

Go Figure: The Strategy of Nonliteral Speech

Hugo M. Mialon and Sue H. Mialon¹

May 29, 2012

Abstract

We develop a simple model of figurative or indirect speech, which may convey a meaning that differs from its literal meaning. The model yields analytical conditions for speech to be figurative in equilibrium and delivers a number of comparative statics results. For instance, it predicts that the likelihood of figurative speech is greater if the benefit to the listener of correctly understanding the speaker is greater, or if the probability that the speaker and listener disagree over actions is greater. We then apply the model to systematically analyze particular forms of indirect speech, including terseness, irony, and veiled bribery. Interestingly, the model explains why most instances of irony are negative or sarcastic and provides a novel argument for the effectiveness of laws that strictly punish attempted bribery.

Keywords: Literal Speech, Figurative Speech, Terseness, Irony, Bribery, Law

JEL Codes: D83, K42

¹ Hugo Mialon (corresponding author), Department of Economics, Emory University, Atlanta, GA 30322-2240 (E-mail: hmialon@emory.edu; Phone: 404-727-0355; Fax: 404-727-4639). Sue Mialon, Department of Economics, Emory University, Atlanta GA 30322-2240 (E-mail: smialon@emory.edu; Phone: 404-712-8169; Fax: 404-727-4639). We are grateful to the Editor, two anonymous referees, Maxwell Stinchcombe, Sandeep Baliga, Ehud Kalai, Tilman Klumpp, Prashant Parikh, Jason Quinley, and Paul Rubin for wonderfully helpful comments.

1. Introduction

This paper develops a signaling model of figurative or indirect speech, which may convey a meaning that differs from its literal meaning. In the model, a speaker has a thought or meaning that she may want to communicate to a listener. The speaker can send the listener a direct and unambiguous message that clearly reveals her thought to the listener. Alternatively, she can send an indirect and ambiguous message that has a literal meaning that differs from her actual thought. In other words, she can express her thought figuratively.

Expressing a thought figuratively may actually be less costly than expressing it unambiguously for several reasons. First, expressing a thought figuratively may simply be easier and less time-consuming than disambiguating it, especially if the thought is complicated. Second, by expressing a thought figuratively, the speaker can potentially communicate it without articulating it, which may enable the speaker and listener to avoid liability for offending third-party listeners with whom they may have a conflict of interest. Third, it may enable the speaker to avoid incurring liability for offending the listener if the speaker and listener have a disagreement over actions. As Pinker (2008) and Pinker, Nowak, and Lee (2008) have argued, indirect speech carries the advantage of “plausible deniability.” However, expressing a thought figuratively carries a greater risk of miscommunication, because the listener might naïvely interpret the expression literally even though it is meant figuratively (an aspect not taken into account in the analysis by Pinker, 2008, or Pinker, Nowak, and Lee, 2008). The model assumes that there is a potential tradeoff between figurative and direct speech, and that the speaker and listener choose how to speak and interpret most advantageously, given this potential tradeoff.

We analyze the model in the case where the speaker and listener agree over actions and in the case where they potentially disagree over actions. From the model, we derive analytical

conditions for speech to be figurative in equilibrium. We then employ these conditions to obtain comparative statics results and to systematically analyze particular forms of figurative speech, including terseness, irony, and veiled bribery. For instance, in the case where the speaker and listener agree on actions, we find that, *ceteris paribus*, speech is figurative for a larger range of the model's parameters if the speaker cares only a little about being understood while the listener cares a lot about correctly understanding. Then, the speaker does not pay the cost of disambiguating her message, and the receiver nonetheless deciphers it, giving rise to terseness (using few words to convey much meaning). The model also explains why irony (using words to express the opposite of their literal meaning) is rarely positive and, instead, is usually negative or sarcastic. If the speaker's thought is negative (positive), speaking ironically involves using an expression that has a literal meaning that is positive (negative). Given the possibility of naïve interpretation, using an expression with a positive literal meaning is generally less costly than using one with a negative literal meaning. On the other hand, speaking directly is generally more costly if the speaker's thought is negative than if it is positive. Thus, irony is more likely to be negative.

We also find that, in the case where the speaker and listener potentially disagree on actions, speech is figurative for a greater range of parameters if the probability that they disagree on actions is higher, because this increases the speaker's expected cost of being direct. In an application to bribing of police officers who can issue speeding tickets at their discretion, we find that bribes are more likely to be veiled than direct if more officers are honest and reasonable, if the premium for car insurance rises less sharply with speeding offenses, or if the penalty for attempted bribery is higher.

The model also implies that increasing the penalty for attempted bribery reduces the probability of successful bribery taking place, even if it has no effect on the probability

of attempted bribery occurring. The reason is that increasing the penalty for attempted bribery induces the briber to bribe more indirectly, which reduces the probability that the bribe will succeed. This provides a novel justification for laws that strictly punish not only completed bribery but also attempted bribery.²

Section 2 below discusses related literature and our contributions to it. Section 3 develops a basic model in which interlocutors agree on actions and uses it to analyze two forms of figurative speech, terseness and irony. Section 4 develops an extended model in which interlocutors may disagree on actions and uses it to analyze another form of figurative speech, veiled bribery. Section 5 summarizes and suggests avenues for future work.

2. Literature Review and Contribution

2.1 Economics Literature

Our paper is related to the economics literature on communication. In the standard economic model of communication, a sender with private information sends a message to an uninformed receiver, who then chooses an action that affects the payoffs of both the sender and receiver. One approach, initiated by Grossman (1981) and Milgrom (1981), assumes that the sender's information is verifiable and that the sender can withhold information but not lie. This is referred to as "verifiable disclosure games." The second approach, initiated by Crawford and Sobel (1982), assumes that the sender's information is unverifiable and that the sender can lie arbitrarily without direct costs. This is referred to as "cheap talk" games. We assume that information is not always verifiable and that talk is not cheap. We emphasize that direct communication can be more costly than indirect communication, but that direct

² For example, the punishment for attempted bribery and completed bribery are identical under the U.S. federal bribery statute (18 U.S.C. § 201), and under California Penal Code Section 67, the attempted or completed bribery of a police officer is a felony, which can carry a prison term of from two to four years.

For canonical legal and economic analyses of penalties for bribery, see Bowles and Garoupa (1997) and Rose-Ackerman (2010).

communication is more likely to be understood.

Kartik, Ottaviani and Squintani (2007) and Kartik (2009) introduce direct lying costs in the Crawford and Sobel framework and show that senders almost always claim that their type is higher than it is and receivers nevertheless infer the true types of the senders from their claims, i.e., language is “inflated” in equilibrium. While they model deceptive speech, which involves a deviation from truth, we model figurative speech, which involves a deviation from literal meaning. The two kinds of speech are not the same and involve different costs and benefits. For example, deceptive speech involves “moral” and “institutional” costs that are not present in the case of figurative speech. Moreover, a sender benefits from deceptive speech when the receiver is deceived by it, i.e., interprets it as being truthful. In contrast, a speaker can benefit from figurative speech even if the listener is not deceived by it, e.g., because it is less fastidious or offensive to third-party listeners. Our basic model assumes no incentives to deceive and shows that speech is nonetheless figurative under certain conditions.

In their modeling of deceptive speech, Kartik, Ottaviani and Squintani (2007) and Kartik (2009) introduce credulous receivers who believe whatever they hear as being true and examine how the presence of such receivers affects the behavior of fully rational agents. We employ a similar strategy in our modeling of figurative speech: we introduce naïve receivers who always interpret ambiguous messages in a certain way. This device allows us to pin down the literal meaning of ambiguous messages. Crawford (2003) is the first to introduce behavioral or boundedly rational types in a formal model of communication. The author studies incentives to lie about intentions regarding future actions in a class of asymmetric hide-and-seek games. Ellingsen and Östling (2010) develop a general level- k bounded rationality approach, and Demichelis and Weibull (2008) develop an evolutionary stability approach, to analyze lying about intentions in large classes of games that include coordination games.

A few papers formalize aspects of literal meaning in cheap-talk games. Farrell (1993) assumes that the literal meaning of messages not used in equilibrium is clear, i.e., these messages are understood even if they are not believed, but does not address the literal meaning of messages used in equilibrium. We address whether messages have literal or figurative interpretation in equilibrium. Blume (1996) models the literal meaning of messages via trembles and finds that, at least in common interest games, only equilibria in which equilibrium meaning coincides with literal meaning are robust. Lipman (2009) argues convincingly that the prevalence of vagueness in language is difficult to explain using a framework in which messages are costless and in which the speaker and listener are rational and their preferences are perfectly aligned. We provide an explanation for figurativeness in language using a framework in which messages are costly and may be interpreted naïvely rather than rationally and in which the speaker and listener may disagree over actions.

Blume and Board (2010) analyze intentional vagueness in a rich framework in which messages are costless and the speaker and listener are fully rational or strategic but disagree over actions. In their model, the speaker is one of two types depending on the realization of a private signal, and each type of the speaker has the same continuum of costless messages available. The speaker has a bias that measures the degree to which she disagrees with the listener over actions, and the listener is assumed to observe the speaker's bias. Our model is different in a number of respects: messages are costly; not all messages are available to all types of the speaker; the listener may be of a sophisticated or naïve type, where the naïve type interprets messages non-strategically; the listener may also be one of two other types, agreeing or disagreeing with the speaker over actions; and the speaker's types are not observable to the listener. Moreover, because our model is simpler in some dimensions, we are able to find equilibria for general parameter values using analytical methods, rather

than compute equilibria numerically. Despite these modeling differences, one of our key results has a clear parallel in Blume and Board (2010). The authors find that intentional vagueness is monotonic in the sender’s bias. Similarly, we find that a greater probability of disagreement over actions increases the parameter range for figurative speech. We also employ our analytical conditions to obtain several other comparative statics (e.g., a greater benefit to the listener of correctly understanding the speaker also increases the parameter range for figurative speech) and to address a variety of instances of pragmatic inference, such as terseness, irony, and bribery, which Blume and Board (2010) do not address.

Whereas Blume and Board (2010) and Kartik, Ottaviani and Squintani (2007) assume that no messages are type-specific, our model assumes that some messages are type-specific and some messages are not. Kartik, Ottaviani and Squintani (2007) naturally assume that all messages are available in all states because they model deception, and Blume and Board (2010) naturally assume that all messages are available in all states since they assume that messages are costless. However, we model direct versus indirect speech, not costless speech or deceptive speech. Indirect speech need not be employed to deceive, and direct speech may be costlier than indirect speech. In modeling direct versus indirect speech, it is reasonable to assume that some messages are costlier than others and that some messages are only available in some states. Consider the classic Gricean example of terseness that we will employ to illustrate our basic model later on: Matt wants beer for his party, and Liz says, “There’s a store on 3rd Street.” If she knows that there is a store on 3rd Street but does not know whether it sells beer, she can say, “There’s a store on 3rd street,” or say, “There’s a store on 3rd street, but I don’t know if it sells beer.” Obviously, the latter statement is more fastidious and costlier to utter than the former. Now, if Liz knows that there is a store on 3rd Street that sells beer, she can say, “There’s a store on 3rd street,” or say, “There’s a

store on third street, and I know it sells beer.” But if she knows that there is a store on 3rd Street that sells beer, she would never say, “There’s a store on 3rd street, but I don’t know if it sells beer,” unless she has incentive to lie outright. In our basic model, we assume no incentives to lie and provide conditions for speech to nonetheless be figurative in equilibrium.

Blume and Board (2011) focus on the efficiency losses arising from private information about language competence. They model the listener’s lack of language competence as an inability to distinguish possible messages. We model the listener’s lack of sophistication as an inability to interpret messages non-literally. Hertel and Smith (2011) develop a model in which the sender incurs a greater cost to send a message that is more elaborate. We make related assumptions in our model. However, Blume and Board (2011) and Hertel and Smith (2011) are not concerned with figurative or indirect speech.

2.2 Linguistics Literature

Our paper is also related to the literature on applications of game theory to pragmatics. For a selective survey, see Jaeger (2008). Glazer and Rubinstein (2006) derive pragmatic rules of persuasion that maximize the functionality of discourse. Sally (2003, 2005) models communication as a coordination game, drawing implications for a wide range of linguistic phenomena. Our model is different in that it features private information. Parikh (2001, 2007) develops what he calls a “game of partial information” to account for successful communication in coordination settings. In such a game, the listener’s act of understanding is explicit, whereas it is part of the Bayesian updating and solution process in signaling games of the Lewis (1969) and Spence (1973) tradition. Van Rooij (2004, 2008) analyzes conversational implicatures profitably within a classic signaling framework. Our model differs from those of Van Rooij and Parikh in that we not only consider the uncertainty about the speaker’s meaning but also about the listener’s type.

Pinker (2008) and Pinker, Nowak, and Lee (2008) analyze indirect speech in a model where the speaker is uncertain about the listener’s type and where the listener may be of a type who would not cooperate with the speaker. They show that indirect speech is a dominant strategy because it carries the advantage of plausible deniability if the listener is an uncooperative type. Our model differs from theirs in that we consider the uncertainty about the speaker’s meaning as well as about the listener’s type. With uncertainty of the speaker’s type, indirect speech carries a risk of miscommunication and therefore is not a dominant strategy, contrary to what Pinker (2008) and Pinker, Nowak, and Lee (2008) have argued. Thus, our model unifies two strands of the game-theoretical linguistics literature by considering a fuller type space for the speaker and listener.

Franke (2009) defines a new equilibrium refinement, termed “iterative best response” (IRB), which is argued to be more intuitive and effective than existing refinements in signaling games applied to linguistics. IRB assumes that players differ in terms of their reasoning level, k , and that a level- $(k + 1)$ player always best responds to an unbiased belief that her opponent is a level- k player. The equilibrium refinement is further set up to uniquely pick out the equilibrium that involves implicature in the numerical examples of signaling games that are analyzed. Franke (2009) does not provide conditions on the signaling game under which the iterative best response procedure always reaches a fixed point. Also, this paper does not derive formal comparative statics for implicature, as we do here.

2.3 Summary of Contribution

We summarize the contributions of our paper relative to previous work as follows. First, our model allows for different types of the listener as well as the speaker, and it allows the costs and benefits of speaking and understanding to depend on the speaker’s and listener’s types and to be arbitrary to a large extent. It features type-specific messages as well as messages

available to all types and allows costs of different messages to be different, which we argue are reasonable choices for modeling direct versus indirect speech. Second, our model provides analytical conditions for speech to be figurative and yields sharp comparative statics results, e.g., a greater benefit to the listener of correctly understanding the speaker increases the parameter range for figurative speech. Third, it allows us to address a variety of observed patterns of pragmatic inference, including terseness, irony, and bribery. Our model provides a novel explanation for why irony is usually sarcastic and a novel argument for the effectiveness of laws that strictly punish attempted bribery.

3. Basic Model

A speaker, S , has private information, $\theta \in \{\theta_1, \theta_2\}$, which he would like to convey to a listener, L , who must take an action, $a(\theta_1)$ or $a(\theta_2)$. Action $a(\theta)$ is the action that the listener would take following an inference that the speaker's type is θ . There are two direct messages, " θ_1 " and " θ_2 ", each of which is only available to the speaker in the corresponding state. Thus, sending either of them would completely reveal the state to the listener. However, it is costly for the speaker to send and for the listener to receive " θ_1 " and " θ_2 ", with costs $d_1^S > 0$ and $d_2^S > 0$ for the speaker and with costs $d_1^L > 0$ and $d_2^L > 0$ for the listener, respectively; the motivation being that these messages may be long or compromising. There is also an indirect message, call it " $\bar{\theta}_2$ ", that is available to the speaker in both states, with costs to the speaker of c_1^S in state θ_1 and c_2^S in state θ_2 and with cost to the listener of $c_1^L > 0$; this may represent a statement that is shorter or less compromising. We assume that " $\bar{\theta}_2$ " has the literal meaning of θ_2 , and hence there is an asymmetry in that $c_1^S > c_2^S = 0$.

Upon hearing the message " $\bar{\theta}_2$ ", the listener must interpret it. We assume that the listener is one of two types, $\sigma \in \{\sigma_1, \sigma_2\}$: a sophisticated type, σ_1 , who chooses whether to interpret

“ $\bar{\theta}_2$ ” literally as indicating θ_2 or figuratively as indicating θ_1 , i.e., chooses between actions $a(\theta_1)$ and $a(\theta_2)$; and a naïve type, σ_2 , who always interprets “ $\bar{\theta}_2$ ” literally as indicating θ_2 and so always chooses the action $a(\theta_2)$. Upon hearing the message “ θ_1 ”, the listener always chooses the action $a(\theta_1)$, and upon hearing the message “ θ_2 ”, the listener always chooses the action $a(\theta_2)$. Note that incorporating a naïve type who always interprets “ $\bar{\theta}_2$ ” as indicating θ_2 is a way of specifying that the literal meaning of “ $\bar{\theta}_2$ ” is θ_2 .

In the basic model, the speaker and listener agree over actions in that both want the action $a(\theta)$ to be taken in the state θ . If the state is θ_1 and the listener takes the action $a(\theta_1)$, then the speaker receives a benefit $b_1^S > 0$ and the listener receives a benefit $b_1^L > 0$. If the state is θ_2 and the listener takes the action $a(\theta_2)$, then the speaker receives a benefit $b_2^S > 0$ and the listener receives a benefit $b_2^L > 0$. We denote by $q \in (0, 1)$ the prior probability that the speaker’s information is θ_1 and by $p \in (0, 1)$ the prior probability that the receiver is sophisticated. The extensive form of the game is given in Figure 1. The speaker has two information sets, which are labelled $S.1$ and $S.2$, and the type- σ_1 listener has one non-singleton information set, which is labelled $L.1$.

We assume that $d_1^S - c_1^S > 0$ (otherwise, the speaker would never use message “ $\bar{\theta}_2$ ” in state θ_1). We characterize the perfect Bayesian equilibria (PBEs) of the game in Figure 1 and derive conditions for the existence and uniqueness of PBEs in which speech is figurative. We define a PBE to be figurative if it involves the speaker sending the ambiguous message “ $\bar{\theta}_2$ ” in state θ_1 and the listener responding by taking action $a(\theta_1)$ (i.e., interpreting “ $\bar{\theta}_2$ ” as meaning θ_1). There are two possible types of figurative PBEs. In what we call a *type-P figurative PBE*, the speaker sends message “ $\bar{\theta}_2$ ” in state θ_1 and message “ $\bar{\theta}_2$ ” in state θ_2 , and the type- σ_1 listener responds by taking action $a(\theta_1)$. In a *type-S figurative PBE*, the speaker sends message “ $\bar{\theta}_2$ ” in state θ_1 and message “ θ_2 ” in state θ_2 , and the type- σ_1 listener

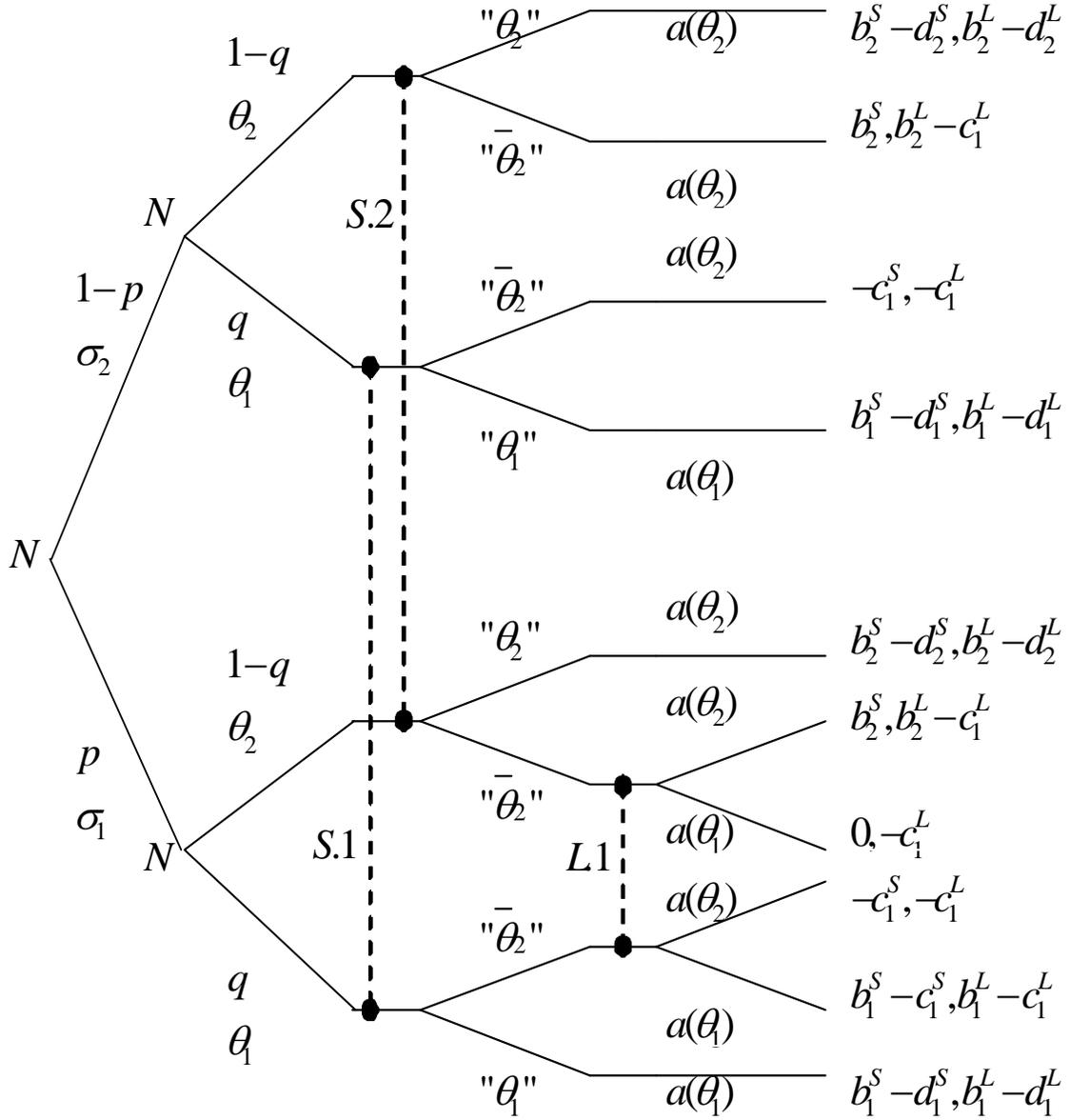


Figure 1: Model When Speaker and Listener Agree on Actions.

responds by taking action $a(\theta_1)$. In a type-P or type-S figurative PBE, the probability that speech is figurative is pq (since there can be no figurative speech with a naïve listener).

We define the other possible types of PBEs to be non-figurative. In what we call a *type-P non-figurative PBE*, the speaker sends message “ $\bar{\theta}_2$ ” in state θ_1 and message “ $\bar{\theta}_2$ ” in state θ_2 , and the type- σ_1 listener responds by taking action $a(\theta_2)$. In a *type-S1 non-figurative PBE*, the speaker sends message “ θ_1 ” in state θ_1 and message “ $\bar{\theta}_2$ ” in state θ_2 , and the type- σ_1 listener responds to “ $\bar{\theta}_2$ ” by taking action $a(\theta_2)$. In a *type-S2 non-figurative PBE*, the speaker sends message “ θ_1 ” in state θ_1 and message “ θ_2 ” in state θ_2 , and the type- σ_1 listener responds to “ $\bar{\theta}_2$ ” by randomizing between actions $a(\theta_1)$ and $a(\theta_2)$.

There can also be mixed-strategy PBEs in which both the speaker and listener randomize. However, there is at least one pure-strategy PBE in every range of the model’s parameter space (as shown in Proposition 1 below), and any mixed-strategy PBE in which both the speaker and listener randomize is unstable in the sense that any small perturbation of the listener’s beliefs about what the speaker meant upsets it and leads to a pure-strategy PBE. In contrast, the types of PBEs named above are stable in the sense that they are robust to at least some small perturbations. For this reason, we focus only on these types of PBEs.

The types of PBEs named above are also stable in the sense that they satisfy the Intuitive Criterion (Cho and Kreps, 1987). Any type-P figurative, type-S figurative, type-P non-figurative, and type-S1 non-figurative PBE obviously satisfies the Intuitive Criterion since in any such PBE, all non-singleton information sets are on the equilibrium path. In a type-S2 non-figurative PBE, the information set following the message “ $\bar{\theta}_2$ ” is off the equilibrium path. However, since $d_1^S - c_1^S > 0$, sending message “ $\bar{\theta}_2$ ” can never be dominated for the type- σ_1 speaker relative to this equilibrium, whether the state is θ_1 or θ_2 . Thus, even a type-S2 non-figurative PBE satisfies the Intuitive Criterion.

3.1 Equilibrium Analysis

The following proposition provides a complete characterization of the stable PBEs of the game in Figure 1. Proofs of propositions are in the Appendix.

Proposition 1 (I) *Suppose $c_1^S < d_1^S - b_1^S < d_1^S - b_1^S + (\frac{b_1^S}{b_2^S})d_2^S$.*

- (a) *If $p > \frac{d_2^S}{b_2^S}$ and $q > \frac{b_2^L}{b_2^L + b_1^L}$, there is only a type-S figurative PBE.*
- (b) *If $p < \frac{d_2^S}{b_2^S}$ and $q > \frac{b_2^L}{b_2^L + b_1^L}$, there is only a type-P figurative PBE.*
- (c) *If $p > \frac{d_2^S}{b_2^S}$ and $q < \frac{b_2^L}{b_2^L + b_1^L}$, there is a type-S figurative and a type-P non-figurative PBE.*
- (d) *If $p < \frac{d_2^S}{b_2^S}$ and $q < \frac{b_2^L}{b_2^L + b_1^L}$, there is only a type-P non-figurative PBE.*

(II) *Suppose $d_1^S - b_1^S < c_1^S < d_1^S - b_1^S + (\frac{b_1^S}{b_2^S})d_2^S$.*

- (a) *If $p < \frac{d_2^S}{b_2^S}$ and $q < \frac{b_2^L}{b_2^L + b_1^L}$ or $p < 1 - (\frac{d_1^S - c_1^S}{b_1^S})$ and $q > \frac{b_2^L}{b_2^L + b_1^L}$, there is only a type-S1 non-figurative PBE.*
- (b) *If $1 - (\frac{d_1^S - c_1^S}{b_1^S}) < p < \frac{d_2^S}{b_2^S}$ and $q > \frac{b_2^L}{b_2^L + b_1^L}$, there is a type-P figurative and a type-S1 non-figurative PBE.*
- (c) *If $p > \frac{d_2^S}{b_2^S}$, there is a type-S figurative and a type-S1 non-figurative PBE.*

(III) *Suppose $d_1^S - b_1^S < d_1^S - b_1^S + (\frac{b_1^S}{b_2^S})d_2^S < c_1^S$.*

- (a) *If $p < 1 - (\frac{d_1^S - c_1^S}{b_1^S})$, there is a type-S1 non-figurative and a type-S2 non-figurative PBE.*
- (b) *If $p > 1 - (\frac{d_1^S - c_1^S}{b_1^S})$, there is a type-S figurative, a type-S1 non-figurative, and a type-S2 non-figurative PBE.*

The following corollary follows immediately from Proposition 1:

Corollary 1 *There is a type-S figurative PBE iff*

$$p > \max\left\{1 - \left(\frac{d_1^S - c_1^S}{b_1^S}\right), \frac{d_2^S}{b_2^S}\right\}, \quad (1)$$

and there is a type-P figurative PBE iff

$$p \in \left[1 - \left(\frac{d_1^S - c_1^S}{b_1^S}\right), \frac{d_2^S}{b_2^S}\right] \text{ and } q > \frac{b_2^L}{b_2^L + b_1^L}. \quad (2)$$

Moreover, there is a unique figurative PBE (of one type or the other) iff

$$q > \frac{b_2^L}{b_2^L + b_1^L} \text{ and } c_1^S < d_1^S - b_1^S < d_1^S - b_1^S + \left(\frac{b_1^S}{b_2^S}\right)d_2^S. \quad (3)$$

From condition sets (1)-(3) in Corollary 1, we obtain the following comparative statics:

Corollary 2 *There is a figurative PBE for a larger range of parameters, and there is a unique figurative PBE for a larger range of parameters, if q is higher, d_1^S is higher, c_1^S is lower, b_1^S is lower, b_1^L is higher, or b_2^L is lower.*

Ceteris paribus, speech is more likely to be figurative when the sender cares only a little about the state in question (b_1^S is low) while the receiver cares a lot about it (b_1^L is high). Then, the sender does not pay the cost of disambiguating the message, and the receiver nonetheless deciphers it, giving rise to conversational implicature.

3.2 Applications

Condition sets (1)-(3) in Corollary 1 can help to explain what causes figurative speech or conversational implicature to be likely to work, and what makes it likely to fail. We now employ these conditions to provide an original, systematic analysis of two classic examples of conversational implicature that have been adapted from Grice (1989).

3.2.1 Terseness

Example 1. Matt wants beer for his party. Responding to Matt, his sister Liz says, “There’s a store on 3rd Street.”

Correspondence with model. Either there is a store on 3rd Street that sells beer, state θ_1 , or there is a store on 3rd Street, which may or may not sell beer, state θ_2 . If Liz knows that there is a store on 3rd Street that sells beer, she can say, “There’s a store on 3rd Street, and I know that it sells beer,” message “ θ_1 ”, or she can say, “There’s a store on 3rd Street,” message “ $\bar{\theta}_2$ ”. If Liz knows simply that there is a store on 3rd Street, which may or may not sell beer, she can say, “There’s a store on 3rd Street,” message “ $\bar{\theta}_2$ ”, or she can say, “There’s a store on 3rd Street, but I don’t know if it sells beer,” message “ θ_1 ”. If Matt

is sophisticated, and Liz says, “There’s a store on 3rd Street,” Matt can interpret this as meaning that there is a store on 3rd street that sells beer and therefore go to the store on 3rd street, action $a(\theta_1)$, or he can interpret it as meaning simply that there is a store on 3rd street, which may not sell beer, and thus go somewhere else, action $a(\theta_2)$. If Matt is naïve, and Liz says, “There’s a store on 3rd Street,” Matt always interprets this as meaning simply that there is a store on 3rd street, which may not sell beer, and thus go somewhere else, action $a(\theta_2)$. If Liz says, “There’s a store on 3rd Street, and I know it sells beer,” Matt always understands that there is a store on 3rd Street that sells beer and thus goes to it, action $a(\theta_1)$. If Liz says, “There’s a store on 3rd Street, but I don’t know if it sells beer,” he always understands that there is simply a store on 3rd Street, which may not sell beer, and thus goes somewhere else, action $a(\theta_2)$.

Analysis. Many stores sell beer, so the prior q that there is a store on 3rd Street that sells beer is high. Liz’s cost d_1^S of saying, “There’s a store on 3rd Street, and I know it sells beer,” is high because such prolixity is tiresome. In contrast, Liz’s cost c_1^S of saying, “There’s a store on 3rd Street,” is low since this statement is concise. Matt’s benefit b_1^L of understanding that there is a store on 3rd Street that sells beer when there is such a store is high because he wants beer to make his party successful. In contrast, Liz’s benefit b_1^S of communicating that there is a store on 3rd Street that sells beer when there is such a store is low because, although she still cares a little about her brother’s party being successful, it is not her party. On the other hand, Liz’s cost d_2^S of saying, “There’s a store on 3rd Street, but I don’t know if it sells beer,” is high because this sentence is lengthy and tiresome. In contrast, Liz’s benefit b_2^S of communicating, and Matt’s benefit b_2^L of understanding, that there is simply a store on 3rd Street, which may not sell beer, when there is such a store is low because this information is not as relevant in this context. Lastly, Liz knows that her

brother is not too sophisticated, though not too naïve either, so the prior p is intermediate. Thus, condition sets (2) and (3) in Corollary 1 hold, and there is only a type-P figurative PBE in which Liz says, “There’s a store on 3rd Street,” when she wants to communicate that there is a store on 3rd Street that sells beer, and she says, “There’s a store on 3rd Street,” when she wants to communicate that there is simply a store on 3rd street, which may not sell beer, and Matt interprets, “There’s a store on 3rd Street,” as meaning that there is a store on 3rd Street that sells beer if he is sophisticated.

Now, suppose instead that Liz cares a lot about the party being successful because she is co-organizing it. Then, her benefit b_1^S of communicating that there is a store on 3rd Street that sells beer is very high. In this case, neither of the condition sets (1) or (2) in Corollary 1 are satisfied, so there is no figurative PBE. ■

As this analysis suggests, terseness (the use of few words to convey much meaning) is more likely to be part of an equilibrium if the speaker cares little about successful communication, while the listener cares a great deal about it. Then, the sender does not pay the cost of disambiguating his message, and the receiver must decipher it, giving rise to terseness.

3.2.2 Irony

Example 2. Ted has a reputation for not being a fine friend. Speaking to Liz at the party, Tom says, “Ted is a fine friend.”

Correspondence with model. Ted is not a fine friend, state θ_1 , or he is a fine friend, state θ_2 . If Tom knows that Ted is not a fine friend, he can say, “Ted is plainly not a fine friend,” message “ θ_1 ”, or he can say, ironically, “Ted is a fine friend,” message “ $\bar{\theta}_2$ ”. If Tom knows that Ted is a fine friend, he can say, “Ted is a fine friend,” message “ $\bar{\theta}_2$ ”, or he can say, “Ted is simply a fine friend,” message “ θ_2 ”. If Liz is sophisticated, and Tom says, “Ted is a fine

friend,” Liz can interpret this as meaning that Ted is not a fine friend and therefore avoid him, action $a(\theta_1)$, or she can interpret it as meaning that Ted is a fine friend and thus not avoid him, action $a(\theta_2)$. If Liz is naïve, and Tom says, “Ted is a fine friend,” Liz always interprets this as meaning that Ted is a fine friend and thus does not avoid him, action $a(\theta_2)$. If Tom says, “Ted is plainly not a fine friend,” Liz always understands that Ted is not a fine friend and thus avoids him, action $a(\theta_1)$. If Tom says, “Ted is simply a fine friend,” Liz always understands that he is a fine friend and thus does not avoid him, action $a(\theta_2)$.

Analysis. Tom’s cost d_1^S of saying, directly, “Ted is plainly not a fine friend,” when in fact Ted is not a fine friend is very high because others at the party may hear this and tell Ted that Tom has been talking trash about him behind his back. Moreover, Tom’s benefit b_1^S of communicating that Ted is not a fine friend, or equivalently his cost of miscommunicating that Ted is a fine friend, when Ted is not a fine friend is not too high. Indeed, Tom’s cost of being misunderstood as meaning that Ted is a fine friend is moderate since at least this imparts a positive feeling and allows Tom to avoid the impression that he is talking badly behind Ted’s back. In contrast, Liz’s benefit b_1^L of understanding that Ted is not a fine friend is high because this would give Liz a warning not to associate with Ted. On the other hand, Tom’s cost d_2^S of disambiguating that Ted is a fine friend by saying, “Ted is simply a fine friend,” is low because saying something nice about a friend is easy and pleasing. Moreover, Tom’s benefit b_2^S of communicating that Ted is a fine friend, or equivalently his cost of miscommunicating that Ted is not a fine friend, when Ted is a fine friend is very high. Indeed, Tom’s cost of being misunderstood as saying that Ted is not a fine friend when Ted is a fine friend is significant since this could result in his close friend’s reputation being harmed. Lastly, the prior q is high because Ted has a reputation for not being a fine friend, and the prior p is high because Liz is known to be generally sharp-witted. Thus, condition

sets (1) and (3) in Corollary 1 hold, and there is only a type-S figurative PBE in which Tom says, “Ted is a fine friend,” when Ted is not a fine friend, and he says, “Ted is simply a fine friend,” when Ted is a fine friend, and if Liz is sophisticated, she correctly interprets, “Ted is a fine friend,” ironically as meaning that Ted is not a fine friend. ■

Example 3. Ted has a reputation for being a fine friend. Speaking to Liz at the party, Tom says, “Ted is not a fine friend.”

Correspondence with model. Ted is a fine friend, state θ_1 , or he is not a fine friend, state θ_2 . If Tom knows that Ted is a fine friend, he can say, “Ted is simply a fine friend,” message “ θ_1 ”, or he can say, ironically, “Ted is not a fine friend,” message “ $\bar{\theta}_2$ ”. If Tom knows that Ted is not a fine friend, he can say, “Ted is not a fine friend,” message “ $\bar{\theta}_2$ ”, or he can say, “Ted is plainly not a fine friend,” message “ θ_2 ”. If Liz is sophisticated, and Tom says, “Ted is not a fine friend,” Liz can interpret this as meaning that Ted is a fine friend and thus not avoid him, action $a(\theta_1)$, or she can interpret it as meaning that Ted is not a fine friend and thus avoid him, action $a(\theta_2)$. If Liz is naïve, and Tom says, “Ted is not a fine friend,” Liz always interprets this as meaning that Ted is not a fine friend and thus avoids him, action $a(\theta_2)$. If Tom says, “Ted is simply a fine friend,” Liz always understands that Ted is a fine friend and does not avoid him, action $a(\theta_1)$. If Tom says, “Ted is plainly not a fine friend,” Liz always understands that Ted is not a fine friend and avoids him, action $a(\theta_2)$.

Analysis. Tom’s cost d_1^S of saying, directly, “Ted is simply a fine friend,” when Ted is a fine friend is low since saying something nice about a friend is easy. But Tom’s benefit b_1^S of communicating that Ted is a fine friend, or equivalently his cost of miscommunicating that Ted is not a fine friend, when Ted is a fine friend is very high. Indeed, Tom’s cost of being misunderstood as saying that Ted is not a fine friend when Ted is a fine friend is significant, since this could result in his good friend’s reputation being harmed. Thus, neither of the

condition sets (1) and (2) in Corollary 1 are satisfied, so there is no figurative PBE. ■

This analysis suggests that irony will typically be negative or sarcastic. By definition, it need not be: according to the *American Heritage Dictionary*, verbal irony is “the use of words to express something opposite to their literal meaning,” while sarcasm is “a sneering or cutting remark that is intended to wound.” However, research by psychologists and linguists demonstrates that most instances of verbal irony are considered to be sarcastic (Lee and Katz, 1998; Gibbs, 2000; and Bryant and Fox Tree, 2002). Our model provides an explanation. It implies that figurative speech is more likely when the cost of expressing a thought directly is higher and when the benefit of being understood, or equivalently the cost of being misunderstood, is lower. If the speaker’s thought is negative (positive), speaking ironically involves using an expression that has a literal meaning that is positive (negative). Having an expression with a positive literal meaning be interpreted naïvely is generally less costly than having an expression with a negative literal meaning be interpreted naïvely. Moreover, the cost of expressing a negative thought directly is generally higher than the cost of expressing a positive thought directly. Thus, irony is more likely to be negative than positive.

4. Extended Model: Potential Disagreement on Actions

So far, we have assumed that the speaker and listener both derive a benefit if the listener correctly interprets the speaker’s type. However, the speaker may derive no benefit from the listener correctly interpreting the speaker’s type if the listener is of a type who would not cooperate with the speaker’s type. We now extend the model to allow for this possibility. The model is the same as the basic model except that now the listener is also one of two additional types, $\eta \in \{\eta_1, \eta_2\}$: a type, η_1 , who would cooperate with the speaker regardless of the speaker’s type, and a type, η_2 , who would only cooperate with the speaker following

an inference that the speaker's type is θ_2 . Thus, the listener is now one of a total of four types, $(\sigma, \eta) \in \{(\sigma_1, \eta_1), (\sigma_1, \eta_2), (\sigma_2, \eta_1), (\sigma_2, \eta_2)\}$. Action $a(\theta, \eta)$ is the action that the type- (σ, η) listener would take following an inference that the speaker's type is θ .

As before, if the speaker's type is θ_1 , the speaker sends the direct message " θ_1 " or the ambiguous message " $\bar{\theta}_2$ ". If the speaker's type is θ_2 , the speaker sends the direct message " θ_2 " or the ambiguous message " $\bar{\theta}_2$ ". The speaker's costs of sending, and the listener's costs of receiving, direct messages may depend on the listener's type. If the listener's type is (σ, η_1) , the speaker's costs of sending messages " θ_1 " and " θ_2 " are $d_{11}^S > 0$ and $d_{21}^S > 0$, respectively, and the listener's costs of receiving " θ_1 " and " θ_2 " are $d_{11}^L > 0$ and $d_{21}^L > 0$, respectively. If the listener's type is (σ, η_2) , the speaker's costs of sending " θ_1 " and " θ_2 " are $d_{12}^S > 0$ and $d_{22}^S > 0$, respectively, and the listener's costs of receiving " θ_1 " and " θ_2 " are $d_{12}^L > 0$ and $d_{22}^L > 0$, respectively. If the speaker's type is θ_1 , the speaker incurs cost $c_{11}^S > 0$ of sending " $\bar{\theta}_2$ " if the listener's type is (σ, η_1) and cost $c_{12}^S > 0$ of sending " $\bar{\theta}_2$ " if the listener's type is (σ, η_2) . The type- (σ, η_1) and type- (σ, η_2) listeners incur costs $c_{11}^L > 0$ and $c_{12}^L > 0$ of receiving " $\bar{\theta}_2$ ", respectively. The type- (σ_1, η) listener either interprets " $\bar{\theta}_2$ " literally as indicating θ_2 or figuratively as indicating θ_1 , i.e., chooses between actions $a(\theta_1, \eta)$ and $a(\theta_2, \eta)$. The type- (σ_2, η) listener always interprets " $\bar{\theta}_2$ " as indicating θ_2 and so always chooses action $a(\theta_2, \eta)$.

If the listener's type is (σ, η_1) , the speaker and type- (σ, η_1) listener both want action $a(\theta, \eta_1)$ to be chosen if the speaker's type is θ . More precisely, if the state is θ_1 , and the type- (σ, η_1) listener takes action $a(\theta_1, \eta_1)$, then the speaker receives a benefit $b_{11}^S > 0$ and the type- (σ, η_1) listener receives a benefit $b_{11}^L > 0$. If the state is θ_2 , and the type- (σ, η_1) listener takes action $a(\theta_2, \eta_1)$, the speaker receives a benefit $b_{21}^S > 0$ and the type- (σ, η_1) listener receives a benefit $b_{21}^L > 0$.

If the listener's type is (σ, η_2) , the speaker and type- (σ, η_2) listener both want action $a(\theta_2, \eta_2)$ to be chosen if the speaker's type is θ_2 . However, only the type- (σ, η_2) listener wants action $a(\theta_1, \eta_2)$ to be chosen if the speaker's type is θ_1 . More precisely, if the state is θ_2 , and the type- (σ, η_2) listener takes $a(\theta_2, \eta_2)$, then the speaker receives a benefit $b_{22}^S > 0$ and the type- (σ, η_2) listener receives $b_{22}^L > 0$. However, if the state is θ_1 , and the type- (σ, η_2) listener takes $a(\theta_1, \eta_2)$, then the speaker receives no benefit, i.e., $b_{12}^S = 0 < b_{11}^S$, while the type- (σ, η_2) listener receives a benefit $b_{12}^L > 0$.

Let $r \in (0, 1)$ be the prior probability that the listener is of type η_1 . The extensive form of the game is given in Figure 2. The speaker has two information sets, labelled $S.1$ and $S.2$, and the listener has two non-singleton information sets, labelled $L.1$ and $L.2$.

We make the following reasonable assumptions: $d_{12}^S - c_{12}^S > d_{11}^S - c_{11}^S > 0$ (the speaker's cost savings from indirectly communicating θ_1 is always positive and is greater if the listener is uncooperative) and $b_{21}^S > b_{22}^S$ and $d_{22}^S > d_{21}^S$ (the speaker's benefit of communicating θ_2 is greater if the listener is cooperative and the speaker's cost of directly communicating θ_2 is greater if the listener is non-cooperative).

There are six possible types of figurative PBEs in this game. In a *type-PS1 figurative PBE*, the speaker sends message " $\bar{\theta}_2$ " in state θ_1 and in state θ_2 , the type- (σ_1, η_1) listener responds by interpreting " $\bar{\theta}_2$ " as θ_1 and thus taking action $a(\theta_1, \eta_1)$, and the type- (σ_1, η_2) listener responds by interpreting " $\bar{\theta}_2$ " as θ_2 and thus taking action $a(\theta_2, \eta_2)$. In a *type-SS1 figurative PBE*, the speaker sends message " $\bar{\theta}_2$ " when the speaker's type is θ_1 and message " θ_2 " when the speaker's type is θ_2 , the type- (σ_1, η_1) listener responds by interpreting " $\bar{\theta}_2$ " as θ_1 and thus taking action $a(\theta_1, \eta_1)$, and the type- (σ_1, η_2) listener responds by interpreting " $\bar{\theta}_2$ " as θ_2 and thus taking action $a(\theta_2, \eta_2)$. In a type-PS1 or type-SS1 figurative PBE, the probability that speech is figurative is rpq .

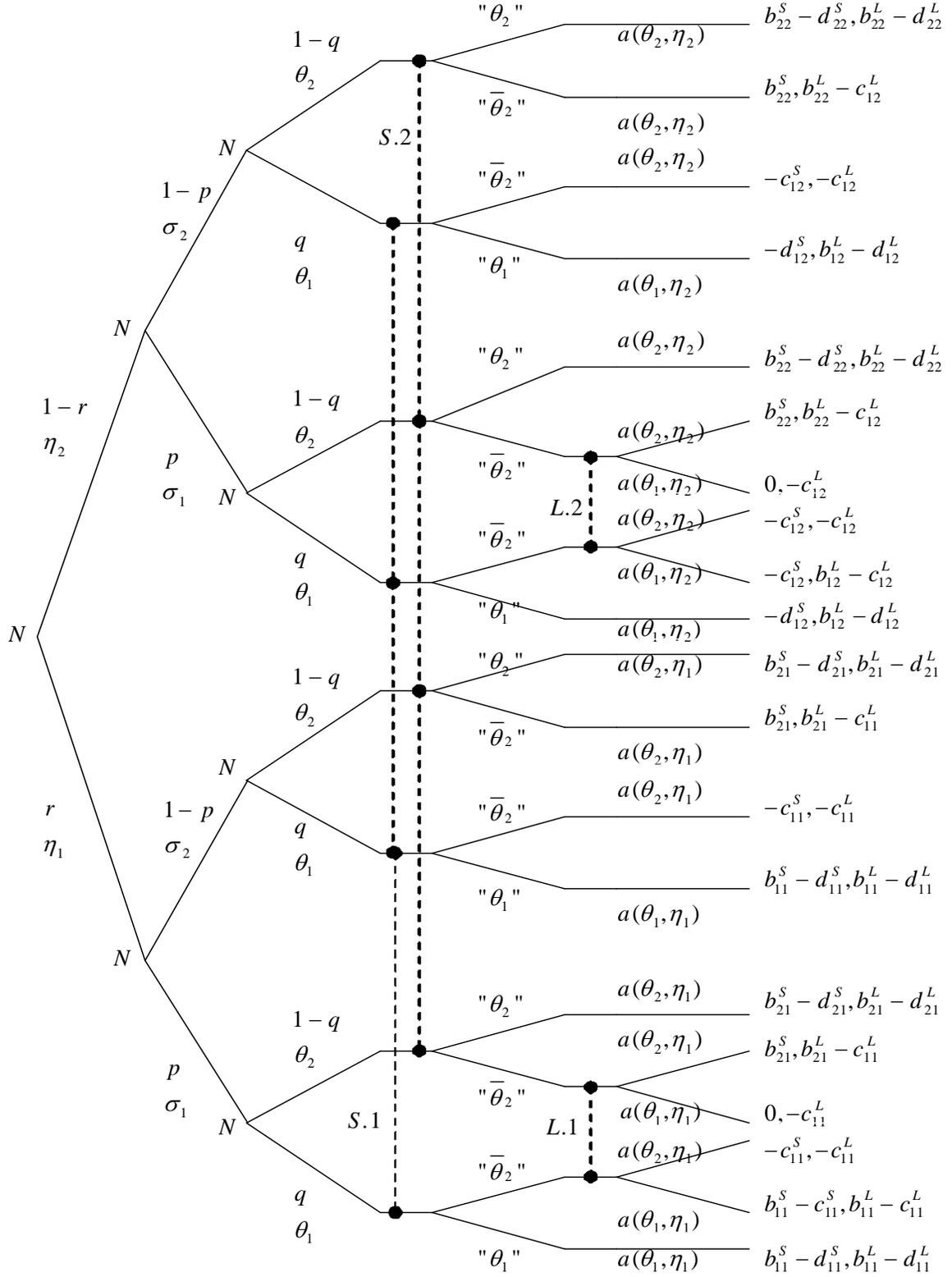


Figure 2: Model When Speaker and Listener May Disagree on Actions.

In a *type-PP figurative PBE*, the speaker sends “ $\bar{\theta}_2$ ” in state θ_1 and in state θ_2 , the type- (σ_1, η_1) listener responds by interpreting “ $\bar{\theta}_2$ ” as θ_1 and thus taking $a(\theta_1, \eta_1)$, and the type- (σ_1, η_2) listener responds by interpreting “ $\bar{\theta}_2$ ” as θ_1 and thus taking $a(\theta_1, \eta_2)$. In a *type-SP figurative PBE*, the speaker sends “ $\bar{\theta}_2$ ” in state θ_1 and “ θ_2 ” in state θ_2 , the type- (σ_1, η_1) listener responds by interpreting “ $\bar{\theta}_2$ ” as θ_1 and thus taking $a(\theta_1, \eta_1)$, and the type- (σ_1, η_2) listener responds by interpreting “ $\bar{\theta}_2$ ” as θ_1 and thus taking $a(\theta_1, \eta_2)$. In a type-PP or type-SP figurative PBE, the probability that speech is figurative is pq .

In a *type-PS2 figurative PBE*, the speaker sends “ $\bar{\theta}_2$ ” in state θ_1 and in state θ_2 , the type- (σ_1, η_1) listener responds by interpreting “ $\bar{\theta}_2$ ” as θ_2 and taking $a(\theta_2, \eta_1)$, and the type- (σ_1, η_2) listener responds by interpreting “ $\bar{\theta}_2$ ” as θ_1 and taking $a(\theta_1, \eta_2)$. In a *type-SS2 figurative PBE*, the speaker sends “ $\bar{\theta}_2$ ” in state θ_1 and “ θ_2 ” in state θ_2 , the type- (σ_1, η_1) listener responds by interpreting “ $\bar{\theta}_2$ ” as θ_2 and taking $a(\theta_2, \eta_1)$, and the type- (σ_1, η_2) listener responds by interpreting “ $\bar{\theta}_2$ ” as θ_1 and taking $a(\theta_1, \eta_2)$. In a type-PS2 or type-SS2 figurative PBE, the probability that speech is figurative is $(1 - r)pq$.

There are also many types of non-figurative PBEs. To simplify the analysis of the extended model, we focus only on the existence of figurative PBEs. In any of the possible figurative PBEs, all non-singleton information sets are on the equilibrium path. Thus, as in the basic model, any of the figurative PBEs also satisfies the Intuitive Criterion.

4.1 Existence of Figurative Equilibria

We now provide conditions for each of the possible figurative equilibria to exist:

Proposition 2 *There is a type-SP figurative PBE iff*

$$r \in \left[\frac{d_{22}^S - pb_{22}^S}{d_{22}^S - pb_{22}^S + pb_{21}^S - d_{21}^S}, \frac{d_{12}^S - c_{12}^S}{d_{12}^S - c_{12}^S - d_{11}^S + c_{11}^S + (1 - p)b_{11}^S} \right], \quad (4)$$

There is a type-PP figurative PBE iff

$$q > \max\left\{\frac{b_{21}^L}{b_{21}^L + b_{11}^L}, \frac{b_{22}^L}{b_{22}^L + b_{12}^L}\right\} \text{ and} \quad (5)$$

$$r < \min\left\{\frac{d_{12}^S - c_{12}^S}{d_{12}^S - c_{12}^S - d_{11}^S + c_{11}^S + (1-p)b_{11}^S}, \frac{d_{22}^S - pb_{22}^S}{d_{22}^S - pb_{22}^S + pb_{21}^S - d_{21}^S}\right\},$$

There is a type-PS1 figurative PBE iff

$$q \in \left[\frac{b_{21}^L}{b_{21}^L + b_{11}^L}, \frac{b_{22}^L}{b_{22}^L + b_{12}^L}\right] \text{ and} \quad (6)$$

$$r < \min\left\{\frac{d_{12}^S - c_{12}^S}{d_{12}^S - c_{12}^S - d_{11}^S + c_{11}^S + (1-p)b_{11}^S}, \frac{d_{22}^S}{d_{22}^S + pb_{21}^S - d_{21}^S}\right\},$$

There is a type-PS2 figurative PBE iff

$$q \in \left[\frac{b_{22}^L}{b_{22}^L + b_{12}^L}, \frac{b_{21}^L}{b_{21}^L + b_{11}^L}\right] \text{ and} \quad (7)$$

$$r < \min\left\{\frac{d_{12}^S - c_{12}^S}{d_{12}^S - c_{12}^S - d_{11}^S + c_{11}^S + b_{11}^S}, \frac{d_{22}^S - pb_{22}^S}{d_{22}^S - pb_{22}^S - d_{21}^S}\right\},$$

There is no type-SS1 or type-SS2 figurative PBE.

The following comparative statics follow from Proposition 2 and our assumptions:

Corollary 3 *There is a figurative PBE (of one type or another) for a larger range of parameters if r is lower, q is higher, d_{12}^S is higher, c_{12}^S is lower, or b_{11}^S is lower.*

Ceteris paribus, speech is more likely to be figurative if the probability that the listener is cooperative (r) is lower or if the cost of speaking unambiguously to an uncooperative listener (d_{12}^S) is higher, since this increases the speaker's expected cost of being unambiguous.

4.2 Application

We now employ the condition sets (4)-(7) in Proposition 2 to provide a systematic analysis of another classic example of indirect speech, veiled bribery. The example has been adapted from Pinker (2008) and Pinker, Nowak, and Lee (2008).

4.2.1 Veiled Bribery

Example 5. Driving with Liz after the party, Ted is pulled over by an Orange County police officer for speeding 5 m.p.h. above the limit. When the officer asks for his license, Ted pulls out his wallet, turning it at an angle where the bills are in plain view, and says, “Gee officer, is there any way you could let me go with a warning?”

Correspondence with model. Ted is asking the officer to accept a bribe, state θ_1 , or he is asking for leniency, state θ_2 . The officer is dishonest and unreasonable (would accept a bribe if he thought that Ted was asking him to accept a bribe, and would not let Ted off with a warning if he thought that Ted was asking for leniency, even though the infraction was somewhat technical), state η_1 , or honest and reasonable (would not accept a bribe and would arrest Ted for attempted bribery if he thought that Ted was asking him to accept a bribe, and would let Ted off with a stern warning if he thought Ted was asking for leniency), state η_2 . If Ted is asking the officer to accept a bribe, he can say, “I’ll give you \$100 if you don’t report this,” message “ θ_1 ”, or he can say, “Gee officer, is there any way you could let me go with a warning?,” message “ $\bar{\theta}_2$ ”. If Ted is asking for leniency, he can say, “Gee officer, is there any way you could let me go with a warning?,” message “ $\bar{\theta}_2$ ”, or he can say, avoiding any suggestive antics with his wallet, “I’m sorry and will be extra careful from now on. Could you let me go with a warning just this once?,” message “ θ_2 ”.

Suppose the officer is dishonest and unreasonable. If the officer is sophisticated, and Ted says, “Gee officer, is there any way you could let me go with a warning?,” then the officer can interpret this as meaning that Ted is attempting to bribe him and thus say “yes” and accept a bribe, action $a(\theta_1, \eta_1)$, or he can interpret it as meaning that Ted is asking for leniency and thus say “no” and issue him a ticket, action $a(\theta_2, \eta_1)$. If the officer is naïve, and Ted says, “Gee officer, is there any way you could let me go with a warning?,” then

the officer always interprets this as meaning that Ted is asking for leniency and thus says “no” and issues him a ticket, $a(\theta_2, \eta_1)$. If Ted says, “I’ll give you \$100 if you don’t report this,” the officer always understands that Ted wants to bribe him and thus says “yes” and accepts a bribe, action $a(\theta_1, \eta_1)$. If Ted says, “I’m sorry and will be extra careful from now on. Could you let me go with a warning just this once?,” the officer always understands that Ted is asking for leniency and thus says “no” and issues him a ticket, action $a(\theta_2, \eta_1)$.

Suppose the officer is honest and reasonable. If the officer is sophisticated, and Ted says, “Gee officer, is there any way you could let me go with a warning?,” the officer can interpret this as meaning that Ted is asking him to accept a bribe and thus say “no” and issue him a ticket, action $a(\theta_1, \eta_2)$, or he can interpret it as meaning that Ted is asking for reasonable leniency and thus say “yes” and let him off with a stern warning, $a(\theta_2, \eta_2)$. If the officer is naïve, and Ted says, “Gee officer, is there any way you could let me go with a warning?,” the officer always interprets this as meaning that Ted is asking for leniency and thus says “yes” and lets him off with a stern warning, $a(\theta_2, \eta_2)$. If Ted says, “I’ll give you \$100 if you don’t report this,” the officer always understands that Ted is asking him to accept a bribe and thus says “no” and arrests him for attempted bribery, $a(\theta_1, \eta_2)$. If Ted says, “I’m sorry and will be extra careful from now on. Could you let me go with a warning just this once?,” the officer always understands that Ted is asking for reasonable leniency and thus says “yes” and lets him off with a warning, $a(\theta_2, \eta_2)$.

A situation where there is a type-PS1 figurative PBE. The dishonest/unreasonable officer’s benefit b_{11}^L of correctly understanding that Ted is asking him to accept a bribe if Ted says, “Gee officer, is there any way you could let me go with a warning?,” is high since he is interested in taking a bribe. The dishonest/unreasonable officer’s benefit b_{21}^L of correctly understanding that Ted is asking for leniency when Ted says, “Gee officer, is there any way

you could let me go with a warning?,” is moderate since he does not care much about being reasonable with his discretion to apply the law and is not much worried about being accused by Ted of being willing to be bribed as there would be no hard evidence.

The honest/reasonable officer’s benefit b_{22}^L of correctly understanding that Ted is asking for reasonable leniency when Ted says, “Gee officer, is there any way you could let me go with a warning?,” is high since he cares about being fair with his discretion to apply the law. Moreover, the honest/reasonable officer’s benefit b_{12}^L of correctly understanding that Ted is offering a bribe if Ted says, “Gee officer, is there any way you could let me go with a warning?,” is moderate since although the officer can then get some satisfaction from issuing Ted a ticket, he cannot arrest Ted for attempted bribery since Ted’s message is ambiguous and plausibly deniable. Moreover, the prior q that Ted is bribing the officer is not too low since it is not uncommon for people who are pulled over to try to curry favor in order to avoid a fine. Thus, $q \in [b_{21}^L/(b_{21}^L + b_{11}^L), b_{22}^L/(b_{22}^L + b_{12}^L)]$.

On the other hand, the prior r that the officer is dishonest/unreasonable is low since most officers are honest/reasonable. Moreover, Ted’s cost d_{12}^S of saying unambiguously to the officer, “I’ll give you \$100 if you don’t report this,” when the officer is honest/reasonable, is extremely high because this would result in Ted being arrested and convicted for attempted bribery. Moreover, Ted lives in California, where attempted (as well as completed) bribery of a police officer is a felony, which can result in a prison sentence of between 2 and 4 years (California Penal Code Section 67). In contrast, Ted’s cost c_{12}^S of saying ambiguously to the officer, “Gee officer, is there any way you could let me go with a warning?,” when the officer is honest/reasonable, is much lower since there is little chance of this message resulting in a conviction for attempted bribery as it carries the advantage of plausible deniability. In fact, d_{12}^S is so large relative to other parameters that $r < (d_{12}^S - c_{12}^S)/(d_{12}^S - c_{12}^S - d_{11}^S + c_{11}^S + (1-p)b_{11}^S)$.

Furthermore, Ted's cost d_{22}^S of saying to the officer, "I'm sorry and will be extra careful from now on. Could you let me go with a warning just this once?," is about the same whether he faces a dishonest/unreasonable or an honest/reasonable officer, i.e., $d_{21}^S \approx d_{22}^S$, and is high since this message is pride-swallowing. In contrast, Ted's benefit b_{21}^S of successfully communicating to a dishonest/unreasonable officer that he is asking for leniency is close to zero, for he will still be issued a ticket. Thus, $r < d_{22}^S / (d_{22}^S + pb_{21}^S - d_{21}^S)$. Hence, condition set (6) in Proposition 2 is satisfied, and there is a type-PS1 figurative PBE in which Ted says, "Gee officer, is there any way you could let me go with a warning?," whether he is asking the officer to accept a bribe or asking for leniency, and if the officer is sophisticated, he interprets this as meaning that Ted is asking him to accept a bribe if he is dishonest/unreasonable and interprets it as meaning that Ted is asking for leniency if he is honest/reasonable.

A situation where there is no figurative PBE. If, instead, the prior r that the officer is dishonest/unreasonable is high, Ted's cost d_{12}^S of saying unambiguously, "I'll give you \$100 if you don't report this," when the officer is honest/reasonable, is not too high (because Ted lives in a place where the punishment for attempted bribery is not too high), Ted's cost d_{11}^S of saying unambiguously, "I'll give you \$100 if you don't report this," when the officer is dishonest/unreasonable is low (because the street is deserted and there's nobody around), and Ted's benefit b_{11}^S of successfully communicating to the officer that he is asking him to accept a bribe is high (because Ted really wants to avoid a ticket, e.g., because the insurance premium would rise substantially with an additional offense), then neither of the condition sets (4)-(7) in Proposition 2 are satisfied, so there is no figurative PBE. ■

The model also delivers a policy implication in this application. In any type of figurative PBE, the probability of a completed bribe is rpq (the officer must be dishonest/unreasonable and sophisticated and Ted must intend to bribe). In contrast, in any outcome that is not figu-

rative, the probability of a completed bribe is rq (the officer must be dishonest/unreasonable and Ted must intend to bribe, but the officer need not be sophisticated since even an unsophisticated officer understands a bribe when it is direct). On the other hand, in any outcome, whether figurative or not, the probability of an attempted bribe is q (since Ted always attempts to bribe if he intends to bribe, the question in this case being only how he attempts to bribe). Now, as Corollary 3 and the above analysis demonstrate, a figurative PBE is more likely if the punishment for attempted bribery (d_{12}^S) is higher. Thus, increasing the punishment for attempted bribery reduces the probability of completed bribery even if it does not affect the probability of attempted bribery. The reason is that it induces the briber to bribe more indirectly, which reduces the probability that the bribe will succeed. This provides a novel argument for the effectiveness of laws that strictly punish not only completed bribery but also attempted bribery.

5. Summary and Future Work

In this paper, we have developed a model of communication to help understand how context affects whether or not speech is figurative or indirect. The model provides analytical conditions for speech to be figurative in equilibrium and delivers a number of comparative statics results. For example, it predicts that a greater benefit to the listener of correctly understanding the speaker or a greater disagreement over actions between the speaker and listener increases the likelihood that figurative speech is employed. We also applied the model to systematically analyze various forms of figurative speech, including terseness, irony, and veiled bribery. The model provided an explanation for why irony is usually sarcastic, and it yielded a policy implication with respect to bribery: increasing the penalty for attempted bribery reduces the probability of successful bribery taking place, even if it has no effect on

the probability of attempted bribery occurring, because it induces the briber to bribe more indirectly, which reduces the probability that the bribe will succeed.

The model could be extended in several potentially interesting ways. First, while we introduced a naïve type of the listener who always interprets messages literally (in order to pin down the literal meaning of ambiguous messages), it might also be interesting to introduce a naïve type of the speaker who always uses messages literally. One interesting additional issue that arises when introducing a naïve type of the speaker is that figurative speech can then potentially be a signal of the speaker’s cognitive ability. Indeed, one of the reasons people use figurative or indirect language might simply be to show off that they are sophisticated and not naïve. Investigating this possibility would require modeling the benefits to the speaker of an inference by the listener that the speaker is sophisticated.

Second, while we employed the concept of plausible deniability to interpret the costs associated with different messages in our extended model with potential disagreement over actions, it would be interesting to provide a more formal representation of the concept. One simple way to formally represent plausible deniability in our extended model would be to explicitly model the continuation game following the chosen messages and actions. In the bribery example, if Ted says to the police officer who stopped him for speeding, “Gee officer, is there any way you could let me go with a warning?,” and if the officer interprets this as a bribe (rightfully or wrongfully) and arrests Ted, then the game would proceed to Court, where Ted would have the option to deny that he had meant to bribe the officer, in which case there may be too little proof for conviction. But if Ted had initially said to the officer, “I’ll give you \$100 if you don’t report this,” it would be hard for him to deny in court that he had meant to bribe the officer, and a conviction would be more likely. In situations with potential disagreement over actions, indirect speech leaves open the option to deny having

had certain intentions. Explicitly modeling this option value of indirect speech is another potentially interesting avenue for future work.

Third, it might be fruitful to explore conversational dynamics. One might try to add to the model an earlier stage in which a person can say something that sets the context for the exchange and possibly influences the beliefs of the other person, thereby changing the equilibrium. Some types may want to change the equilibrium in particular ways. One might also try to add to the model a subsequent stage in which a person can follow up on a related issue or ask for clarification of a previous one. Clarification would undo the figurativeness of speech, but, in many cases, the listener may choose to not ask for clarification.

Lastly, it might be interesting to test the predictions of our model experimentally. Subjects could be offered a choice of messages with different levels of directness, and one could observe whether their choices vary with the parameters of the conversational situation in the ways that our model predicts.

6. Appendix

Proof of Proposition 1. Let α_1 and α_2 be the probability that the speaker chooses “ $\bar{\theta}_2$ ” in the state θ_1 and the probability that the speaker chooses “ $\bar{\theta}_2$ ” in the state θ_2 , respectively. Let β be the type- σ_1 listener’s belief that the state is θ_1 if the speaker chooses message “ $\bar{\theta}_2$ ”, i.e., the probability of being at the first node in $L.1$. Then,

$$\beta = \frac{q\alpha_1}{q\alpha_1 + (1 - q)\alpha_2}. \quad (8)$$

The expected payoffs to the type- σ_1 listener of choosing $a(\theta_1)$ and $a(\theta_2)$ are then βb_1^L and $(1 - \beta)b_2^L$, respectively. Thus, the listener chooses $a(\theta_1)$ upon hearing “ $\bar{\theta}_2$ ” iff

$$\beta > \frac{b_2^L}{b_2^L + b_1^L}. \quad (9)$$

Let δ be the probability that the type- σ_1 listener chooses $a(\theta_1)$ at $L.1$. Then, if the state is θ_1 , i.e., the speaker is at $S.1$, then the speaker chooses “ $\bar{\theta}_2$ ” iff

$$\delta > \frac{1}{p} \left(1 - \left(\frac{d_1^S - c_1^S}{b_1^S} \right) \right). \quad (10)$$

Similarly, if the state is θ_2 , i.e., the speaker is at $S.2$, then the speaker chooses “ $\bar{\theta}_2$ ” iff

$$\delta < \frac{1}{p} \left(\frac{d_2^S}{b_2^S} \right). \quad (11)$$

Consider a type-S figurative PBE. This equilibrium arises when the speaker chooses message “ $\bar{\theta}_2$ ” in state θ_1 and message “ θ_2 ” in state θ_2 , and the type- σ_1 listener responds to “ $\bar{\theta}_2$ ” by choosing action $a(\theta_1)$. If $\alpha_1 = 1$ and $\alpha_2 = 0$, then $\beta = 1$, and thus, (9) is satisfied, so $\delta = 1$. On the other hand, $\alpha_1 = 1$ and $\alpha_2 = 0$ if (10) is satisfied but (11) is not satisfied. Substituting $\delta = 1$ in these conditions, we obtain

$$p > \max \left\{ 1 - \left(\frac{d_1^S - c_1^S}{b_1^S} \right), \frac{d_2^S}{b_2^S} \right\}. \quad (12)$$

Hence, a type-P figurative PBE exists if this condition holds. If $c_1^S < d_1^S - b_1^S + \left(\frac{b_1^S}{b_2^S}\right)d_2^S$, the condition reduces to $p > \frac{d_2^S}{b_2^S}$. If $c_1^S > d_1^S - b_1^S + \left(\frac{b_1^S}{b_2^S}\right)d_2^S$, the condition reduces to $p > 1 - \left(\frac{d_1^S - c_1^S}{b_1^S}\right)$.

Consider a type-P figurative PBE. This equilibrium arises when the speaker chooses the message “ $\bar{\theta}_2$ ” in both states θ_1 and θ_2 , and the type- σ_1 listener responds to “ $\bar{\theta}_2$ ” by choosing action $a(\theta_1)$. If $\alpha_1 = 1$ and $\alpha_2 = 1$, then $\beta = q$, and the type- σ_1 listener responds by taking the action $a(\theta_1)$ iff

$$q > \frac{b_2^L}{b_2^L + b_1^L}. \quad (13)$$

If this condition is satisfied, $\delta = 1$. On the other hand, $\alpha_1 = 1$ and $\alpha_2 = 1$ if (10) and (11) are both satisfied. Substituting $\delta = 1$ in these conditions, we obtain

$$\frac{1}{p} \left(\frac{d_2^S}{b_2^S} \right) > 1 > \frac{1}{p} \left(1 - \left(\frac{d_1^S - c_1^S}{b_1^S} \right) \right). \quad (14)$$

These conditions are satisfied if $c_1^S < d_1^S - b_1^S + (\frac{b_1^S}{b_2^S})d_2^S$ and $1 - (\frac{d_1^S - c_1^S}{b_1^S}) < p < \frac{d_2^S}{b_2^S}$. Hence, a type-P figurative PBE exists if $c_1^S < d_1^S - b_1^S + (\frac{b_1^S}{b_2^S})d_2^S$, $1 - (\frac{d_1^S - c_1^S}{b_1^S}) < p < \frac{d_2^S}{b_2^S}$, and $q > \frac{b_2^L}{b_2^L + b_1^L}$.

Consider a type-P non-figurative PBE. This equilibrium arises when the speaker chooses the message “ $\bar{\theta}_2$ ” in both states θ_1 and θ_2 , and the type- σ_1 listener responds by taking the action $a(\theta_2)$. If $\alpha_1 = 1$ and $\alpha_2 = 1$, then $\beta = q$, and thus, the type- σ_1 listener responds by taking the action $a(\theta_2)$ iff

$$q < \frac{b_2^L}{b_2^L + b_1^L}. \quad (15)$$

If this condition is satisfied, $\delta = 0$. Then, from (10) and (11), we obtain the conditions

$$\frac{1}{p} \left(\frac{d_2^S}{b_2^S} \right) > 0 > \frac{1}{p} \left(1 - \left(\frac{d_1^S - c_1^S}{b_1^S} \right) \right). \quad (16)$$

These conditions are satisfied if $c_1^S < d_1^S - b_1^S$. Hence, a type-P non-figurative PBE exists if $c_1^S < d_1^S - b_1^S$ and $q < \frac{b_2^L}{b_2^L + b_1^L}$.

Consider a type-S1 non-figurative PBE. This equilibrium arises when the speaker chooses message “ θ_1 ” in state θ_1 and message “ $\bar{\theta}_2$ ” in state θ_2 . If $\alpha_1 = 0$ and $\alpha_2 = 1$, $\beta = 0$, and thus, (9) is not satisfied, so $\delta = 0$. Then, from (10) and (11), we obtain the conditions

$$0 < \frac{1}{p} \left(1 - \left(\frac{d_1^S - c_1^S}{b_1^S} \right) \right) \text{ and } 0 < \frac{1}{p} \left(\frac{d_2^S}{b_2^S} \right). \quad (17)$$

These conditions are satisfied if $d_1^S - b_1^S < c_1^S$. Hence, a type-S1 non-figurative PBE exists if $d_1^S - b_1^S < c_1^S$.

Consider a type-S2 non-figurative PBE. This equilibrium arises when the speaker chooses message “ θ_1 ” in state θ_1 and message “ θ_2 ” in state θ_2 . Since $\alpha_1 = 0$ and $\alpha_2 = 0$, the information set of the listener is off-the-equilibrium path. From (10) and (11), this strategy profile is a PBE for any δ such that

$$\frac{1}{p} \frac{d_2^S}{b_2^S} < \delta < \frac{1}{p} \left(1 - \left(\frac{d_1^S - c_1^S}{b_1^S} \right) \right). \quad (18)$$

Such δ exists only if $c_1^S > d_1^S - b_1^S + (\frac{b_1^S}{b_2^S})d_2^S$.

In sum, there are three cases: (I) $c_1^S < d_1^S - b_1^S < d_1^S - b_1^S + (\frac{b_1^S}{b_2^S})d_2^S$, (II) $d_1^S - b_1^S < c_1^S < d_1^S - b_1^S + (\frac{b_1^S}{b_2^S})d_2^S$, and (III) $d_1^S - b_1^S < d_1^S - b_1^S + (\frac{b_1^S}{b_2^S})d_2^S < c_1^S$. Suppose case (I) holds. If $p > \frac{d_2^S}{b_2^S}$ and $q > \frac{b_2^L}{b_2^L + b_1^L}$, there is only a type-S figurative PBE. If $p < \frac{d_2^S}{b_2^S}$ and $q > \frac{b_2^L}{b_2^L + b_1^L}$, there is only a type-P figurative PBE. If $p > \frac{d_2^S}{b_2^S}$ and $q < \frac{b_2^L}{b_2^L + b_1^L}$, there is a type-S figurative PBE and a type-P non-figurative PBE. If $p < \frac{d_2^S}{b_2^S}$ and $q < \frac{b_2^L}{b_2^L + b_1^L}$, there is only a type-P non-figurative PBE. Now suppose case (II) holds. If $p < \frac{d_2^S}{b_2^S}$ and $q < \frac{b_2^L}{b_2^L + b_1^L}$ or $p < 1 - (\frac{d_1^S - c_1^S}{b_1^S})$ and $q > \frac{b_2^L}{b_2^L + b_1^L}$, there is only a type-S1 non-figurative PBE. If $1 - (\frac{d_1^S - c_1^S}{b_1^S}) < p < \frac{d_2^S}{b_2^S}$ and $q > \frac{b_2^L}{b_2^L + b_1^L}$, there is a type-P figurative PBE and a type-S1 non-figurative PBE. If $p > \frac{d_2^S}{b_2^S}$, there is a type-S figurative PBE and a type-S1 non-figurative PBE. Lastly, suppose case (III) holds. If $p < 1 - (\frac{d_1^S - c_1^S}{b_1^S})$, there is a type-S1 non-figurative PBE and a type-S2 non-figurative PBE. If $p > 1 - (\frac{d_1^S - c_1^S}{b_1^S})$, there is a type-S figurative PBE, a type-S1 non-figurative PBE, and a type-S2 non-figurative PBE. ■

Proof of Proposition 2. Let β_1 be the type- (η_1, σ_1) listener's probability of being at the first node in $L.1$ and let β_2 be the type- (η_2, σ_1) listener's probability of being at the first node in $L.2$. We have $\beta_1 = \beta_2 = \beta$. Let α_1 and α_2 be the probability that the speaker chooses " $\bar{\theta}_2$ " in the state θ_1 and the probability that the speaker chooses " $\bar{\theta}_2$ " in the state θ_2 , respectively. Then,

$$\beta = \frac{q\alpha_1}{q\alpha_1 + (1-q)\alpha_2}. \quad (19)$$

The type- (η_1, σ_1) listener chooses $a(\theta_1, \eta_1)$ at $L.1$ iff

$$\beta > \frac{b_{21}^L}{b_{21}^L + b_{11}^L} = B_1. \quad (20)$$

The type- (η_2, σ_1) listener chooses $a(\theta_1, \eta_2)$ at $L.2$ iff

$$\beta > \frac{b_{22}^L}{b_{22}^L + b_{12}^L} = B_2. \quad (21)$$

Let δ_1 and δ_2 be the probability that the type- (η_1, σ_1) listener chooses $a(\theta_1, \eta_1)$ at $L.1$ and the probability that the type- (η_2, σ_1) listener chooses $a(\theta_1, \eta_2)$ at $L.2$, respectively. Then, the speaker chooses “ $\bar{\theta}_2$ ” at $S.1$ iff

$$r < \frac{d_{12}^S - c_{12}^S}{d_{12}^S - c_{12}^S - (d_{11}^S - c_{11}^S) + (1 - \delta_1 p)b_{11}^S} = \Phi_1(\delta_1). \quad (22)$$

The speaker chooses “ $\bar{\theta}_2$ ” at $S.2$ iff

$$r < \frac{d_{22}^S - p\delta_2 b_{22}^S}{d_{22}^S - d_{21}^S + p(\delta_1 b_{21}^S - \delta_2 b_{22}^S)} = \Phi_2(\delta_1, \delta_2). \quad (23)$$

Consider a type-PS1 figurative PBE. This equilibrium arises when the speaker chooses message “ $\bar{\theta}_2$ ” in both states, and the type- (η_1, σ_1) listener chooses $a(\theta_1, \eta_1)$ and type- (η_2, σ_1) listener chooses $a(\theta_2, \eta_2)$. If $\alpha_1 = 1$ and $\alpha_2 = 1$, then $\beta = q$, and thus, $\delta_1 = 1$, $\delta_2 = 0$ is rational only if (20) is satisfied while (21) is not satisfied. Then, it must be that $q \in [B_1, B_2]$. On the other hand, $\alpha_1 = \alpha_2 = 1$ if both (22) and (23) are satisfied. Let

$$\begin{aligned} \Phi_1^1 &= \Phi_1(1) = \frac{d_{12}^S - c_{12}^S}{d_{12}^S - c_{12}^S - (d_{11}^S - c_{11}^S) + (1 - p)b_{11}^S} > 0 \text{ and} \\ \Phi_2^{10} &= \Phi_2(1, 0) = \frac{d_{22}^S}{d_{22}^S - d_{21}^S + pb_{21}^S} > 0. \end{aligned}$$

Then, the conditions are satisfied if $r < \min[\Phi_1^1, \Phi_2^{10}]$. Thus, there is a type-PS1 figurative PBE if

$$q \in [B_1, B_2] \text{ and } r < \min[\Phi_1^1, \Phi_2^{10}]. \quad (24)$$

Consider type-PS2 figurative PBE. Since $\beta = q$, $\delta_1 = 0$, $\delta_2 = 1$ is rational only if (20) is not satisfied while (21) is satisfied. Thus, we obtain $q \in [B_2, B_1]$. Also, $\alpha_1 = \alpha_2 = 1$ if both (22) and (23) are satisfied. Let

$$\begin{aligned} \Phi_1^0 &= \Phi_1(0) = \frac{d_{12}^S - c_{12}^S}{d_{12}^S - c_{12}^S - (d_{11}^S - c_{11}^S) + b_{11}^S} > 0 \text{ and} \\ \Phi_2^{01} &= \Phi_2(0, 1) = \frac{d_{22}^S - pb_{22}^S}{d_{22}^S - d_{21}^S - pb_{22}^S}. \end{aligned}$$

Then, the conditions are satisfied if $r < \min[\Phi_1^0, \Phi_2^{01}]$. Thus, there is a type-PS2 figurative PBE if

$$q \in [B_2, B_1] \text{ and } r < \min\{\Phi_1^0, \Phi_2^{01}\}. \quad (25)$$

Consider a type-PP figurative PBE. When $\alpha_1 = 1$ and $\alpha_2 = 1$, $\beta = q$, and thus, $\delta_1 = 1$, $\delta_2 = 1$ is rational only if both (20) and (21) are satisfied, which requires that $q > \max\{B_1, B_2\}$. Let

$$\Phi_2^{11} = \Phi_2(1, 1) = \frac{d_{22}^S - pb_{22}^S}{d_{22}^S - d_{21}^S + p(b_{21}^S - b_{22}^S)}.$$

From (22) and (23), $\alpha_1 = \alpha_2 = 1$, only if $r < \min[\Phi_1^1, \Phi_2^{11}]$. Thus, there is a type-PP figurative PBE if

$$q > \max\{B_1, B_2\} \text{ and } r < \min\{\Phi_1^1, \Phi_2^{11}\}. \quad (26)$$

Consider a type-SP figurative PBE. When $\alpha_1 = 1$ and $\alpha_2 = 0$, $\beta = 1$, and thus, both (20) and (21) are satisfied, so $\delta_1 = \delta_2 = 1$. From (22) and (23), $\alpha_1 = 1$, $\alpha_2 = 0$ only if $r \in [\Phi_2^{11}, \Phi_1^1]$. Thus, there is a type-SP figurative PBE if

$$r \in [\Phi_2^{11}, \Phi_1^1]. \quad (27)$$

Consider a type-SS1 figurative PBE. This equilibrium exists if the speaker chooses message “ $\bar{\theta}_2$ ” in state θ_1 and message “ θ_2 ” in state θ_2 , and the type- (η_1, σ_1) listener responds to “ $\bar{\theta}_2$ ” by choosing action $a(\theta_1, \eta_1)$ and type- (η_2, σ_1) listener chooses $a(\theta_2, \eta_2)$. If $\alpha_1 = 1$ and $\alpha_2 = 0$, then $\beta = 1$, and thus, both conditions in (20) and (21) must be satisfied, which implies that $\delta_1 = \delta_2 = 1$. This contradicts that type- (η_2, σ_1) listener chooses $a(\theta_2, \eta_2)$. Thus, this equilibrium does not exist.

Similarly, a type-SS2 figurative PBE does not exist because if $\alpha_1 = 1$ and $\alpha_2 = 0$, $\beta = 1$, and thus, $\delta_1 = \delta_2 = 1$, which contradicts that type- (η_1, σ_1) listener chooses $a(\theta_2, \eta_2)$.

In sum, there is a type-SP figurative PBE if $\Phi_2^{11} < \Phi_1^1$ and $r \in [\Phi_2^{11}, \Phi_1^1]$, and there is no type-SP figurative PBE otherwise; there is a type-PP figurative PBE if $q > \max\{B_1, B_2\}$ and $r < \min\{\Phi_1^1, \Phi_2^{11}\}$, and there is no type-PP figurative PBE otherwise; there is a type-PS1 figurative PBE if $B_1 < B_2$, $q \in [B_1, B_2]$ and $r < \min\{\Phi_1^1, \Phi_2^{10}\}$, and there is no type-PS1 figurative PBE otherwise; there is a type-PS2 figurative PBE if $B_2 < B_1$, $q \in [B_2, B_1]$ and $r < \min\{\Phi_1^0, \Phi_2^{01}\}$, and there is no type-PS2 figurative PBE otherwise; and there is no type-SS1 or type-SS2 figurative PBE. ■

REFERENCES

- Blume, Andreas, 1996. "Neighborhood Stability in Sender-Receiver Games," *Games and Economic Behavior* 13, 2-25.
- Blume, Andreas and Board, Oliver, 2010. "Intentional Vagueness," Department of Economics, University of Pittsburgh Working Paper.
- Blume, Andreas and Board, Oliver, 2011. "Language Barriers," Revise and Resubmit at *Econometrica*.
- Bowles, Roger and Garoupa, Nuno, 1997. "Casual Police Corruption and the Economics of Crime," *International Review of Law and Economics* 17, 75-87.
- Bryant, Gregory A., and Fox Tree, Jean E., 2002. "Recognizing Verbal Irony in Spontaneous Speech," *Metaphor and Symbol* 17, 99-117.
- Cho, In-Koo and Kreps, David M., 1987. "Signaling Games and Stable Equilibrium," *Quarterly Journal of Economics* 102, 179-221.
- Crawford, Vincent P. and Sobel, Joel, 1982. "Strategic Information Transmission," *Econometrica* 50, 1431-1451.
- Crawford, Vincent P., 2003. "Lying for Strategic Advantage: Rational and Boundedly Rational Misrepresentation of Intentions," *American Economic Review* 93, 133-149.
- Demichelis, Stefano and Weibull, Jörgen, 2008. "Language, Meaning, and Games: A Model of Communication, Coordination, and Evolution," *American Economic Review* 98, 1292-1311.
- Ellingsen, Tore and Östling, Robert, 2010. "When Does Communication Improve Coordination," *American Economic Review* 100, 1695-1724.
- Farrell, Joseph, 1993. "Meaning and Credibility in Cheap-Talk Games," *Games and Economic Behavior* 5, 514-531.

- Franke, Michael, 2009. *Signal to Act: Game Theory in Pragmatics*, ILLC Dissertation Series DS-2009-11, Institute for Logic, Language and Computation, University of Amsterdam.
- Gibbs, Raymond W., 2000. "Irony In Talk Among Friends," *Metaphor and Symbol* 15, 5-27.
- Glazer, Jacob, and Rubinstein, Ariel, 2006. "A Study in the Pragmatics of Persuasion: A Game Theoretical Approach," *Theoretical Economics* 1, 395-410.
- Grice, Paul, 1989. *Studies in the Ways of Words*, Cambridge, Massachusetts: Harvard University Press.
- Grossman, Sanford J., 1981. "The Informational Role of Warranties and Private Disclosure about Product Quality," *Journal of Law and Economics* 24, 461-483.
- Hertel, Johanna and Smith, John, 2011. "Not So Cheap Talk: Costly and Discrete Communication," MPRA Working Paper 29148.
- Jaeger, Gerhard, 2008. "Applications of Game Theory in Linguistics," *Language and Linguistics Compass* 2/3, 406-421.
- Kartik, Navin, Ottaviani, Marco, and Squintani, Francesco, 2007. "Credulity, Lies, and Costly Talk," *Journal of Economic Theory* 134, 93-116.
- Kartik, Navin, 2009. "Strategic Communication with Lying Costs," *Review of Economic Studies* 76, 1359-1395.
- Lee, Christopher J. and Katz, Albert N., 1998. "The Differential Role of Ridicule in Sarcasm and Irony," *Metaphor and Symbol* 13, 1-15.
- Lewis, David, 1969. *Convention: A Philosophical Study*, Harvard University Press, Cambridge, MA.
- Lipman, Barton L., 2009. "Why is Language Vague?" Department of Economics, Boston University Working Paper.
- Milgrom, Paul R., 1981. "Good News and Bad News: Representation Theorems and Applications," *RAND Journal of Economics* 12, 380-391.
- Parikh, Prashant, 2001. *The Use of Language*, Stanford, California: CSLI Publications.
- Parikh, Prashant, 2007. "Situations, Rules, and Conventional Meaning: Some Uses of Games of Partial Information," *Journal of Pragmatics* 39, 917-933.
- Pinker, Steven, Nowak, Martin A., and Lee, James J., 2008. "The Logic of Indirect Speech," *Proceedings of the National Academy of Sciences* 105, 833-838.
- Pinker, Steven, 2008. *The Stuff of Thought: Language as a Window into Human Nature*, London: Penguin Books.
- Rose-Ackerman, Susan, 2010. "The Law and Economics of Bribery and Extortion," *Annual Review of Law and Economics* 6, 217-236.

Sally, David, 2003. "Risky Speech: Behavioral Game Theory and Pragmatics," *Journal of Pragmatics* 35, 1223-1245.

Sally, David, 2005. "Can I Say 'Bobobo' and Mean There is No Such Thing as Cheap Talk?" *Journal of Economic Behavior and Organization* 57, 245-266.

Spence, Michael A., 1973. "Job Market Signaling," *Quarterly Journal of Economics* 87, 355-374.

van Rooij, Robert, 2004. "Signaling Games Select Horn Strategies," *Linguistics and Philosophy* 27, 493-527.

van Rooij, Robert, 2008. "Games and Quantity Implicatures," *Journal of Economic Methodology* 15, 261-274.