Strategic information transmission (trojan teaching) in client-consultant relationships

Alexander Poddiakov[1] Stanislav Moskovtsev[2] Alexis Belianin[3]
Alexei Boulatov[2] Andrey Kim[2]

[1]Department of Psychology, Higher School of Economics (HSE), Moscow, Russia
[2]ICEF, Higher School of Economics, Moscow, Russia
[3]ICEF, Higher School of Economics, and IMEMO RAS, Moscow, Russia

November 27, 2014, Bishkek, KSU

Trojan teaching

Trojan teaching (©Alexander Poddiakov) stands for the situation when the informed party (sender) communicates to the uninformed party (receiver) less than full information in posession of the sender, to own advantage and at the expense of the receiver.

It seems appropriate to speak of trojan teaching (or information transmission) whenever the sender (he)

- has superior information (finer partition on the set of possible states),
- knows his information is superior,
- knows that receiver (she) does not know this (otherwise, cannot act strategically),
- knows that receiver would have benefited had her information been as complete as that of himself (full transmission)
- expects to get strategic benefits from incomplete information transmission (has intention and will to do so — ethical issues)

Omission of *any* of these characteristics defines a *different* (but possibly very interesting!) task from that of trojan teaching in our sense.

Examples

- Children games with partial communication of information
- ForEx trade: teachers benefit not only from licensing fees, but also from incremental liquidity brought in by noize traders (Kim e.a., 2012)
- Consultancy business: consultant allegedly better knows how to solve particular problem of a client (main motivating story)

Colloqually, this means that trojan teachers communicate truth and only truth, but not all truth (in contrast to blatant lies).

Literature connections

- Crawford and Joel Sobel (1982) study a prototype problem of that kind, and show that in any Bayesian Nash equilibirium, sender introduces noize in the signal by sending one of possible signal in strategically partitioned information set.
- Gneezy (2005) experimentally studies deception game, when sender has to communicate to the receiver which of the two actions brings her higher income, when one of the two possible messages is explicitly false. He finds that false information increases when the margin of sender's gains over receiver is maximal.
- Rode (2006) extends this setup to 1) three information conditions (high, medium and low uncertainty of the receiver), and 2) cooperation (coordination) vs. competition (matching pennies) games. He reports costly truth-telling of order of 1/5-1/3 of cases (same across treatments), and following the adivce in 2/3-3/4 of cases, with significantly less under high uncertainty and competitive treatment.

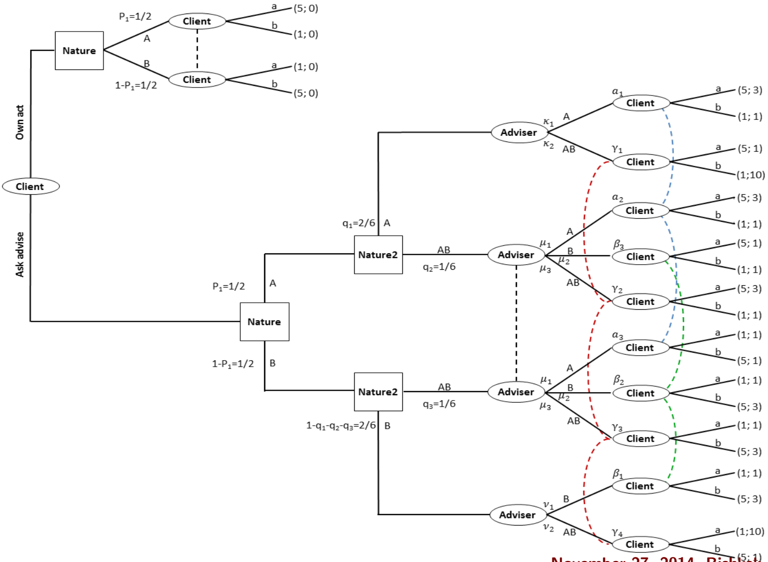
Paying for useless advice

Powdthavee and Riyanto, 2012

Experimental test: 5 tosses of coin(s) coming from the subjects, with changes of coin and tosses by volunteer participants. Subjects are endowed with 100 tokens, and are to bet consecutively on the outcome of 5 tosses, one after another.
All subjects also had 5 envelopes containing randomly generated forecast of the outcome of the next toss, which they can buy for 10 tokens before each round, and check its correctness for free ex post. Of 378 participants from two countries (Thailand and Singapore), 191 received a correct prediction in the first round; 92 received all-correct predictions after the first two rounds; 48 after the first three rounds; and 23 after four rounds.

Finding: significant positive, and monotonically increasing effect on probability of purchase of sequences of correct predictions (linear probability coefficients from linear model are 0.0522**, 0.153***, 0.195***, 0.276***).

Our experiment



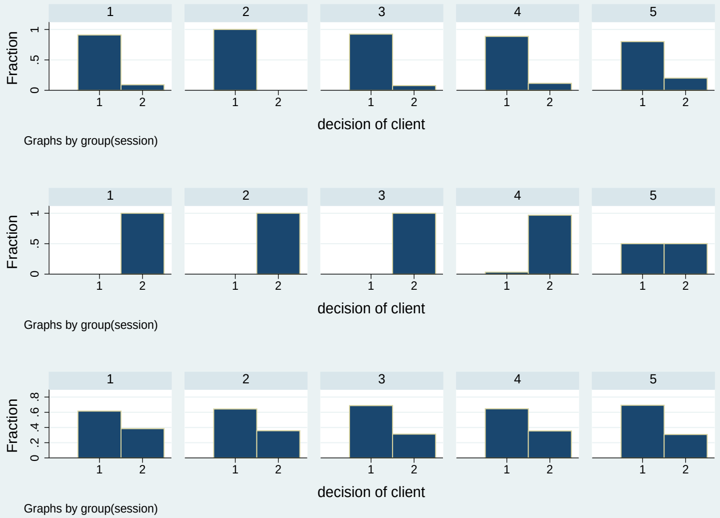
Solution

- Payoff in the game are alighed in a way that in all sequential equilibria, sender has to send noisy signal no matter what he receives himself; hence receiver is indifferent between asking advice and acting on her own.
- This is the static solution though, although pairs are in partner treatment. Dynamic extension is on the way (?)
- Experimental data complemented with questionnaire (to be explored)
- What other payoffs do make sense?

Experiment

- 28 paid (16 + 12 subjects, for 15 periods) and 34 unpaid (10 for 15 periods, 12 for 25 and 10 periods, resp) Moscow students took part in 2012. (time varied to check for time learning effect).
- Overall, 210 choices under paid conditions, and 285 choices under unpaid conditions.
- Programmed in z-tree, instructions handled and read aloud
- Extension to market: planned, but not realized

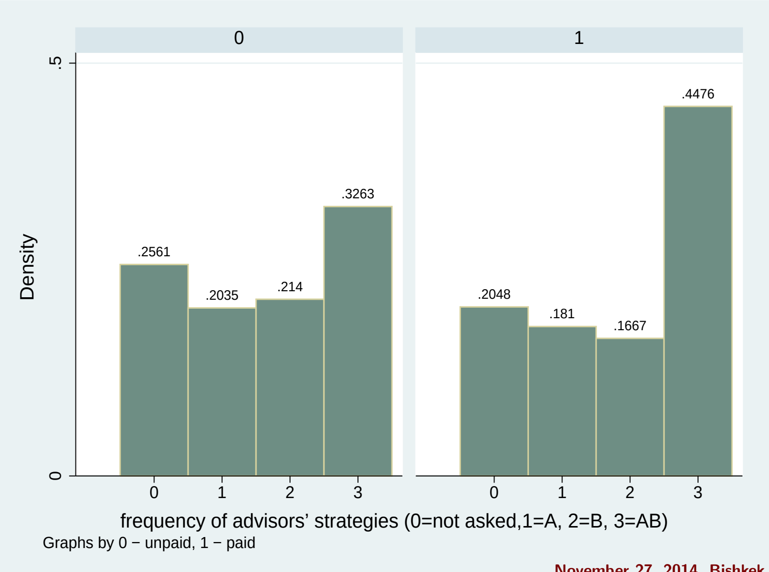
Clients' choices by signals (in rows) and sessions (cols)



Clients: Results

- Cliens made overall 495 choices, of which 1 =A was slightly more frequent (57% of cases), both overall and when deciding on their own.
- In all sessions except one, clients who received precise signal strongly follow the advice, whereas clients who received noizy advice favor option 1 =A.
- Possible framing effect.

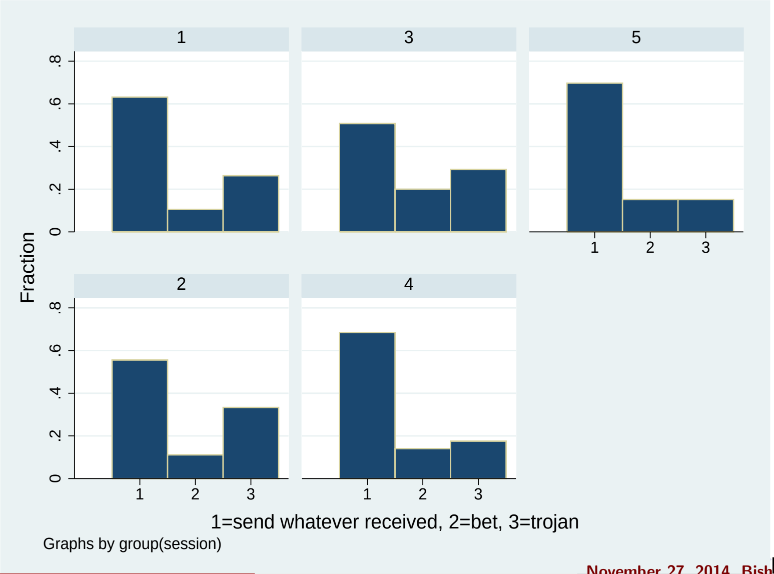
Advisors: signals sent (if any)



Advisors: results

- Advisors under unpaid conditions send noizy signal more often
- Difference among treatments significant overall (ANOVA F-test$= 5.18$, $p < 0.023$) and on advice only (ANOVA F-test$= 3.95$, $p < 0.047$).
- Result robust across time (similar tendency if attention is limited to first 10 periods).
-

Advisors: signals received and sent



Outcomes, paid ($N = 38 \times 15$ periods)

message \ signal	1	2	12	21	Total
0	21	17	5	10	53
1	34	0	10	7	51
2	0	41	7	7	55
12	39	0	36	0	75
21	0	29	0	22	51
Total	94	87	58	46	285

Table : 1 – A, 2 – B, 12 – AB after A, 21 – AB after B

Out of 285 cases, 133, or 46% are honest, 53, or 19% do not ask for help, and 68, or 24% are equilibrium

Results

- Prevailing strategy is truth telling (communicate whatever received)
- Deliberately trojan teaching (received clean, sent noisy signal) is systematic.
- No significant differences across treatments (ANOVA F-test$= 1.83$, $p < 0.177$).
- Overall frequency of noisy signal is 49.3%, but half of it (24.8%) occurs when signal received was noisy as well.

Model setup

An example of Trojan teaching is incomplete information transmission in financial markets. ‘Teacher’ teaches his ‘student’ to use a particular strategy which makes finite expected profit.

Students increase liquidity supply to the market, and teacher, knowing her strategy, plays against it as liquidity demander, makes the more money the more students exist in the market. Unique symmetric Bayesian Nash Equilibrium linear strategies yield positive profits to students and teachers, but teachers’ profit is strictly larger if they submit a noise signal to students.

We model this situation in the Kyle (1985) framework.

Kyle (1985) market microstructure model

There are 3 kind of traders who trade in a single-asset market:

informed traders have insider information d_i about the true expected value of a single traded asset. They are risk-neutral liquidity demanders, submit market orders against the book, and act as teachers — trustees of uninformed guys).

liquidity traders (noize traders) are uninformed agents who want to buy assets, although they may also be motivated by cash balancing or diversification motives. Submit book orders for assets (provide liquidity) in an non-strategic way.

market makers (dealers) are rational agents who have information s_j, and are numerous enough too supply liquidity y_j so as to clear the market at price P. They see only aggregate orders from informed and noize traders (cannot disentangle them), but can infer in case of linear strategy what is true price.

The market

- J liquidity providers (market makers and liquidity traders) and N informed traders.
- Dealer j determines optimal liquidity supply schedule $y_j^* = \arg\max_{y_j} \mathrm{E}[(\tilde{P} - \tilde{v})y_j | s_j, P]$, where $\tilde{v}$ is market value of the asset.
- Informed trader i demands liquidity (supplies assets) $x_i^* = \arg\max_{y_j} \mathrm{E}[(\tilde{v} - \tilde{P})x_i | d_i]$.
- The market clears: $\sum_j^J y_j(s_j, \tilde{P}) = \sum_i^N x_i(d_j))$

True value of the asset is $v = v_1 + v_2$, but informed trader can instead send noise signal $v_g = v_2 + v_\epsilon$, $v_\epsilon \sim \mathcal{N}(0, \sigma_\epsilon^2)$

Equilibria

Proposition 1 If $J > 2$, there exists a symmetric Bayesian Nash Equilibrium in linear strategies is $y(P) = \frac{J\delta}{N+1}v + \delta P, x(v) = \beta_1 v_1 + \beta_2 v_2 + \beta_\epsilon + v_\epsilon$.

Proposition 2 If $J > 2$ and the teacher submits noisier signal, there exists a symmetric Bayesian Nash Equilibrium in linear strategies with $y(P) = \frac{J\delta}{N+1}v + \delta P, x(v) = \beta_1 v_1 + \beta_2 v_2 + \beta_\epsilon + v_\epsilon$, which yields lower utility to the liquidity traders.