

Signaling Theory: A Review and Assessment

Brian L. Connelly

Auburn University

S. Trevis Certo

Arizona State University

R. Duane Ireland

Texas A&M University

Christopher R. Reutzell

Utah State University

Signaling theory is useful for describing behavior when two parties (individuals or organizations) have access to different information. Typically, one party, the sender, must choose whether and how to communicate (or signal) that information, and the other party, the receiver, must choose how to interpret the signal. Accordingly, signaling theory holds a prominent position in a variety of management literatures, including strategic management, entrepreneurship, and human resource management. While the use of signaling theory has gained momentum in recent years, its central tenets have become blurred as it has been applied to organizational concerns. The authors, therefore, provide a concise synthesis of the theory and its key concepts, review its use in the management literature, and put forward directions for future research that will encourage scholars to use signaling theory in new ways and to develop more complex formulations and nuanced variations of the theory.

Keywords: *signal; signaling theory; information asymmetry; literature review*

Acknowledgments: This research was conducted, in part, under the sponsorship of Auburn University's Lowder Center for Family Business and Entrepreneurship. In addition, we gratefully acknowledge the guidance and direction of the editor, Steven Michael, and two anonymous reviewers whose guidance considerably improved our review.

Corresponding author: Brian L. Connelly, Auburn University, 415 West Magnolia Avenue, Auburn, AL 36849, USA

Email: bconnelly@auburn.edu

When top executives increase ownership stakes in their firms, they communicate to capital markets that diversification strategies are in the owners' best interests (Goranova, Alessandri, Brandes, & Dharwadkar, 2007). A college football coach visits area high schools in a Hummer™ limousine emblazoned with the school's logo to denote a resource-rich environment to prospective recruits (Turban & Cable, 2003). Leaders of a young firm in an initial public offering (IPO) stack their board with a diverse group of prestigious directors to send a message to potential investors about the firm's legitimacy (Certo, 2003; Filatotchev & Bishop, 2002). Each of these examples illustrates how one party may undertake actions to signal its underlying quality to other parties.

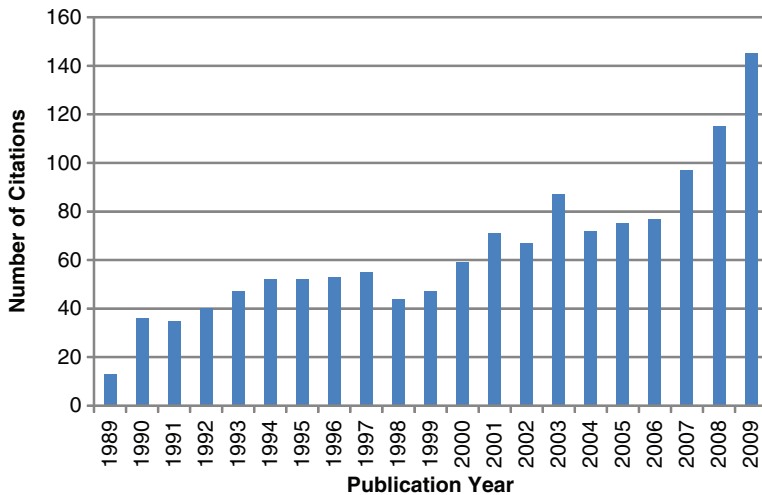
Signaling theory is fundamentally concerned with reducing information asymmetry between two parties (Spence, 2002). For example, Spence's (1973) seminal work on labor markets demonstrated how a job applicant might engage in behaviors to reduce information asymmetry that hampers the selection ability of prospective employers. Spence illustrated how high-quality prospective employees distinguish themselves from low-quality prospects via the costly signal of rigorous higher education. This work triggered an enormous volume of literature applying signaling theory to selection scenarios that occur in a range of disciplines from anthropology to zoology (Bird & Smith, 2005).

Management scholars have also applied signaling theory to help explain the influence of information asymmetry in a wide array of research contexts. A recent study of corporate governance, for example, shows how CEOs signal the unobservable quality of their firms to potential investors via the observable quality of their financial statements (Zhang & Wiersema, 2009). Diversity researchers use signaling theory to explain how firms use heterogeneous boards to communicate adherence to social values to a range of organizational stakeholders (Miller & Triana, 2009). Signaling theory is frequently used in the entrepreneurship literature, where scholars have examined the signaling value of board characteristics (Certo, 2003), top management team (TMT) characteristics (Lester, Certo, Dalton, Dalton, & Cannella, 2006), venture capitalist and angel investor presence (Elitzur & Gavius, 2003), and founder involvement (Busenitz, Fiet, & Moesel, 2005). Signaling theory is also important to human resource management, where a number of studies have examined signaling that occurs during the recruitment process (Suazo, Martínez, & Sandoval, 2009). As illustrated in Figure 1, the use of signaling theory has gained momentum in the management literature in recent years as scholars have expanded the range of potential signals and the contexts in which signaling occurs.

Despite the emergence of signaling theory in management research, as of yet there exists no concise review in the management literature. As a result, management scholars almost universally refer to either Spence's (1973) examination of signaling in job markets or Ross's (1977) study of managerial incentives as signals to describe the theory's central tenets. Over time, however, the key concepts underlying signaling theory have become blurred (Highhouse, Thornbury, & Little, 2007), causing some to argue that signaling theory is ill defined (Ehrhart & Ziegert, 2005). Although a number of studies integrate signaling concepts with related management theories (e.g., Deephouse, 2000; Ryan, Sacco, McFarland, & Kriska, 2000; Sanders & Boivie, 2004), no existing management research has systematically described the core ideas of signaling theory and how management scholars have applied them. We address this gap in the literature by reviewing management research relying on signaling theory.

Our review offers several intended contributions to management research involving signaling theory. First, we collect and synthesize signaling theory's key constructs. This includes

Figure 1
Management Publications That Cite Signaling or Signaling Theory, 1989-2009



Note: The search terms included the British variant *signalling theory*.

describing the important role of information asymmetry in the signaling process and reviewing key studies in economics to explicate core signaling concepts. We are hopeful this section will provide an extra measure of clarity to the literature, as our review revealed that research in management utilizing signaling theory is laden with inconsistent terminology. We then consider how management scholars have used the theory to study and explain organizational phenomena. We examined key studies dealing with these issues from leading management journals, including the *Academy of Management Journal*, *Academy of Management Review*, *Journal of Management*, *Journal of Management Studies*, *Strategic Management Journal*, *Journal of Business Venturing*, *Entrepreneurship Theory and Practice*, *Journal of Applied Psychology*, and *Personnel Psychology*. This section, we hope, will help unify and integrate the diverse ways in which management researchers have applied signaling theory to organizational concerns. Lastly, we extend the discussion of signaling theory in the literature by highlighting and developing a number of potential avenues for future management research. We are hopeful the ideas we put forth encourage scholars to use signaling theory in new ways and to develop more complex formulations and nuanced variations of the theory.

Information Asymmetry and Signaling Theory

Information Asymmetry

Information affects the decision-making processes used by individuals in households, businesses, and governments. Individuals make decisions based on public information, which is freely

available, and private information, which is available to only a subset of the public. Stiglitz (2002: 469) explained that information asymmetries occur when “different people know different things.” Because some information is private, information asymmetries arise between those who hold that information and those who could potentially make better decisions if they had it.

For more than a century, formal economic models of decision-making processes were based on the assumption of perfect information, where such information asymmetries are ignored (Stiglitz, 2002). Despite the well-known imperfections of information, economists had largely assumed that markets with minor information imperfections would behave substantively the same as markets with perfect information (Stiglitz, 2000). A number of scholars have devoted their careers to understanding the extent to which imperfect information influences decision making in the marketplace. In fact, George Akerlof, Michael Spence, and Joseph Stiglitz received the 2001 Nobel Prize in Economics for their work in information economics. Advances in this regard appear to reveal the limited utility of many traditional economic models but also provide insights regarding phenomena that traditional models do not consider (Stiglitz, 1985).

Stiglitz (2000) highlights two broad types of information where asymmetry is particularly important: information about quality and information about intent. In the first case, information asymmetry is important when one party is not fully aware of the characteristics of another party. In the second case, information asymmetry also is important when one party is concerned about another party's behavior or behavioral intentions (Elitzur & Gavious, 2003). Much of the research on information asymmetry about behavior and intentions examines the use of incentives as mechanisms for reducing potential moral hazards that result from an individual's behavior (Jensen & Meckling, 1976; Ross, 1973). For the most part, this literature on moral hazard in the context of executive decision making has been well documented (for an excellent review, see Devers, Cannella, Reilly, & Yoder, 2007). In contrast, we focus on the role of signaling in understanding how parties resolve information asymmetries about latent and unobservable quality, which constitutes the majority of management studies that explicitly invoke signaling theory.

Signaling Theory

The intuitive nature of signaling theory in part helps explain its pervasiveness. A journalist once famously asked Spence, who first put forth the theory, if it were possible that one could receive the Nobel Prize in Economics for simply noticing that in some markets certain participants do not know certain things that others in the market may wish to communicate (Spence, 2002). Spence replied that the correct answer was probably “no” but that what did blossom at the time was a serious attempt to capture the *informational* aspects of market structures. The profundity of the theory, therefore, lies in ascribing costs to information acquisition processes that resolve information asymmetries in a wide range of economic and social phenomena.

In his formulation of signaling theory, Spence (1973) utilized the labor market to model the signaling function of education. Potential employers lack information about the quality of job candidates. The candidates, therefore, obtain education to signal their quality and reduce

information asymmetries. This is presumably a reliable signal because lower quality candidates would not be able to withstand the rigors of higher education. Spence's model stands in contrast to human capital theory because he deemphasizes the role of education for increasing worker productivity and focuses instead on education as a means to communicate otherwise unobservable characteristics of the job candidate (Weiss, 1995).

Kirman and Rao (2000) provide a general example that helps illustrate a basic signaling model. Like most examples of signaling, the authors distinguish between two entities: high-quality firms and low-quality firms. Although the firms in this example know their own true quality, outsiders (e.g., investors, customers) do not, so information asymmetry is present. Consequently, each firm has the opportunity to signal or not signal its true quality to outsiders. When high-quality firms signal, they receive Payoff A, and when they do not signal they receive Payoff B. In contrast, low-quality firms receive Payoff C when they signal and Payoff D when they do not signal. Signaling represents a viable strategy for high-quality firms when $A > B$ and when $D > C$. Given these circumstances, high-quality firms are motivated to signal and low-quality firms are not, which results in a separating equilibrium. In such cases, outsiders are able to accurately distinguish between high- and low-quality firms. In contrast, when both types of firms benefit from signaling (i.e., $A > B$ and $C > D$), a pooling equilibrium results and outsiders are not able to distinguish between the two types of firms (for a review of pooling and separating equilibria, see Cadsby, Frank, & Maksimovic, 1990).

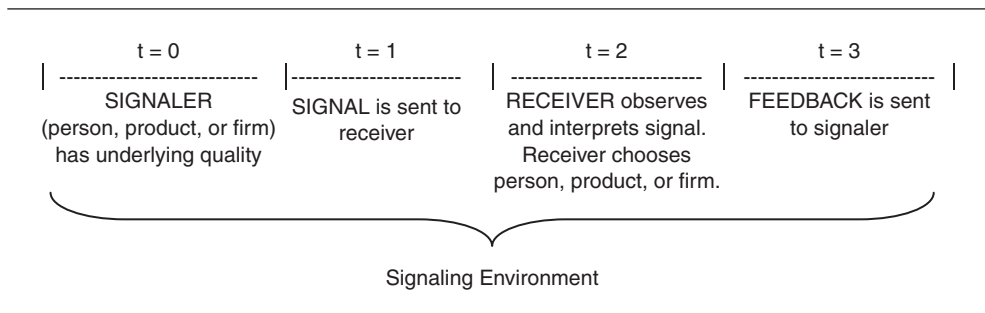
Financial economists have developed several examples to demonstrate these general relationships. They have posited, for instance, that firm debt (Ross, 1973) and dividends (Bhattacharya, 1979) represent signals of firm quality. According to these models, only high-quality firms have the ability to make interest and dividend payments over the long term. In contrast, low-quality firms will not be able to sustain such payments. Consequently, such signals influence outside observers' (e.g., lenders, investors) perceptions of firm quality. Owing to this foundational work, many of the core concepts and constructs of signaling theory grew out of the finance and economics literatures (Riley, 2001).

Although most signaling models include quality as the distinguishing characteristic, the notion of quality can be interpreted in a wide range of relevant ways. For the purposes of our review, *quality* refers to the underlying, unobservable ability of the signaler to fulfill the needs or demands of an outsider observing the signal. In Spence's classic example, *quality* refers to the unobservable ability of the individual, which is signaled by completion of the educational requirements necessary for graduation. In Ross's example, *quality* refers to the unobservable ability of the organization to earn positive cash flows in the future, which may be signaled by financial structure and/or managerial incentives. The notion of quality shares some characteristics with terms such as *reputation* (Kreps & Wilson, 1982) and *prestige* (Certo, 2003), but we put forth that these terms are largely socially constructed and derive from the signaler's unobserved quality (or lack thereof).

Key Concepts in Signaling

In the previous discussion, we highlighted the relationship between information asymmetry and signaling theory. In this section, we review signaling theory's primary elements in the form of a timeline, illustrated in Figure 2. The timeline includes two primary actors—the

Figure 2
Signaling Timeline



Note: t = time.

signaler and receiver—as well as the signal itself. This figure also shows possible feedback to the signaler and the signaling environment, but we describe these ancillary mechanisms in the next section where we review signaling in the management literature. Also, some situations may involve multiple signalers, receivers, and/or signals. For instance, myriad individuals (e.g., investors, bondholders, etc.) may observe multiple, possibly even competing, signals sent by different entities within a firm. We circumvent these issues here to explain the theoretical concepts in their simplest form by focusing on a single dyad, signaler and receiver, communicating one signal. This approach is consistent with how signaling theory has developed as a one-to-one or transaction-specific communication.

Signaler. At the essence of signaling theory is that signalers are insiders (e.g., executives or managers) who obtain information about an individual (e.g., Spence, 1973), product (e.g., Kirmani & Rao, 2000), or organization (e.g., Ross, 1977) that is not available to outsiders.¹ At a broad level, insiders obtain information, some of which is positive and some of which is negative, that outsiders would find useful. This information could include, for example, specifics about the organization's products or services. Such information might include early stage research-and-development results or later stage news regarding preliminary sales results reported by sales agents. Insiders also obtain information about other aspects of the organization such as pending lawsuits or union negotiations. Simply stated, this private information provides insiders with a privileged perspective regarding the underlying quality of some aspect of the individual, product, or organization.

Signal. Insiders obtain both positive and negative private information, and they must decide whether to communicate this information to outsiders. Signaling theory focuses primarily on the deliberate communication of positive information in an effort to convey positive organizational attributes. With that said, some scholars have examined actions taken by insiders that communicate negative information about organizational attributes. For instance, issuing new shares of a firm is generally considered a negative signal because executives

may issue equity when they believe their company's stock price is overvalued (Myers & Majluf, 1984). It is important to note, however, that insiders generally do not send these negative signals to outsiders with a view toward reducing information asymmetry, but this is often an unintended consequence of the insider's action.

In contrast, signaling theory focuses mainly on actions insiders take to intentionally communicate positive, imperceptible qualities of the insider. Insiders could potentially inundate outsiders with observable actions, but not all of these actions are useful as signals. There are, however, two chief characteristics of efficacious signals. The first is *signal observability*, which refers to the extent to which outsiders are able to notice the signal. If actions insiders take are not readily observed by outsiders, it is difficult to use those actions to communicate with receivers.

Observability is a necessary but not sufficient characteristic of a signal; *signal cost* represents the second characteristic of efficacious signals. Signal cost is so central to signaling theory that some refer to it as the "theory of costly signaling" (e.g., Bird & Smith, 2005). The notion of cost in the signaling context involves the fact that some signalers are in a better position than others to absorb the associated costs. The costs associated with obtaining ISO9000 certification, for example, are high because the certification process is time consuming, and these costs make cheating, or false signaling, difficult. However, ISO9000 certification is less costly for a high-quality manufacturer as compared with a low-quality manufacturer because a low-quality manufacturer would be required to implement considerably more change to be awarded the certification. If a signaler does not have the underlying quality associated with the signal but believes the benefits of signaling outweigh the costs of producing the signal, the signaler may be motivated to attempt false signaling. If this were to happen, misleading signals would proliferate until receivers learn to ignore them. Thus, to maintain their effectiveness, the costs of signals must be structured in such a way that dishonest signals do not pay.²

Receiver. The receiver of the signal is the third element in the signaling timeline. According to signaling models, receivers are outsiders who lack information about the organization in question but would like to receive this information. At the same time, signalers and receivers also have partially conflicting interests such that successful deceit would benefit the signaler at the expense of the receiver (Bird & Smith, 2005). For signaling to take place, the signaler should benefit by some action from the receiver that the receiver would not otherwise have done (i.e., signaling should have a strategic effect); this usually involves selection of the signaler in favor of some alternatives. For example, the receiver may make a choice about hiring, purchasing, or investing. Studies testing signaling theory incorporate shareholders (Certo, Daily, & Dalton, 2001) and debt holders (e.g., Elliot, Prevost, & Rao, 2009) as receivers. Studies in marketing use customers as receivers (Basuroy, Desai, & Talukdar, 2006; Rao, Qu, & Ruekert, 1999). A key point to this signaling is that these outsiders stand to gain (either directly or in a shared manner with the signaler) from making decisions based on information obtained from these signals. Shareholders, for example, would profit from buying shares of companies that signal more profitable futures. Similarly, customers would gain from purchasing goods and services that are associated with signals of high quality.

Management Research on Signaling

Management scholars have applied signaling theory to a range of organizational concerns, summarized in Table 1. We list the signaler, signal, and receiver that are the primary focus of each study and note the key contributions the study makes to furthering our knowledge of signaling theory. In addition to applying the theory, several studies have extended signaling constructs and integrated the theory with other explanations of organizational phenomena. Therefore, in Table 2 we summarize definitions of the key concepts from the prior section as well as those introduced here in our review of signaling theory in the management literature.

Signaler

Signalers in the management literature generally represent a person, product, or firm. Organizational behavior and human resource management (OB/HR) studies focus mainly on signals emanating from individuals, such as recruiters (Ehrhart & Zeigert, 2005; Ma & Allen, 2009; Rynes, Bretz, & Gerhart, 1991), managers (Ramaswami, Dreher, Bretz, & Wiethoff, 2010), or employees (Hochwater, Ferris, Zinko, Arnell, & James, 2007). However, some human resource studies also explore firm-level signalers, with a view toward understanding how job seekers and applicants examine visible organizational characteristics to assess unobservable qualities, such as organizational culture (Highhouse et al., 2007; Ryan et al., 2000). Entrepreneurship studies, on the other hand, focus almost exclusively on the leaders of start-up and IPO firms as signalers (Bruton, Chahine, & Filatotchev, 2009; Zimmerman, 2008), although some work examines the signaling that occurs by franchisors (Michael, 2009) and individual entrepreneurs (Elitzur & Gaviols, 2003). Strategy studies lay somewhere in the middle. Many strategy studies consider the signals sent by firms (Basdeo, Smith, Grimm, Rindova, & Derfus, 2006; Zhang & Wiersema, 2009), but others are concerned with specific groups of individuals such as managers (Carter, 2006; Goranova et al., 2007) and directors (Kang, 2008; Miller & Triana, 2009). Still other strategy studies explore product signals (Chung & Kalnins, 2001; Lampel & Shamsie, 2000), but these are more extensively examined in the marketing literature (Gammoh, Voss, & Chakraborty, 2006; Rao et al., 1999).

Because signalers and receivers have partially competing interests, inferior signalers have incentive to “cheat,” intentionally producing false signals so that receivers will select them (Johnstone & Grafen 1993). The potential presence of false signalers is inherent to many management studies, which places emphasis on the importance of differential signal costs for high-quality and low-quality signalers (Ndofor & Levitas, 2004). For instance, Westphal and Zajac (2001) describe how some firms that signal future stock repurchases do not actually purchase the stock; the authors refer to this discrepancy between formal plans and subsequent actions as *decoupling*. Over time, firms and executives that decouple their plans and subsequent actions may develop a reputation for dishonesty. For this reason, management scholars refer to *signal honesty* (Durcikova & Gray, 2009), which we define as the extent to which the signaler actually has the underlying quality associated with the signal. Some management studies use different terms to describe the same concept. For example,

Table 1
Select Review of Management Research Using Signaling Theory, 2000-2009

Year	Author(s) Journal	Signaler	Signal	Receiver	Key Signaling Theory Concepts Addressed
<i>Strategy studies</i>					
2000	Deephouse <i>Journal of Management</i>	Firms	<i>Fortune</i> Reputation rank	Stakeholders	<ul style="list-style-type: none"> • Study integrates resource-based view by discussing signal value
2000	Lampel & Shamsie <i>Journal of Management</i>	Movie studios	Product aesthetics	Consumers	<ul style="list-style-type: none"> • Signals have strength, weak or strong • Firms underinvest in signaling when differentiation is high • Study integrates signaling theory and persuasion techniques
2001	Chung & Kalnins <i>Strategic Management Journal</i>	Brand managers	Advertising and branding	Consumers	<ul style="list-style-type: none"> • More signals increase signaling effectiveness • Signaling reduces search costs • There are penalty costs for false signals
2001	Lee <i>Strategic Management Journal</i>	Internet firms	Firm names	Investors	<ul style="list-style-type: none"> • Signals have strength • Markets are not easily fooled by weak signals • Signals must be costly to be credible • Firms rely on signals to avoid hazards, avoiding the adverse selection problem • Signal strength is conditional on the signals of competitors
2002	Coff <i>Journal of Management</i>	Acquisition targets	Reputation	Acquirers	
2003	Karamanos <i>Journal of Management Studies</i>	Firms	Structural embeddedness	Other firms	
2004	McGrath & Nerkar <i>Strategic Management Journal</i>	Firms	Number of patents in an industry	Competitors	<ul style="list-style-type: none"> • Signaling reduces search costs • Costly, same-domain signals are inherently credible • Study integrates signaling theory with real-options reasoning
2004	Ndofor & Levitas <i>Journal of Management</i>	Knowledge-based firms	Strategic flexibility and endowments	Capital and labor markets	<ul style="list-style-type: none"> • Signaling environment plays a key role in determining which signal to use • Firms that rely on information asymmetry as a basis for competition must signal quality without losing the value of their knowledge
2005	Park & Mezias <i>Strategic Management Journal</i>	Firms	Alliance announcements	Investors	<ul style="list-style-type: none"> • One signal can have multiple meanings • Signals have different strengths • Signal strength is moderated by the signaling environment

(continued)

Table 1 (continued)

Year	Author(s) Journal	Signaler	Signal	Receiver	Key Signaling Theory Concepts Addressed
2005	<i>Strategy studies</i> Perkins & Hendry <i>Journal of Management Studies</i>	Top managers	Consultant surveys and qualitative market outcomes	Board of directors	<ul style="list-style-type: none"> • Signals are qualitative, requiring interpretation • Signals can be unintentional and negative
2006	Basdeo, Smith, Grimm, Rindova, & Derflus	Firms	Market actions	Competitors	<ul style="list-style-type: none"> • The signaling process can change the nature of the characteristic being signaled
2006	<i>Strategic Management Journal</i> Carter <i>Journal of Management Studies</i>	Top management teams	Press releases	Consumers and the media	<ul style="list-style-type: none"> • Study integrates signaling theory with impression management • Large firms signal more frequently • Diversified firms have lower signal consistency • Signals must be observable and are costly to imitate
2007	Goranova, Alessandri, Brandes, & Dharwadkar	Managers	Firm ownership	Shareholders	
2008	<i>Strategic Management Journal</i> Kang <i>Academy of Management Journal</i>	Boards of directors	Interlocks	Shareholders	<ul style="list-style-type: none"> • Study integrates signaling theory with attribution theory • Signal strength is contingent on who in the organization is signaling
2009	Miller & Triana <i>Journal of Management Studies</i>	Boards of directors	Diversity	Organizational stakeholders	<ul style="list-style-type: none"> • Study integrates signaling theory with behavioral theory of the firm
2009	Zhang & Wiersema <i>Strategic Management Journal</i>	Firms	CEO background and shareholding	Investors	<ul style="list-style-type: none"> • Signals that are more visible are more effective • Past deception reduces signal honesty • Signals reduce information asymmetry
2001	<i>Entrepreneurship studies</i> Certo, Daily, & Dalton <i>Entrepreneurship Theory and Practice</i>	initial public offering (IPO) firms	Board structure	Investors	<ul style="list-style-type: none"> • Credibility of the signaler affects signal strength • Good signals are observable and costly to imitate
2002	Filatortchev & Bishop <i>Strategic Management Journal</i>	IPO firms	Insider ownership Board diversity	Investors	<ul style="list-style-type: none"> • Signals communicate private information for receivers • Multiple signals (increasing frequency) improves the likelihood of accurate interpretation
2003	Certo <i>Academy of Management Review</i>	IPO firms	Board prestige	Potential investors	<ul style="list-style-type: none"> • Firms consciously use signals to disguise potential weaknesses (e.g., the liability of newness)

(continued)

Table 1 (continued)

Year	Author(s) Journal	Signal	Receiver	Key Signaling Theory Concepts Addressed
2003	<i>Entrepreneurship studies</i> Davila, Foster, & Gupta <i>Journal of Business Venturing</i>	Young firms	Labor market	<ul style="list-style-type: none"> • Signal credibility changes over time
2003	Elitzur & Gavious <i>Journal of Business Venturing</i>	Entrepreneurs	Potential investors	<ul style="list-style-type: none"> • Signals reduce moral hazards for receivers
2003	Gulati & Higgins <i>Strategic Management Journal</i>	Young firms	Potential investors	<ul style="list-style-type: none"> • Signal strength is moderated by receiver attention to the signaler and the signaling environment • Signals have different strengths • Signals mitigate uncertainty • Signal frequency improves the signaling process, especially in dynamic environments • Signal credibility changes over time
2003	Janney & Folta <i>Journal of Business Venturing</i>	Young firms	Potential investors	<ul style="list-style-type: none"> • Signals may be unintentional • Uncertainty motivates the receiver • Study integrates signaling theory with screening theory • Signals can transfer risk from receiver to signaler • One signal can send multiple messages • Greater signal cost is an indicator of greater signal reliability
2004	Sanders & Boivie <i>Strategic Management Journal</i>	Young Internet firms	Potential investors	<ul style="list-style-type: none"> • Costly signals are more credible, or valid • Receivers are more likely to attend to costly signals
2005	Busenitz, Fiet, & Moesel <i>Entrepreneurship Theory and Practice</i>	Young firms	VCs	<ul style="list-style-type: none"> • Study integrates signaling theory with the resource-based view of the firm • Signals may be unintentional
2005	Cohen & Dean <i>Strategic Management Journal</i>	IPO firms	Potential investors	<ul style="list-style-type: none"> • Receivers become more attuned to signals as information asymmetry and uncertainty increase • Signals have varying strength • Study integrates signaling theory with upper echelons theory
2005	Daily, Certo, & Dalton <i>Journal of Business Venturing</i>	IPO firms	Investment bankers	<ul style="list-style-type: none"> • Article introduces a typology of multiple types of signals
2006	Higgins & Gulati <i>Strategic Management Journal</i>	IPO firms	Potential investors	

(continued)

Table 1 (continued)

Year	Author(s) Journal	Signaler	Signal	Receiver	Key Signaling Theory Concepts Addressed
2006	<i>Entrepreneurship studies</i> Janney & Folta <i>Journal of Business Venturing</i>	Young firms	Private equity	Potential investors	<ul style="list-style-type: none"> • Good signals are observable, irreversible, governed, and credible • Signal strength is moderated by the signaling environment • Signals gain or lose strength over time • Different signals may be used in patterns to improve credibility • Signals may conflict
2007	Balboa & Marti <i>Journal of Business Venturing</i>	Private equity operators	Association membership Investments	Potential investors	
2007	Fischer & Reuber <i>Entrepreneurship Theory and Practice</i>	Young firms	Divestments Reputational characteristics	Organizational stakeholders	<ul style="list-style-type: none"> • Signals can be positive or negative • Study integrates signaling theory with social cognition theory
2008	Arthurs, Busenitz, Hoskisson, & Johnson <i>Journal of Business Venturing</i>	IPO firms	Lockup period	Potential investors	<ul style="list-style-type: none"> • Different receivers process signals differently • Study integrates signaling theory with bonding and trust • Different signals may substitute for each other
2008	Bell, Moore, & Al-Shammari <i>Entrepreneurship Theory and Practice</i>	Foreign IPO firms	Geographic scope Insider ownership	Potential U.S. investors	<ul style="list-style-type: none"> • Study integrates signaling theory with institutional theory and agency theory • One signal can send multiple messages
2008	Jain, Jayaraman, & Kini <i>Journal of Business Venturing</i>	IPO firms	Insider ownership Management quality	Potential investors	<ul style="list-style-type: none"> • Study integrates signaling theory with agency theory • Signals can be positive or negative
2008	Zimmerman <i>Entrepreneurship Theory and Practice</i>	IPO firms	TMT heterogeneity	Potential investors	<ul style="list-style-type: none"> • Firms send a wide range of signals that must be managed • Signalers send only relevant and important information in their signals
2009	Bruton, Chahine, & Filatotchev <i>Entrepreneurship Theory and Practice</i>	IPO firms	Retained ownership	Potential investors	<ul style="list-style-type: none"> • Study integrates signaling theory with agency theory • Different characteristics require different types of signals
2009	Michael <i>Managerial and Decision Economics</i>	Franchisors	Earnings claims	Potential franchisees	<ul style="list-style-type: none"> • Article challenges traditional economic models that suggest resource providers will not transact if information asymmetry is not overcome • Many high-quality insiders choose not to signal their underlying quality

(continued)

Table 1 (continued)

Year	Author(s) Journal	Signaler	Signal	Receiver	Key Signaling Theory Concepts Addressed
<i>Organizational behavior and human resource management studies</i>					
2000	Ryan, Sacco, McFarland, & Kriska <i>Journal of Applied Psychology</i>	Police departments	Hiring process	Police applicants	<ul style="list-style-type: none"> • Unintended signals may communicate negative information to the receiver • Study integrates signaling with image and expectancy theory
2001	Srivastava <i>Organizational Behavior & Human Decision Processes</i>	Sellers	Reservation price	Buyers	<ul style="list-style-type: none"> • Signals have credibility based on their cost • Receivers interpret signals and send feedback with countersignals
2005	Ehrhart & Zeigert <i>Journal of Management</i>	Recruiters	Recruiter behavior and activities	Job applicants	<ul style="list-style-type: none"> • Study integrates signaling theory with other theories of organizational attraction
2007	Hochwater, Ferris, Zinko, Arnell, & James <i>Journal of Applied Psychology</i>	Employees	Political behavior	Coworkers	<ul style="list-style-type: none"> • Signals may be manipulated by the signaler to achieve greater or lesser fit
2007	Highbury, Thornbury, & Little <i>Organizational Behavior and Human Decision Processes</i>	Hiring organizations	Various organizational characteristics	Job seekers	<ul style="list-style-type: none"> • Signals have both an instrumental inference and a symbolic inference • Social identity moderates the relationship between signaler and receiver

Table 2
Key Signaling Theory Constructs

Construct (alternate names)	Definition	Management Journal References
<i>Signaler</i>		
Honesty (genuineness, veracity)	Extent to which the signaler actually has the unobservable quality being signaled	Arthurs, Busenitz, Hoskisson, & Johnson, 2008 Ndofor & Levitas, 2004
Reliability (credibility)	The combination of a signal's honesty and fit	Busenitz, Fiet, & Moesel, 2005 Sanders & Boivie, 2004
Signal Signal cost	Transaction costs associated with implementing a signal	Bhattacharya & Dittmar, 2001 Certo, 2003
Observability (intensity, strength, clarity, visibility)	Signal strength, not accounting for distortions and deception	Lampel & Shamsie, 2000 Warner, Fairbank, & Steensma, 2006 Ramaswami, Dreher, Bretz, & Wiethoff, 2010
Fit (value, quality)	Extent to which the signal is correlated with unobservable quality	Busenitz et al., 2005 Zhang & Wiersema, 2009
Frequency (timing)	Number of times the same signal is transmitted	Baum & Korn, 1999 Carter, 2006
Consistency	Agreement between signals from one source	Chung & Kalnins, 2001 Fischer & Reuber, 2007
<i>Receiver</i>		
Receiver attention	Extent to which receivers vigilantly scan the signaling environment	Gulati & Higgins, 2003 Janney & Folta, 2006
Receiver interpretation (calibration)	Amount of distortion introduced by the receiver, and/or weights applied to signals by the receiver	Perkins & Hendry, 2005 Rynes, Bretz, & Gerhart, 1991
<i>Feedback/environment</i>		
Countersignals (feedback)	Responsive signaling from the receiver designed to improve signal interpretation	Gulati & Higgins, 2003 Gupta, Govindarajan, & Malhotra, 1999
Distortion	Noise that can be introduced by the signaling environment, external referents, or other signalers.	Branzei, Ursacki-Bryant, Vertinsky, & Zhang, 2004 Zahra & Filatotchev, 2004

Cohen and Dean (2005) discuss the genuineness and suspiciousness of different signals and Busenitz et al. (2005) use the term *veracity*, both of which speak to the signaler's integrity.

The usefulness of a signal to the receiver depends on the extent to which the signal corresponds with the sought-after quality of the signaler (i.e., what we define in the next section as signal fit) and the extent to which signalers attempt to deceive (i.e., average honesty). Since both are required, we define this combination as *signal reliability*. Some management scholars use the term *credibility* to describe the same notion, the extent to which the signaler is honest and the signal corresponds with signaler quality (Davila, Foster, & Gupta, 2003).³ Researchers frequently confuse *signal fit*, *honesty*, *reliability*, and related terms, often using them interchangeably, but the semantic distinctions we describe here may help clarify their distinct underlying concepts.

Signal

Management scholars have identified a variety of signals of quality. One of the most central of these combines signaling theory with institutional theory, which sees firms striving for legitimacy in order to survive (Certo, 2003). One way firms gain legitimacy is by signaling their unobservable quality with prestigious boards of directors (Certo et al., 2001) or prestigious top managers (Lester et al., 2006). Somewhat related, others have described how firms attempt to gain a positive reputation over time as a signal of underlying quality (Coff, 2002; Deephouse, 2000). Another common signal in the management literature is focused on the firm's owners. Because insiders have access to information from which others could benefit, they may signal firm quality through insider ownership, which is obviously costly to the signaler (Filatotchev & Bishop, 2002; Sanders & Boivie, 2004). For start-ups, founder ownership can be an even more important signal of quality, given that the founder is likely to have more information than anyone else about firm quality (Busenitz et al., 2005). Still other signals of quality in the management literature include interorganizational ties (Gulati & Higgins, 2003; Park & Mezas, 2005), management stability (Perkins & Hendry, 2005), and intellectual property (Warner, Fairbank, & Steensma, 2006).

Some signals of quality may be more readily detected by the receiver than other signals are, so management scholars sometimes suggest that signals may be "strong" or "weak" (Gulati & Higgins, 2003). For instance, Lampel and Shamsie (2000) describe the strength of signals put out by movie studios about the quality of new film releases. In fact, a recent study by Ramaswami et al. (2010) draws a theoretical distinction between signal strength and visibility. These authors describe signal strength as how important, or salient, the signal is for a given signaler, which we would contend is akin to what we define next as signal fit. *Visibility*, on the other hand, is consistent with *observability* as we defined it in the previous section. Other management scholars have used related terms, such as *signal clarity* (Warner et al., 2006), *intensity* (Gao, Darroch, Mather, & MacGregor, 2008), and *quality* (Kao & Wu, 1994), to describe the same characteristic of observability in the absence of environmental or receiver distortion.

An important scenario occurs when signalers send signals that are not particularly well correlated with the signaler's unobservable quality (Busenitz et al., 2005; Zhang & Wiersema, 2009). The discrepancy between the signal and signaler, in this case, is due to poor signaling. We, therefore, define *signal fit* as the extent to which the signal is correlated with unobservable quality. This is a statistical description of the relationship between public information (the signal) and private information (the signaler's unobservable quality). Fit and honesty may be distinguished insofar as the former is a characteristic of the signal, whereas the latter is a characteristic of the signaler.

Signaling effectiveness can be enhanced by sending more observable signals or increasing the number of signals, which we call *signal frequency* (Janney & Folta, 2003). Signals are essentially snapshots pointing to unobservable signaler quality at a particular point in time (Davila et al., 2003). However, organizations operate in dynamic environments, and information that is available to both signalers and receivers is constantly changing. If signalers wish to remain differentiated, they will signal repetitively to keep reducing information asymmetry (Janney & Folta, 2003, 2006; Park & Mezas, 2005). Signaling repetitively can increase the effectiveness

of the signaling process, especially if one uses different signals to communicate the same message (Balboa & Marti, 2007). This raises the related issue of *signal consistency*, which we define as the agreement between multiple signals from one source (Gao et al., 2008). Conflicting signals confuse the receiver, making communication less effective, but signal consistency can help mitigate this problem (Chung & Kalnins, 2001; Fischer & Reuber, 2007).

Although we are concerned mainly with signals of quality in this review, some signals in management research are aimed at both quality and intent. As an example, Johnson and Greening (1999) proposed that managerial equity holdings serve as a signal to potential investors. Managers of high-quality firms demonstrate signaler quality by retaining large equity positions (Connelly, Hoskisson, Tihanyi, & Certo, 2010). If managers of low-quality firms imitate this strategy, they would likely experience decreases in personal wealth when the "true" value of the firm is revealed. Similarly, managerial holdings also point to managerial (signaler) intent (Filatotchev & Bishop, 2002). Whereas managers with high levels of equity are likely to make decisions consistent with shareholder preferences, managers with low levels of equity are less likely to make such decisions (Jensen & Meckling, 1976).

Receiver

Receivers in the management literature are generally individuals or groups of individuals. In entrepreneurship studies, the receiver is nearly always an existing or potential investor, with some distinction between private (Busenitz et al., 2005; Daily, Certo, & Dalton, 2005; Michael, 2009) and public (Cohen & Dean, 2005; Jain, Jayaraman, & Kini, 2008) investors. Strategy researchers have also considered receivers that are existing shareholders, potential investors, or both (Kang, 2008; Park & Mezas, 2005), but they have also given attention to a broader array of stakeholders, such as consumers, competitors, and employees (Basdeo et al., 2006; Carter, 2006). OB/HR studies using signaling theory are most frequently concerned with the labor market, or elements within the labor market, as receivers (Davila et al., 2003; Ehrhart & Zeigert, 2005).

Management researchers have found that signaling effectiveness is determined in part by the characteristics of the receiver. For example, the signaling process will not work if the receiver is not looking for the signal or does not know what to look for. Therefore, we define *receiver attention* as the extent to which receivers vigilantly scan the environment for signals. Gulati and Higgins (2003) lend support for this concept as they find that the success of a young company's signaling efforts depends in large part on whether receivers are attending to the IPO market. Monitoring the environment can be particularly important for weak signals, which are difficult to observe unless the receiver is looking for them (Ilmola & Kuusi, 2006). Once receivers have received a signal and used it to successfully make an informed choice, they are more likely to attend to similar signals in the future (Cohen & Dean, 2005).

Others have noted how some receivers interpret signals differently than others do (Perkins & Hendry, 2005; Srivastava, 2001). We therefore define *receiver interpretation* as the process of translating signals into perceived meaning. For example, Branzei, Ursacki-Bryant, Vertinsky, and Zhang (2004) describe how different receivers may "calibrate" signals, giving

signals different strengths or even different meanings. OB/HR researchers have been particularly helpful in extending our understanding of signaling to include the receiver's perspective (Suazo et al., 2009; Turban & Greening, 1996). For instance, Rynes (1991) describes how job applicants use signals from recruiters to draw conclusions about facets of organizational quality. Different applicants may not have the same concerns about their potential employers, so they attend to different signals or interpret the same signal differently (Highhouse et al., 2007). Receivers may apply weights to signals in accordance with preconceived notions about importance or cognitively distort signals so that their meanings diverge from the original intent of the signaler (Branzei et al., 2004; Ehrhart & Zieger, 2005).

Feedback

As management scholars have sought to apply signaling theory to organizational phenomena, a number of studies have uncovered the importance of receivers sending information back to signalers about the effectiveness of their signals (e.g., Gupta, Govindarajan, & Malhotra, 1999). To facilitate more efficient signaling, receivers can send feedback in the form of *countersignals*. The fundamental assumption here is that information asymmetry works in two directions: Receivers desire information about signalers, but signalers also desire information about receivers so that they may know which signals are most reliable, to which signals receivers are paying the most attention, and how receivers are interpreting signals. Signalers that heed such countersignals can adapt future signals to improve reliability (Gulati & Higgins, 2003). Thus, in the same way that receiver attention can improve the signaling process, signaler attention to countersignals can also result in more efficient signaling, particularly in an iterative or sequential bargaining context (Srivastava, 2001).

Signaling Environment

The signaling environment, either within an organization or between organizations, can also affect the extent to which signaling reduces information asymmetry (Rynes et al., 1991; Lester et al., 2006). Environmental *distortion* occurs whenever the medium for propagating the signal reduces the observability of the signal. For example, press releases serve as signals (Carter, 2006), but media outlets reporting on those releases introduce potential distortions. Branzei et al. (2004) describe how external referents, such as other receivers, can also change the relationships between signalers and receivers. For example, rankings signal educational quality for universities, but prospective students calibrate rankings based on the opinions of peers (i.e., other receivers). When a signal is interpreted by others in a particular way, an individual who is unsure about how to interpret the signal may look to imitation as a means of decision making (Sliwka, 2007). This could result in a bandwagon effect, where signals are interpreted in a certain manner that may or may not be accurate (McNamara, Haleblan, & Dykes, 2008). Other signalers are also important insofar as more honest signalers increase signal reliability and larger numbers of deceptive signalers decrease signal reliability.

Future Research

Management research has made substantive contributions toward understanding the complex signaling processes that occur between two parties in an environment of asymmetrical information. Scholars might pair our review of the management literature with reviews from biology (Maynard-Smith & Harper, 1995), anthropology (Bird & Smith, 2005), economics (Riley, 2001), and marketing (Kirmani & Rao, 2000) to form a more complete picture of the insights gained about signaling theory constructs, relationships, and processes. However, our review also shows that management research to date generally seeks to apply some of the most basic principles of signaling theory to help explain foundational signaling relationships. In contrast, less research has sought to extend the boundaries of what we know about signaling to develop a more comprehensive theory that scholars might use to explain a broader range of social and organizational phenomena. In this section, we describe some practical ways to do so, considering each of the key components in the signaling timeline. We also extend the discussion of future research by putting forward some key research questions in Table 3 that, if addressed, could inform each aspect of the signaling process. To illustrate our thinking about each research question, we provide examples for signals that pertain to a person, product, and firm.

Signaler

The questions management scholars choose to examine may have the potential to inform signaling theory in a number of ways. For instance, because signalers have the option of sending multiple signals over time; incorporating longer periods of time into signaling theory represents a viable area for future research. George and Jones (2000) suggest that scholars consider how the past and the future are represented in a theory's constructs. The efficacy of a firm's signal, for example, may be influenced by historical signals as firms earn a reputation from prior signals (Heil & Robertson, 1991). Scholars have examined how firms may appoint prestigious directors to signal legitimacy to investors (Certo 2003; Certo et al., 2001). However, the effectiveness of such signals may depend on the firm's previous director appointments. Future research might investigate whether prestigious directors are more or less valuable when the firm has already appointed a number of prestigious directors. It may be, for example, that the value of signals diminishes as the number of signals increases. In addition, the future is embedded in the present in the form of expectations, possibilities, and strivings (George & Jones, 2000). This suggests that receivers' interpretations of signals in the present could be moderated by their expectations or by what they strive to accomplish in the future via the signaling process.

The signaler's choice of when to signal and how often to signal also requires further research attention. Janney and Folta (2003, 2006) are some of the first to have considered this issue as they describe a signaler's use of signals that grow weaker over time. Yet, we know little about how signalers might find an efficient balance of signal rates and durations, about the consequences of using signals that change faster or slower, and about how signals with different rates of change might interact with each other to enhance or diminish the signaling process.

Table 3
Directions for Future Research

Key Research Questions for Future Study	Person Example	Product Example	Firm Example
<p><i>Signal</i></p> <p>How can signalers manage a portfolio of signals to maximize their collective effectiveness?</p> <p>How does sending different signals from the same signaler, or the same signal from different signalers, reinforce the message being signaled?</p> <p>How can signalers efficiently balance the rate at which they signal to effectively reinforce the message they are signaling?</p>	Managers signal career progress with senior mentoring, compensation, and promotion.	Movie studios send signals about film quality via commercials, the premier, and actor salaries.	Firms send signals about quality via top management team ownership, board prestige, and CEO tenure.
	Managers and recruiters send similar, or conflicting, signals about organizational culture.	Consultants and former customers send similar, or conflicting, signals about customer service.	Founders and venture capitalists send similar, or conflicting, signals about initial public offering (IPO) quality.
	Employees signal organizational commitment through voluntary actions at differential rates.	Advertising repetition is used to signal brand quality.	New ventures pace their venture capital funding to reflect growth and increasing value.
	Owner absence from daily franchise operation signals lack of commitment.	Product failures and recalls signal poor manufacturing.	Poor corporate social performance signals an unattractive organization to prospective employees.
<p><i>Signal</i></p> <p>How do negative signals disturb the signaling process?</p> <p>What different types of signals do signalers use?</p> <p>How might signals be coded so that only intended receivers observe them?</p>	Recruiters use both "activating" signals (e.g., on-site interviews) and "pointing" signals (e.g., brochures) to communicate organizational culture.	Brand managers use "need" signals to communicate the extent to which they require corporate resources for survival or growth.	Firms use "camouflage" signals to direct attention away from a liability, such as the liability of foreignness.
	Employees signal organizational commitment to managers in their firm but not to outsiders.	Advertisers signal intended market space to a targeted social group by using specific language, idioms, and images.	Firms signal long-term financial objectives to particular types of investors by controlling prospectus information.
	Applicants in a multiple-hurdle selection process interpret signals at defined intervals.	Retailers offer products at discounted rates at sufficient intervals to signal ongoing value.	Firms control dividend patterns over time to signal growth or reinvestment.
	Employees recommend cost-saving initiatives as unprecedented signals of their own innovativeness.	Technology manufacturers use new features as unprecedented signals of product quality.	A firm becomes the first mover in a geographic market as an unprecedented signal of growth.
<p><i>Receiver</i></p> <p>How do receivers meaningfully aggregate signals in sequences and patterns?</p> <p>How might "signal precedence" affect receiver interpretation?</p> <p>How might a systemic model change our understanding of how signals are interpreted?</p>	College applicants interpret signals about campus life and academics in view of their high school peers.	Consumers interpret signals about brand image in light of the opinions of authorities and celebrities.	Investors look to each other to interpret stock market signals about firm quality.

(continued)

Table 3 (continued)

Key Research Questions for Future Study	Person Example	Product Example	Firm Example
<i>Feedback</i>			
How does response speed influence the efficacy of subsequent signals?	The speed of managerial response to organizational citizenship behaviors reinforces the use of those signals.	Consumer reaction to price increases or decreases provides information about the effectiveness of those signals.	Markets react to firm announcements, indicating shareholder preferences about those signals.
How does feedback-seeking behavior improve the signaling process?	Recruiters communicate with those who were not hired to learn how their signals are being interpreted.	Focus groups help firms understand how signals about their brand are being interpreted by different social strata.	Start-ups seek advice from venture capitalists about how to effectively signal quality to other investors.
How do signaling costs and penalty costs substitute or complement each other?	The human resources (HR) reputation has signal costs (investment in the HR function) and penalty costs (potential lawsuits and organizational inefficiencies).	Cross-branding has signal costs (only firms with a high-quality, established brand can signal) and penalty costs (could water down the established brand).	Sustainability initiatives have signal costs (investment) and penalty costs (illegitimacy, long-term performance).
<i>Environment</i>			
How do formal and informal institutions moderate signals?	Organizational citizenship behavior signals may be more effective in some organizational cultures than in others.	“Green” products may be a more positive signal of organizational concern in some industries than in others.	Host country directors as a signal of legitimacy for foreign IPOs may be more important for some home countries than for others.
When do noisy environments diminish signal observability?	Job applicants signaling quality may be drowned out by large numbers of signals and signalers.	Signaling a desired quality on a food package (e.g., low fat) depends on the floor space allocated to the package.	Alliance partners have difficulty signaling trust in industry contexts where distrust predominates.
How might competing receivers intentionally inject noise into the signaling environment?	Employees facing layoffs use gossip or manipulate work outcomes to signal the poor quality of other employees.	Rival brands use negative advertising to signal undesirable characteristics of their rivals.	Firms establish footholds in a rival's markets to diminish the value of the rival's signals in those markets.

It would also be useful to explore the overall rate of deception within a community of signalers to determine its influence on signal reliability. Sending different signals from the same signaler, or the same signal from different signalers, could change the way receivers interpret those signals.

Finally, future research might also further investigate the incentives of signalers. It may be, for example, that signals are less effective when a signaler has incentives to deceive the receiver. Studies might examine, for instance, the extent to which signals of firm quality are more or less predictive of firm performance when CEOs have incentives to artificially influence stock prices (e.g., Westphal & Zajac, 1998).

Signal

As illustrated in our review, studies of signaling theory often examine the quality of the signaler. Future research would benefit from examining in more depth the various qualities signaled and more carefully linking the signals used to measure these qualities. At its essence, the link between a signal and the underlying quality represents a measurement issue that we call *signal fit*. Does the signal represent a valid and reliable measure of the underlying quality that the signaler is attempting to communicate? Future research may benefit from theoretical work examining the conditions required to align signals with the desired signaled characteristic. In addition, signaling models often distinguish between high-quality and low-quality firms, but management researchers should note that firms reside on a continuum and not a dichotomy.

Signals that are not intentional are an avenue for future study that has been relatively ignored in the literature (Janney & Folta, 2003). Parties may send a wide range of signals without even being aware they are signaling (Spence, 2002). Such signals could potentially conflict with intentional signals or be communicating negative information about the signaler. Signalers may have incurred signal costs that are negatively, rather than positively, correlated with an unobservable characteristic that is valuable to receivers. As yet, however, there is little empirical study of such negative signals, how they are unique from other signals, or how they disturb or enhance the signaling process (Bell, Moore & Al-Shammari, 2008; Fischer & Reuber, 2007).

In fact, there may be opportunity for management scholars to develop a conceptually based typology of signals that appear in organizational contexts. Biologists have cataloged and categorized signals from their own discipline in a variety of ways (Hasson, 1997; Maynard-Smith & Harper, 1995; Vehrencamp, 2000). A large rack of antlers, for instance, is an honest signal that provides females with information about male genetic quality; differential squawks among nestlings, on the other hand, provide mother birds with information about which nestlings have the greatest need for food (Zahavi & Zahavi, 1997). Management researchers, too, might consider these classification schemes as a model and begin to partition the landscape of organizational signals into meaningful categories.

To spur academic discussion along these lines, we offer the following classifications that could potentially describe different types of signals. Signals of quality, as described in this review, could potentially be divided into activators and pointers. *Pointing signals* indicate a

characteristic, apart from the signal, that separates the signaler from competitors. *Activating signals* indicate a characteristic that separates the signaler from competitors and are also essential to activating the quality in the signaler (Hasson, 1997). Thus, for instance, the presence of outside directors on the board could be considered an activating signal of good corporate governance (Certo et al., 2001) because the directors are an important mechanism of bringing about good governance.

Still other possible categories include signals of intent, camouflage, and need. *Intent signals* indicate future action, possibly conditional on the receiver's response. Thus, for example, when a firm is quick to implement a response to a competitive action initiated by a rival it may signal toughness and resolve that the firm will not roll over easily in that market (Baum & Korn, 1999). *Camouflage signals* disguise a potential liability. These are different from other signals insofar as they are designed to divert attention away from a potential vulnerability toward some other characteristic. For example, Dacin, Oliver, and Roy (2007) describe how firms expanding internationally may be subject to liabilities of foreignness, so they use strategic alliances to draw attention away from those liabilities by signaling organizational legitimacy. *Need signals* communicate requirements to the receiver. Thus, for example, in a firm with multiple divisions or subsidiaries, each is responsible for signaling its need for common funds and resources, and headquarters is in the position of deciding which are signaling the greatest need (Gupta et al., 1999).

Receiver

Management research may also benefit from further examining the role of receivers in the signaling process. As we noted earlier, for example, management research on signaling focuses to a large extent on shareholders as receivers in the signaling process. Future research might study the impact of signals on additional stakeholders. For example, as many stakeholders such as host communities, employees, and customers become increasingly concerned about sustainability, how can firms signal their commitment to a sustainable enterprise? It seems that false signaling may be of particular concern in this situation, so how can firms leverage signal costs and penalty costs to differentiate themselves from lower quality (less sustainably minded) firms? As firms obtain feedback on the importance of sustainability from different and possibly competing stakeholders, such as government in the form of regulations and consumers in the form of behavior, how do they differentially adjust their signaling activity?

An important consideration that has received limited scholarly attention is how receivers meaningfully aggregate signals. There may be consistencies to the way individuals or organizations bracket their signaling episodes to ascribe meaning to groups of signals, which in turn gives rise to different signaling experiences for different receivers based on these groupings (Balboa & Marti, 2007). This raises the issue of how receivers interpret sequencing and signal patterns. To date, signaling theory research has typically focused on a given signal, but as the theory evolves, scholars could yield greater attention to more complex formulations. An important measure that deserves attention is signal separation, which would describe the extent to which a given signal in a sequence of signals is temporally or ordinally isolated from other signals. Similarly, signal precedence is a measure that would describe the extent

to which a signal precedes or follows other signals. This research could help explain how receivers organize a coordinated series of signals into meaningful wholes (Rindova, Ferrier, Wiltbank, & Basdeo, 2002). Future research could explore how firms or individuals manage their portfolios of signals and how different types of signals interact with one another. Much in the way music has not only individual notes but also chords and melodies, scholars might begin to explore how receivers not only interpret individual signals but also examine sequences and motifs.

Management scholars have relied primarily on a mechanistic understanding of signaling that emphasizes the technical aspects of signal transmission and reception. Alternative perspectives of the signaling process, however, could result in a different understanding of receiver interpretation. For example, a social constructivist view of signaling might consider the development of signals within their social contexts (Burr, 2003). In this perspective, signals would be created, given meaning, and institutionalized as a function of continuously interacting parties (e.g., Basdeo et al., 2006). Alternatively, applying a systemic model to the signaling process would emphasize integrated relationships between parts of the whole (cf. Bertalanffy & Sutherland, 1974, and general systems theory). Such a perspective would be less concerned with autonomous receivers, preferring instead to describe the entire signaling community as an indivisible whole. Park and Mezias (2005) touch on this perspective by explaining how the meanings of signals are embedded within the signaling environment. A systemic model of signaling is consistent with Langfield-Smith's (1992) notion of a "shared cognitive map," where the meaning ascribed to signals is a function not only of individual interpretation but also of collective beliefs about the signal.

Feedback

We described the central role of costs in signaling theory, which is imperative to discourage false signaling. However, the management literature is mainly focused on signal costs, containing less discussion of the role of penalty costs, which are a form of negative feedback from the receiver (Gammoh et al., 2006). Future research might explore the extent to which signal costs and penalty costs serve as substitutes or complements. This would be important to gaining a better understanding of the implications for the signaling process when penalty costs are not enforced. Scholars might also consider the relative effectiveness of different types of penalties. For example, there is a range of negative feedback that may be sent when a partner in an interorganizational relationship detects a false signal. It may be immediate (e.g., the receiver could immediately terminate the relationship). It may be delayed (e.g., the receiver could maintain the relationship but not extend its duration or expand it in other contexts). It may be enforced by third parties (e.g., the receiver could leverage the court system to impose fines for the false signal). Lastly, it may be communal (e.g., the receiver communicates with other receivers that the signaler is not to be trusted; Chung & Kalnins, 2001). As scholars, we still have much to learn about what makes an effective penalty and how various types of penalties interact with signal costs to make a more effective signaling process.

Again considering alternative perspectives, a critical needs model of signaling might change the way we view feedback in the signaling process. Critical needs theory would emphasize

signaling as a means of extending control and describe signals as overt moves designed to persuade or subdue (Held, 1980). Feedback, in this model, would be to the benefit of the signaler but the detriment of the receiver. For example, scholars arguing from a critical needs perspective would describe the price of beer as a signal of product quality that beer producers use to manipulate consumers (Van Munching, 1997). Feedback about consumer (receiver) behavior provides signalers with added information that they may use to adjust their signals and gain even greater control. The benefits of considering this model in organizational signaling reside in its ability to explain the influence of power dependencies between signalers and receivers.

Signaling Environment

The signaling environment on the whole is an underresearched aspect of signaling theory. For example, in interorganizational signaling we might expect different effects to arise from the influence of the institutional environment, the task environment, and the industry competitive environment (Sanders & Boivie, 2004). Some of these influences may compete with each other to make signals more or less observable. As the context in which signaling occurs becomes more noisy, we would expect the value of the signaling process to diminish (Jiang, Belohlav, & Young, 2007; Zahra & Filatotchev, 2004). Lester et al. (2006) begin to address this issue as they consider the influence of environmental dynamism, complexity, and munificence on the signaling process. Although they did not find empirical evidence of moderation in the IPO context, their conceptual arguments warrant further attention in other signaling contexts.

In addition, management research might further investigate the role of information asymmetry in studies of signaling theory. Other disciplines have developed measures of information asymmetry and incorporated the construct in signaling studies (Aboody & Lev, 2000; Frankel & Li, 2004), and management research would benefit from this approach. The addition of information symmetry would allow both theoretical and empirical research in management to incorporate and further develop the contingent nature of signaling.

Although we have partitioned our discussion of future research into separate sections to align with the structure of our review, there exist considerable opportunities for future research to bridge these domains. For example, signals have various characteristics (e.g., reliability, observability), but these characteristics might take on different meanings when used by different signalers. Similarly, we described areas of research surrounding the signaler and receiver, but certain signaler–receiver pairs may interact to yield especially effective, or ineffective, signaling. Also, potential exists for exploring signaling at multiple levels of analysis (Bamberger, 2008). Consider, for instance, how the aggregate signaling that occurs between managers and subordinates in an organization could have implications for signaling firm quality between the organization and its stakeholders (Wayne, Shore, & Liden, 1997).

Conclusion

Joseph Stiglitz (2002: 473) observed that some individuals wish to convey information and others wish not to have information conveyed, but “in either case, the fact that actions

convey information leads people to alter their behavior, and . . . this is why information imperfections have such profound effects.” Signaling theory provides a unique, practical, and empirically testable perspective on problems of social selection under conditions of imperfect information. In this review, we seek to bring clarity to the abundance of concepts that permeate the theory; describe the signalers, signals, and receivers that management scholars have explored as they have used the theory; and lay out a road map for how the scholarly community might advance the theory. The fact that researchers in areas as diverse as anthropology, economics, and marketing continue to use signaling theory to explain selection phenomena in their own disciplines is reassuring. We hope that our review of signaling theory in the management literature will lead researchers to extend and broaden their use of the theory when studying the eclectic range of selection issues that occur in and between organizations.

Notes

1. Individuals may also serve as their own insiders when signaling about themselves (e.g., in the job market). Signals about investments are also common (e.g., Goranova, Alessandri, Brandes, & Dharwadkar, 2007), but we combine these with organizational signals.

2. Whereas signaling theory focuses mainly on costly signals (Riley, 2001), scholars have also extended research on information asymmetries to include less costly forms of communication. For example, Farrell and Rabin (1996), in an article titled “Cheap Talk,” provided an influential analysis of how insiders communicate costless information. In related work, Almazan, Banerji, and De Motta (2008) extended this perspective to model how managers employ cheap talk to communicate with capital markets.

3. This should be distinguished from the related notion of “credible commitment,” which is more about signaler intent than signaler quality (Bergara, Henisz, & Spiller, 1998).

References

- Aboudy, D., & Lev, B. 2000. Information asymmetry, R&D, and insider gains. *Journal of Finance*, 55: 2747-2766.
- Almazan, A., Banerji, S., & De Motta, A. 2008. Attracting attention: Cheap managerial talk and costly market monitoring. *Journal of Finance*, 63: 1399-1436.
- Arthurs, J. D., Busenitz, L. W., Hoskisson, R. E., & Johnson, R. A. 2008. Signaling and initial public offerings: The use and impact of the lockup period. *Journal of Business Venturing*, 24: 360-372.
- Balboa, M., & Marti, J. 2007. Factors that determine the reputation of private equity managers in developing markets. *Journal of Business Venturing*, 22: 453-480.
- Bamberger, P. 2008. Beyond contextualization: Using context theories to narrow the micro-macro gap in management research. *Academy of Management Journal*, 51: 839-846.
- Basdeo, D. K., Smith, K. G., Grimm, C. M., Rindova, V. P., & Derfus, P. J. 2006. The impact of market actions on firm reputation. *Strategic Management Journal*, 27: 1205-1219.
- Basuroy, S., Desai, K. K., & Talukdar, D. 2006. An empirical investigation of signaling in the motion picture industry. *Journal of Marketing Research*, 43: 287-295.
- Baum, J. A. C., & Korn, H. J. 1999. Dynamics of dyadic competitive interaction. *Strategic Management Journal*, 20: 251-278.
- Bell, R. G., Moore, C. B., & Al-Shammari, H. A. 2008. Country of origin and foreign IPO legitimacy: Understanding the role of geographic scope and insider ownership. *Entrepreneurship Theory and Practice*, 32: 185-202.
- Bergara, M., Henisz, W. J., & Spiller, P. T. 1998. Political institutions and electric utility investment: A cross-nation analysis. *California Management Review*, 40: 18-35.

- Bertalanffy, L., & Sutherland, J. W. 1974. *General systems theory: Foundations, developments, and applications*. New York: Braziller.
- Bhattacharya, S. 1979. An exploration of nondissipative dividend-signaling structures. *Journal of Financial and Quantitative Analysis*, 14: 667-668.
- Bhattacharya, U., & Dittmar, A. 2001. *Costless versus costly signaling: Theory and evidence from share purchases*. Working paper, Indiana University, Bloomington.
- Bird, R. B., & Smith, E. A. 2005. Signaling theory, strategic interaction, and symbolic capital. *Current Anthropology*, 46: 221-248.
- Branzei, O., Ursacki-Bryant, T. J., Vertinsky, I., & Zhang, W. 2004. The formation of green strategies in Chinese firms: Matching corporate environmental responses and individual principles. *Strategic Management Journal*, 25: 1075-1095.
- Bruton, G. D., Chahine, S., & Filatotchev, I. 2009. Founders, private equity investors, and underpricing in entrepreneurial IPOs. *Entrepreneurship Theory and Practice*, 33: 909-928.
- Burr, V. 2003. *Social constructionism*. London: Psychology Press.
- Busenitz, L. W., Fiet, J. O., & Moesel, D. D. 2005. Signaling in venture capitalist–new venture team funding decisions: Does it indicate long-term venture outcomes? *Entrepreneurship Theory and Practice*, 29: 1-12.
- Cadsby, C. B., Frank, M., & Maksimovic, V. 1990. Pooling, separating, and semiseparating equilibria in financial markets: Some experimental evidence. *Review of Financial Studies*, 3: 315-342.
- Carter, S. M. 2006. The interaction of top management group, stakeholder, and situational factors on certain corporate reputation management activities. *Journal of Management Studies*, 43: 1146-1176.
- Certo, S. T. 2003. Influencing initial public offering investors with prestige: Signaling with board structures. *Academy of Management Review*, 28: 432-446.
- Certo, S. T., Daily, C. M., & Dalton, D. R. 2001. Signaling firm value through board structure: An investigation of initial public offerings. *Entrepreneurship Theory and Practice*, 26(2): 33-50.
- Chung, W., & Kalnins, A. 2001. Agglomeration effects and performance: A test of the Texas lodging industry. *Strategic Management Journal*, 22: 969-988.
- Coff, R. W. 2002. Human capital, shared expertise, and the likelihood of impasse in corporate acquisitions. *Journal of Management*, 28: 107-128.
- Cohen, B. D., & Dean, T. J. 2005. Information asymmetry and investor valuation of IPOs: Top management team legitimacy as a capital market signal. *Strategic Management Journal*, 26: 683-690.
- Connelly, B. L., Hoskisson, R. E., Tihanyi, L., & Certo, S. T. 2010. Ownership as a form of corporate governance. *Journal of Management Studies*. doi:10.1111/j.1467-6486.2010.00929.x
- Dacin, M. T., Oliver, C., & Roy, J. P. 2007. The legitimacy of strategic alliances: An institutional perspective. *Strategic Management Journal*, 28: 169-187.
- Daily, C. M., Certo, S. T., & Dalton, D. R. 2005. Investment bankers and IPO pricing: Does prospectus information matter? *Journal of Business Venturing*, 20: 93-111.
- Davila, A., Foster, G., & Gupta, M. 2003. Venture capital financing and the growth of startup firms. *Journal of Business Venturing*, 18: 689-708.
- Deephouse, D. L. 2000. Media reputation as a strategic resource: An integration of mass communication and resource-based theories. *Journal of Management*, 26: 1091-1112.
- Devers, C. E., Cannella, A. A., Jr., Reilly, G. P., & Yoder, M. E. 2007. Executive compensation: A multidisciplinary review of recent developments. *Journal of Management*, 33: 1016-1072.
- Durcikova, A., & Gray, P. 2009. How knowledge validation processes affect knowledge contribution. *Journal of Management Information Systems*, 25(4): 81-107.
- Ehrhart, K. H., & Ziegert, J. C. 2005. Why are individuals attracted to organizations? *Journal of Management*, 31: 901-919.
- Elitzur, R., & Gaviols, A. 2003. Contracting, signaling, and moral hazard: A model of entrepreneurs, "angels," and venture capitalists. *Journal of Business Venturing*, 18: 709-725.
- Elliott, W. B., Prevost, A. K., & Rao, R. P. 2009. The announcement impact of seasoned equity offerings on bondholder wealth. *Journal of Banking and Finance*, 33: 1472-1480.
- Farrell, J., & Rabin, M. 1996. Cheap talk. *Journal of Economic Perspectives*, 10: 103-118.

- Filatotchev, I., & Bishop, K. 2002. Board composition, share ownership, and "underpricing" of U.K. IPO firms. *Strategic Management Journal*, 23: 941-955.
- Fischer, E., & Reuber, R. 2007. The good, the bad, and the unfamiliar: The challenges of reputation formation facing new firms. *Entrepreneurship Theory and Practice*, 31: 53-75.
- Frankel, R., & Li, X. 2004. Characteristics of a firm's information environment and the information asymmetry between insiders and outsiders. *Journal of Accounting and Economics*, 37: 229-259.
- Gammoh, B. S., Voss, K. E., & Chakraborty, G. 2006. Consumer evaluation of brand alliance signals. *Psychology and Marketing*, 23: 465-486.
- Gao, H., Darroch, J., Mather, D., & MacGregor, A. 2008. Signaling corporate strategy in IPO communication: A study of biotechnology IPOs on the NASDAQ. *Journal of Business Communication*, 45: 3-30.
- George, J. M., & Jones, G. R. 2000. The role of time in theory and theory building. *Journal of Management*, 26: 657-684.
- Goranova, M., Alessandri, T. M., Brandes, P., & Dharwadkar, R. 2007. Managerial ownership and corporate diversification: A longitudinal view. *Strategic Management Journal*, 28: 211-225.
- Gulati, R., & Higgins, M. C. 2003. Which ties matter when? The contingent effects of interorganizational partnerships on IPO success. *Strategic Management Journal*, 24: 127-144.
- Gupta, A. K., Govindarajan, V., & Malhotra, A. 1999. Feedback-seeking behavior within multinational corporations. *Strategic Management Journal*, 20: 205-222.
- Hasson, O. 1997. Towards a general theory of biological signaling. *Journal of Theoretical Biology*, 185: 139-156.
- Heil, O., & Robertson, T. S. 1991. Toward a theory of competitive market signaling: A research agenda. *Strategic Management Journal*, 12: 403-418.
- Held, D. 1980. *Introduction to critical theory*. Berkeley: University of California Press.
- Higgins, M. C., & Gulati, R. 2006. Stacking the deck: The effects of top management backgrounds on investor decisions. *Strategic Management Journal*, 27: 1-25.
- Highhouse, S., Thornbury, E. E., & Little, I. S. 2007. Social-identity functions of attraction to organizations. *Organizational Behavior and Human Decision Processes*, 103: 134-146.
- Hochwater, W. A., Ferris, G. R., Zinko, R., Arnell, B., & James, M. 2007. Reputation as a moderator of political behavior-work outcomes relationships: A two study investigation with convergent results. *Journal of Applied Psychology*, 92: 567-576.
- Ilmola, L., & Kuusi, O. 2006. Filters of weak signals hinder foresight: Monitoring weak signals efficiently in corporate decision-making. *Futures*, 38: 908-924.
- Jain, B. A., Jayaraman, N., & Kini, O. 2008. The path-to-profitability of Internet IPO firms. *Journal of Business Venturing*, 23: 165-194.
- Janney, J. J., & Folta, T. B. 2003. Signaling through private equity placements and its impact on the valuation of biotechnology firms. *Journal of Business Venturing*, 18: 361-380.
- Janney, J. J., & Folta, T. B. 2006. Moderating effects of investor experience on the signaling value of private equity placements. *Journal of Business Venturing*, 21: 27-44.
- Jensen, M. C., & Meckling, W. H. 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3: 305-360.
- Jiang, B., Belohlav, J. A., & Young, S. T. 2007. Outsourcing impact on manufacturing firms' value: Evidence from Japan. *Journal of Operations Management*, 25: 885-900.
- Johnstone, R. A., & Grafen, A. 1993. Dishonesty and the handicap principle. *Animal Behaviour*, 46: 759-764.
- Johnson, R. A., & Greening, D. W. 1999. The effects of corporate governance and institutional ownership types on corporate social performance. *Academy of Management Journal*, 42: 564-576.
- Kang, E. 2008. Director interlocks and spillover effects of reputational penalties from financial reporting fraud. *Academy of Management Journal*, 51: 537-555.
- Kao, C., & Wu, C. 1994. Tests of dividend signaling using the Marsh-Merton model: A generalized friction approach. *Journal of Business*, 57(1): 45-68.
- Karamanos, A. G. 2003. Complexity, identity and the value of knowledge-intensive exchanges. *Journal of Management Studies*, 40: 1971-1890.
- Kirmani, A., & Rao, A. R. 2000. No pain, no gain: A critical review of the literature on signaling unobservable product quality. *Journal of Marketing*, 64(2): 66-79.

- Kreps, D. M., & Wilson, R. 1982. Reputation and imperfect information. *Journal of Economic Theory*, 27: 253-279.
- Lampel, J., & Shamsie, J. 2000. Critical push: Strategies for creating momentum in the motion picture industry. *Journal of Management*, 26: 233-257.
- Langfield-Smith, K. 1992. Exploring the need for a shared cognitive map. *Journal of Management Studies*, 29: 349-368.
- Lee, P. 2001. What's in a name .com? The effects of ".com" name changes on stock prices and trading activity. *Strategic Management Journal*, 22: 793-804.
- Lester, R. H., Certo, S. T., Dalton, C. M., Dalton, D. R., & Cannella, A. A. 2006. Initial public offering investor valuations: An examination of top management team prestige and environmental uncertainty. *Journal of Small Business Management*, 44: 1-26.
- Ma, R., & Allen, D. G. 2009. Recruiting across cultures: A value-based model of recruitment. *Human Resource Management Review*, 19: 334-346.
- Maynard-Smith, J., & Harper, D. 1995. Animal signals: models and terminology. *Journal of Theoretical Biology*, 177: 305-311.
- McGrath, R. G., & Nerkar, A. 2004. Real options reasoning and a new look at the R&D investment strategies of pharmaceutical firms. *Strategic Management Journal*, 25: 1-21.
- McNamara, G. M., Halebian, J., & Dykes, B. J. 2008. The performance implications of participating in an acquisition wave: Early mover advantages, bandwagon effects, and the moderating influence of industry characteristics and acquirer tactics. *Academy of Management Journal*, 51: 113-130.
- Michael, S. C. 2009. Entrepreneurial signaling to attract resources: The case of franchising. *Managerial and Decision Economics*, 30: 405-422.
- Miller, T., & Triana, M. D. C. 2009. Demographic diversity in the boardroom: Mediators of the board diversity—firm performance relationship. *Journal of Management Studies*, 46: 755-786.
- Myers, S., & Majluf, N. 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13: 187-221.
- Ndofo, H. A., & Levitas, E. 2004. Signaling the strategic value of knowledge. *Journal of Management*, 30: 685-702.
- Park, N. K., & Mezas, J. M. 2005. Before and after the technology sector crash: The effect of environmental munificence on stock market response to alliances of e-commerce firms. *Strategic Management Journal*, 26: 987-1007.
- Perkins, S. J., & Hendry, C. 2005. Ordering top pay: Interpreting the signals. *Journal of Management Studies*, 42: 1443-1468.
- Ramaswami, A., Dreher, G. F., Bretz, R., & Wiethoff, C. 2010. Gender, mentoring, and career success: The importance of organizational context. *Personnel Psychology*, 63: 385-405.
- Rao, A. R., Qu, L., & Ruekert, A. R. 1999. Signaling unobservable product quality through a brand ally. *Journal of Marketing Research*, 36: 258-268.
- Riley, J. C. 2001. Silver signals: Twenty-five years of screening and signaling. *Journal of Economic Literature*, 39: 432-478.
- Rindova, V. P., Ferrier, W. J., Wiltbank, R., & Basdeo, D. 2002. *Beautiful music or noise? How investor perceptions of competitive strategy influences the market valuation of publicly traded internet firms*. Paper presented at the Academy of Management Meeting, Denver, CO.
- Ross, S. 1973. The economic theory of agency: The principal's problem. *American Economic Review*, 63: 134-139.
- Ross, S. A. 1977. The determination of financial structure: The incentive signaling structure. *Bell Journal of Economics*, 8: 23-40.
- Ryan, A. M., Sacco, J. M., McFarland, L. A., & Kriska, S. D. 2000. Applicant self-election: Correlates of withdrawal from a multiple hurdle process. *Journal of Applied Psychology*, 85: 163-179.
- Rynes, S. L. 1991. Recruitment, job choice, and post-hire consequences: A call for new research directions. In M. D. Dunnette & L. M. Howe (Eds.), *Handbook of industrial and organizational psychology*: 399-444. Palo Alto, CA: Consulting Psychologists Press.
- Rynes, S. L., Bretz, R. D., & Gerhart, B. 1991. The importance of recruitment in job choice: A different way of looking. *Personnel Psychology*, 44: 487-521.
- Sanders, W. G., & Boivie, S. 2004. Sorting things out: Valuation of new firms in uncertain markets. *Strategic Management Journal*, 25: 167-186.

- Sliwka, D. 2007. Trust as a signal of a social norm and the hidden costs of incentive schemes. *American Economic Review*, 97: 999-1012.
- Spence, M. 1973. Job market signaling. *Quarterly Journal of Economics*, 87: 355-374.
- Spence, M. 2002. Signaling in retrospect and the informational structure of markets. *American Economic Review*, 92: 434-459.
- Srivastava, J. 2001. The role of inferences in sequential bargaining with one-sided incomplete information: Some experimental evidence. *Organizational Behavior and Human Decision Processes*, 85: 166-187.
- Stiglitz, J. E. 1985. Information and economic analysis: A perspective. *Economic Journal*, 95: 21-41.
- Stiglitz, J. E. 2000. The contributions of the economics of information to twentieth century economics. *Quarterly Journal of Economics*, 115: 1441-1478.
- Stiglitz, J. E. 2002. Information and the change in the paradigm in economics. *American Economic Review*, 92: 460-501.
- Suazo, M. M., Martinez, P. G., & Sandoval, R. 2009. Creating psychological and legal contracts through human resource practices: A signaling theory perspective. *Human Resource Management Review*, 19: 154-166.
- Turban, D. B., & Cable, D. M. 2003. Firm reputation and applicant pool characteristics. *Journal of Organizational Behavior*, 24: 733-751.
- Turban, D. B., & Greening, D. W. 1996. Corporate social performance and organizational attractiveness to prospective employees. *Academy of Management Journal*, 40: 658-672.
- Van Munching, P. 1997. *Beer blast: The inside story of the brewing industry's bizarre battles for your money*. New York: Crown Business Press.
- Vehrencamp, S. L. 2000. Handicap, index and conventional signal elements of bird song. In Y. Espmark, T. Amundsen, & G. Rosenqvist (Eds.), *Animal signals: Signalling and signal design in animal communication*: 277-300. Trondheim, Norway: Tapir Academic Press.
- Warner, A. G., Fairbank, J. F., & Steensma, H. K. 2006. Managing uncertainty in a formal standards-based industry: A real options perspective on acquisition timing. *Journal of Management*, 32: 279-298.
- Wayne, S. J., Shore, L. M., & Liden, R. C. 1997. Perceived organizational support and leader-member exchange: A social exchange perspective. *Academy of Management Journal*, 40: 82-111.
- Weiss, A. 1995. Human capital vs. signaling explanations of wages. *Journal of Economic Perspectives*, 9: 133-154.
- Westphal, J. D., & Zajac, E. J. 1998. The symbolic management of stockholders: Corporate governance reforms and shareholder reactions. *Administrative Science Quarterly*, 43: 127-153.
- Westphal, J. D., & Zajac, E. J. 2001. Decoupling policy from practice: The case of stock repurchase programs. *Administrative Science Quarterly*, 46: 202-228.
- Zahavi, A., & Zahavi, A. 1997. *The handicap principle: A missing piece of Darwin's puzzle*. Oxford, UK: Oxford University Press.
- Zahra, S. A., & Filatotchev, I. 2004. Governance of the entrepreneurial threshold firm: A knowledge-based perspective. *Journal of Management Studies*, 41: 885-897.
- Zhang, Y., & Wiersema, M. F. 2009. Stock market reaction to CEO certification: The signaling role of CEO background. *Strategic Management Journal*, 30: 693-710.
- Zimmerman, M. A. 2008. The influence of top management team heterogeneity on the capital raised through an initial public offering. *Entrepreneurship Theory and Practice*, 32: 391-411.