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Diffusion as Classification

ABSTRACT

An overlooked aspect of the diffusion of a practice in a population is the emergence of a de facto *classificatory schema, distinguishing between actors that adopt a practice and those that do not. To investigate diffusion-as-classification, I develop a simulation model that highlights the conditions under which limited diffusion of practices leads to the emergence and entrenchment of classificatory schemas. The model depicts classification as a systemic phenomenon resulting from the interplay of actor level micromotives and field level macrobehaviors which jointly drive diffusion. Whereas extant theory on the origin of classificatory schemas emphasizes the role of agency, results from the model suggest that classificatory schemas can emerge somewhat unintentionally as practices diffuse. Moreover, by conceptualizing diffusion as classification I suggest a means for disentangling the closely related and often conflated concepts of diffusion and institutionalization.*

Keywords: Diffusion, classification, classificatory schemas, institutionalization, signaling, agent-based modeling

Understanding the diffusion of practices[1] is a central pursuit for organizational theorists (Strang and Soule 1998, Wejnert 2002). The foundation for this body of research is the analysis of the diffusion of innovations pioneered by Rogers (1995). The now iconic S-shaped diffusion curve depicts a stylized trajectory progressing from innovators and early adopters through majority adopters and culminating with laggards. Empirical support for this curve is plentiful, especially for technological products (Rogers 1995). One outcome implicit in the S-curve is that an innovation eventually diffuses through a population in its entirety. And indeed, the literature on diffusion has focused largely on explaining the rate and processes through which practices are adopted – rather than the extent of adoption – tacitly assuming that every potential adopter eventually adopts (Abrahamson and Rosenkopf 1997).

In reality, however, not all practices diffuse fully within a population. Limited diffusion may occur for a variety of reasons. Practices may be rejected because environmental conditions shift during the diffusion process, rendering the practices less effective for late adopters seeking to improve performance (Abrahamson 1991). Or, uptake may be limited due to lack of fit between the diffusing practice and the characteristics of a subset of actors within the population: actors for which the practice is likely to be useful decide to adopt, whereas others decide to reject (Ansari et al. 2010). Diffusion halts and is often reversed when results attained from practice adoption fall short of expectations, prompting abandonment (Greve 2011, Rao et al. 2001).

Shortcomings of the practice itself, such as its ineffectiveness in improving operational or technical outcomes, however, may not always be the primary rationale for practice rejection. In fact, either adoption or rejection might be chosen in order to appease or appeal to certain audiences in the organizational environment. In these situations, practice adoption or rejection can be understood as a means of sending a signal, or conveying information, to external constituents. Jonsson (2009) depicted such an occurrence in the Swedish financial industry, in which some fund managers decided to establish

[1] Following Strang and Soule (1998), for clarity of exposition I use the term practice to denote any diffusing item, which might be a behavior, strategy, belief, technology or structure.

socially responsible investment (SRI) funds. Other fund managers, however, rejected this innovation for fear that clients would apply a deviance discount to firms that offered these instruments. Even though SRI funds began diffusing in the industry, by refraining from imitation, certain fund managers classified themselves as unswayed by the encroachment of these new, extraneous professional norms. Similarly, yet in a vastly different setting, Negro, Hannan and Rao (2011) tracked the diffusion of modern vinification techniques in the Barolo/Barbaresco district of Italy. These practices were adopted by producers pursuing consistency in their product offerings, but were rejected by traditionalist winemakers intent on adhering to the region's distinctiveness and an emphasis on *terroir*.

Several aspects common to these two cases are noteworthy, and are at the heart of the issues examined in this article. First, they demonstrate how limited diffusion yields *de facto* classificatory schemas, enabling differentiation of organizations based on a criterion that is salient for audiences – namely, investing principles in the former example and wine characteristics in the latter. Second, the cases suggest that classificatory schemas distinguishing between adopters and non-adopters can be durable - as opposed to transient - if practice adoption remains limited to a subset of the population indefinitely, rather than progressing to full diffusion or dissipating through abandonment. Third, the cases demonstrate that classificatory schemas are not always initiated exogenously by market mediators, and may in fact emerge endogenously as organizations adopt or reject practices that are diffusing through a population.

Understanding diffusion as classification provides a complementary lens through which to examine processes of institutionalization. In the common view of diffusion as institutionalization, analytical scrutiny centers upon the adoption decision and its causal predictors (Boxenbaum and Jonsson 2008). In this view, institutionalization coincides with full diffusion and ubiquity as an entire population succumbs to isomorphic pressures. Diffusion as classification, in contrast, directs analytical attention toward the classificatory schema as a socially constructed, population level phenomenon. Rather than focusing on the individual adoption or rejection decision, it examines when and how classificatory schemas emerge and become entrenched.

Of course, not all instances of limited diffusion can or should be attributed to classification. In this article, I therefore focus on delineating the antecedents, processes and conditions through which limited diffusion engenders classificatory schemas. I develop a model that depicts classification as an emergent, systemic phenomenon resulting from the interplay of actor level "micromotives" and field level "macrobehaviors" that drive diffusion (Schelling 1978, Zucker 1977). Its recursive nature emphasizes the role of actors in shaping field-level expectations which subsequently affect the adoption decisions of others. Importantly, it demonstrates how categories can emerge and become entrenched in a gradual, endogenous manner, rather than through deliberate action or exogenous forces. Ultimately, the model suggests that diffusion can in some instances promote, yet in others inhibit, the emergence and entrenchment of classificatory schemas.

LINKING CLASSIFICATION AND DIFFUSION

Classification pervades organizational settings because it facilitates comparability and commensuration. By condensing data and reducing information loads, classification is an immensely useful cognitive mechanism that simplifies and accelerates both decision-making and action (Dutton and Jackson 1987, Powell and Colyvas 2008). As such, it is central to the functioning of not only public administration (Bowker and Star 1999, Mohr 1994) and the nation state (Porter 1995, Starr 1992), but also commercial settings as diverse as gastronomy (Rao et al. 2005), financial markets (Lounsbury and Rao 2004, Zuckerman 1999) and cinema (Waguespack and Sorenson 2011, Zuckerman et al. 2003).

Yet, while categorization and classification[2] are ubiquitous, the specific classes and categories in use at a given point in time are often transient (Douglas 1986, Lounsbury and Rao 2004). Examples of category emergence abound, including hitherto uncategorized medical conditions (Foucault 2006 [1972], Hacking 2006), the establishment of "new" races and ethnicities (Robbin 1999), and the rise of food classified as organic (Lee 2009). Often, research on the emergence and entrenchment of classificatory

[2] The terms "class" and "category" are often used interchangeably. Hannan, Pólos and Carroll (2007) define categories simply as classes characterized by a particularly high level of consensus.

schemas ascribes an important role to agency. Self-interested actors such as critics, analysts and intermediaries in "mediated markets" (Zuckerman 1999: 1400) have an important stake in creating and cultivating classificatory schemas, and subsequently classifying actors within them (Fleischer 2009, Zuckerman 2000). If successful, these schemas can become entrenched, occasionally becoming veritable institutions in their own right (e.g. the Michelin Red Guide for hotels and restaurants and the Fortune 500 list).

But while some classificatory schemas are devised and managed by market intermediaries, others hinge upon classificatory choices made by actors themselves. For example, a university diploma classifies individuals into graduates and non-graduates, serving as a signaling device that is used extensively in labor markets (Weiss 1995). A diploma enables "high quality" job-seekers to differentiate themselves from "low quality" job-seekers, and allows the former to pursue more lucrative employment opportunities, thereby offsetting the costs they invest in university education (Spence 1973). This signal is viable only when some, but not all, individuals in a population decide to attain a diploma, thereby creating a "separating equilibrium", distinguishing between graduates and non-graduates. Figure 1 depicts the proportion of the United States population with high school and university diplomas in the United States in the years 1940-2012. High school diplomas constituted a signal which classified actors "usefully" for employers in the middle of the 20th century. But, as high school graduation rates swelled, this classificatory capacity declined. For signaling theorists, high school education - in the present - is an example of a "pooled equilibrium" which cannot function as a classificatory schema, because it is attained by nearly the entire population. In contrast, the university diploma, currently conferred upon roughly 30 percent of the population, does serve as a classificatory schema, precisely because it is attained by only a subset of the population. As a consequence, even though individuals pursue higher education for a variety of reasons (Frazis 2002), "college graduate" has become a reified classificatory label in labor markets, with both employees and employers acutely aware of, and acting in accord with, the label's significance. And, through the recurrent adoption *and* rejection decisions of generations of actors that decide to pursue or forego attainment of the diploma, this classificatory schema is continuously reconstituted.

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FIGURE 1 ABOUT HERE
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Signaling theory thus provides a compelling explanation for how classificatory schemas function, once they are in place. Yet, it is doubtful that the diploma as classificatory schema was instituted as a labor market mechanism, or even envisioned as such, when universities were first established by Catholic clergy in Middle-Age Europe. Rather, the importance of university education (or lack thereof) as a signal of employee competency emerged gradually and became entrenched much later, *after* universities had become a fixture of society, thus begging the question: how did the signal originate? Signaling theory is ill-equipped to provide an answer because it is fundamentally "an equilibrium theory with no dynamics" (Bacharach and Gambetta 2001: 168), and therefore cannot shed light on how classificatory schemas emerge, change over time, or fall into disuse. Moreover, signaling theory - like other economically grounded theories - is predicated upon independent, rational actors. But large numbers of independent, rational actors are unlikely to form a consensus around a specific action that all will agree serves as a signal (Holm 1995, Schelling 1957). This implies that universally accepted classificatory schemas, perhaps unlike other economic institutions (North 1991) are virtually impossible to design *ex ante*, or put in place purposefully. Indeed, as noted by Suddaby (2010: 16), we do not yet understand "the process by which categories originate and become reified". How then, might classificatory schemas emerge?

Limited diffusion and classification

Diffusion is a particularly mature arena of research, yet relatively few studies have examined the extent of diffusion (Abrahamson and Rosenkopf 1997). In fact, researchers studying diffusion focus primarily on widely diffused practices, paying scant attention to processes in which diffusion plateaus or discontinues (Rogers 1995). This emphasis on full diffusion has been intertwined with theoretical interest in processes of institutional isomorphism, wherein organizations become increasingly similar over time. Full diffusion is often conceptualized as a manifestation of isomorphism: a process of homogenization through which organizations come to increasingly resemble each other (Boxenbaum and Jonsson 2008).

Indeed, institutional theorists have emphasized that many diffusing practices are adopted due to actors' perception that they must acquiesce to "external assessment criteria" (Meyer and Rowan 1977: 350). By adopting certain *modus operandi* (Baron et al. 1986, Mezias 1990), forms (Fligstein 1985) and structures (Rao and Sivakumar 1999, Tolbert and Zucker 1983), organizations signal their conformity to these external criteria. These demands often become more stringent over time, impelling actors to adopt the same practices as their peers, thereby driving "an inexorable push towards homogenization" (DiMaggio and Powell 1983: 148), ultimately resulting in full diffusion. In this manner, full diffusion coincides with homogeneity. Because homogeneity renders differentiation impossible, organizational isomorphism is essentially an account of the demise of classificatory capacity. Put differently, in a homogeneous population, classification is precluded.

While influential statements have emphasized the high degree of homogeneity resulting from institutionalization processes (Baron et al. 1986, Tolbert and Zucker 1983), recent theorizing has advocated a more nuanced view. Lounsbury (2007) and Schneiberg (2007) have shown that institutionalization does not always lead to full diffusion and complete isomorphism by demonstrating that distinct practices and organizational forms often thrive concurrently. Colyvas and Jonsson (2011) have emphasized the conceptual difference between diffusion and institutionalization noting that institutionalization can lead to practices that are acceptable, yet not commonplace. Others have highlighted the importance of research on limited diffusion, both to mitigate the pro-adoption bias in empirical research (Denrell and Kovács 2008), and also to comprehend why beneficial innovations diffuse more slowly than expected (Rogers 1995).

Regardless of why some practices do not diffuse fully, when populations of adopters and non-adopters do co-exist in an organizational environment, classification becomes possible, based upon the decision to adopt or reject. To illustrate, Figure 2 depicts the classificatory ramifications of two stylized diffusion trajectories. In Figure 2a, much like the diffusion trajectory of college diplomas depicted in Figure 1, adoption stabilizes at 40 percent of the population, yielding a classificatory schema that distinguishes between adopters and non-adopters. In Figure 2b, a practice diffuses fully within a

population, echoing the trajectory of the diffusion of high school diplomas depicted in Figure 1. Initially, classification is possible, but as time passes and adoption culminates, the resultant isomorphism precludes classification. When the population in its entirety has adopted a practice, that practice can no longer serve as a means of differentiating between members. The extent of diffusion therefore either engenders or precludes the emergence of classificatory schemas.

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FIGURE 2 ABOUT HERE
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Emergence of classificatory schemas

The classification and categorization literature which has risen to prominence in organizational research in the span of the past two decades (for overviews, see Hannan 2010, Hannan et al. 2007) is underpinned by work in cognitive psychology that examines how individuals classify. More specifically, it is grounded upon the "common" or "prototype" view of categories (Mervis and Rosch 1981, Rosch and Mervis 1975). According to this view, individuals possess in their minds pre-existing prototypes of objects which serve as yardsticks to which other objects are compared. Categorization occurs as individuals assess the similarity or dissimilarity of a given object to the prototype for that category. Common categories are relatively stable, and are uni-directional, meaning that they are imposed by audiences upon producers. By nature, they are disciplinary, meaning that organizations which deviate from the prototype are penalized by audiences (Zuckerman 1999, 2000).

In addition to this common view of categories, however, cognitive psychologists have developed other views of how categories originate and shape perception (Murphy 2004). One such view emphasizes categories which are goal-based or *ad hoc* (Barsalou 2010), developed by audiences specifically to aid decision making. Prior intention is a prerequisite for the emergence of *ad hoc* categories; without a specific goal or intent, *ad hoc* categories do not come into existence (Barsalou 1983). Further, *ad hoc* categories do not implant ideal, prototypical objects in actors' memory which subsequently serve as classificatory prototypes. Rather, *ad hoc* categories group together potentially diverse objects which may

have few shared characteristics except for their relevance to the specific goal being pursued (Barsalou 1991). An example of an *ad hoc* category is "things to extract from a burning house", which can include objects like wallet, photo album and cat. Notably, these items share very few attributes - beyond the fact that they are worthy of salvage - making *ad hoc* categories difficult to reconcile with the prototype view.

In organizational settings, audiences are likely to develop goal-based or *ad hoc* categories for decision making in domains such as purchasing, investing, or boycotting, as part of the process of identifying producers with whom to engage (Durand and Paolella 2012). In these contexts, audience members do not necessarily pre-possess an image of a prototypical organization with which they seek to transact. Rather, they begin by defining a goal (e.g. purchasing, investing, or boycotting, given a set of constraints) and then scan producers in order to categorize them in a manner conducive to goal attainment. For example, for the purpose of investment, audiences might be interested in distinctions among firms based on their use of incentive programs for executive compensation (Westphal et al. 1997). Or, for the purpose of purchasing, audiences might be interested in distinctions among firms based on their utilization of an environmental management standard (King et al. 2005). Adoption or rejection of a salient practice is particularly conducive to goal-based categorization, because an adoption or rejection decision is inherently dichotomous, making it straightforward to distinguish between two subsets of a population along a dimension of interest.

Entrenchment of classificatory schemas

At the level of the individual, if *ad hoc* categories are accessed frequently, they become well-established in memory (Barsalou 1983, 2010). Analogously, in organizations, *ad hoc* categories which proved useful for prior goal attainment are likely to be accessed again, if a similar or identical context reappears. Like other decision making processes, when goal-based decisions recur frequently, they can become routinized (Cyert and March 1963), gradually undergoing a process of formalization, which codifies and thereby perpetuates interpretation, eventually yielding classificatory labels (Dutton and Jackson 1987). As these labels cohere, producers come to realize that their adoption or rejection decisions

are assessed by audiences and that a classificatory schema has emerged. Consequently, over time, adoption and rejection decisions become imbued with meaning, because both producers and audiences understand that the decision is significant in terms of its classificatory implications. The classificatory schema becomes entrenched.

Importantly, whereas common categories are primarily disciplinary, *ad hoc* categories serve as a medium for coordination among producers and audiences, and do not penalize deviance. As such, *ad hoc* categories are consistent with the notion of signals as mechanisms for improving information flows in markets (Spence 1973). The use of concise, informative labels such as "college graduate" simplifies categorization and facilitates decision making, without overtly devaluing either adoption or rejection. Over time, the use of practice adoption as a signal - a mode of conveying information - becomes a convention, a "congealed … pragmatic solution to an economic problem … reified as normal" (Biggart and Beamish 2003: 458). Eventually, much like other processes of institutionalization, the rationale that originally generated the categorical schema may eventually recede into the background, leaving the resultant list of features in the foreground, unquestioned (Durand and Paolella 2012).

Summarizing the theoretical argument, I have proposed that diffusion processes can be driven, at least in part, by the significance audiences attach to producer adoption and rejection decisions. Classificatory schemas can emerge when diffusion remains limited to a certain proportion of the population, enabling audiences to distinguish between adopting and non-adopting producers. Over time, these emergent classificatory schemas can become entrenched and congeal into conventions, accepted by audiences and producers alike as social fact. To fully understand these processes, however, first requires an understanding of how individual actors decide whether to adopt or reject diffusing practices.

Diffusion and practice adoption

Diffusion is a population level phenomenon. Yet, it is also an aggregation of decisions made by individual actors, each deciding on whether to adopt or reject a specific practice. Such decisions are commonplace, because practices emerge frequently, forcing actors to make choices. Often the discourse

surrounding emergent practices emphasizes benefits that can be gained through adoption. Trendsetters, including consultants, journalists and researchers, trumpet the positive outcomes that emergent practices can confer (Abrahamson and Fairchild 1999), generating a pro-adoption bias in decision making (Abrahamson 1991, Denrell and Kovács 2008). Yet, reasons to refrain from adoption may also be persuasive, including lack of fit between the practice and actor characteristics, or the withdrawal of valuable resources pursuant to an adoption decision.

In fact, although pressures to adopt a practice may be powerful, actors will weigh the adoption decision carefully, especially if adoption necessitates significant effort (Rao et al. 2001). Such a decision incorporates several elements. First, the potential adopter must be aware that a practice is diffusing. Second, the potential adopter must have some motivation to adopt, by perceiving a benefit of adopting, a penalty of not adopting, or both. And third, a cost is involved, reflecting the degree to which the practice is aligned with the actor's competencies. These three components of decision making are explored below.

Awareness A central stream in diffusion research has examined the social structure that underlies adoption decisions, and the communication channels through which information about new practices flows (Strang and Soule 1998). Actors can become aware of new practices through inter-organizational networks (Davis 1991), geographic proximity (Davis and Greve 1997) media coverage (Abrahamson and Eisenman 2008), or influential fashion-setters (Abrahamson and Fairchild 1999). Markets too can provide feedback regarding the success of practice adoption, simply by revealing how prior adopters flourish or perish (Lee and Pennings 2002, Terlaak and Gong 2008). The underlying insight is that practice adoption trends are knowable within a population, and that awareness of a new practice increases as more and more referent peers adopt (Abrahamson and Rosenkopf 1993, Ansari et al. 2010, Rossman 2009).

Motivation Even after actors become aware of a new practice diffusing, they still face a decision regarding whether they themselves should adopt it. Reasons for adoption are manifold, but in essence, they can be grouped in two overarching concepts: instrumental utility and social benefits of legitimacy (Westphal et al. 1997). Instrumental utility refers to the technical gains from adoption, attained through

greater operational efficiency, whereas social benefits of legitimacy refers to avoidance of sanctions due to lack of conformity.

Costs Even though new practices might be alluring, actors might be hesitant in adopting them. Practice adoption implies disrupting existing routines and investing in the implementation of new ones, and is clearly not costless. These costs will not necessarily be equal for all actors. New practices might be particularly easy for certain actors to implement, yet onerous for others. In fact, the degree of fit between the practice and actor capabilities determine the extent to which these costs are high (Ansari et al. 2010, Rogers 1995), and therefore whether adoption or rejection will be selected (Spence 1973). Actors with a set of capabilities, to which the diffusing practice is amenable, will incur lower costs.

In short, a decision on whether to adopt or reject a practice begins with awareness of its diffusion. Once aware, actors choose to adopt or reject the practice based on their assessment of its costs and benefits. Awareness, costs and benefits of adoption vary through time, as diffusion progresses. In the next section, I develop a formal model that portrays this process and probes its classificatory implications.

MODEL

Although both diffusion and classification are familiar concepts which have been examined thoroughly, each has developed as a distinct research stream. Diffusion research has focused primarily on the macro level mechanisms through which practices diffuse, whereas research on classification has emphasized the micro level cognitive aspects of categorization. In order to develop new theoretical insights linking well-defined yet unrelated domains, simulation via computer modeling is a particularly useful tool (Davis et al. 2007). Agent based simulation models are singularly well suited for understanding and exploring interactions between micro and macro levels (Macy and Willer 2002, Rousseau 2011).

In these models, a population of agents constantly scans its environment, with each agent acting and reacting to what other agents are doing (Axelrod and Cohen 1999). The output generated by agent based models captures the cumulative, population-level outcomes resulting from actor level decisions

made over time (Holland 1995). Agent based models used in the social sciences have typically focused on complex population-level processes, such as the emergence of norms (Schelling 1971), participation in collective action (Granovetter 1978) or the diffusion of innovations (Rosenkopf and Abrahamson 1999). In these models, agents respond to social influences and selection pressures, often yielding counterintuitive patterns of differentiation, stratification, and clustering (DiMaggio and Garip 2011, Macy and Willer 2002).

Four characteristics of agent based models make them attractive for examining diffusion and classification. First, the feedback processes which are at the core of the models make them particularly suitable for analyzing longitudinal, chronically reproduced (Jepperson 1991) processes such as diffusion and institutionalization. In other words, they explicitly model dynamic "systems of interaction" (Schelling 1978: 14) among actors, wherein actor level "micromotives" and population level "macrobehaviors" are continuously influenced by each other (Mohr and White 2008, Powell and Colyvas 2008, Zucker 1977). Second, agent based models do not require audiences to directly and explicitly influence actor decision making. They are thus particularly effective for describing settings in which actors typically do not – and cannot – perceive or analytically derive the demands and expectations of individual audience members (Leifer and White 1987). In agent based models, as in reality, actors make decisions based upon knowledge of their own quality and the observable behavior of their competitors (White 1981). Third, the models allow for time to be partitioned into very small increments. As such, they can be more accurate than traditional analyses of diffusion and institutionalization which parse diffusion trajectories into distinct phases (Fligstein 1985), in some cases distinguishing only between early and late adoption (Palmer et al. 1993, Tolbert and Zucker 1983). And finally, agent based models support the analysis of heterogeneous actors, with varying attributes on one or more dimensions. This characteristic is important for analyses of diffusion, in which rationales for adoption likely differ within the population (Strang and Tuma 1993, Struben and Sterman 2008).

A formal model

A model for diffusion as classification describes a population of N producers, into which a new practice is introduced. At each time period, the producers in the population can choose to adopt or reject the practice, based on awareness, motivation and costs. In terms of output, the model generates, at each time period, data on the number, n, and quality, q, of both adopters and non-adopters. The analysis centers on the contingencies which lead to the emergence and entrenchment of a classificatory schema distinguishing between actors that adopt a practice and those that reject it.

More specifically, each member i of the population is characterized by two uncorrelated attributes, *quality* and *perceptivity*, both distributed normally and time independent. *Quality* (q) quantifies a producer's endowment of a certain characteristic of interest for audiences. For example, this characteristic might be the producer's level of commitment to socially responsible investing or its wine-making philosophy, as highlighted in the introduction[3].

Perceptivity (p) quantifies the capability of a producer to attend to the emergence of new practices. This skill is unrelated to the quality of the producer just described. Some producers may be endowed with high quality q_i yet because of their low p_i remain oblivious to the emergence of new practices and incognizant of the benefits that that adoption might yield. Other producers may be very skillful at perceiving emergent practices (high p_i), yet their low quality level q_i might render adoption less compelling.

The model is run for T periods. At each period t in T, producers that have not yet adopted a practice make an adoption/rejection decision. At time t=0 all producers are non-adopters, therefore $n_0 = 0$.

[3] Note that there is no normative weight associated with either "high" or "low" quality labels. For example, SRI funds have the attribute of integrating social concerns into investment decisions, whereas this attribute is absent from other funds. So, funds that emphasize SRI principles have higher quality in terms of integrating social concerns into investment decisions, whereas mainstream funds are lower in this quality. Alternatively, and entirely equivalent in terms of classificatory significance, mainstream funds can be characterized as having higher quality in terms of traditional financial values, and SRI-focused funds as lower quality. Model outcomes are invariant under these initial designations.

Once producers adopt a practice at time *t*, they cannot subsequently abandon it (this assumption is relaxed later). Practice adoption is assumed to be enacted at least in part for external audiences, so adoption/rejection decisions are publicly knowable. At each period *t*, a non-adopter's decision to adopt the practice or reject it is determined in two stages: first, whether the producer is aware of the practice, and if so, whether the producer benefits from adoption.

Stage 1 Each producer's *awareness* of the practice at a given period *t* ($a_{i,t}$) depends on two things: its time-independent perceptivity score p_i, described above; and the number of adopters in the previous period, n_{t-1}. As the number of adopters increases, the adoption trend becomes more obvious, and hence *awareness* increases. When $a_{i,t}$ exceeds a certain threshold *H*, producer *i* becomes cognizant of the diffusing practice and can then decide whether to adopt it or not. Formally:

(1) $$a_{i,t} = \begin{cases} 1 & if\ P_i + n_{t-1} > H \\ 0 & if\ P_i + n_{t-1} < H \end{cases}$$

This simulates a realistic situation in which perceptive producers recognize an emerging practice at early stages, whereas producers that are poor at identifying trends become cognizant of an emerging practice only after many of their peers have already adopted it. As *t* approaches *T*, if a classificatory schema has emerged, virtually all producers become aware of it, even if adoption rates are low (much like the college diploma, for example).

Stage 2 Once a producer has become aware of a practice, she proceeds to determine whether adoption would be favorable for her. A producer perceives both costs and benefits in the adoption decision, as captured by three factors: adoption costs (*AC*); adoption benefits (*AB*); and market value (*MV*). For each actor *i*, the decision to adopt at time *t* hinges upon whether the following inequality holds:

(2) $$MV_t + AB_t - AC_i > 0$$

Each of these three factors is determined as follows. *Adoption costs* (*AC*) are the costs that a producer invests in order to adopt a practice. They are time-independent. In order to capture the concept

of fit, implying that costs are greater for producers whose competencies are not aligned with the practice, *adoption costs* (AC_i) decline with quality (q_i):

(3) $$AC_i = MAC - q_i$$

where *MAC* is the maximum adoption cost for all producers in the model.

Market value (*MV*) is a function of audience interest in the practice. *Ad hoc* classificatory schemas do not emerge if audiences are uninterested in classifying producers based on a practice, but if audience members believe the diffusing practice to be meaningful, they attach value to its adoption. This value typically evolves over time as audiences continuously recalibrate the value they assign to transacting with signaling actors (Spence 2002). Typically, early adopters capture greater value from audiences as they differentiate themselves from non-adopting producers. Later in the diffusion process, however, as a greater number of producers adopt the practice, the logic of supply and demand dictates that the premium accruing from audience interest will decline. This decline in premium is pronounced in early stages, whereas in later stages - as the number of adopters *n* nears *N* and the market becomes increasingly saturated - these changes in premium become diminishingly small. *Market value* (*MV*) is thus modeled as a function of the square root of the number of adopters in the previous period n_{t-1}. As opposed to *adoption costs*, *market value* is determined not by a producer's *quality*, but rather by a population level attribute - the number of prior adopters (n_{t-1}):

(4) $$MV_t = AI_{t=1} - \sqrt{n_{t-1}}$$

where $AI_{t=1}$ is a constant that captures audience interest in the practice at time $t=1$. This equation associates a specific value to the rather indeterminate concept of audience interest, and specifies $AI_{t=1}$ as equivalent to the market value of adoption for the first adopter in the population. Further, if audiences are entirely uninterested in the practice ($AI_{t=1} = 0$), then $MV_{t=0} = 0$, meaning that the practice has no market value at all.

Adoption benefits (*AB*) captures the two types of benefits attained through adoption: instrumental and social. In contrast with *adoption costs*, which differ between actors, the instrumental benefits that

accrue from adoption are essentially equal and time invariant (for example, lower waste costs as a result of adopting a quality management system). Social benefits, in contrast, are a manifestation of audience interest and vary over time. At early stages, when a new practice such as quality management is introduced into the population of producers, audiences are relatively indifferent to it. In later stages, however, as more and more producers adopt the practice, audience interest intensifies and audiences become increasingly hesitant to transact with a non-adopting producer, for fear that it lacks legitimacy. As the number of adopters *n* nears *N*, the social benefit of adoption increases markedly, because late adopters have the most to gain from joining the ranks of their legitimate counterparts, thus warding off expulsion from the market. *Adoption benefit* is thus modeled not linearly, but rather as an exponential function of the number of adopters in the previous period $n_{adopt,t-1}$.

(5) $$AB_{\mathrm{t}} = SB_{\mathrm{t}} + \mathrm{IB} = \left(\frac{\mathrm{AI}_{t=1}}{C}\right) * {n_{t-1}}^{LI} + \mathrm{IB}$$

Where *SB* captures the *social benefits* of adoption, *IB* the *instrumental benefits* of adoption, *LI* is *legitimacy intensity, C* is a scaling constant and $AI_{t=1}$ is the same as in equation 4. High *LI* implies strong environmental demands for legitimacy resulting in ever-greater *adoption benefits* as adoption progresses. Like *MV*, *AB* too is a function of the number of prior adopters. Note that at *t=1 AB = IB*, meaning that there are no social benefits in adoption, in line with theoretical expectations.

Recapping, in each period *t*, non-adopters face a two stage decision process, first involving awareness and the second involving an assessment of the costs and benefits of practice adoption (see Figure 3). If the producer is aware of the emergent practice and the benefits outweigh the costs, the producer adopts the practice. At the end of each period *t*, after all non-adopters have made their adoption/rejection decisions, two outcomes are assessed: the extent of diffusion, as measured by the number of adopters; and the clarity of the classificatory schema (Hannan et al. 2007, Hsu et al. 2012), as measured by the difference in average quality of the adopting group and the rejecting group.

Initial parameters for the model are specified in Table 1. Causal loop diagrams (e.g. Rudolph and Repenning 2002, Sterman 2001) are useful for depicting time-dependent, feedback-based dynamic

systems. A causal loop diagram of the model is provided in Figure 4. I used the Ventana Simulation Environment (Vensim DSS) software to develop and run the model[4]. For robustness, in each scenario examined below, the model was run 200 times, each with a unique draw from random distributions of *perceptivity* and *quality*. Results shown are the average over all 200 runs.

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TABLE 1, FIGURE 3 AND FIGURE 4 ABOUT HERE
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RESULTS

Each run of the model yields two graphs (see Figure 5). The graph on the bottom panel plots the number of actors aware of the practice as well as the number of adopters, *n*, at each *t* in *T*. The graph on the top panel plots the average quality of the group of adopters and the average quality of the group of non-adopters, again for each *t* in *T*. Figure 5a depicts the model output with *legitimacy intensity* (*LI*) set at 1.0. Figure 5b plots the model with all other parameters equal and *LI* set at 1.85.

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FIGURE 5 ABOUT HERE
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Base model

Figure 5a depicts a trajectory of limited diffusion. In line with the canonical S-curve trajectory, adoption progresses slowly at first, then increases rapidly for a brief period, before slowing again. Adoption subsequently stabilizes when the number of adopters is still significantly smaller than *N (n* = roughly 26 percent of the population at *t = T).* This trajectory occurs only when the intensity of environmental demands for legitimacy is low. Initially, a large proportion of the population is unaware of

[4] The model is essentially a discrete-time model of difference equations, and can therefore be run with other software, even on a spreadsheet. The code for the model is available from the author upon request.

the new practice, and non-adoption is primarily a result of ignorance, rather than purposive rejection. But, as adoption increases, audience influence on the adoption decision becomes more potent, altering the practice's market value and adoption benefits. Eventually, as adoption rates increase mid-way through the S-curve trajectory, most actors become aware of the opportunity to signal, and a classification process begins. Rather than adopting or rejecting the practice based solely on the instrumental benefits it confers, actors make a deliberate signaling decision, and classify themselves by either adopting or refraining from adoption. Actors with higher quality incur lower costs of adoption and decide to adopt, whereas actors with lower quality face higher costs and therefore perceive a negative net value of adoption, and consequently reject the practice. As a result, the average quality of adopters diverges from the mean in a positive direction and the average quality of non-adopters diverges from the mean in a negative direction. Moreover, as the gap between the average quality of adopters and non-adopters widens, schema clarity increases. When diffusion stops, the average quality of adopters is substantially higher than the population mean and the average quality of non-adopters is substantially lower than the mean. The end result is an entrenched and clear classificatory schema.

In contrast, when the intensity of environmental demands for legitimacy is high, adoption is rapid and quickly approaches *N*, thus precluding classification. This full diffusion trajectory (Figure 5b), at first parallels the limited diffusion trajectory, in which early adopters with certain capabilities perceive instrumental benefit in practice adoption. A tentative classificatory schema emerges, initially distinguishing adopters from non-adopters. However, when the practice continues diffusing, other producers are impelled by legitimacy concerns to adopt. And since legitimacy intensity is high, eventually all actors are compelled to conform via adoption, even if there is very little fit between their quality and the practice. The average quality of adopters consequently converges to the mean, thereby nullifying the emergent schema. Full diffusion of the practice precludes classification of actors based on adoption and rejection decisions.

The model thus generates trajectories consistent with both limited diffusion and full diffusion, suggesting that both scenarios can be explicated with one parsimonious set of constructs. In fact, one

factor determines which of the two trajectories is generated in a given run: *legitimacy intensity* (*LI*). In part, this result simply restates the obvious: when environmental demands for legitimacy are inexorable, isomorphism ensues. The obverse of this argument, however, has not been examined in great depth: namely, what happens when environmental demands for legitimacy are *not* inexorable. The model suggests that classificatory schemas will emerge endogenously and subsequently become entrenched in situations where environmental demands for legitimacy are relatively weak, or, in other words when rejection is not illegitimate.

> *Proposition 1: Limited diffusion begets classification only when non-adoption does not threaten legitimacy.*

Scope Conditions

Emergence and stability The model suggests that *adoption costs* play a significant role in determining whether a classificatory schema becomes emerges. At high *adoption costs*, few actors adopt, leaving many high-quality actors in the non-adopting group. In other words, diffusion does not progress beyond the early-adoption stage, and the trajectory of adoption follows a concave form (see Figure 6), rather than the canonical S-curve. In essence, the classificatory schema does not take root. The small number of initial adopters creates relatively little awareness among producers – less than 20%, as compared to over 90% in the base model above. With the level of awareness low, subsequent adoption is also low, and a positive feedback loop between producers and audiences which leads to further adoption does not materialize. Absent a "critical mass" of adopters, a classificatory schema does not emerge.

Classification is precluded not only when diffusion is weak, but also, albeit differently, when diffusion is strong and adoption widespread. In particular, when *adoption costs* are very low, a practice diffuses quickly and fully through the population, and is eventually adopted by all actors. But when the vast majority or all actors have adopted a practice, its adoption can no longer serve as a classificatory mechanism. Whereas meager adoption prevents a classificatory schema from emerging, full adoption nullifies a schema (Figure 5b). In conjunction, these outcomes suggest that the range of adoption costs

that fosters the development of classificatory schemas is rather narrow, lying between the excessively affordable and the inordinately expensive (see Figure 7).

Proposition 2: Classification through limited diffusion will emerge and endure when adoption costs are substantial but not overwhelming.

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FIGURES 6 AND 7 ABOUT HERE
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Population characteristics The extent to which actors are similar to or different from each other also has significant implications for the behavior of populations (Abrahamson and Rosenkopf 1993, Granovetter 1978). The effects of population heterogeneity are displayed in Figure 8, in which the standard deviation of *quality* in the population is depicted as the independent variable. When a population is relatively homogeneous, the gap between the average quality of adopters and the average quality of non-adopters is small. In fact, at low heterogeneity, a classificatory schema does not emerge, and the diffusion trajectory is similar to that depicted in Figure 6. When heterogeneity is greater, the population includes a larger number of high quality actors that adopt early, thus transforming practice adoption into an emergent classificatory mechanism which yields greater *adoption benefits*, in turn triggering the positive feedback loop which leads to classificatory entrenchment. Even though adoption rates increase with heterogeneity, schema clarity also increases, because cost and benefit differentials between adopters and rejecters are more pronounced in heterogeneous populations.

Proposition 3a: Ceteris paribus, greater heterogeneity in the population leads to higher rates of adoption.

Proposition 3b: Ceteris paribus, greater heterogeneity in the population leads to greater schema clarity.

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FIGURE 8 ABOUT HERE
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Bounded rationality The base model assumes that producers can precisely calculate the costs and benefits of adoption, based on knowledge of their own quality and the benefits that adoption will provide. This calculation, however, is in reality a difficult feat for producers to accomplish with a high degree of accuracy. To investigate the effects of incomplete knowledge of environmental conditions and inaccurate self-assessment of *quality*, an error term was added to the adoption decision (equation 2). This random, normally-distributed term, with a mean of zero, led some producers to err on the side of optimism and believe that adoption would be more beneficial than its actual value, and others to undervalue the benefits of adoption. Introduction of the error term led to higher adoption rates because its effect was to increase the number of adopters in early time periods, and thereby trigger the positive feedback loop that increases subsequent adoption. As such, the effect of bounded rationality on adoption rates is similar to that of increased heterogeneity. In contrast to the case of heterogeneity however, the linkage between quality and the adoption/rejection decision is attenuated, because actors do not possess accurate information about themselves and about the effects of practice adoption, thereby reducing schema clarity (Figure 9).

Proposition 4a: Ceteris paribus, greater ambiguity about the costs and benefits of practice adoption leads to higher adoption rates.

Proposition 4b: Ceteris paribus, greater ambiguity about the costs and benefits of practice adoption leads to lesser schema clarity.

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FIGURE 9 ABOUT HERE
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Extensions

Abandonment Actors that adopt practices may subsequently abandon them (Rao et al. 2001). For example, the benefit of a classificatory schema might become negative for early adopters as later adopters

make the practice more prevalent, thereby reducing its *market value*. Reciprocal defection (Lenox 2006) may ensue, wherein each instance of abandonment encourages additional abandonment, potentially "snowballing" and leading to complete unraveling of a classificatory schema (Akerlof 1980). To investigate this possibility, the model was modified to allow actors that had previously adopted a practice to reconsider their decision. Specifically, in each time window t, *all* actors, not just non-adopters, assessed the net value of adoption using equation 2. As before, actors that had not yet adopted the practice assessed whether the net value of adoption was greater than 0, but in addition, actors that had previously adopted the practice assessed whether the value of their prior adoption remained positive, and were able to abandon the practice if the assessment yielded a negative result.

Running the model with this extension revealed that unraveling of an entrenched classificatory schema was unlikely. In fact, in various trajectories of diffusion, abandonment did not surpass ten percent of the population of adopters. This was primarily due to the magnitude of social benefits of adoption once classificatory schemas had become entrenched. Absent a sudden, large decrease in market value, classificatory schemas continue to have a strong effect on actor adoption/rejection decisions, discouraging abandonment. However, whereas the option of abandoning did not lead to unraveling of entrenched schemas, it did prevent some schemas from emerging. Specifically, for relatively costly practices, abandonment by a small number of actors in early stages, when schema emergence was at its frailest, did prevent an S-curve from developing. Yet, in general, results indicated that large scale abandonment, after a classificatory schema had become entrenched, was unlikely to occur endogenously.

Proposition 5: Entrenched classificatory schemas remain entrenched unless environmental conditions change.

Loose coupling and decoupling Practice adoption does not always yield instrumental benefits. In some cases, the practice may not be a good fit for the adopting organization and therefore fail to deliver the expected results. In other cases, adoption might be purposefully symbolic, and pursued solely in order to conform with audience expectations, rather than substantially modify organizational outcomes

(Westphal and Zajac 1994, 1998). In other words, practice adoption and quality could be either loosely coupled or decoupled entirely.

To examine the effects of loose coupling, equation 5 was modified. *Instrumental benefit* was modified to be a linear function of *quality*, rather than a constant, as in the base model. As a result of this modification, high quality actors, for whom the practice is a good fit, gain greater *instrumental benefits* of adoption than low quality actors. This model yielded roughly 6% greater adoption than the base model, and also slightly reduced schema clarity, albeit nearly imperceptibly.

A more extreme case decouples the linkage between *quality* and *adoption costs* entirely. This was modeled by defining *adoption cost* as a random variable itself, uncorrelated with *quality*. The resultant diffusion trajectory is identical to the base model, but, unsurprisingly, schema clarity is nullified entirely. This means that from an audience standpoint, solely observing diffusion trajectories can provide no information whatsoever as to whether the resultant classificatory schema conveys meaningful information about quality.

Proposition 6: Absent a concrete linkage between adoption costs and quality, audiences cannot gauge the clarity of a classificatory schema.

Temporality Economic signals function most accurately when they are invariant over time. For example, in the case of the diploma, the underlying quality about which the job-seeker provides information is understood to be something akin to “perseverance”, a trait coveted by employers (Weiss 1995). A person that can overcome the trials and tribulations inherent in the pursuit of an academic degree is one that demonstrates steadfast commitment to goals over a multi-year period, and therefore, by implication, is not one to back away from challenging tasks in a work environment. This underlying trait - perseverance - is understood to be relatively time-invariant, carrying over from university studies to the labor market.

The extent to which time-invariance is applicable to organizations, however, is questionable. A firm committed to fair and balanced executive remuneration that establishes a Compensation Committee

reporting to its Board of Directors may not remain committed to the same ideals in subsequent years, while keeping the Committee in place. Or an organization certified to an environmental management system may subsequently reverse course in its pursuit of environmental goals and fall behind comparable peers in this regard, with decertification occurring only years later, if at all. Organizations, in short, are not consistently of high or low quality; rather their quality varies over time, and such changes in quality may not closely correspond to adoption and abandonment decisions. To assess the impact of change in quality over time, the assumption of time-invariance in *quality* was relaxed. Results (Figure 10) suggest that if *quality* is time-dependent, a practice will diffuse more broadly, and reduce schema clarity. At its most extreme, if quality fluctuates considerably, full diffusion ensues even at low levels of *legitimacy intensity*. This occurs because even if quality is high only during a brief period, prompting adoption, it sets in motion the feedback loops which accentuate social benefits of adoption and thereby increase subsequent adoption rates.

Proposition 7a: Ceteris paribus, greater mutability of quality over time leads to higher adoption rates.

Proposition 7b: Ceteris paribus, greater mutability of quality over time leads to lesser schema clarity.

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FIGURE 10 ABOUT HERE
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DISCUSSION

When diffusion of a certain practice is not full, but rather limited, researchers may portray this outcome as an institutionalization attempt that falls short, and identify reasons for this "failure" (Davis and Anderson 2008, Rao and Giorgi 2006). Or, limited diffusion might be understood as a short-lived state in which organizations oscillate between adopting and abandoning practices (Abrahamson 1991, Miner and Raghavan 1999). However, limited diffusion does not necessarily need to be unstable or

transitory. In fact, limited diffusion can constitute a schema for classification. This occurs when the diffusing practice is enticing, yet external pressures to adopt are not overwhelming, thereby permitting actors to make equally legitimate adoption or rejection decisions. A college diploma functions as a powerful classificatory schema not despite its limited diffusion, but *because* of it.

This view of diffusion-as-classification stands in contrast to the more common view of diffusion-as-institutionalization. In the latter view, practices diffuse because environmental pressures compel actors to adopt practices in order to signal legitimacy. As these practices become prevalent, adoption becomes taken-for-granted. Institutionalization coincides with full diffusion and ubiquity because the entire population succumbs to isomorphic pressures. However, this tight linkage between diffusion and institutionalization generates a "conceptual muddle" (Colyvas and Jonsson 2011: 27) not only around definitions of diffusion and institutionalization but also around the meaningfulness of empirical findings (Boxenbaum and Jonsson 2008).

Conceptualizing diffusion as classification helps surmount some of these difficulties by shifting analytical focus to the classificatory schema, rather than practice adoption. In viewing diffusion as classification, it is the schema that is understood to be a taken-for-granted, rationalized myth (Meyer and Rowan 1977), not the adoption decision. Actors do not question the social fact of the classificatory schema or the necessity of sorting themselves, but they do think carefully about whether to adopt or reject a diffusing practice, because both adoption and rejection are legitimate decisions. Reified classificatory schemas persist precisely because they do not render adoption decisions trivial, and do not jeopardize actors' legitimacy. This conceptualization disentangles not only institutionalization and diffusion but also institutionalization and legitimacy (Deephouse and Suchman 2008, Jepperson 1991) by demonstrating that the legitimacy of an institution - the classificatory schema as social fact - does not necessarily beget a dichotomy of legitimate (adoption) decisions vs. illegitimate (rejection) decisions.

Further, diffusion as classification suggests that audiences attempting to influence producer behavior face a quandary when striving to institutionalize practices intended to improve governance, increase workplace diversity, reduce environmental impacts and the like. If audiences proactively demand

adoption of certain practices by increasing legitimacy intensity and making non-adoption illegitimate, they cannot concurrently assess producer quality. The more pressure they place upon a producer to adopt a practice, the more likely that these pressures will lead to symbolic adoption and full diffusion, thereby leading to reduction in schema clarity. In other words, the more strident the demands to adopt practices, the less audiences will be able to assess the effectiveness of these practices. Conversely, reasonably accurate assessment of producer quality can be attained if legitimacy intensity is kept low, but low legitimacy intensity will not impel many producers to adopt practices that can lead to desired outcomes. Audiences cannot pressure producers to adopt a certain practice and at the same time accurately assess the effectiveness of that practice.

Importantly, diffusion as classification can occur in a stable context, in line with calls for development of theory that does not require "momentous events" (Powell and Colyvas 2008: 277) for explaining institutional emergence and change (Clemens and Cook 1999, Schneiberg 2005). Indeed, the only driver of diffusion highlighted in the model is local decision-making performed by structurally equivalent actors (Schelling 1978, Strang and Soule 1998). Entrenchment and institutionalization are simply the end result of self-reinforcing feedback loops established by "interacting, thoughtful (but perhaps not brilliant) agents" (Miller and Page 2007: 3) co-existing in a stable environment, engaged in "mundane [tasks], aimed at interpretation, alignment, and muddling through" (Powell and Colyvas 2008: 277). Consequently, the model's output suggests that classificatory schemas can emerge haphazardly, as opposed to being purposefully initiated or externally imposed. Institutional entrepreneurship or other forms of agency are not a precondition.

To reiterate, not all instances of diffusion can or should be explained through a classificatory lens. Classification through practice adoption, it would seem, emerges and becomes entrenched over relatively long periods of time, rather than in instances where adoption and abandonment occur in spikes or waves. Classificatory schemas based on limited diffusion would appear to be those which are based on practices that necessitate significant investment of resources and prior deliberation, as opposed to inexpensive practices, or those which delegitimize non-adopters. Such classificatory schemas will generally be distinct

from extant classificatory schemas already salient to a field, around which common categories have previously adhered. It may be particularly fruitful to use the lens of diffusion-as-classification to examine the origins and persistence of stratification by means of logics (Lounsbury 2007) and governance (Okhmatovskiy and David 2012, Schneiberg 2007), in order to understand the contingencies which lead to the establishment of fields characterized by an enduring coexistence of small numbers of organizational archetypes.

Additionally, classificatory schemas and their attendant diffusion trajectories can be of central importance for analyzing collective identity development (Fiol and Romanelli 2012) Whether by rejecting a diffusing practice (such as modern vinification techniques) or adopting one (such as socially responsible investing principles), identity based movements are meaningful only insofar as they stand in contrast to other, more mainstream behavior (Lamont and Molnár 2002). Actors intent on maintaining differentiation may therefore see value in preserving and reinforcing an emergent classificatory schema, as opposed to having practices diffuse fully. Indeed, identity movements appear to be, by their very nature, minority movements, prone to self-limiting dynamics that preserve uniqueness (Bearman and Brückner 2001).

Of course, theoretical statements developed and illustrated through simulation should be subsequently extended and probed through empirical analysis. Models are inevitably shaped by choices made by modelers, such as scope conditions, and the functional form of parameters employed (Starbuck 2006). Recognizing that models are unavoidably incomplete and simplified depictions of complex social realities, future empirical research can provide much greater nuance and richness to processes of diffusion as classification. In particular, future work should strive to link the somewhat artificial coefficients utilized in the model with grounded, real-world constructs. Greater specificity will serve not only to test the usefulness of the view of diffusion as classification, but also allow comparative research between contexts. Longitudinal studies, especially, are likely to be helpful for understanding which emergent classificatory schemas are attended, how they gain traction, when they become institutionalized, and why they become irrelevant, either through full diffusion or abandonment.

Notably, the model developed here did not explore the effects of implementation. Adoption is essentially a discrete, dichotomous decision, and is often executed in a manner that is visible to audiences, particularly when legitimacy intensity is high. Implementation, in contrast, is often neither discrete nor dichotomous. Actors and organizations that decide to adopt a practice can then implement it to a varying extent, doing so either quickly or gradually. Often, the thoroughness of implementation is not easy for external audiences to gauge. Moreover, the relation between adoption and implementation is often nuanced. For example, practices can be adopted grudgingly and ceremonially but then implemented more thoroughly than initially expected, yielding surprisingly significant changes in quality (Feldman and March 1981, Lounsbury 2001). Future research should delve more deeply into the link between adoption and implementation, and its ensuing effects on classification.

An important line of future research could integrate the view of classification presented here and extant work on classificatory schemas as disciplinary devices driven, in large part, by enthusiasts, market mediators and opinion leaders (Hannan et al. 2007, Iyengar et al. 2011, Zuckerman 1999). Many practices that begin diffusing do, at some point, attract market mediators and undergo codification and formalization via processes of standardization, accreditation and association, eventually becoming institutionalized sources of trust in market settings (Zucker 1986). When and at what point market mediators seize upon emergent classificatory schemas and convert them into such sources of trust is a worthy arena for future research. More broadly, development of a more profound understanding of how classificatory schemas can serve as both informative (enabling) and disciplinary (constraining) market mechanisms would appear to be an important theoretical undertaking.

Organizational scholars have devoted considerable effort to understanding how organizations respond to institutional pressures of various types (Oliver 1991). By and large, however, prior research has suggested that responses to these pressures are bifurcate. Actors are often portrayed as facing an all-or-nothing decision, to either succumb to existing norms, or set about overthrowing them through acts of institutional entrepreneurship, with very little middle-ground between these two extremes (David and Bitektine 2009, Heugens and Lander 2009, Powell and Colyvas 2008). A more nuanced view would

suggest that a middle-ground is in fact plausible, engendering limited diffusion and thereby maintaining diversity. A better understanding of the antecedents of limited diffusion and its consequences is thus conducive to a more robust and comprehensive theory of institutions.

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TABLE 1

Summary of model variables and parameters

Parameter	**Definition**	**Base model value**	**Subsequent variation**	**Theoretical development**
N	Population size	1000		
q_i	Quality	Mean = 100; Standard Deviation = 18	9 – 25	Proposition 3
			q = q(t)	Proposition 7
p_i	Perceptivity	Mean = 100; Standard Deviation = 18		
H	Awareness Threshold	131		
MAC	Maximum Adoption Cost	150	100 - 180	Proposition 2
$AI_{t=1}$	Audience Interest at t=1	41		
C	Scaling constant for social benefits of adoption	1400		
IB	Instrumental Benefits of adoption	6	IB = constant*Q	Proposition 6
LI	Legitimacy Intensity	1	1 - 2	Proposition 1

FIGURE 1

Proportions of high school and university graduates in the United States, 1940-2008 (U.S. Census data)

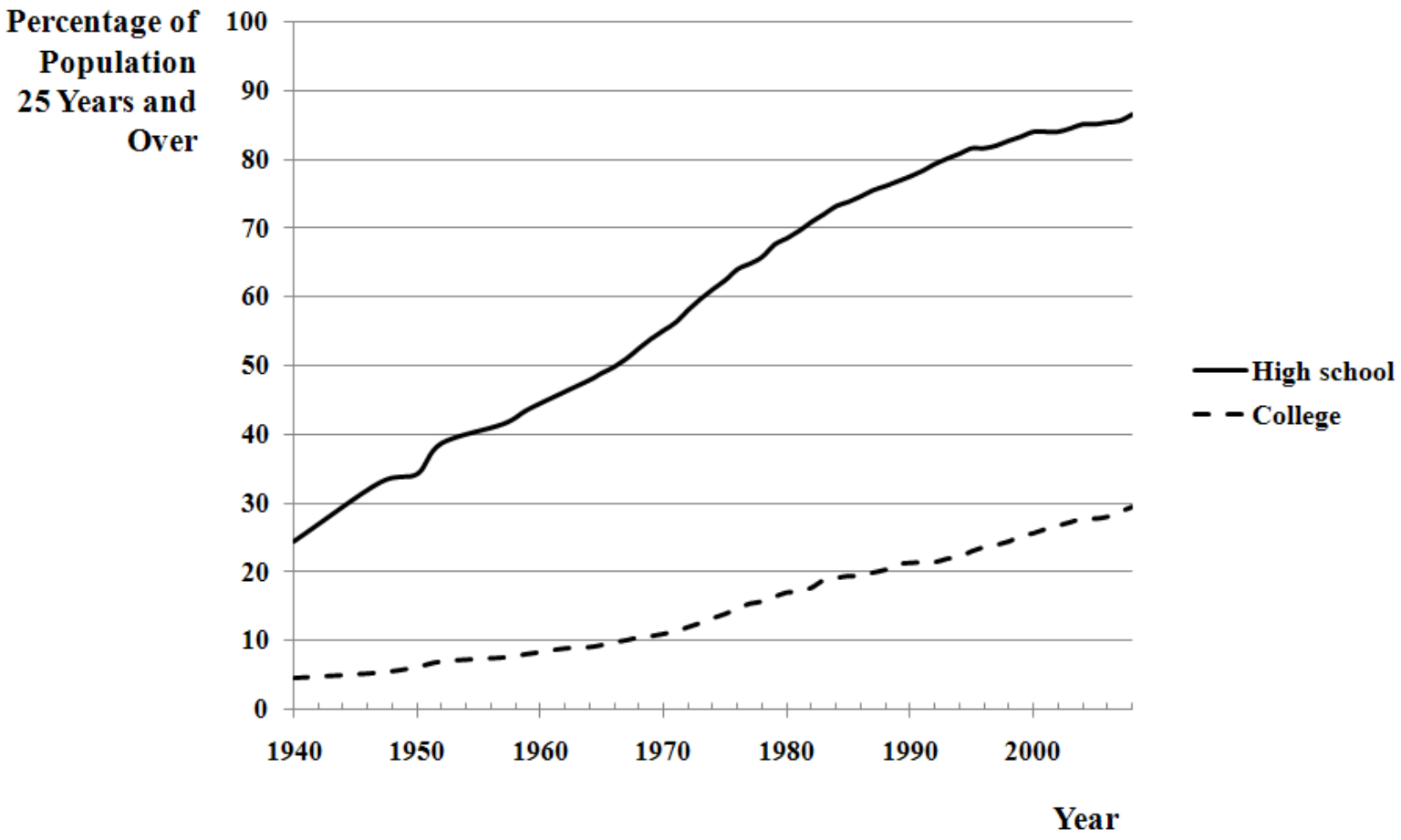
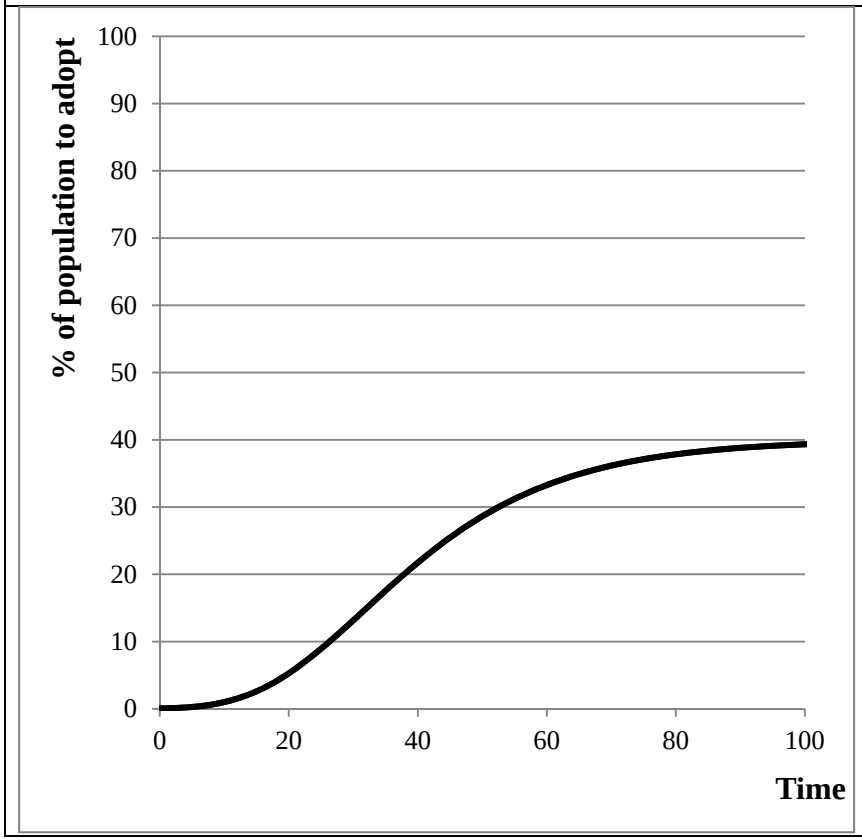


FIGURE 2

Full and limited diffusion trajectories

2a – Limited diffusion and the emergence of a classificatory schema



2b – Full diffusion precluding classification

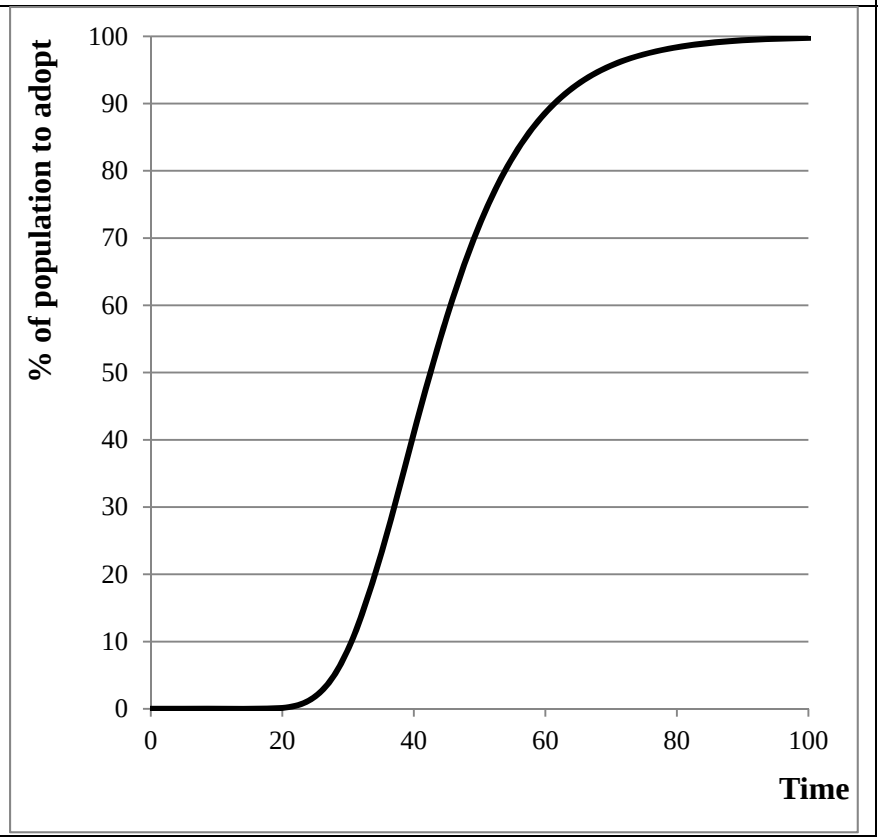


FIGURE 3

Decision Process

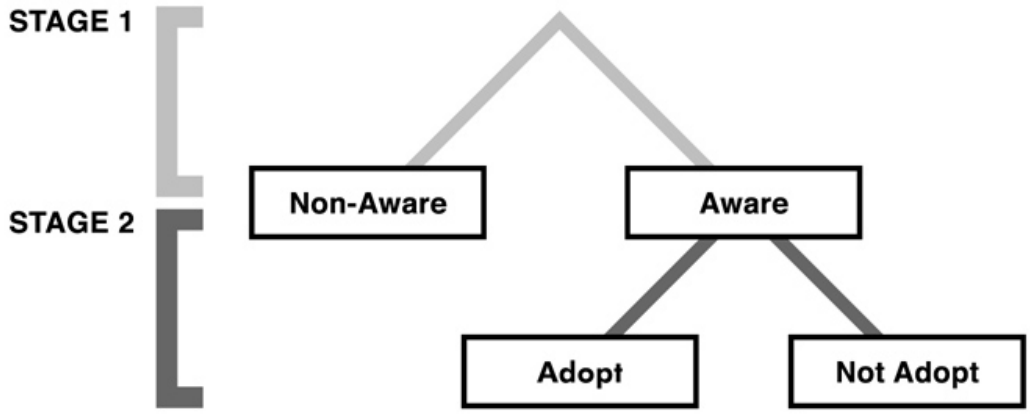
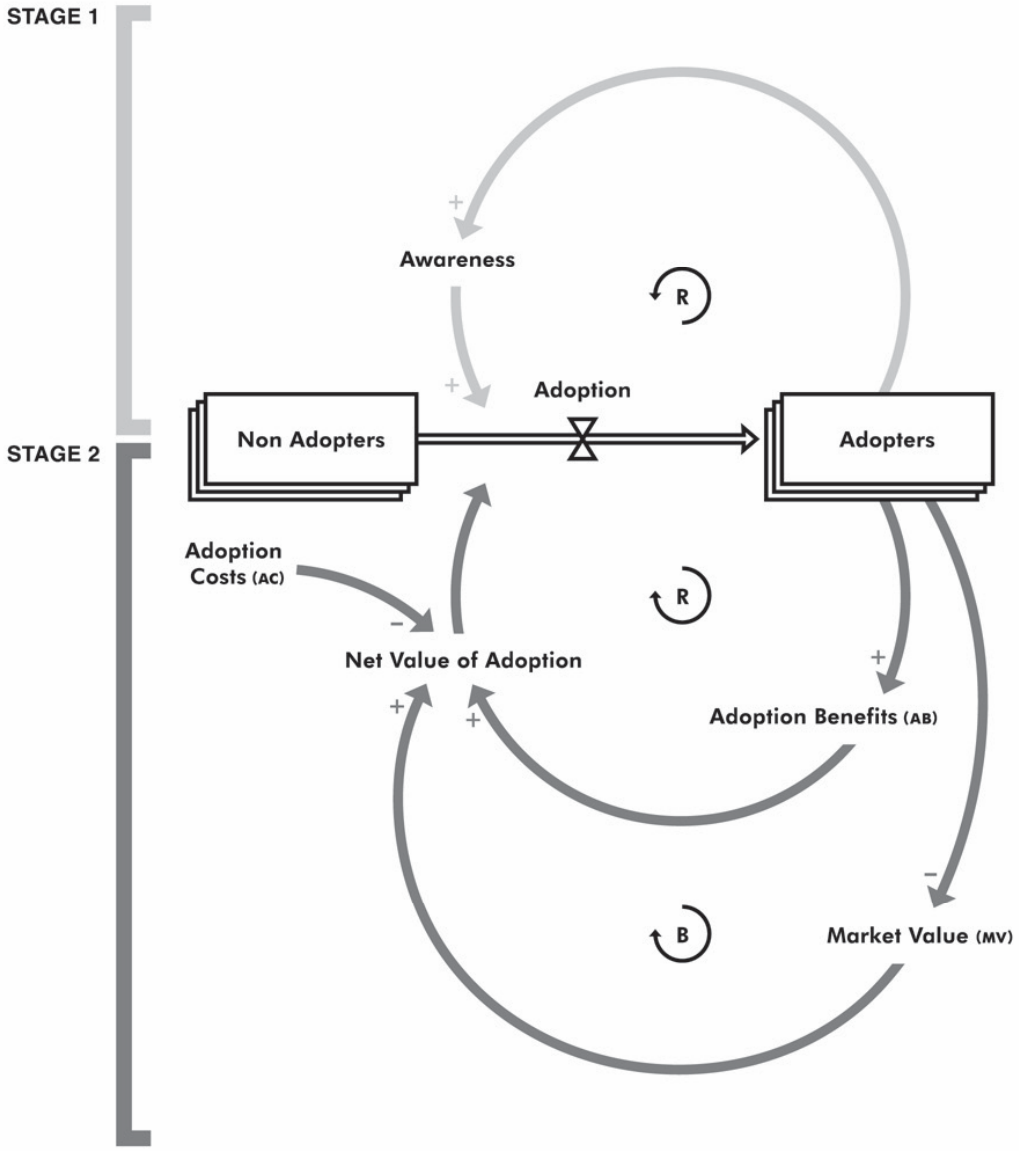


FIGURE 4

Causal loop diagram of the simulation model



Note: The "+" and "-" signs adjacent to each of the arrows indicate the causal influence of one variable upon the next. A "+" sign implies that a higher value of the variable at the base of the arrow leads to a higher value in the variable at the head of the arrow, and a "-" sign implies the reverse. Conjointly, sequences of positive and negative arrows lead to either "Reinforcing" (positive feedback) or "Balancing" (negative feedback) loops, as indicated by the letters "B" and "R" in each of the three causal loops in the model. The Stage 1 causal loop determines awareness, and is separate and prior to the Stage 2 loops which jointly determine adoption. The adoption loops are triggered only if a producer is aware of the practice.

FIGURE 5

Limited and full diffusion, contingent upon *legitimacy intensity* (LI)

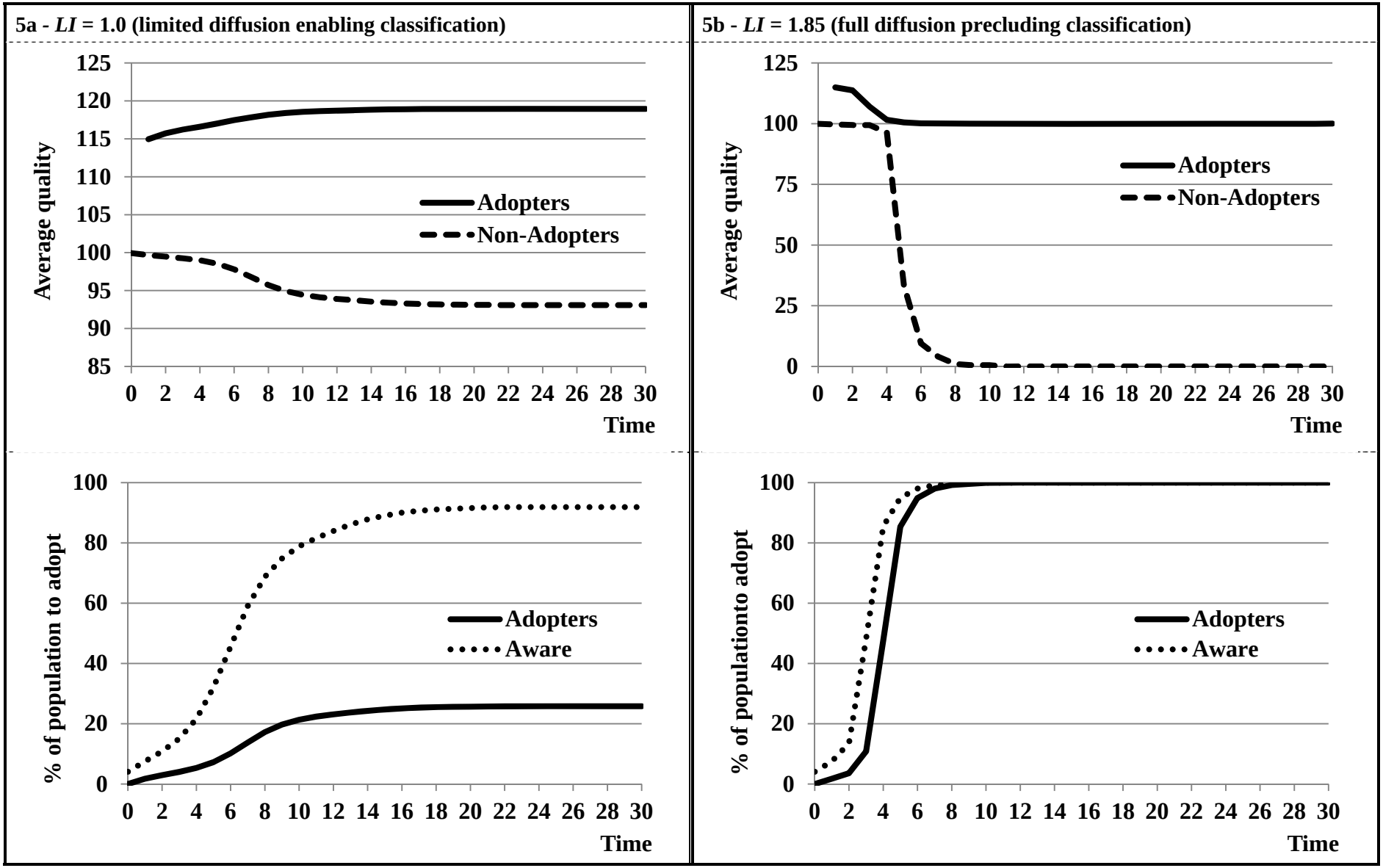
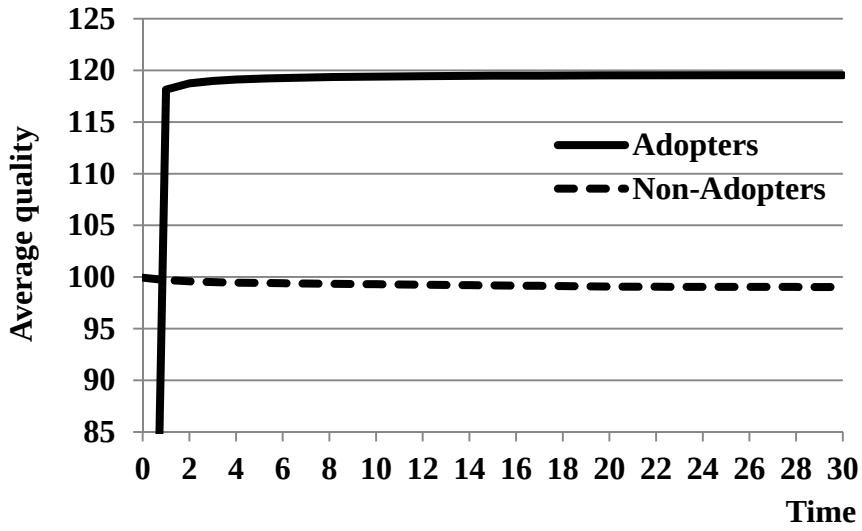


FIGURE 6

Concave diffusion trajectory characterizing non-emergence of classificatory schema (*LI* = 1.0; *IC* = 155)



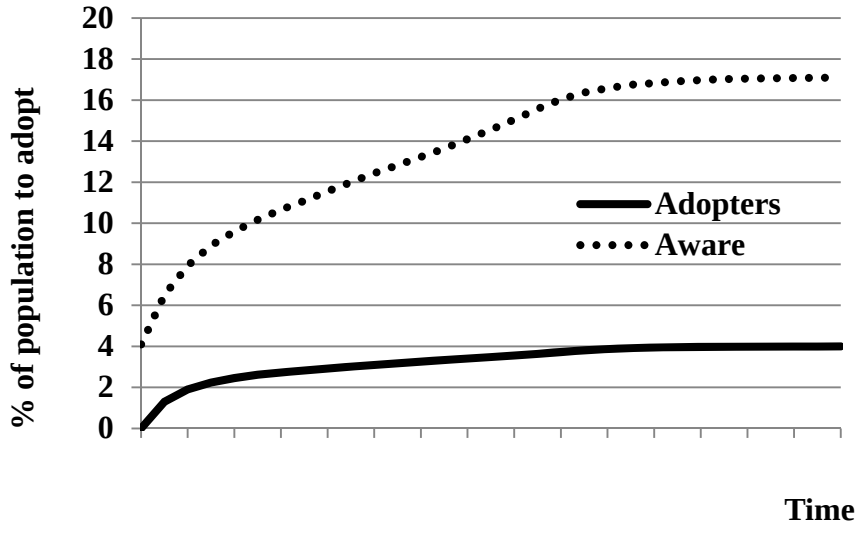
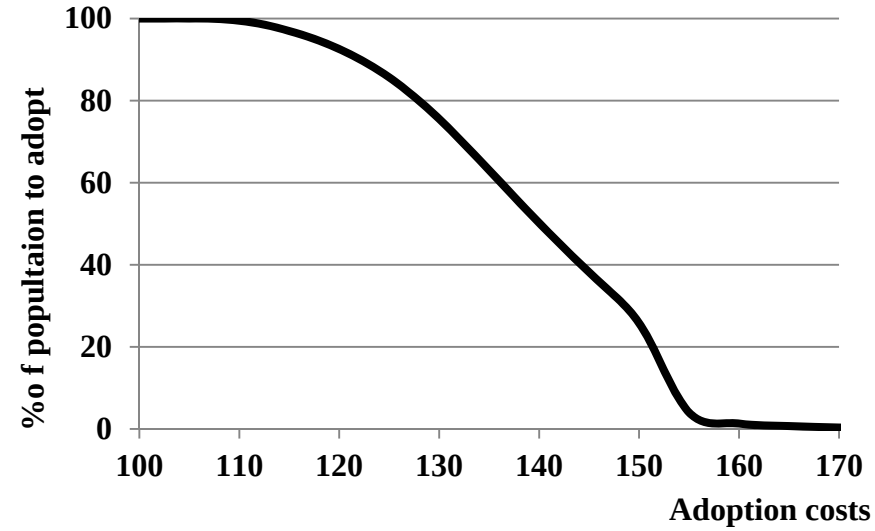


FIGURE 7

Effect of adoption costs on adoption rates and schema clarity (LI = 1.0)



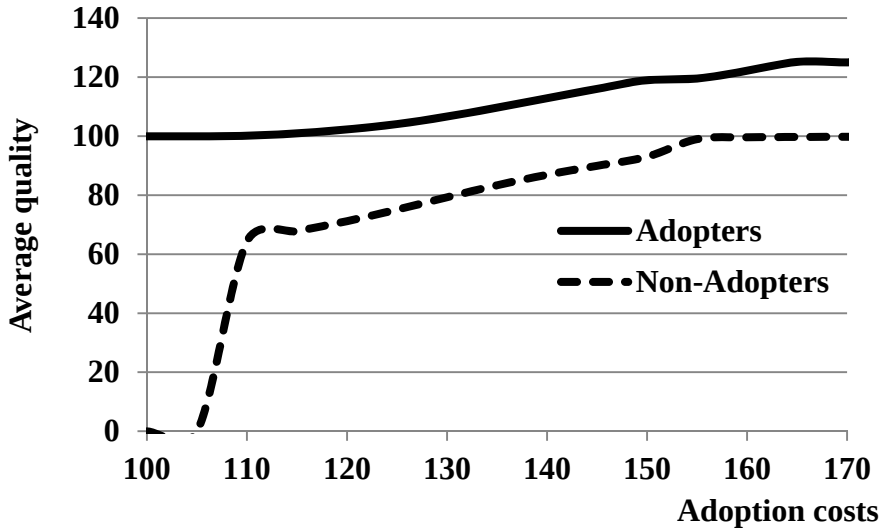
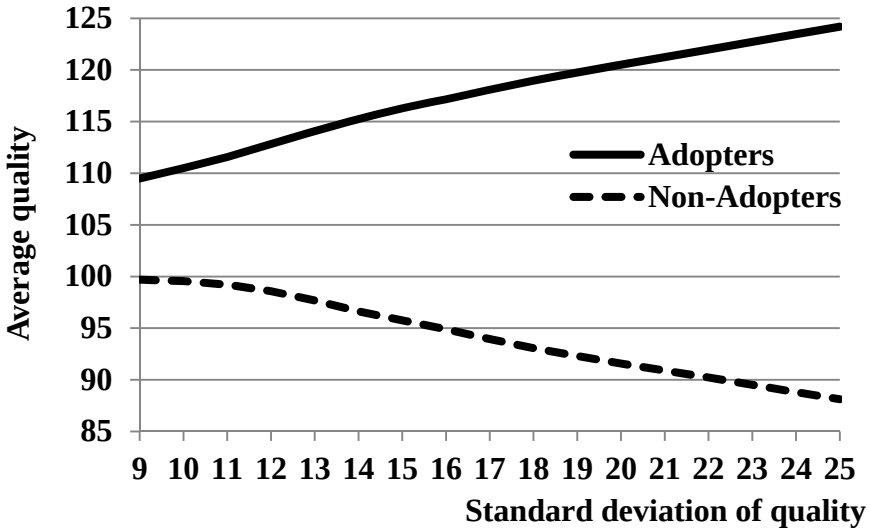


FIGURE 8

Effect of population heterogeneity on adoption rates and schema clarity



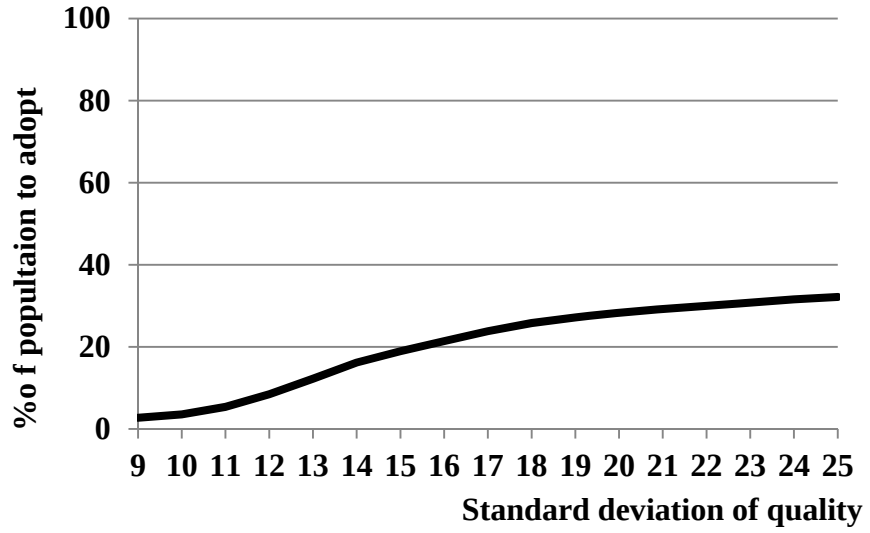
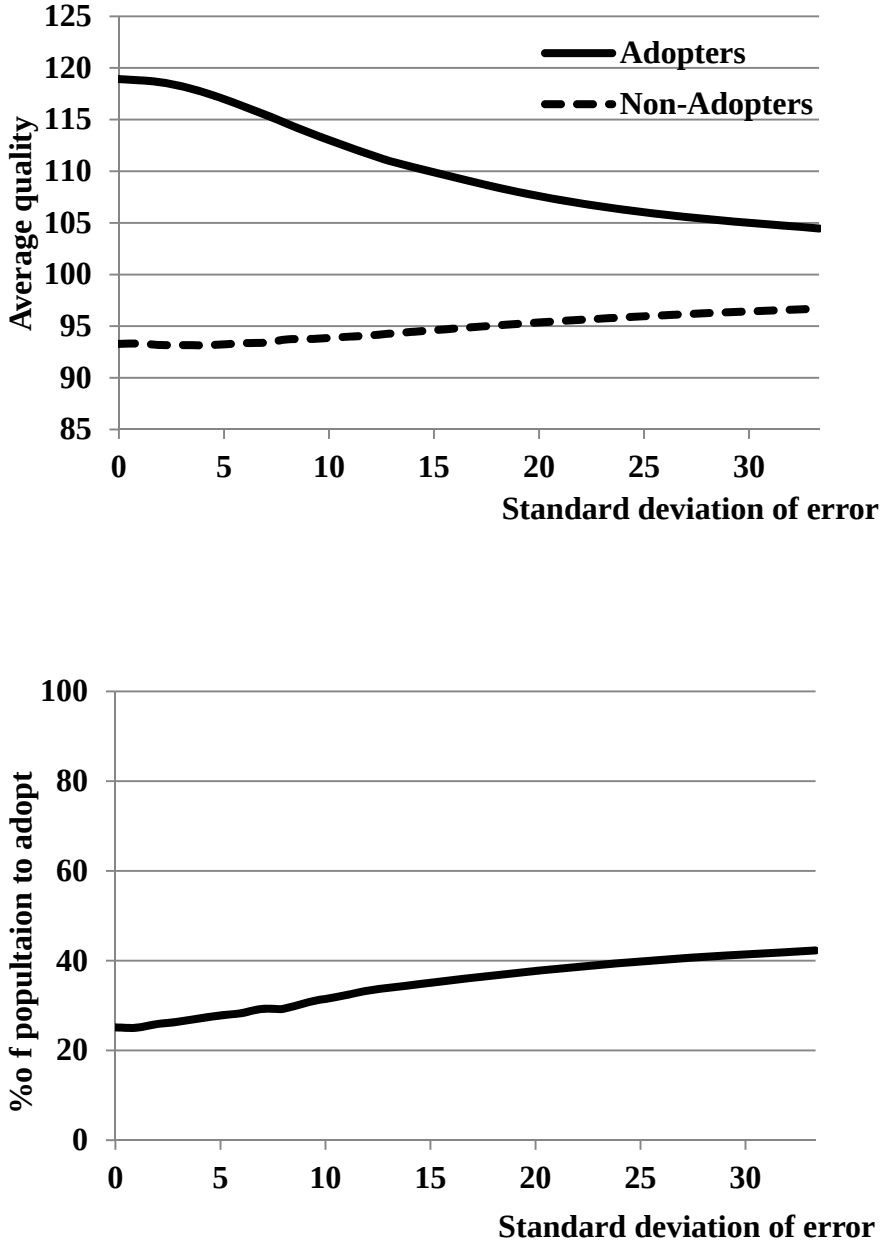


FIGURE 9

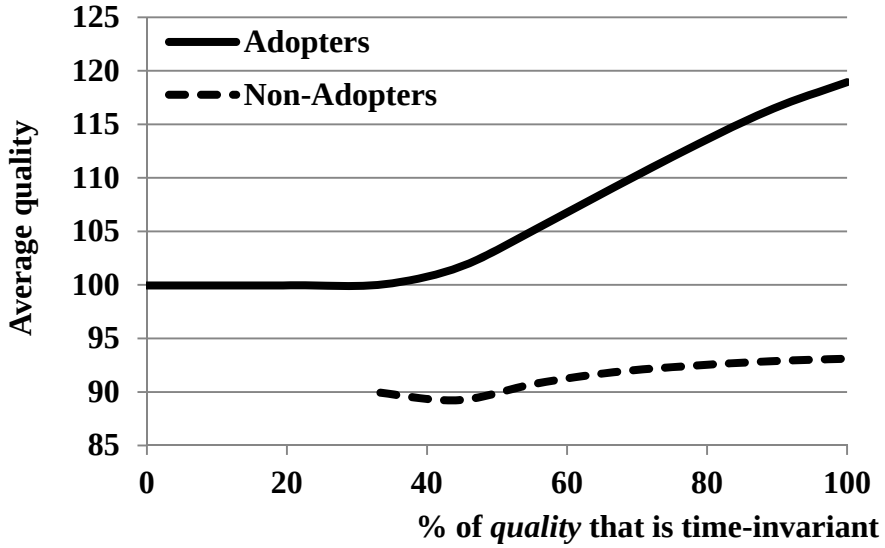
Effect of bounded rationality on adoption rates and schema clarity

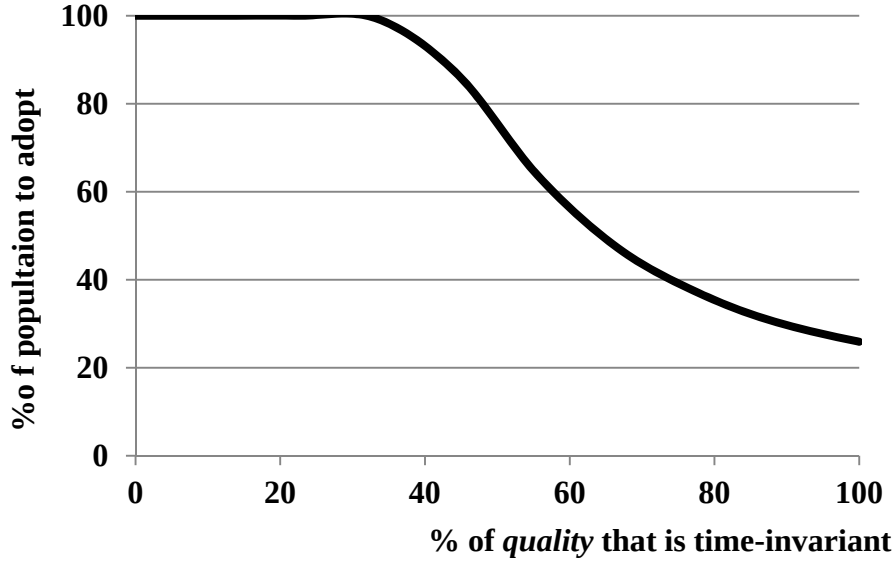


Note: Standard deviation of error is expressed as a percentage of *adoption cost*.

FIGURE 10

Effect of quality consistency on adoption rates and schema clarity





Note: 100 on the x axis implies that *quality* is time invariant. 50 implies that half the *quality* measure is time invariant, and the other half is drawn from a random distribution in each time *t*.