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ABSTRACT

We present a model of coarse thinking, in which individuals group situations into categories, and transfer the informational content of a given message from situations in a category where it is useful to those where it is not. The model explains how uninformative messages can be persuasive, particularly in low involvement situations, and how objectively informative messages can be dropped by the persuader without the audience assuming the worst. The model sheds light on product branding, the structure of product attributes, and several puzzling aspects of mutual fund advertising.

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Introduction

In most societies, a tremendous amount of resources is devoted to persuasion (McCloskey and Klamer 1995). Selling, advertising, political campaigns, organized religion, law, much of the media, and good parts of education are devoted to changing beliefs in a way advantageous to the persuader. Moreover, persuasion is not simply about expending resources: the exact content of the message crucially shapes its effectiveness[2]. But what constitutes persuasive content?

Economists typically assume that only one type of persuasive content matters: objectively useful information. Stigler (1987, p. 243), for example, writes that "advertising may be defined as the provision of information about the availability and quality of a commodity." Economists have typically modeled persuasion, including advertising (Stigler 1961), political campaigns (Downs 1957), or legal argument (Milgrom and Roberts 1986, Dewatripont and Tirole 1999) as provision of information. In some frameworks, such as Grossman (1981), Grossman and Hart (1980), Milgrom (1981), and Okuno-Fujiwara et al. (1990), the persuader uses information strategically, but conveys information nonetheless[3].

Psychologists understand persuasion quite differently. They argue that people evaluate various propositions or objects using representativeness, metaphors, analogies, and more generally associative strategies (Tversky and Kahneman 1982, Lakoff 1987, Edelman 1992, Zaltman 1997). Associations play a central role in our approach. There are two ways associations may operate, which one might call associative thinking and

[2] Bertrand et al. (2006) present some clear evidence that persuasive content matters in a field experiment using loan advertisements by a South African consumer lending institution.
[3] Recent years saw a revival of research on communication and persuasion from the information-theoretic perspective. See, e.g., Glazer and Rubinstein (2001, 2004).

associative feeling. Associative thinking is transference of information from one context to another. When a message has some connotation in one context, a person may take it to have a similar connotation in a related context (even when it does not). This kind of association operates through a cognitive process. Associative feeling, on the other hand, reflects an emotional response to some messages. This response may be a quick and dirty aggregator of many associations summarized in a message. Persuasion surely takes advantage of both types of associations, but here we focus on the cognitive channel.

To motivate our analysis, consider three persuasive messages:

A successful television and print advertising campaign for American Express Travelers Checks featured Karl Malden, an actor who played a detective on the television show "The Streets of San Francisco." The ads advised the audience that, for safety, they should carry American Express Travelers Checks rather than cash.

After the crash of the internet bubble, the brokerage firm Charles Schwab launched an advertising campaign that featured judges, ship captains, crossing guards, doctors, grandmothers, and other steady and reliable individuals, each standing next to a Schwab investment specialist. The headline of one ad, depicting a Schwab professional standing next to a pediatrician, advised that "Both are seen as pillars of trust."

As an example of political persuasion, consider Arnold Schwarzenegger's memorable speech at the 2004 Republican National Convention. In the best remembered part of his speech, Schwarzenegger defended free trade: "To those critics who are so pessimistic about our economy, I say: Don't be economic girlie men!... Now they say India and China are overtaking us. Don't you believe it. We may hit a few bumps – but America always moves ahead. That's what Americans do."

What do these persuasive messages have in common? In all of them, a piece of information that has some objective value in one context gets transferred by the persuader into another context, where it has limited or no value. A piece of data that might carry objective weight in one situation is brought to bear on another, where it is uninformative.

In the American Express example, the listeners, many of whom have watched "The Streets of San Francisco," know that Karl Malden keeps people safe. The ads seek to convince them that the travelers' checks recommended by Karl Malden also keep people safe. The information (Karl Malden is involved) that is useful in one context (an episode of a television show) for predicting safety is being transferred to another context (travelers checks), where it is objectively useless. For how can it matter objectively which actor endorses travelers' checks?

The Schwab ads take advantage of the belief that people in some positions – judges, pediatricians, grandmothers – are both trustworthy and wise. The ads hope that this information (trustworthiness), which from the general experience of the readers is a good description of some types of professionals (judges and pediatricians), rubs off on its investment professionals as well, where the proposition is not as self-evident.

Schwarzenegger taps into a common conceptualization of foreign trade as a contest or even war. His audience undoubtedly finds the information (America always moves ahead) as plausible for a contest, especially coming from a former champion. Accepting that trade is a contest, Schwarzenegger invites the audience to transfer the information that Americans typically win into that realm. Of course, both the contest analogy and the winning message are largely irrelevant for the assessment of whether free trade, outsourcing, or globalization is beneficial to the public.

Schwarzenegger's speech was not accidental. In his advice to Congressional candidates, the Republican political strategist Frank Luntz (2006) writes: "Never, never, never begin a response to outsourcing by saying it is beneficial to the U.S. economy. Never… Don't talk like economists. Words like 'protectionist,' 'capitalist,' and 'isolationist' turn the average voter off. The key word is winning. It is essential that you capture the theme of winning and insert it into all your communications efforts."

The transfer of data that is informative in one context into another, where it might not be, is obviously related to associational, analogical, or metaphoric thinking, all of which have been discussed by psychologists (e.g., Lakoff 1987, Zaltman 1997). Such thinking is both common and extremely useful in everyday life because it reduces the evaluation of new situations to comparison with familiar ones. Some writers think that, for this reason, our brains have evolved so as to make metaphor and analogy standard hard-wired forms of reasoning (Edelman 1992). Of course, the patterns of thought that are *usually* extremely helpful are not *always* so. We suggest that persuaders take advantage of people utilizing a strategy which, though usually useful, may or may not be useful in the situation of interest to the persuader.

To this end, we present a model of persuasion that assumes that individuals deviate from Bayesian rationality in one key way. Specifically, people put situations into categories, and failing to differentiate between co-categorized situations, use one model for all the situations in the same category. We refer to such inference as coarse thinking. Coarse thinking implies transference: the impact of a message in one situation depends on how that message is interpreted in other co-categorized situations. Persuasion takes advantage of coarse thinking.

The model yields several implications. First, it shows how messages that are non-informative in a given situation nonetheless affect beliefs, and delineates the contexts in which they do so more effectively. Second, it demonstrates the effects of increasing the sophistication of the audience on the efficacy of non-informative persuasion. The recognition by the audience that the persuader is acting strategically reduces, but does not eliminate, the scope for non-informative persuasion. Third, with coarse thinking, the persuader can get away with concealing payoff-relevant information without his audience assuming the worst, even when the audience takes the persuader's strategy into account. This result gets us away from the full revelation conclusions of, for example, Grossman-Hart (1980) or Milgrom (1981)[4]. On the other hand, if the audience is fully Bayesian and treats each situation differentially – does not engage on coarse thinking – the possibility of uninformative persuasion disappears, at least in our model.

Perhaps the largest literature looking at persuasion focuses on advertising. Nelson's (1974) classic study tried to broaden the range of what might be seen as informative advertising. Stigler and Becker (1977) and Becker and Murphy (1993) examine models in which advertising enters the utility function directly. Some recent studies, such as Gabaix and Laibson (2006) and Shapiro (2006), offer explicitly behavioral models of advertising. Recent research on persuasion has also gone beyond advertising, and includes studies of hatred (Glaeser 2005), media (Mullainathan and Shleifer 2002, 2005, Gentzkow and Shapiro 2006, Della Vigna 2007), and political persuasion (Becker 2001, Murphy and Shleifer 2004, Glaeser, Ponzetto, and Shapiro

[4] Okuno-Fujiwara, Postlewaite, and Suzumura (1990) provide sufficient conditions for information revelation and show that when these conditions are not met full revelation may not occur in equilibrium. While these conditions can be restrictive (in particular, that all messages are certifiable) they are naturally met in the applications we consider. For instance, past returns of a mutual fund are certifiable and are known to the mutual fund at the time of advertisement.

2005). As far as we know, however, our paper is the first to study persuasion in a model of associative thinking so central to psychological work.

Economic theory has also considered analogical reasoning. Aragones, Gilboa, Postlewaite, and Schmeidler (2005) study persuasion as re-organization of available data. Case Based Decision Theory (Gilboa and Schmeidler 1995) assumes that, when facing a new problem, an agent chooses an action based on what has performed well in a similar problem in the past. Our model focuses on beliefs rather than risk attitudes. Analogy Based Expectation Equilibrium (Jehiel 2005, Jehiel and Koessler 2006, Ettinger and Jehiel 2006) is a game theoretic solution concept that assumes that individual forecast other players' behavior in a coarse manner. Individuals group distinct situations, states, and games together into analogy classes and expect others' behavior to be their average behavior across elements of the class. Our model focuses on beliefs about nature rather than about other players' strategies.

In Section 2, we present a model of inference and persuasion for both Bayesian and coarse thinkers. We show how this model can account for the examples we have described, as well as more generally for the creation of objectively uninformative messages by persuaders. This is the case regardless of whether the audience understands that the persuader is acting strategically. In Section 3, we ask whether persuaders can get away with dropping informative messages. Again, with coarse thinkers, the answer is yes, even if they understand that the persuader is acting strategically. In Sections 4-6, we show that the basic model helps shed light on three important problems in industrial organization: product branding, the choice of product attributes, and the advertisement of mutual funds. Section 7 concludes.

2. Uninformative Messages

Basic setup

In this section, we show that persuaders may pay to create *uninformative* messages. An individual must assess the quality of a given object, such as a traveler's check, a mutual fund, or a political candidate. We denote this underlying quality of the object by $q \in (-\infty,\infty)$. The individual receives a potentially informative message $m \in \{b, g\}$ about q. He then uses this message to form expectations about underlying quality.

The individual faces two similar, but not identical, situations $s \in \{0, 1\}$. Absent persuasion, the underlying joint distribution of quality, messages and situations is $p(q,m,s)$. We make several assumptions about this joint distribution. First, we assume that the distribution of quality conditional on the situation is the same across situations: $p(q|s=0)=p(q|s=1)=p(q)$. Second, we assume that $p(q)$ is such that the expected quality is zero: $E^B[q|s=0]=E^B[q|s=1]=E^B[q]=0$, where superscript B denotes the rational (Bayesian) expectation. Third, we assume that $p(m|s) > 0$ for all m, s.

A key feature of our model is that messages are informative in one situation (situation 1) but not in the other (situation 0). Specifically, the conditional distributions $p(q|m = b, s = 1)$ and $p(q|m=g, s = 1)$ are such that $E^B(q|m=b,s=1)<E^B(q|m=g,s=1)$. That is, in $s = 1$, the message g reflects good news and b reflects bad news. Note that

$$E^B(q \mid m=b, s=1) = -E^B(q \mid m=g, s=1)\frac{p(m=g \mid s=1)}{p(m=b \mid s=1)} \qquad (1)$$

In contrast, we assume that these messages are uninformative in situation s=0, i.e, $p(q|m=g, s = 0) = p(q|m = b, s = 0) = p(q|s = 0) = p(q)$ for all q. The Bayesian expectation of quality in situation 0 given message m is then:

$$E^B(q \mid m=g, s=0) = E^B(q \mid m=b, s=0) = E^B(q \mid s=0) = 0 \tag{2}$$

Schwarzenegger's defense of free trade illustrates our setup. Let $s=0$ be foreign trade, and $s=1$ be a military engagement or a sports contest. Let message b be some neutral or null message[5], and g be "Americans are likely to win." Message g is informative for the assessment of American success in $s=1$, but not in $s=0$. A Bayesian is able to distinguish among the different situations s he faces, and therefore to update his beliefs correctly for each situation. By using a different model for each situation, a Bayesian correctly infers that Schwarzenegger's reminder would improve his assessment of American success in a military engagement, but not in globalization.

Coarse Beliefs

The essential assumption in our model is that individuals do not have separate mental representations for every situation. Instead, they have only one representation for all the situations in a category and are effectively unable to differentiate between these situations. For example, they might interpret the message "Americans are likely to win" in the same way for foreign trade as for a military engagement. Categorical thinking has been previously modeled by Mullainathan (2000), Fryer and Jackson (2004), and Peski (2006); we rely most closely on Mullainathan (2000).

Specifically, we assume that individuals group situations $s = 0$ and $s = 1$ together into the same category. Upon receiving the message m, the coarse thinker updates as a

[5] In the formal model, the message b denotes a bad signal. Here also the neutral message would also imply a negative update (relative to no news) since it indicates the absence of good news.

Bayesian who observes the category he is in but not the specific situation. Such a thinker, for each situation $s = 0, 1$, derives the conditional distribution

$$p^C(q \mid m,s) = p(q \mid m,s=0)p(s=0 \mid m) + p(q \mid m,s=1)p(s=1 \mid m) \tag{3}$$

Individuals respond not to the actual informativeness of a message in the current situation *s*, but rather to a weighted average of its informativeness across all situations co-categorized with *s*. The coarse thinker weighs the informativeness of the message in situation *s* by the likelihood of that situation in the category given that the message is *m*: $p(s|m)$. This would, for example, be the updating rule of a frequentist who receives data from both situations but ignores which situation generated the data[6].

The coarse thinker's updating rule implies that, upon observing message *m*, his revised expectation of quality is:

$$\begin{aligned} E^C(q \mid m,s) &= E^B(q \mid m,s=0)p(s=0 \mid m) + E^B(q \mid m,s=1)p(s=1 \mid m) \\ &= E^B(q \mid m,s=1)p(s=1 \mid m) \\ &= \begin{cases} E^B(q \mid m=g,s=1)\dfrac{p(m=g \mid s=1)}{p(m=g)}p(s=1) \text{ if } m=g \\ -E^B(q \mid m=g,s=1)\dfrac{p(m=g \mid s=1)}{p(m=b)}p(s=1) \text{ if } m=b \end{cases} \end{aligned} \tag{4}$$

In expression (4), the second to last equality takes into account the fact that $E^B(q|m, s = 0) = 0$ for all *m*. Coarseness implies that updating happens as if the person cannot distinguish the various situations in a category. When individuals form categories that include only one situation, their inference is identical to that of a Bayesian.

[6] Our results also go through if the coarse thinker is even more naïve (or coarse), and does not condition the weights of different situations on the message; i.e, if he uses $p(s=0)$ and $p(s=1)$ as weights.

This model produces empirically plausible patterns of under- and over-reaction. By comparing the updating rules, we can see which messages are under- or over-responded to by a coarse thinker relative to a Bayesian. To do this, recall that

$$E^{C}(q \mid m,s) = E^{B}(q \mid m,s=0)\,p(s=0 \mid m) + E^{B}(q \mid m,s=1)\,p(s=1 \mid m) \qquad (5)$$

Comparing this to the Bayesian's response $E^B(q|m,s)$ suggests two distortions. First, since $p(s \mid m) \leq 1$, the response of the coarse thinker only mutedly depends on how informative that message m is for situation s itself, as measured by $E^B(q|m,s)$. This effect can lead to an under-reaction to news. Take, for example, the case where $E^B(q|m,s)>0$ and $E^B(q|m,s') = 0$ for s'. We see here that $E^C(q|m,s) \leq E^B(q|m,s)$. Coarse thinking leads to an under-response to news relative to the Bayesian. The uninformativeness of the message in other situations dilutes its impact in situation s, precisely because the current situation is under-weighted in the update rule.

Second, the response of the coarse thinker also depends on a term that the Bayesian's response does not depend on: the informativeness of the message in the other situation s' in the same category. This implies that the coarse thinker could react to non-information or over-react to information. Take the case, for example, where $E^B(q|m,s) = 0$, so the message is uninformative in situation s, but is informative in the other co-categorized situation ($E^B(q|m,s') > 0$). Then, $E^C(q|m,s) \geq E^B(q|m,s)$. The coarse thinker is now reacting to a piece of data uninformative in situation s because it is informative in other situations in the same category. His use of the same model to interpret messages in all situations leads him to over-react to non-informative data. This, we suggest, is what a person responding to Schwarzenegger's characterization of trade, or to Karl Malden's endorsement of travelers' checks, is doing. This transference of information across situations drives our results below. Indeed, the strategy of persuasion is to trigger such transference: successful persuasion in our model takes advantage of over-reaction.

The perspective on over-reaction used in this model is similar to that used in some recent research in finance, which discusses stock price movements in response to non-information. Daniel and Titman (2006) suggest that over-pricing of some growth stocks is best understood as an over-reaction to non-fundamental "intangible" information, which is subsequently reversed. Analytically, our view of over-reaction as an unjustified response to news about items within the same category is distinct from the interpretation of over-reaction in Mullainathan (2000) and Mullainathan-Shleifer (2002), who look at it in terms of category change. The perspective here is much closer to the finance perspective, which talks about stock price moves unjustified by fundamental news.

As this discussion makes clear, our results rely crucially on assumptions regarding which situations belong together in a category. This raises a question: what determines categories? We take categorizations to be exogenous and fixed. People already bear in mind that judges and grandmothers are trustworthy. Indeed, the perspective that people already have systems of mental categories and associations that the advertiser needs to tap into is not unusual (see, e.g., Zaltman 1997, Rapaille 2006).

More generally, a situation can be part of several categories, and these categories may change over time and place. Depending on which product attribute the persuader wants to stress, he could rely on a different categorization. Mullainathan and Shleifer (2006) suggest along these lines that individuals co-categorize investing with other activities that make you *free to* do things when stock prices are rising rapidly, but with protection and activities that keep you *free from* adversity in more normal circumstances.

Advertisers of mutual funds accordingly use images of wealth when stock prices are rising, and of security when they are falling. Moreover, some members of categories are more central (prototypical) than others, so agents who reason categorically do not treat them symmetrically. Football is a more prototypical example of a contest than international trade. Last but not least, persuasion itself can create or shape categories. For decades, the Avis car rental company advertised as "We are number two (to Hertz). We try harder." The campaign relied on the general category of underdogs, but suggested in the area where it was probably not used previously[7]. All these issues of category determination are extremely important, but are not considered in the model.

Persuasion (face value)

The persuader in situation $s = 0$ maximizes the individual's expected quality, net of persuasion costs. Presumably, the higher the expected quality, the greater the support the persuader receives, whether through sales, votes, or membership in his organization.[8] The persuader can alter messages. Specifically we assume that the persuader observes the signal m that the individual would see absent intervention (for example, if the shampoo appears on a store shelf without advertising). He can then either intervene prior to the individual's observing m and create an altered message $m' \in \{g, b\}$ not equal to m at cost c, or simply report $m' = m$ at zero cost. The individual then observes m' and never sees the original m. We assume that the persuader in situation $s = 0$ can create an altered message since m is uninformative in $s = 0$.

[7] Along these lines, Aragones et al (2005) study persuasion as re-organization of available data. In our model, if messages create categories then the set of co-categorized situations becomes $C(s,m)$ rather than $C(s)$, and the analysis becomes correspondingly more complex.

[8] In a Bayesian framework, Holden and Kamenica (2006) examine persuasion where the objective is to change the consumer's decision rather than his beliefs about the state of the world.

The persuader's strategy is determined by how individuals respond to the messages. In this subsection, we make the *face value assumption*: individuals, including both Bayesians and coarse thinkers, take the message *m'* they see and update as if it were the original message. They do not make the extra inference that seeing *m'* tells them that the original message might have been a different *m*. In the next subsection, we allow for strategic inference by the individual, and show that the results presented in this section are largely robust. The persuader maximizes his payoff, given by:

$$\begin{array}{c} E(q\,|\,m',s)-c \text{ if } m'\neq m \\ E(q\,|\,m',s) \text{ if } m'=m \end{array} \tag{6}$$

The persuader's payoff when individuals are face value coarse thinkers is mathematically equivalent to his payoff in an alternative setup where individuals are face value Bayesians, but the persuader observes the situation *s* while his audience does not. However, the two setups have very different interpretations. In the coarse thinking setup, individuals observe the situation they are in, but use the same model to interpret messages in co-categorized situations. In the asymmetric information setup, individuals have distinct models for the two situations, but do not observe which situation they are in.

Proposition 1: Suppose individuals are face value Bayesians and messages are uninformative in situation $s = 0$. Then the optimal strategy of the persuader in situation $s = 0$ is to always report *m* and to never pay the cost to replace *m* with another message.

Proof: For an audience of face value Bayesians, the persuader never pays the cost to create an uninformative signal and simply reports the truth. To understand why, first note that the persuader would never optimally choose to alter the message $m = g$ since it is the most positive message available. Additionally, he would never pay the cost to alter the message $m = b$ and replace it with $m' = g$ for face value Bayesians since the payoff if he reports $m = b$ is $E^B(q|m' = b, s = 0) = 0$ which is greater than the payoff if he replaces $m = b$ with $m' = g$: $E^B(q|m' = g, s = 0) - c = - c < 0$. ♦

The face value coarse thinker, on the other hand, is vulnerable to persuasion:

Proposition 2: Suppose individuals are face value coarse thinkers and messages are uninformative in situation $s = 0$. Then the optimal strategy of the persuader in situation $s = 0$ may involve creation of a message. Specifically, the persuader's optimal strategy dictates replacing $m = b$ with $m' = g$ if

$$c \quad < \quad E^B(q \mid m = g, s = 1)\, p(m = g \mid s = 1)\, p(s = 1)\left(\frac{1}{p(m = b)\, p(m = g)}\right) \tag{7}$$

$$\equiv \qquad c^*.$$

Proof: To understand this result, note that if the persuader reports $m = b$ to a face value coarse thinker, his payoff is: $E^C(q \mid m = b, s) = -E^B(q \mid m = g, s = 1)\frac{p(m = g \mid s = 1)}{p(m = b)}p(s = 1)$. If he replaces $m = b$ with $m = g$, his payoff is

$E^C(q \mid m = g, s) - c = E^B(q \mid m = g, s = 1)\frac{p(m = g \mid s = 1)}{p(m = g)}p(s = 1) - c$. Subtracting the first payoff from the second, we find that the persuader replaces the message if this difference is positive or, equivalently, if $c < c^*$. ♦

Condition (7) yields a corollary:

Corollary 1: Suppose individuals are face value coarse thinkers and let c^* be the upper bound on the cost of fabrication for which it is optimal for the persuader in situation $s=0$ to replace $m = b$ with $m' = g$. Then, c^* is increasing in (i) the probability of situation 1, $p(s = 1)$ and (ii) the informativeness of message g in $s = 1$, $E^B(q \mid m = g, s = 1)$.

According to Proposition 1, persuaders never manufacture messages for face-value Bayesians. Because messages in situation $s = 0$ are assumed to be uninformative, Bayesians – unlike coarse thinkers – do not update their beliefs from them. Persuaders may, however, manufacture messages for coarse thinkers. Their decision depends on whether the gap (in terms of the improved assessment of quality) between the best possible message and the true message is big enough to offset the cost of persuasion.

Corollary 1 highlights the fact that, with two co-categorized situations, persuaders are more likely to manufacture a message in situation s if it has a lower probability within its category. Since the benefit for manufacturing messages is the transference of informational content from other situations in a category to the current one, a higher probability of these other situations increases transference and therefore this benefit.

This point may shed light on what advertisers refer to as consumer involvement, a notion closely related to but not identical to that of "stakes." A high involvement product occupies a huge probability space in its category ($p(s = 0)$ is high), so the transference from other situations is small, and hence so is the benefit of non-informative advertising. Our model predicts, as the marketing research recommends, that advertising in these instances should be informative (Sutherland and Sylvester 2000). In contrast, low involvement products are mixed up in consumers' minds with many similar situations and hence there is greater scope for persuasion, exactly as the marketing literature suggests. American Express travelers' checks and Schwarzenegger's defense of free trade are both consistent with this point. Voting may be another low involvement activity, which encourages non-informative advertising. Our point is *not* that people are incapable of rational high involvement thinking, but rather that in many instances they do not engage in such thinking, perhaps because it is not worth it. It is precisely in those instances of coarse thinking that persuasion pays.

Persuasion (sophisticated)

So far we have assumed that individuals take information at face value. Sophisticated individuals, however, make inferences from the observed message about what the underlying information of the persuader must have been, recognizing that he is a rational payoff maximizer. We now ask how the recognition of strategic behavior influences inference about the true state of affairs.

Suppose that the persuader operates according to a strategy that dictates replacing the message *m* with message *m'* with probability $\phi(m, m')$. We assume that individuals know this strategy and update their expectations of quality accordingly. Define $p_\phi(m \mid s, m') = \dfrac{p(m \mid s)\phi(m, m')}{p(m \mid s)\phi(m, m') + p(m' \mid s)\phi(m', m')}$ to be the probability that the true message is *m* when the audience observes message *m'* and the persuader's strategy is $\phi(m, m')$. A Bayesian in this case updates his assessment of quality according to:

$$p^{SB}(q \mid m', s) = p_\phi(g \mid m', s)p(q \mid g, s) + p_\phi(b \mid m', s)p(q \mid b, s) \tag{8}$$

implying that his revised expectation of quality is:

$$E^{SB}(q \mid m', s) = p_\phi(g \mid m', s)E^B(q \mid g, s) + p_\phi(b \mid m', s)E^B(q \mid b, s) \tag{9}$$

The coarse thinker has a more complicated updating rule. He makes inferences about quality based on the strategies of persuaders in the whole category, rather than based solely on the strategy of the persuader in the particular situation[9]. Define $p_{\phi}(s \mid m)$ to be the probability the coarse thinker assigns to being in situation *s* given that he observes message *m*. He then updates his assessment of quality according to:

$$p^{SC}{}_{\phi}(q \mid m', s) = p^{SB}(q \mid m', s=0) p_{\phi}(s=0 \mid m') + p^{SB}(q \mid m', s=1) p_{\phi}(s=1 \mid m') \quad (10)$$

implying that his revised expectation of quality is:

$$E^{SC}(q \mid m', s) = E^{SB}(q \mid m', s=0) p_{\phi}(s=0 \mid m') + E^{SB}(q \mid m', s=1) p_{\phi}(s=1 \mid m') \quad (11)$$

As before, we assume that the persuader maximizes (6). The equilibrium concept we use is sequential equilibrium (Kreps and Wilson 1982).[10] Our next results describe the effectiveness of persuasion against sophisticated Bayesians and coarse thinkers.

Proposition 3: Suppose that individuals are sophisticated Bayesians and that messages are uninformative in situation $s = 0$. Then, in the unique equilibrium, the optimal strategy of the persuader in situation $s = 0$ is to always report *m* and to never pay the cost to replace *m* with *m'*.

Proof: See appendix. ♦

Proposition 4: Suppose individuals are sophisticated coarse thinkers, that messages are uninformative in situation $s = 0$, and that the persuader in situation $s = 1$ always tells the truth. Then, whenever $c < c^*$, it cannot be optimal for the persuader in situation $s = 0$ to

[9] We assume that the sophisticated coarse thinker updates as a sophisticated Bayesian who differentiates between persuaders' strategies across co-categorized situations but does not observe the situation he is in.

[10] Technically the equilibrium concept we use is not exactly sequential equilibrium since we assume that individuals do not always update rationally. We use the natural analog of sequential equilibrium given our assumptions regarding how individuals update beliefs.

always tell the truth: in any equilibrium, the persuader replaces $m = b$ with $m' = g$ with some positive probability, but this probability might be less than one. When $c > c^*$, there is an equilibrium in which the persuader always tells the truth.

Proof: See appendix. ♦

Proposition 4 shows that sophistication does not eliminate the advantage of uninformative persuasion for coarse thinkers. The cost threshold c^* is the same as in the face-value case[11]. In contrast to the face value case, however, when condition (7) holds, the equilibrium probability that the persuader replaces $m = b$ with $m' = g$ may be less than one. While sophistication, as opposed to belief in the face value of the message, might render persuasion less effective and therefore less likely to be used at a given level of cost, it does not eliminate the incentive to manufacture uninformative data. Proposition 4 shows that persuasion is primarily a consequence of coarse thinking and not of the failure to understand the strategic motive of the persuader. The face value assumption simplifies our results, but it is not critical.

3. Informative Messages

Face Value

In Section 2, we considered the case where messages are uninformative in situation *0* and informative in situation *1*. This assumption enabled us to examine when uninformative messages might be created by the persuader. It is also interesting to ask

[11] Unlike in the face value case, however, for some parameter values there exist equilibria in which the persuader replaces $m = b$ with $m' = g$ even when $c > c^*$.

when informative messages, such as mutual fund fees, can be dropped[12]. This question is most naturally considered in a situation where persuaders cannot fabricate messages, as they did in Section 2, perhaps because such deception (e.g., about fees) is illegal.

To examine this question, we consider the case where messages are informative in both situations, i.e., $p(q|m, s = 0) = p(q|m, s = 1)$ for all q, m, where $p(q|m, s = 1)$ is as specified in Section 2. In addition, we expand the set of possible messages to include the empty message, Ø, and assume that the empty message is in general uninformative:

$$p(q \mid \varnothing, s) = p\ (q \mid s) \tag{12}$$

for all q and $s = 0, 1$[13].

To get clear results, we make two strong assumptions. First, we assume that the empty message occurs naturally in situation $s = 1$, but not in $s = 0$. In other words, $p(Ø|s = 0) = 0$ and $p(Ø|s = 1) \neq 0$. Second, to capture the idea that persuaders cannot lie about easily verifiable facts without consequence, we assume that, since messages are informative, the persuader can never change a message in situation $s = 0$, but only drop it, i.e., costlessly replace it with the empty message, Ø. An advertiser of athletic shoes can omit the information about their price from the ads, but he cannot lie about it.

Consider the optimal strategy of the persuader when individuals take messages at face value, be they Bayesian or coarse thinkers.

Proposition 5: Suppose individuals are face value Bayesians or face value coarse thinkers and messages are informative in situation $s = 0$. Then the optimal strategy of the persuader in situation $s = 0$ is to replace $m = b$ with $m = Ø$, and report $m = g$ truthfully.

---

[12] Gabaix and Laibson (2006) show that firms might choose to suppress information (such as the cost of add-ons) in the presence of naïve consumers. See also the discussion in Ellison (2005). Eyster and Rabin (2005) show that when individuals do not fully appreciate how much other peoples' actions are correlated with their types, people may successfully hide negative information in equilibrium.

[13] We assume that $p(q|Ø,s) = p(q|s)$ even when $p(m = Ø|s) = 0$.

Proof: The persuader has only two options when facing message $m \in \{g, b\}$: report m or replace m with $Ø$ at zero cost. In making his decision, the persuader compares his payoff from reporting m, $E(q|m, s)$, with the payoff from dropping m, $E(q|m = Ø, s) = 0$. When individuals are face value Bayesians, the persuader in situation $s = 0$ chooses to drop m whenever $m = b$ since $E^B(q|m = b, s = 0) < 0 = E^B(q|m = Ø, s = 0)$. Likewise, when individuals are face value coarse thinkers, the persuader in situation $s = 0$ chooses to drop m whenever $m = b$ since $E^C(q|m = b, s = 0) < 0 = E^C(q|m = Ø, s = 0)$. On the other hand, the persuader chooses to report $m = g$ in either case since this message is positive.♦

Sophistication

Now we examine the effects of sophistication. To simplify the analysis, we assume that, when the persuader is indifferent between dropping and not dropping a message, he chooses to not drop it. Again, the equilibrium concept we utilize is sequential equilibrium. The following propositions summarize the results:

Proposition 6: Suppose that individuals are sophisticated Bayesians, that messages are informative in situation $s = 0$, and that $p(Ø|s = 0) = 0$. Then, in the unique equilibrium, the persuader does not drop any messages.[14]

Proof: See appendix. ♦

[14] The uniqueness of the equilibrium hinges on our assumption that, when indifferent between dropping and not dropping a message, the persuader chooses not to drop it. When this assumption is relaxed, there are also equilibria under which the persuader drops the bad message with positive probability (and always truthfully reports the good message). In these equilibria, the persuader is indifferent between dropping and not dropping the bad message since the audience updates in the same way when viewing the empty message as when viewing the bad one.

Proposition 7: Suppose that individuals are sophisticated coarse thinkers, that messages are informative in situation $s = 0$, that the persuader in situation $s = 1$ is telling the truth, and that $p(Ø|s = 0) = 0$ but $p(Ø|s = 1) \neq 0$. Then, in the unique equilibrium, the persuader drops message $m = b$ with probability 1.[15]

Proof: See appendix. ♦

Proposition 6 illustrates the traditional analysis of persuasion with sophisticated Bayesian consumers. In this case, when messages are informative and the only possible explanation for a missing message is that the persuader dropped it, firms face only one avenue for persuasion: full provision of all available information; they cannot use non-information to persuade. Our result replicates the standard Grossman/Hart (1980) – Grossman (1981) – Milgrom (1981) result that, with sophisticated Bayesian thinkers it does not pay the persuader to drop messages when the probability of the empty message is zero since, when messages are absent, the audience assumes the worst.[16]

On the other hand, Proposition 7 highlights the fact that, even when the probability of the empty message is zero in a situation, there may still be room for selective dropping of information when the audience consists of sophisticated coarse thinkers. In particular, Proposition 7 demonstrates that when the probability of the empty message is non-zero in a co-categorized situation, it pays for the persuader to drop

[15] The result that the persuader always drops bad messages with probability one when individuals are sophisticated coarse thinkers is an artifact of the assumptions that there is no cost to dropping messages and that there is only one negative message. When there is a positive cost to dropping messages or when there are several different negative messages (some less negative than others), then the persuader may drop some of the negative messages with probability less than one in equilibrium. However, unlike when individuals are sophisticated Bayesians, the empty message will always be viewed as a less negative signal than the most negative message when individuals are sophisticated coarse thinkers.

[16] Of course, when the empty message occurs naturally with positive probability, the unraveling result no longer holds (see Example 3 in Okuno-Fujiwara, Postlewaite, and Suzumura, 1990).

negative messages. Unlike the sophisticated Bayesian, the sophisticated coarse thinker places some weight on the message being naturally absent.

4. Application: Product Branding

One of the major challenges for the fields of Industrial Organization and Marketing is to understand product branding. Consumers buy many branded products, often repeatedly, at higher prices than identical or nearly identical "generic" products (Tirole 1988). According to Peter and Olson (2005, p. 97), 71% of cigarette buyers, 65% of mayonnaise buyers, 61% of toothpaste buyers, and 53% of bath soap buyers are loyal to their brands. Although some brands are physically different from generic products, others, such as Clorox bleach, are identical. In this section, we show how firms may be able to differentiate their products and create brands through uninformative advertising.

To fix ideas, consider the case of California Burgundy. Burgundy is a French region that produces high quality and expensive wines from the pinot noir grape. California also produces expensive wines from the pinot noir grape. In California, they are called pinot noir, not burgundy. About 40 years ago, California wine producers started making inexpensive red wines called California Burgundy. These wines contain no pinot noir grape, only cheaper varietals. Even so, a check on the internet showed that Peter Vella sells a 5-liter jug of California Burgundy for $11.99, compared to $10.99 for Delicious Red. California Burgundy is a brand that commands a price premium even though its physical characteristics have nothing to do with burgundy wine.

Consider a consumer facing one of two similar situations: buying a bottle of American red wine ($s = US$) and buying a bottle of French red wine ($s = FR$). Each bottle is either labeled Table (m = *Table)* or Burgundy (m = *Burgundy*). We assume that neither message is informative in evaluating the quality of American wine, but that the label Burgundy is a positive signal of quality of French wine. Specifically[17]

$$\begin{aligned} E^B(q \mid m = Burgundy, s = FR) &> E^B(q \mid m = Table, s = FR) = 0 \\ E^B(q \mid m = Burgundy, s = US) &= E^B(q \mid m = Table, s = US) = 0. \end{aligned} \tag{13}$$

Fraction β of consumers is coarse thinkers who co-categorize buying a bottle of American wine with buying a bottle of French wine. Fraction 1 - β is Bayesians who differentiate the two situations. For coarse thinkers (fraction β of the population):

$$E^C(q \mid m = Burgundy, s = US) > E^C(q \mid m = Table, s = US) \tag{14}$$

For Bayesians (fraction 1 - β of the population):

$$E^B(q \mid m = Burgundy, s = US) = E^B(q \mid m = Table, s = US). \tag{15}$$

All consumers are assumed to take messages at face value.

There are two competing homogeneous red wine producers f = *1, 2* in the United States. Each producer can at zero cost label the wine Table or pay an advertising cost $c > 0$ to label the wine Burgundy.[18] The marginal cost of production is normalized to 0.

Consumers buy at most one bottle from one of the two American wine producers. Decision utility from purchasing a bottle from firm f is given by:

$$U(f) = q_f - p_f,$$

[17] Unlike in the other sections, we are normalizing the expected quality given the neutral message to be zero in the informative situation.
[18] We assume that m = *Burgundy* is not a naturally occurring message for American wine. That is, $p(m = Burgundy \mid s = US) = 0$.

where q_f denotes the quality and p_f the price of firm *f's* wine. Utility from not buying wine is normalized to zero. Consumers maximize the expected (decision) utility.

Consider a game with three periods. In the first period, each firm simultaneously decides whether or not to pay the cost *c* to label its wine Burgundy. In the second, each firm simultaneously chooses the price of its wine. In the third period, consumers decide which wine (if any) to buy. As before, we consider sequential equilibria. We define:

$$\bar{c} \equiv \beta E^C (q \,|\, m = Burgundy, s = US) \tag{17}$$

We restrict attention to pure strategy equilibria in which both firms sell to a positive fraction of the population on the equilibrium path. We then have the following results:

Proposition 8: Suppose all individuals are face value Bayesians and there are two competing homogeneous wine producers in the U.S. Then, in equilibrium, neither producer pays to label its wine Burgundy, and both producers charge the same price.

Proof: See appendix. ♦

Proposition 9: Suppose fraction β of consumers are face value coarse thinkers who co-categorize buying U.S and French wine. Suppose there are two competing homogeneous wine producers in the U.S. If $c < \bar{c}$, product differentiation through uninformative advertising emerges: in the unique equilibrium, one producer replaces *m = Table* with *m' = Burgundy* and charges $\bar{c}/\beta$ for its wine and the other producer reports *m' = Table* and charges zero. The producer charging the higher price sells to the coarse thinkers. If $c > \bar{c}$, then both firms report *m' = Table* and charge zero for their respective wines.

Proof: See appendix. ♦

Proposition 9 shows how product branding can emerge as a market equilibrium. In this equilibrium, the producer of a branded good charges a higher price and earns a profit, whereas the producer of a generic good charges a lower price and does not earn a profit. The reason that this is possible in equilibrium is that the producer of a branded good successfully convinces its coarse-thinking customers that its product is superior by suggesting that it is analogous to something else that they believe is superior. This rendition of branding seems broadly consistent with the standard discussions in the marketing literature (Peter and Olson 2005, Sutherland and Sylvester 2000).

5. Application: Product Attributes

In the analysis so far, persuaders take advantage of coarse thinking by creating messages that influence the audience's assessment of the product, be it a consumer good, a newspaper article, or a public policy. A persuader can also take advantage of coarse thinking by changing actual product attributes. Journalists omit relevant data, or embellish the facts, to tell a story all of whose elements support their narrative (see Mullainathan and Shleifer 2002, 2005). Makers of unhealthy sugar cereals add vitamins to them, and advertise them as being good-for-you. The marketing guru Clotaire Rapaille advised Chrysler to put round rather than square headlights on the Jeep Wrangler to make it look more like a horse. Customers, he figured, analogize driving an open truck to horseback riding, so making a truck look like a horse leads them to expect it to ride like one. This small change in attributes evidently improved sales (Rapaille 2006).

To motivate our analysis more precisely, consider the advertising slogan for the Alberto Culver Natural Silk Shampoo: "We put silk in the bottle." The shampoo actually contained some silk. Nonetheless, during the campaign, the company spokesman conceded that "silk doesn't really do anything for hair" (Carpenter, Glazer and Nakamoto 1994). The audience of the ad was obviously intended to transfer the message that adding silk is good from situations where it is valid, such as fabric, to shampoo[19].

Our model provides a way of thinking about why Culver has changed product attributes, i.e., "put silk in the bottle." An individual faces one of two similar situations: buying a bottle of shampoo (s = *Shampoo*) and buying a tie (s = *Tie*). Suppose both shampoo and ties can be described by a single attribute $a \in \{0, 1\}$, where *0* stands for no silk and *1* stands for some silk. The objective relationship between the underlying quality of the object in situation s and the amount of silk it contains is given by

$$q(a,s) = \alpha^{s} a + \varepsilon, \tag{18}$$

where α^s denotes the weight that should objectively be placed on the attribute a in judging the quality of the product in situation s and ε is a shock with the property that $E(\varepsilon | a) = 0$. This model is a version of Rosen's (1974) hedonic approach, and can be easily extended to multiple dimensions. Marketing research discusses the selection of product attributes in a very similar way (Peter and Olson 2005).

Since the amount of silk is objectively uninformative in the case of shampoo but informative in the case of ties, we assume that $\alpha^{Shampoo} = 0$ and $\alpha^{Tie} = 1$. If the amount of silk is observable, the Bayesian expectation of quality is

$$E^B(q | a, s = Shampoo) = \alpha^{Shampoo} a + E^B(\varepsilon | a) = 0 \tag{19}$$

in the case of shampoo and

[19]A recent reincarnation of this marketing idea, discovered by inspecting products in a drugstore, is *Pure Cashmere Softsoap*, which includes "cashmere extract." Cashmere, of course, adds quality to a sweater.

$$
\begin{aligned}
E^B(q \mid a, s = Tie) &= \alpha^{Tie} a + E^B(\varepsilon \mid a) \\
&= \begin{cases} 1 \text{ if } a = 1 \\ 0 \text{ if } a = 0 \end{cases}
\end{aligned} \tag{20}
$$

in the case of ties. Bayesian consumers expect a bottle of shampoo to be of the same quality whether or not it contains silk, but a tie that contains silk to be of higher quality.

On the other hand, if individuals are coarse thinkers and co-categorize buying a bottle of shampoo with buying a tie then:

$$
\begin{aligned}
E^C(q \mid a, s) &= E^C(\alpha^s \mid a)a + E^C(\varepsilon \mid a) \\
&= \begin{cases} \alpha^{Shampoo} p(s = Shampoo \mid a) + \alpha^{Tie} p(s = Tie \mid a) \text{ if } a = 1 \\ 0 \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \text{if } a = 0 \end{cases} \\
&= \begin{cases} p(s = Tie \mid a) \text{ if } a = 1 \\ 0 \qquad\qquad\qquad \text{if } a = 0 \end{cases}
\end{aligned} \tag{21}
$$

Coarse thinkers expect shampoo that contains silk to be of higher quality.

Suppose that there is a unit mass of identical consumers who can buy at most one bottle of shampoo. Decision utility from purchasing a bottle of shampoo is given by $q - p$, where p is the price of shampoo. Utility from not buying the good is normalized to zero. Consumers maximize expected utility conditional on the observed attributes and are assumed to buy the good when indifferent between buying and not buying.

Consider a monopolist shampoo seller simultaneously deciding on price and whether or not to pay a cost $c > 0$ to "put silk in the bottle" prior to consumers making purchase decisions. The marginal cost of production is constant and normalized to zero. Then, as in Section 2, the company's problem of whether or not to pay the cost to alter the product reduces to solving

$$\max\{E(q \mid a = 1, s = Shampoo) - c, E(q \mid a = 0, s = Shampoo)\}. \qquad (22)$$

Following the logic of Propositions 1 and 2, we have the following results:

Proposition 10: Suppose individuals are Bayesians. Then the shampoo maker does not pay the cost $c > 0$ to "put silk in the bottle."

Proof: See appendix. ♦

Proposition 11: Suppose individuals are coarse thinkers who co-categorize buying a bottle of shampoo with buying a tie. Then the shampoo company pays the cost to "put silk in the bottle" so long as $c < E^C(q \mid a = 1, s) = p(s = Tie \mid a = 1) \equiv \mathrm{c}^*$.

Proof: See appendix. ♦

The silk in the bottle example illustrates how producers might change product attributes to take advantage of coarse thinking, but it is a bit extreme in that silk literally yields no benefit. A more typical example might be that of producers putting vitamins into sugar cereal so as to give coarse thinkers the impression that sugar cereal is good for you. Such a strategy takes advantage of coarse thinkers' view that all members of the category "foods with vitamins" are healthy. Another implication of this analysis, which we do not pursue, is that attribute change might lead to competitive imitation. When one producer adds vitamins to a sugar cereal and succeeds in persuading his customers that the product is healthy, his competitors come under pressure to do likewise. The consequence might be a whole industry selling sugar cereals full of vitamins.

6. Application: Mutual Funds

The mutual fund industry presents a major challenge to financial economics. It is enormous, supervising around $7 trillion of investor assets. It includes thousands of competitors, who nonetheless charge high fees and remain highly profitable. Perhaps most strikingly, it appears to provide no economic value to investors, with virtually all mutual funds underperforming by a significant margin passive investment strategies offered by low-fee index funds (Swensen 2005). How can an industry be so successful while adding so little value and charging so much? Part of the answer is surely successful persuasion.

Our model may help understand mutual fund advertising, and perhaps by implication the success of the industry. Most investors cannot manage their money on their own, and rely on professional advisors, such as mutual funds, for help. Suppose that coarse thinking individuals do not sufficiently differentiate between choosing a mutual fund and selecting other professional advisors, such as doctors or lawyers. Specifically, individuals face two types of situations in selecting professional help: choosing a mutual fund and choosing another professional service.

The different types of messages that an individual might see are as follows. First, he might see information about past performance. For a mutual fund, this could be the return on the fund in the previous year. For another professional service, this could be the history of success of a particular surgery or type of lawsuit. Past performance is hard information that cannot be altered, only dropped. Crucially, we suppose that, for other services, past performance information is sometimes simply unavailable. Second, the individual might see information about the fee for the service. For mutual funds, this is a composite of loads and all fees charged by the fund. For another professional service, this information is its price. Like past performance, fees are hard information, which cannot be altered, only dropped. Again, we suppose that, in some instances, fee information is unavailable for other services. Third, the individual might see qualitative information about the service provider's expertise. For a mutual fund, this would be the "soft" data contained in the ads, such as the number of professionals the money management firm employs or a write-up in a magazine (Reuter and Zitzewitz 2006). For a professional service, this information might include testimonials of past customers.

To apply the results from the previous sections, we assume that only fees are relevant for the evaluation of the quality of a mutual fund (see Carhart 1997, Chevalier and Ellison 1997, Sirri and Tufano 1998, Swensen 2005). In contrast, past performance, fees, and expertise are all relevant for the evaluation of the quality of other services.

If the potential investors in mutual funds are coarse thinkers who co-categorize investment with other professional services, the analysis of the previous sections yields the following predictions. First, mutual funds will report fees when they are low, and drop them when they are high. Second, mutual funds will report past performance when it is good, and drop performance data when it is bad. Third, mutual funds will report data on their expertise (so long as the cost of doing so is low enough), even when these data are objectively uninformative. Note that, in deriving these predictions, we used both the results on dropping informative messages and the results on creating uninformative ones.

These predictions are broadly consistent with the evidence on mutual fund advertising. First, financial ads only rarely include information about fees (Cronqvist 2005). Only the funds with low fees, such as Vanguard, typically talk about them.

Second, as demonstrated by Mullainathan and Shleifer (2006), there is evidence that financial advertisements are more likely to include information on past returns when such information is favorable. The authors study financial advertising in *Money* and *Business Week* magazines during 1994-2003, roughly the full course of the internet bubble. The authors collect all the consumer-oriented financial ads from these magazines, classify them by content, and aggregate them in the quarterly series. One of the variables they consider is the share of ads that contain own past returns (absolute or relative) in all stock mutual fund ads. Figure 1 presents the relationship between this variable and the rolling one quarter lagged Standard and Poor's 500 Index return. As Figure 1 shows, on average only about 60 percent of the mutual fund ads present any data about own past returns, and the correlation between the inclusion of these data in the ads and past market returns is over .7 for both *Money* and *Business Week*. Indeed, Figure 1 makes clear that, after the market crash, past returns disappear from the advertisements. This finding is broadly consistent with the prediction of our model.

Third, again as shown by Mullainathan and Shleifer (2006), much of the information contained in financial advertisements is soft (e.g., describing the alleged expertise and experience of the advertiser). Figure 2 classifies the ads by T. Rowe Price, a mutual fund complex and the most frequent advertiser in the sample, into those for growth funds, other mutual funds, and everything else, which tend to be softer ads about expertise. After the market crashes in 2001, growth fund ads disappear and are replaced, in the first instance, by the softer ads. The post-crash judges and crossing guards campaign from Charles Schwab is representative of a broader phenomenon.

Although one can rationalize all these findings in a number of ways, the perspective of this paper, in which financial advertisers free ride on their audience's broader experience – and hence co-categorization -- with choosing experts, appears to explain all three aspects of the data most simply. By implication, to the extent that the mutual fund industry has succeeded in co-categorizing itself with other suppliers of expertise, we can understand its economic success despite its failure to deliver value.

7. Conclusion

This paper has supplied a simple formal model of associative thinking reflecting ideas about inference and persuasion from such diverse fields as linguistics, psychology, philosophy, politics, and advertising. The main building blocks of the model are categorization and transference: people group diverse situations into categories and use information useful for evaluating one member of a category to evaluate another, even if the information is objectively useless in the latter case. The model includes full Bayesian rationality as a special case, in which each situation is evaluated as if in its own category.

The model sheds light on a number of phenomena. Most importantly, it explains how uninformative persuasion can be effective, especially in low involvement situations, such as evaluating cheap goods or political candidates. The model also helps understand the pervasive phenomenon of persuaders' omitting bad payoff-relevant news from their messages. Both uninformative persuasion and omission of data are possible in our model even if the audience takes into account the strategy of the persuader.

An important prediction of this model is that, for a message to be persuasive, its content must take advantage of available mental categories. Karl Malden would be an effective spokesman for American Express Traveller's Checks, but probably not men's underwear. Angelina Jolie might effectively endorse fragrance, but maybe not mutual funds. In contrast to the view that "sex sells everything," our model suggests that persuasive messages often need to connect with much narrower mental representations.

The model helps in thinking about several otherwise hard-to-understand persuasive messages, but also clarifies some puzzling aspects of marketing. These include product branding, the introduction of useless product attributes, and the content of financial advertising, such as the omission of data about fees and returns (when such data are negative), as well as the preponderance of "soft" messages which, at least in the standard financial model, should be of little interest to investors.

At the methodological level, our model suggests that key to understanding a range of empirically observed manifestations of "bounded rationality" is not either the violation of Bayes' rule, or even the failure of strategic thinking on the part of the decision maker. Rather, the failure seems to lie in the decision maker's use of wrong models, in the very specific sense of co-categorizing distinct situations. Even when coarse thinkers apply Bayes' rule and think strategically, their inference is flawed and they are vulnerable to objectively uninformative persuasion.

As a final point, we reiterate that our paper is just a first step in the analysis of coarse thinking and persuasion. We have not asked how much of persuasion of coarse thinkers is misleading, and how much is a short-cut way to convey useful data (American Express Travelers' Checks may indeed keep you safe). We have treated categories as rigid and exogenously fixed. But, as Lakoff (1987) shows, categories are both multiple and fluid, so the selection of categories becomes a key problem for a persuader. Perhaps most importantly, we have focused on associative thinking rather than associative feeling. Capturing the latter with the tools of economics may significantly advance our understanding of persuasion, and much else as well.

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Appendix: Proofs of Propositions

Proof of Proposition 3: The persuader in situation $s = 0$ cannot choose to replace message m with message $m' \neq m$ in equilibrium. No matter the strategy of the persuader, the payoff if he replaces m with m' is:

$$\begin{aligned} E^{SB}(q \mid m', s=0) - c &= p_\phi(g \mid m', s=0) E^B(q \mid g, s=0) + p_\phi(b \mid m', s=0) E^B(q \mid b, s=0) - c \\ &= p_\phi(g \mid m', s=0) * 0 + p_\phi(b \mid m', s=0) * 0 - c \\ &= -c, \end{aligned}$$

whereas the payoff if he reports m is:

$$\begin{aligned} E^{SB}(q \mid m, s=0) &= 0 \\ &> -c \\ &= E^{SB}(q \mid m', s=0) - c. \end{aligned}$$

Hence, the persuader would be better off deviating from any strategy that places positive probability on replacing message m with message $m' \neq m$, so such a strategy cannot be consistent with equilibrium.♦

Proof of Proposition 4: Suppose that $c < c^*$ and that the strategy of the persuader is to always tell the truth. This cannot be consistent with equilibrium since the persuader is better off deviating from this strategy when facing message $m = b$ and replacing $m = b$ with $m' = g$. In particular, given this strategy, the payoff from deviating is

$$\begin{aligned} E^{SC}(q \mid m'=g, s=0) - c &= E^{SB}(q \mid m'=g, s=0) p_\phi(s=0 \mid m'=g) + E^{SB}(q \mid m'=g, s=1) p_\phi(s=1 \mid m'=g) - c \\ &= E^B(q \mid m'=g, s=0) p(s=0 \mid m'=g) + E^B(q \mid m'=g, s=1) p(s=1 \mid m'=g) - c \\ &= E^C(q \mid m'=g, s) - c \\ &> E^C(q \mid m'=b, s), \end{aligned}$$

the payoff from reporting $m = b$. The final inequality comes from the fact that $c < c^*$.

Unlike in the face value case, the equilibrium probability that the persuader replaces $m = b$ with $m' = g$ when $c < c^*$ may be less than one. The reason is that, for certain parameter values, the benefit of replacing $m = b$ with $m = g$:

$$E^{SC}(q \mid m'=g,s) - E^{SC}(q \mid m'=b,s) = E^{B}(q \mid m=g, s=1)\left[p_{\phi}(s=1 \mid m'=g) + \frac{p(m=g \mid s=1)}{p(m=b \mid s=1)} p_{\phi}(s=1 \mid m'=b) \right]$$

is lower when $\phi(b, g) = 1$ than when $\phi(b, g) = 0$ (note that the net effect of increasing $\phi(b, g)$ on the benefit from fabrication is in general unclear since $p_{\phi}(s=1 \mid m'=g)$ decreases but $p_{\phi}(s=1 \mid m'=b)$ increases). For example, let $p(m = g|s = 1) = p(m = g|s = 0) = ¼$ and $p(s = 0) = ½$. In this case, $c^* = 2/3\ E^{B}(q \mid m=g, s=1)$ and $c^{**} = 8/15\ E^{B}(q \mid m=g, s=1)$, where $c^{**} \equiv E^{SC}(q \mid m'=g,s) - E^{SC}(q \mid m'=b,s)$ for $\phi(b, g) = 1$. Thus, since $E^{SC}(q \mid m'=g,s) - E^{SC}(q \mid m'=b,s)$ is continuous in $\phi(b, g)$, there is a mixed strategy equilibrium where the persuader replaces $m = b$ with probability less than 1 whenever $c^{**} < c < c^*$.

Suppose $c > c^*$. Then there is an equilibrium in which the persuader always tells the truth. To see this, suppose that the strategy of the persuader is to always tell the truth. He obviously does not want to deviate from this strategy when he faces $m = g$. He also does not want to deviate when $m = b$ since, given his strategy, the payoff from telling the truth is

$$\begin{aligned} E^{SC}(q \mid m'=b,s=0) &= E^{SB}(q \mid m'=b,s=0)p_{\phi}(s=0 \mid m'=b) + E^{SB}(q \mid m'=b,s=1)p_{\phi}(s=1 \mid m'=b) \\ &= E^{B}(q \mid m'=b,s=0)p(s=0 \mid m'=b) + E^{B}(q \mid m'=b,s=1)p(s=1 \mid m'=b) \\ &= E^{C}(q \mid m'=b,s) \\ &> E^{C}(q \mid m'=g,s) - c, \end{aligned}$$

his payoff from deviating. The last inequality comes from $c > c^*$. ♦

Proof of Proposition 6: Note first that the persuader will not drop message $m = g$ with positive probability in equilibrium. To see this, consider the two possible cases where the persuader drops $m = g$ with positive probability in equilibrium: (i) the persuader drops message $m = g$ with positive probability and drops message $m = b$ with zero probability in equilibrium and (ii) the persuader drops message $m = g$ with positive probability and message $m = b$ with positive probability in equilibrium. To rule out (i), note that, if the persuader used this strategy, the payoff from dropping a message equals:

$$
\begin{aligned}
E^{SB}(q \mid m'=\varnothing, s=0) &= p_{\phi}(g \mid m'=\varnothing, s=0)E^{B}(q \mid m'=g, s=0) + p_{\phi}(b \mid m'=\varnothing, s=0)E^{B}(q \mid m'=b, s=0) + p_{\phi}(\varnothing \mid m'=\varnothing, s=0)E^{B}(q \mid m'=\varnothing, s=0) \\
&= E^{B}(q \mid m'=g, s=0) \\
&> E^{SB}(q \mid m'=b, s=0),
\end{aligned}
$$

the payoff from reporting $m = b$. Thus, the persuader would deviate from this strategy and drop message $m = b$. To rule out (ii), note that, if the persuader behaved according to this strategy, the payoff from dropping a message equals:

$$
\begin{aligned}
E^{SB}(q \mid m'=\varnothing, s=0) &= p_{\phi}(g \mid m'=\varnothing, s=0)E^{B}(q \mid m'=g, s=0) + p_{\phi}(b \mid m'=\varnothing, s=0)E^{B}(q \mid m'=b, s=0) + p_{\phi}(\varnothing \mid m'=\varnothing, s=0)E^{B}(q \mid m'=\varnothing, s=0) \\
&= p_{\phi}(g \mid m'=\varnothing, s=0)E^{B}(q \mid m'=g, s=0) + p_{\phi}(b \mid m'=\varnothing, s=0)E^{B}(q \mid m'=b, s=0) \\
&< E^{B}(q \mid m'=g, s=0) \\
&= E^{SB}(q \mid m'=g, s=0).
\end{aligned}
$$

Thus, the persuader is better off deviating by always reporting message $m = g$.

Hence, in equilibrium, the set of messages that the persuader drops with positive probability can at most equal *{ b}*. Suppose that the persuader drops $m = b$ with positive probability in equilibrium and drops $m = g$ with zero probability. Then, the equilibrium payoff from dropping a message equals

$$
\begin{aligned}
E^{SB}(q\,|\,m'=\varnothing,s=0) &= p_{\phi}(g\,|\,m'=\varnothing,s=0)E^{B}(q\,|\,m'=g,s=0)+p_{\phi}(b\,|\,m'=\varnothing,s=0)E^{B}(q\,|\,m'=b,s=0)+p_{\phi}(\varnothing\,|\,m'=\varnothing,s=0)E^{B}(q\,|\,m'=\varnothing,s=0)\\
&= E^{B}(q\,|\,m'=b,s=0)\\
&= E^{SB}(q\,|\,m'=b,s=0),
\end{aligned}
$$

and the persuader is indifferent between dropping and not dropping message $m = b$. But this contradicts our assumption that, when indifferent, the persuader chooses not to drop the message. Hence, there does not exist a sequential equilibrium satisfying our assumptions in which the persuader drops any messages with positive probability.

It is easy to show that there is, in fact, a sequential equilibrium where the persuader always reports $m = g$ and $m = b$. ♦

Proof of Proposition 7: There is an equilibrium where the persuader drops message $m = b$ with probability one. To see this, let the persuader's strategy be described by $\phi(g, g) = 1$ and $\phi(b, g) = 1$. It is clear that the persuader would not wish to deviate from this strategy by dropping $m = g$. He also would not wish to deviate from this strategy by reporting $m = b$ since the payoff from dropping $m = b$ is greater:

$$
\begin{aligned}
E^{SC}(q\,|\,m'=\varnothing,s=0) &= E^{SB}(q\,|\,m'=\varnothing,s=0)p_{\phi}(s=0\,|\,m'=\varnothing)+E^{SB}(q\,|\,m'=\varnothing,s=1)p_{\phi}(s=1\,|\,m'=\varnothing)\\
&= E^{B}(q\,|\,m'=b,s=0)p_{\phi}(s=0\,|\,m'=\varnothing)+E^{B}(q\,|\,m'=\varnothing,s=1)p_{\phi}(s=1\,|\,m'=\varnothing)\\
&= E^{B}(q\,|\,m'=b,s=0)p_{\phi}(s=0\,|\,m'=\varnothing)\\
&> E^{B}(q\,|\,m'=b,s=0)\\
&= E^{SC}(q\,|\,m'=b,s).
\end{aligned}
$$

The final strict inequality follows from $p_{\phi}(s=0\,|\,m'=\varnothing)<1$ since $p(m'=\varnothing\,|\,s=1)>0$. Since $E^{SC}(q\,|\,m'=\varnothing,s=0)>E^{SC}(q\,|\,m'=b,s=0)$ this equilibrium does not violate our assumption that, when indifferent, the persuader does not drop messages.

In addition, there cannot be an equilibrium where the persuader drops message $m = b$ with probability less than one. The reason is that, no matter the persuader's strategy, ϕ', he would strictly prefer dropping message $m = b$ over reporting the message:

$$
\begin{aligned}
E^{SC}(q \mid m'=\varnothing, s=0) &= E^{SB}(q \mid m'=\varnothing, s=0)p_{\phi'}(s=0 \mid m'=\varnothing) + E^{SB}(q \mid m'=\varnothing, s=1)p_{\phi'}(s=1 \mid m'=\varnothing) \\
&\geq E^{B}(q \mid m'=b, s=0)p_{\phi'}(s=0 \mid m'=\varnothing) + E^{B}(q \mid m'=\varnothing, s=1)p_{\phi'}(s=1 \mid m'=\varnothing) \\
&= E^{B}(q \mid m'=b, s=0)p_{\phi'}(s=0 \mid m'=\varnothing) \\
&> E^{B}(q \mid m'=b, s=0) \\
&= E^{SC}(q \mid m'=b, s).
\end{aligned}
$$

Again, the final inequality follows from $p_{\phi'}(s=0 \mid m'=\varnothing) < 1$.

Thus, in equilibrium, it must be the case that $\phi(b, g) = 1$. It is easy to see that it must also be the case that $\phi(g, g) = 1$ so there is a unique equilibrium. ♦

Proof of Proposition 8:

Since individuals are face value Bayesians they expect the quality of a firm's good to equal zero no matter the message sent. It can then be individually rational for a consumer to buy from firm *f* on the equilibrium path if and only if:

$$p_f \leq \min\{p_{f'}, 0\}.$$

Hence, for both firms to receive positive market shares in equilibrium it must be the case that $p_1 = p_2 \leq 0$ on the equililbrium path.

Since, no matter the message sent by firm *f*, consumers will not pay any positive price for its good, firm *f* will not pay a cost to create the uninformative message in equilibrium. It is also clear that *f* will not set a negative price in equilibrium. Thus, in any equilibrium satisfying our assumptions, neither firm pays the cost to create the uninformative message and $p_1 = p_2 = 0$.

It is left to show that such an equilibrium exists. To this end, suppose that both firms have the same strategy, which is to not send the uninformative message and to set $p_f = 0$ no matter m_f, $m_{f'}$. Further suppose that ½ of consumers follow the strategy to buy from firm f if $p_f = 0 < p_{f'}$ or $p_f < \min\{0, p_{f'}\}$, to buy from firm $f = 1$ if $p_1 = p_2 \leq 0$, and to buy from neither firm if $p_1, p_2 > 0$. Finally, suppose that the other *1/2* of consumers follow the strategy to buy from firm f if $p_f = 0 < p_{f'}$ or $p_f < \min\{0, p_{f'}\}$, to buy from firm $f = 2$ if $p_1 = p_2 \leq 0$, and to buy from neither firm if $p_1, p_2 > 0$. It is easy to see that this strategy profile combined with beliefs specified by the face value assumption (both on and off the equilibrium path) constitutes an equilibrium with the desired properties. ♦

Proof of Proposition 9:

We solve the game backwards. In the third period, it can be consistent with equilibrium for a coarse thinker to buy from firm f if and only if

$$E^C(q_f \mid m_f, s = US) - p_f \geq \max\{E^C(q_{f'} \mid m_{f'}, s = US) - p_{f'}, 0\}$$

and it can be consistent with equilibrium for a Bayesian to buy from firm f if and only if

$$p_f \leq \min\{0, p_{f'}\}.$$

Now we solve for the equilibrium of the continuation game starting at the second period. Denote the equilibrium payoff to firm f in the continuation game following firm *1* choosing m_1 and firm *2* choosing m_2 by $\pi_f(m_1, m_2)$ ($\pi_f(m_1, m_2)$ is a function since, as will be shown, equilibrium payoffs are unique for any message profile). Suppose that firms sent the same message in period 1. Then both coarse thinkers and Bayesians expect the quality of the product produced by firm *f* to be the same as the quality of the product produced by *f'*. That is,

$$E^J(q_f \mid m_f, s = US) = E^J(q_{f'} \mid m_{f'}, s = US)$$

for $J = B, C$. Thus, this is standard Bertrand competition and the unique pure strategy equilibrium of the continuation game involves both firms setting price equal to marginal cost ($p_f = p_{f'} = 0$) assuming that both firms sell to a positive fraction of consumers.[20] Hence, the equilibrium payoff to firm *f* in the continuation game following both firms choosing the same choosing the same message *m'* is[21]

$$\pi_f(m', m') = 0.$$

Now consider the continuation game following one firm paying the cost to create the uninformative message and the other firm not paying that cost. In other words, the continuation game following *f* choosing $m_f = Burgundy$ and *f'* choosing $m_{f'} = Table$. Without loss of generality, let $f = 1$ and $f' = 2$. Then, in any equilibrium satisfying our assumptions, it is clear that firm *1* charges $E^C(q_1 \mid m_1 = Burgundy, s = US)$ and sells to all of the coarse consumers and firm *2* charges *0* and sells to at least some Bayesians.

[20] The assumption that both firms sell to a positive fraction of consumers is important in the continuation game following neither firm paying the cost to create the uninformative message. In this game, there is a pure strategy equilibrium where one firm charges $p_f = 0$, the other firm charges $p_{f'} > 0$, firm *f* sells to a positive fraction of consumers, and *f'* sells to nobody. This is an equilibrium since neither firm wishes to deviate: payoffs are zero for each firm and payoffs are less than or equal to zero for any other possible price profile.

[21] The continuation payoff does not include any cost incurred in the first period.

To see that an equilibrium of the continuation game exists, let firm *1* charge $E^C(q_1 \,|\, m_1 = Burgundy, s = US)$; let firm *2* charge *0*; let each coarse consumer's strategy be to buy from firm *1* if

$$\begin{array}{rcl} E^C(q_1 \,|\, m_1 = Burgundy, s = US) - p_1 & \geq & \max\left\{E^C(q_2 \,|\, m_2 = Table, s = US) - p_2, 0\right\} \\ & = & \max\{-p_2, 0\}, \end{array}$$

to buy from firm *2* if $-p_2 > \max\left\{E^C(q_1 \,|\, m_1 = Burgundy, s = US) - p_1, 0\right\}$, and to buy from neither firm otherwise; and let each Bayesian's strategy be to buy from firm *2* if

$$\begin{array}{rcl} E^B(q_2 \,|\, m_2 = Table, s = US) - p_2 & \geq & \max\left\{E^B(q_1 \,|\, m_1 = Burgundy, s = US) - p_1, 0\right\} \Leftrightarrow \\ -p_2 & \geq & \max\{-p_1, 0\}, \end{array}$$

to buy from firm *1* if $-p_1 > \max\{-p_2, 0\}$, and to buy from neither firm otherwise. It is easy to see that this strategy profile constitutes an equilibrium of the continuation game.

Thus the payoffs to firms *f, f'* in the continuation game following firm *f* creating the uninformative message $m_f = Burgundy$ and firm *f'* reporting $m_{f'} = Table$ are given by

$$\begin{array}{rcl} \pi_f(m_f = Burgundy, m_{f'} = Table) & = & \beta E^C(q_f \,|\, m_f = Burgundy, s = US), \\ \pi_{f'}(m_f = Burgundy, m_{f'} = Table) & = & 0. \end{array}$$

Now we will solve for equilibria of the entire game given *c* and our assumptions. First suppose that $c < \bar{c} \equiv \beta E^C(q \,|\, m = Burgundy, s = US)$. There cannot be a pure strategy equilibrium in which neither firm pays the cost to create the uninformative message. Otherwise firm *1* would wish to deviate and create $m_1 = Burgundy$ since the payoff from deviating is greater than the payoff from conforming:

$$\pi_1(m_1 = Burgundy, m_2 = Table) - c \quad = \quad \bar{c} - c$$
$$> \quad 0.$$

Also, there cannot be a pure strategy equilibrium in which both firms pay the cost to create the uninformative message. Otherwise firm *1* would wish to deviate and report m_1 = *Table* since the payoff from deviating is greater than the payoff from conforming:

$$\begin{aligned} \pi_1(m_1 = Table, m_2 = Burgundy) &= 0 \\ &> -c \\ &= \pi_1(m_1 = Burgundy, m_2 = Burgundy) - c. \end{aligned}$$

Thus, any pure strategy equilibrium must involve one firm paying the cost to create the uninformative message *m'* = *Burgundy* and the other firm reporting *m'* = *Table*. To see that there is such an equilibrium suppose, without loss of generality, that firm *1* pays *c* to create m_1 = *Burgundy* and firm *2* reports m_2 = *Table*. Firm *1* does not wish to deviate since its payoff from deviating, *0,* is less than its payoff from conforming, $\bar{c} - c$. Likewise, firm *2* does not wish to deviate since its payoff from deviating, *-c*, is less than its payoff from conforming, *0*.

Now suppose that $c > \bar{c}$. Then there cannot be a pure strategy equilibrium in which either firm pays the cost to create the uninformative message *m'* = *Burgundy*. Otherwise, a firm paying that cost would wish to deviate since its payoff from deviating is greater than its payoff from conforming: its payoff from deviating is *0* and its greatest possible payoff from conforming is $\bar{c} - c < 0$. To see that there is a pure strategy equilibrium in which both firms report *m'* = *Table,* note that neither firm wishes to deviate since its payoff from deviating, $\bar{c} - c$, is less than its payoff from conforming, *0*.

♦

Proof of Proposition 10:

When individuals are Bayesians their expectation of quality is

$$E^B(q \mid a, s = Shampoo) = 0$$

no matter the value of *a*. Thus individuals will not buy the good if its price is positive and the payoff to the monopolist cannot exceed $-c < 0$ if it pays the cost to alter the product. Since its payoff is *0* if it does not alter the product and charges a price of *0*, the monopolist will optimally not alter the product. ♦

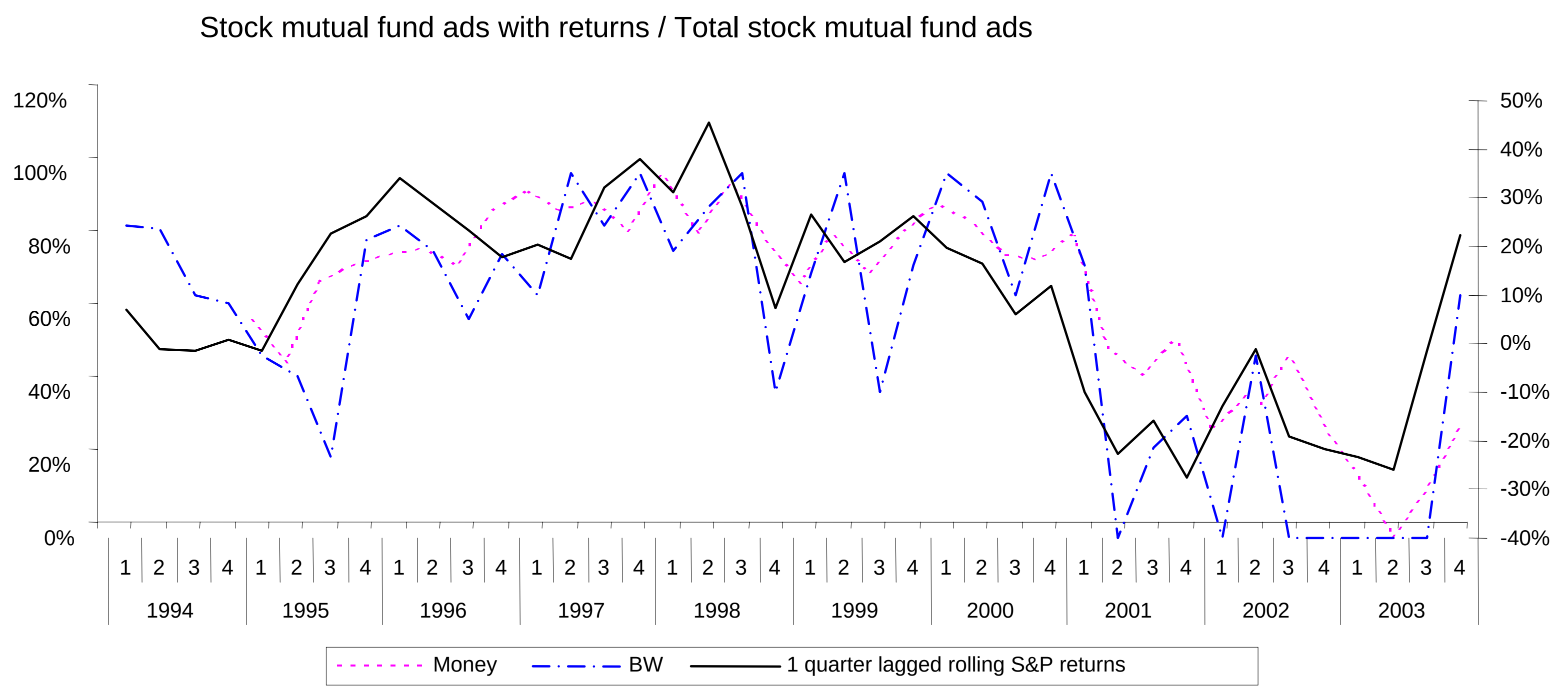
Proof of Proposition 11:

When individuals are coarse thinkers, their expectation of quality is

$$E^C(q \mid a, s) \quad = \quad \begin{cases} p(s = Tie \mid a) & \text{if } a = 1 \\ 0 & \text{if } a = 0 \end{cases}$$

so they will pay at most $p(s = Tie \mid a)$ for the product if it is altered and at most *0* if it is not. Thus, the maximum payoff to the monopolist is $p(s = Tie \mid a) - c$ if it alters the product (achieved by setting price equal to $p(s = Tie \mid a)$) and is *0* if it does not (achieved by setting price equal to *0*). Hence, the monopolist will optimally alter the product if $p(s = Tie \mid a) - c > 0 \Leftrightarrow c < p(s = Tie \mid a)$. ♦

Figure 1



Correlations:

Money / S&P : 71.0%

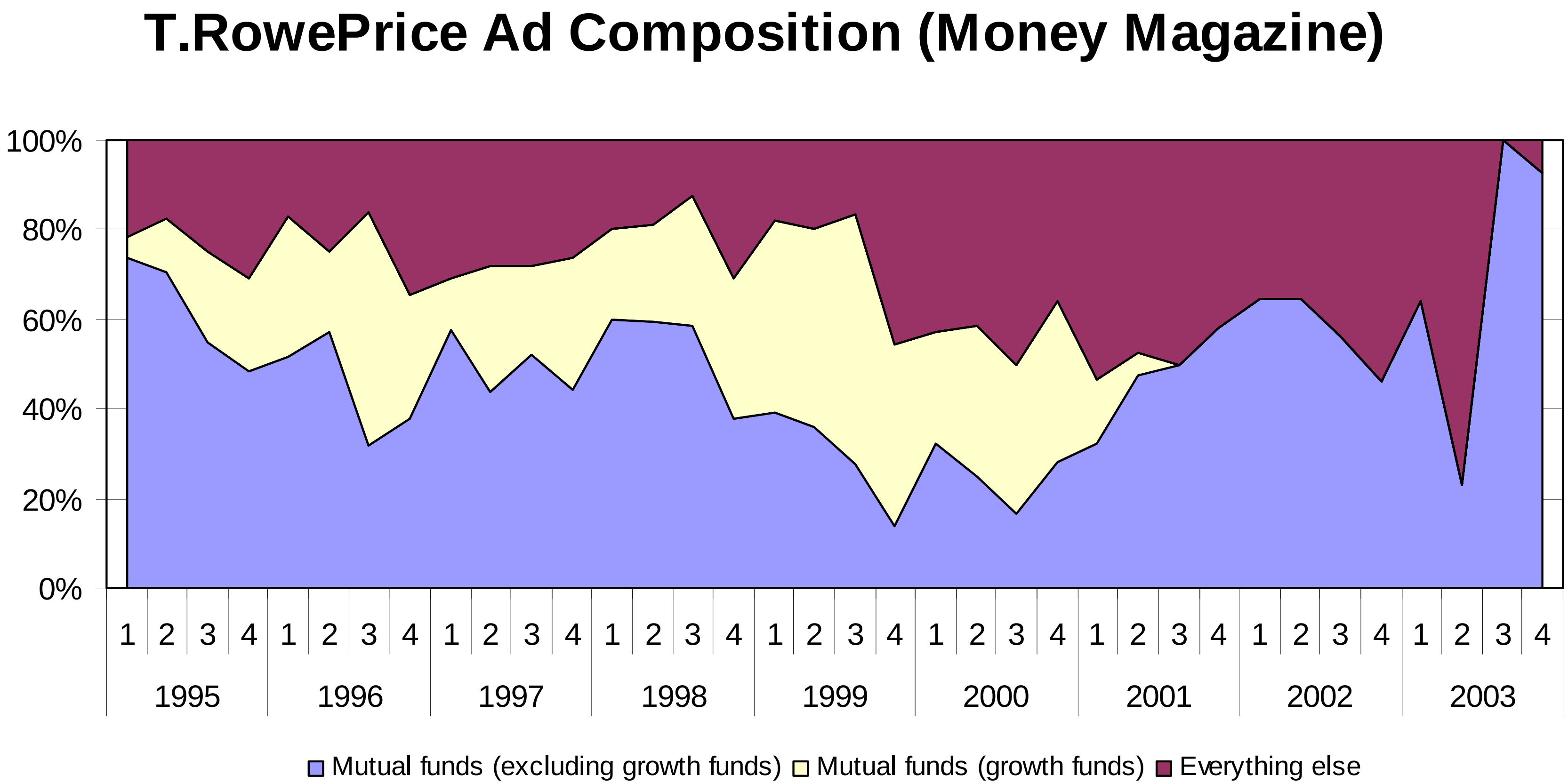
BW / S&P: 74.3%

Means:

Money: 62.4%

BW: 59.0%

Figure 2


T.RowePrice Ad Composition (Money Magazine)
100%
80%
60%
40%
20%
0%
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
1995 1996 1997 1998 1999 2000 2001 2002 2003
Mutual funds (excluding growth funds)
Mutual funds (growth funds)
Everything else