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Truth and lie detection in bluffing☆

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ABSTRACT

Beliefs in signals that reveal lies and truths are widespread. It is shown that such beliefs may be exploited strategically in signaling games of pure conflict of interest. Truth and lie detection is modeled by signals perceived by the receiver that are emitted with a probability contingent on the truth value of the sender's message. Truth or lie detection of this kind always shrinks the equilibrium set and if the probability for the truth or lie signal is sufficiently large the resulting equilibrium is unique. These results are robust to asymmetries regarding prior probabilities and payoffs.

1. Introduction

> "*Your poker face needs work my friend. It took me several seconds, but I can see now that you are lying.*" Dan Brown, The Da Vinci Code (2004, p. 553).

A recurring theme in fiction is that a character believes that others can see through his lies or that he can tell if someone is lying just by looking at or listening to him. In Dostoevsky's "Crime and Punishment" Raskolnikov is haunted by thoughts that police superintendent Nikodim Fomitj can tell that he is lying, and Sir Leigh Teabing in "The Da Vinci Code" believes, as the quote above indicates, that he has the ability to call a bluff. Furthermore, it is not uncommon that people in real life claim that they can see through a lie, while others claim that they are quite bad at bluffing.[1] In addition to this, psychological research suggests that although people in general are relatively bad at distinguishing lies from truths, they tend to believe that

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[1] Beliefs about such abilities might have had some historical impact. One example is when Hitler in a meeting before WWII lied to the ex-British Prime Minister Chamberlain about his intentions to invade Czechoslovakia. Chamberlain, obviously with a certain confidence in his abilities to identify liars, wrote to his sister: "in spite of the hardness and ruthlessness I thought I saw in his face, I got the impression that here was a man that could be relied upon when he had given his word" (Ekman, 1992, pp. 15–16). In the Parliament Chamberlain said that he was convinced that Hitler did not try to deceive him. Czechoslovakia was invaded by Germany a few weeks later.

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certain observable non-verbal cues indicate lies (see e.g., Vrij, 2000, p. 58).[2] This psychological inclination motivates further investigations into the theoretical implications of lie detection cues in strategic situations. This paper will suggest a simple way to model truth and lie detection and demonstrate that detection cues may have important theoretical consequences in strictly competitive games.

Lying in strategic situations has received little attention in economic theory.[3] The standard assumption is that if a player does not want to, communication does not necessarily disclose his type or his intentions. Thus, lying is possible and costless. Without this assumption the literature on asymmetric information ought to be fundamentally modified. It can also be added that since disclosure of real intentions can be exploited by the counterpart, game theory (see Crawford and Sobel, 1982) predicts that zero-cost messages sent in games with conflict of interest are not informative.

Crawford (2003) and Hendricks and McAfee (2006) recognize that many strategic decisions (like where to attack in war) involve a stage where one party has the opportunity to misrepresent information. If players are heterogeneous with respect to their reasoning capacity, Crawford (2003) shows that misrepresentation may matter. However, there is also a more direct and psychological explanation that will be analyzed here. Players may actually be able, or believe that they are able, to recognize signals that are directly observed and related to the act of lying or truth-telling. Mathematically, this implies that the likelihood of detecting a lie is conditional on if the message is a lie or a truth, and furthermore, that the conditional likelihood of detecting a lie may differ from that of detecting a truth. The aim of this paper is to take a first small step in analyzing the implications of truth and lie detection.

Psychological research indicates that detection of truths and lies might differ. For instance, a review based on some 40 studies (see Vrij, 2000, p. 69) noted a 67 percent average accuracy rate for detecting truths. The corresponding accuracy rate for detecting lies was only 44 percent. Possible explanations are that truths are either easier to detect or believed to be associated with more frequent signals than lies.[4] Furthermore, lie and truth signals may be detected by new techniques. There are now several promising findings in neuroscience (see e.g., Spence et al., 2001; Langleben et al., 2002; Kozel et al., 2004) suggesting that certain simple lies (which involve inhibitory processes) are associated with higher activity in certain areas of the brain. The increased activity may differ between individuals, but is detectable by functional magnetic resonance imaging of the brain.[5]

In this paper it is not important if people in general are better at recognizing truths than lies or vice versa; the important thing being that beliefs about the recognizing capacity might differ and be conditional on whether the truth is told. One possibility is detection that is relationship specific. For instance, a man may know (or believe) that his wife sometimes with certainty can tell when he is lying and both are fully aware of this. The reason might simply be that the man is a hopelessly poor liar and that the wife has become a good lie detector after learning some observable cues associated with her husband's lies. When lying, the man is not in full control of when he emits these cues.

The issue of truth and lie detection is (to the author's knowledge) new in economics and game theory, and it would appear that analyzing truth and lie detection with game theoretical tools is something new in psychology. To investigate the effects of truth and lie detection, a simple signaling game is introduced and analyzed in Section 2. Implications of the results are discussed in Section 3 and the paper ends with some concluding remarks.

2. Theory

This section will analyze the implications of truth and lie detection. The class of signaling games, denoted as Bluffing games, can be presented as follows. First, nature selects the state $t \in \{B, W\}$. The probability for state B and W are p and $1-p$, respectively. The S-player observes t and makes a statement $m \in \{B, W\}$ to the R-player about t. R is then to make a guess, $g \in \{T, F\}$, as to whether the message is true ($g = T$) or false ($g = F$). A statement is said to be true if $m = t$ and false otherwise. R wins, if her guess is correct, that is if $g = T$ and $m = t$, or $g = F$ and $m \neq t$. If R's guess is incorrect S wins. The players' payoffs are $u_S(t, m, g)$ and $u_R(t, m, g)$, respectively. Different assumptions about the payoff will be made, but for all variations it is assumed that $u_R(t, m, g) = 0$ when R loses and $u_S(t, m, g) = 0$ when S loses. Below, the impact of truth and lie detection will be analyzed in different sub-classes of Bluffing games.

[2] Even professional groups such as police officers who have to deal with lies on an everyday basis believe in stereotypical cues (like e.g., gaze aversion). It is shown by Mann et al. (2004) that such cues may mislead them in judging the veracity of suspects' stories.

[3] There is however, a growing number of interesting papers that experimentally investigate lying or issues closely related to it (see e.g., Frank et al., 1993; Dickhaut et al., 1995; Ockenfels and Selten, 2000; Blume et al., 2001; Brosig, 2002; Brandts and Charness, 2003; Charness and Dufwenberg, 2006; Gneezy, 2005; Cai and Wang, 2006; Hurkens and Kartik, 2009; Wang et al., 2010; Sánchez-Pagés and Vorsatz, 2007; Kawagoe and Takizawa, 2009). The approaches in these papers differ from the present one in that they involve reasoning about consequences, intentions, social preferences, or preferences for truth-telling.

[4] It should be mentioned that this difference can be explained in different ways. The latter explanation is consistent with the observation that people have a tendency to judge other's statements as truthful.

[5] Note, if lying creates physiologically different reactions from truth-telling, it is possible that this also generate differences in behavior that are (i) observable (ii) more easily recognizable for truths (or lies) than for lies (truths). For instance, Lubow and Fein (1996) found differences in pupil sizes under a "Guilty knowledge Test". Furthermore, voice stress analyzing software is also partly based on physiological different reactions. Despite that its reliability has been debated, this software has already been used by British insurance companies to screen telephone claims in the hope of detecting fraud (see New York Times, 2004, July 1st, "It's the Way You Say It, Truth Be Told", Technology section).