifer, and I. Welch (1992), "A Theory of Fads, Fashion, Custom, and Cultural Change as Information Cascades," *Journal of Political Economy*, Volume 100(5), pages 992-1026.

[6] Bikhchandani, S., D. Hirshleifer, and I. Welch (1998), "Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades" *Journal of Economic Perspectives*, Volume 12(3), pages 151-170.

[7] Çelen, B., S. Choi, and K. Hyndman (2005), "Endogenous Network Formation in the Laboratory," New York University, mimeo.

[8] Çelen, B. and S. Kariv (2004), "Distinguishing Informational Cascades from Herd Behavior in the Laboratory," *American Economic Review*, Volume 94(3), pages 484-497.

[9] Corrazzini, L. and Greiner, B. (2007), "Herding, Social Preferences and (Non-) Conformity," *Economics Letters*, forthcoming.

[10] Drehmann, M., J. Oechssler, and A. Roider, A. (2005a), "Herding with and without Payoff Externalities - An Internet Experiment," University of Heidelberg Discussion Paper No. 420.

[11] Drehmann, M., J. Oechssler, and A. Roider (2005b), "Herding and Contrarian Behavior in Financial Markets - An Internet Experiment," *American Economic Review*, Volume 95(5), pages 1403-1426.

[12] Feddersen, T. J. and W. Pesendorfer (1996), "The Swing Voter's Curse," *American Economic Review*, Volume 86(3), pages 408-424.

[13] Fehr, E. and K. M. Schmidt (1999), "A Theory of Fairness, Competition and Cooperation," *Quarterly Journal of Economics*, Volume 114(3), pages 814-868.

[14] Fischbacher, U. (2007), z-Tree: Zurich Toolbox for Ready-made Economic Experiments, *Experimental Economics*, Volume 10(2), pages 171-178.

[15] Gale, D. (1996), "What Have We Learned From Social Learning?" *European Economic Review,* Volume 40(3-5), pages 617-628.

[16] Hung, A. and C. R. Plott (2001), "Information Cascades: Replication and an Extension to Majority Rule and Conformity-Rewarding Institutions," *American Economic Review*, Volume 91(5), pages 1508-1520.

[17] Kübler, D. and G. Weizsäcker (2004), "Limited Depth of Reasoning and Failure of Cascade Formation in the Laboratory," *Review of Economic Studies*, Volume 71, pages 425-441.

[18] Sherif, M. (1937), "An experimental approach to the study of attitudes," *Sociometry*, Volume 1, pages 90-98.

7. Appendix - Instructions

The following is the set of slides used for both the individual and majority treatments with low stakes (where either the fourth or fifth slide below was shown, respectively). Identical slides were used for the high stakes treatments with the exchange rates altered.

Welcome to CASSEL

Welcome to the CASSEL Lab, and thank you for participating in today's experiment.

It is very important that you do not touch the computer until you are instructed to do so. And when you are told to use the computer, use it only as instructed. In particular, do not attempt to browse the web or do other things unrelated to the experiment.

There should be a pencil in the envelope you received.

Place all of your personal belongings away, so we can have your complete attention.

2

The Experiment

The experiment you will be participating in today is an experiment in decision making. At the end of the experiment you will be paid for your participation in cash. Each of you may earn different amounts. The amount you earn depends on your decisions, chance, and possibly the decisions of other participants.

Please DO NOT socialize or talk during the experiment.

We will go over the instructions slowly. It is important you follow.

When you have a question please raise your hand and one of us will come to you to answer it in PRIVATE.

3

Choosing a Jar

At the beginning of each round we will flip a coin to choose one of two jars:

Red Jar: 7 red balls and 3 blue balls.

Blue Jar: 7 blue balls and 3 red balls.

You will make your choices in sequence.

Your task will be to guess which jar has been chosen.

4

Guessing the Jar

After receiving some information (soon to be explained), you will be asked to guess which jar has been selected.

Correct guess: 100 points

Incorrect guess: 10 points

1

Guessing the Jar

After receiving some information (soon to be explained), you will be asked to guess which jar has been selected.

After everyone has made their guesses, we will determine the most popular guess (the one chosen by the majority; ties resolved randomly)

Majority Correct: **100 points to all**

Majority Incorrect: **10 points to all**

6

Information

You will make your decisions in sequence, one after another.

For persons 1, 2, 3:
You will see the "history of play"

For persons 4, 5, 6, etc.:
You can choose "private sample" or "history of play"

YOUR CHOICE WILL NOT BE REVEALED TO ANYONE.

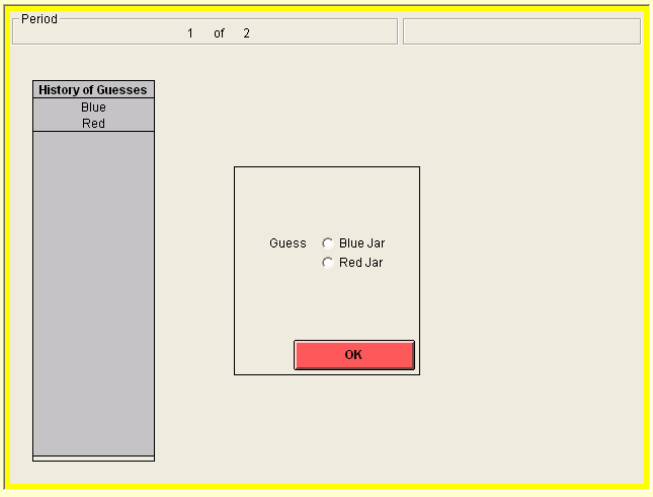
7

Information - continued

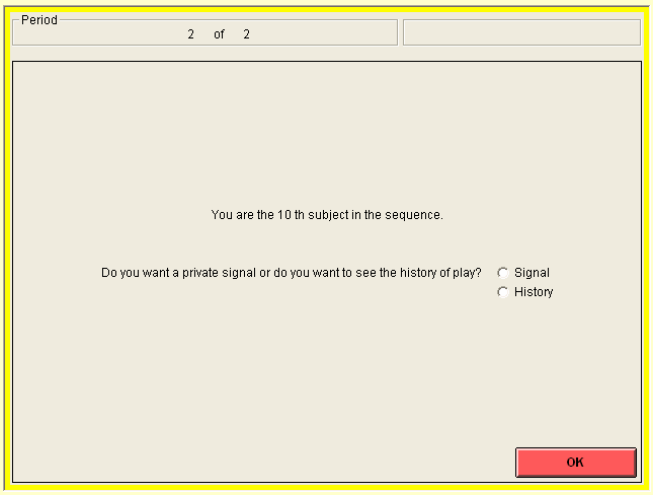
"history of play" – you see the guesses made by everyone before you who has seen history of play (in particular, the first person observing "history of play" receives no information). Only guesses of those who choose "history of play" are listed in the history of play.

"private sample" – you will get to observe the color of one ball drawn at random (and with replacement) from the selected jar.

SCREEN 3rd PERSON

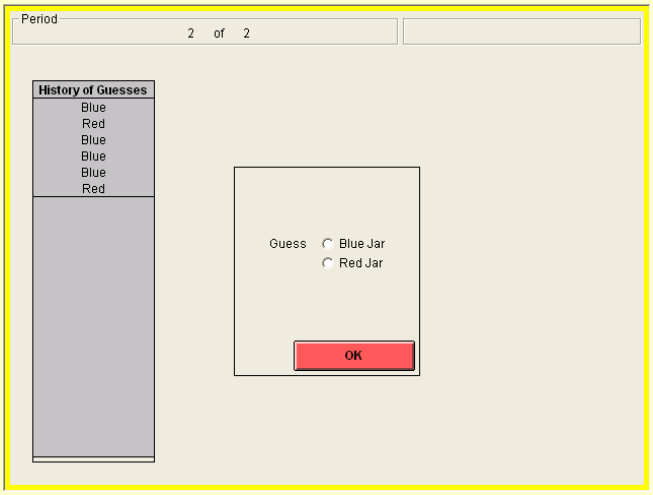


SCREEN 10th PERSON



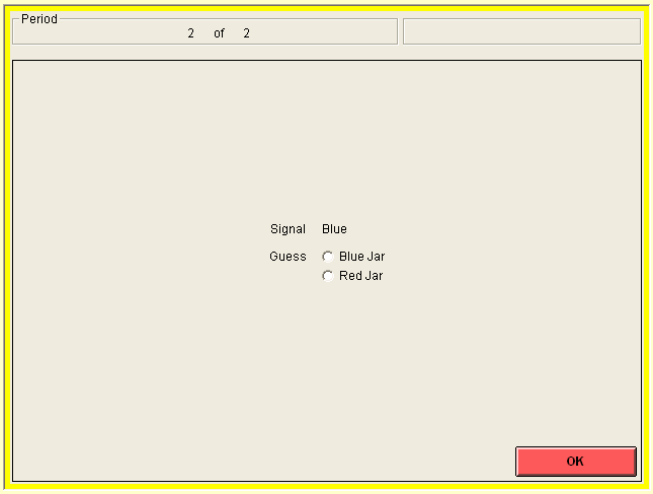
10

Person 10 chooses "history"



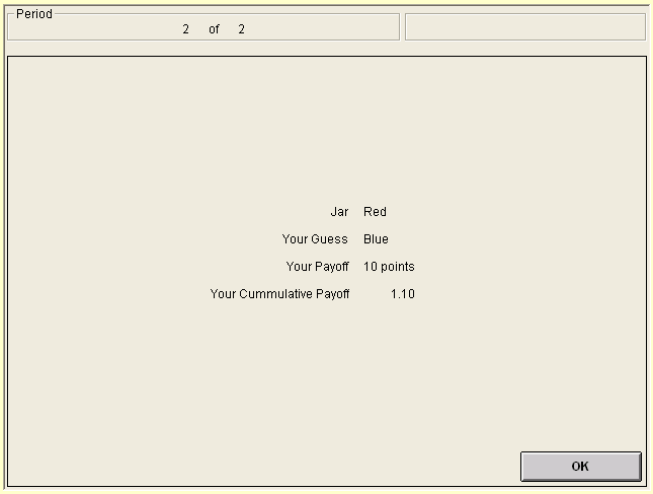
11

Person 10 chooses “signal”



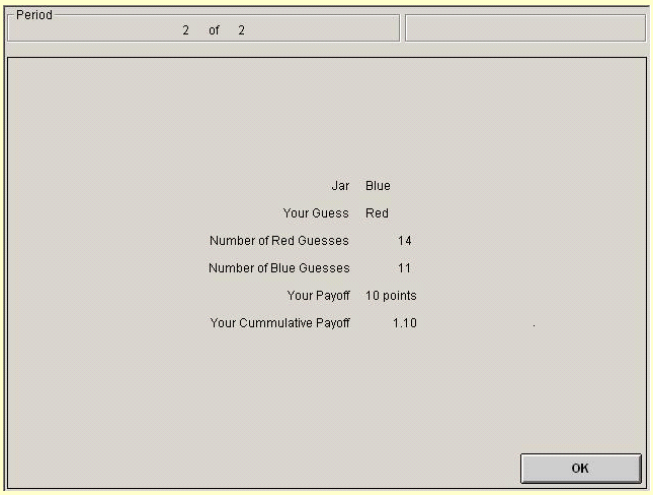
12

(Cumulative) Payoff screen



13

(Cumulative) Payoff screen



14

Summary

In each period:

Each of you, in turn, will be asked to make decisions.

Persons **1 through 3** in the sequence:
you'll see "history of play"

Persons **4, 5, 6, …** in the sequence:
You choose whether to observe
"history of play" or "private sample"
Your choice will NOT be revealed

The experiment consists of **10 periods** as described.

15

Your Earnings

1 point = 1 cent

You will be paid at the end of the experiment the total amount you have earned in all of the rounds. You need not tell any other participant how much you earned.

Let the Experiment Begin!

16