Attention Networks:
A Two-Mode Network View on Valuation

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Abstract. When multiple actors allocate their attention across multiple issues, they create an attention network. We leverage the multiple ties that comprise such an attention network to argue that how competitors interpret a given market situation depends not only on information about that situation but also on the portfolio of other situations to which they pay attention. Specifically, we hypothesize that the more two competitors assess a given situation vis-à-vis a more similar portfolio of other situations, the more they assess that issue similarly. It is so, we argue, because i) competitors who pay attention to the same problems are more likely to make similar cognitive associations and consequently come to more similar solutions on a given problem, and ii) competitors are more likely to adapt their interpretations on the basis of the assessments made by the competitors with whom their attention patterns intersect more frequently. We exploit the two-mode (agents-issues) dynamic structure of these observational networks to study the social and temporal aspects of financial analysts' valuations in markets from 1993-2011. Our findings show that two analysts form more similar earnings estimates about a given firm if they come to that assessment while paying attention to a more similar portfolio of other firms. Our analysis further demonstrates that analysts' estimates of the focal firm are influenced by views that cycle through closed triads.

INTRODUCTION

How do competitors interpret the market problems, issues, and situations they face? In particular, how do they ascribe value to the diverse candidates available on the market, and what shapes the cognitive frameworks through which they assess them? These questions are gaining prominence among economic sociologists and organization theorists (see Lamont, 2012; and Zuckerman, 2012 for recent reviews) who consider valuation as either the expression of the institutional logics (Fligstein, 2002; Lounsbury, 2007; Thornton and Ocasio, 2008) that shape the cognitive frameworks of members of different categorical communities (DiMaggio and Powell, 1991; Abolafia, 1996; Zuckerman, 1999; Hannan, Polos, and Carroll, 2007; Hsu, 2006; Benner, 2007), or the reflection of social pressures of conformity and imitation (Rao, Greeve and Davis, 2001; Phillips and Zuckerman, 2001; Salganick and Watts, 2008).

These sociological approaches to valuation embrace a weak form of cognitivism in which cognition is portrayed as static representations of abstract, disembodied schemas (such as organizational scripts, institutional logics, or categorical frameworks) or depicted as unreflective mimicking of others' decisions. A stronger form of cognitivism, however, is emerging in the organizational literature. Echoing recent advances in cognitive psychology (see Wilson, 2002 for a review, Smith and Semin, 2004, Smith and Collins, 2009, Robbins and Aydede, 2009), it studies how market actors form "generative analogies" (Tripsas and Gavetti, 2000; Gavetti, Levinthal, and Rivkin, 2005; Gavetti and Rivkin, 2007; Gavetti, 2011) and temporal associations (Kaplan and Orlikowski, 2012) that break out of cognitive inertia and thereby facilitate the repurposing of prior existing schemas (Hargadon and Douglas, 2001; Rindova and Petkova, 2007; Cornelissen and Clarke, 2010; Benner and Tripsas, 2012; Bingham and Kahl, 2013). Applied to the problem of valuation, a strong cognitivist view recognizes that in assigning value to objects, individuals make cognitive inferences, associations, and analogies across the available candidates (Podolny and Hill-Popper, 2004). A sociology of valuation must accommodate such cognitive processes (DiMaggio, 1997; Ruef and Patterson, 2009; Kaplan, 2008, 2011; Stark, 2009; Beunza and Stark, 2004, 2012). If it does so by situating cognition in social structures and social processes, it can meet the challenge without returning to the atomistically calculating actor caricatured in the neoclassical economics framework.

To situate cognitive processes of valuation in social structures, we draw on and develop the organizational theory literature that locates cognition in attention structures (Simon, 1957; Ocasio, 1997, 2011, 2012; Greve, 2008; Vissa, Greve and Chen, 2010; Kaplan, 2008; Eggers and Kaplan, 2009; Cho and Hambrik, 2006). But the attention structures we examine are not the organizational setups that channel the attention of the members of an organization. Whereas the existing literature focuses on *organizational* attention structures, we seek to identify *network* attention structures. And whereas it addresses attention within the organization, we focus on patterns of attention among competitors across organizational boundaries. Instead of identifying the organizational practices that structure members' attention, we start by asking the question "to what do actors pay attention?" For us, it is the practices of paying attention that give rise to structure – network attention structures.

Similarly, we draw on the literature studying structures of attention that links candidates to the audiences that valuate them (Zuckerman 1999, 2004; Hsu, 2006; Cattani et al., 2008). But whereas the primary objective of that literature is to study the *activity of candidates* and how they position themselves vis-à-vis an established categorical structure, our primary objective is to study the *activity of valuators* and how their location within structures of attention shapes their evaluations. In the extant literature, patterns of attention are analytically useful only because they can methodologically stand in as proxies for the categorical coherence or incoherence of the candidates. Because patterns of attention are used to make such inferences, this literature must rely on the assumption that networks of attention are coherently bounded and densely connected within each categorical domain (i.e., each actor should pay attention only to the candidates in her category of expertise and, within their category of specialization, each actor should pay attention to the same portfolio of candidates). Because our problem is different, we can relax that assumption. Thus, we need not assume that network structures of attention map isomorphically to classificatory or categorical structure.

In our view, the networks created by patterns of attention across market actors and market issues are not only a map to chart organizational or categorical structure but are also a map to navigate cognitive networks among actors. We argue that valuation is not only embedded in socially constructed categories, or subject to imitative pressures, but is also embedded in networks of attention.

We define an *attention network* as an evolving network created by multiple agents allocating their attention and expressing their judgments across multiple situations. Valuation, we argue, is shaped by an actor's location (or viewpoint) within such an attention network as well as by differential exposure to views shaped by these network properties. The positions actors occupy vis-à-vis each other in this network affect how similarly or differently they will interpret the same market situation.

We begin our argument with the premise that attention has two types of connective properties: 1) it creates links across the issues that are in the competitor's field of view, and 2) it creates links among the competitors who pay attention to the same market issues. In both cases these links are indirect. Objects (assets, issues, situations) are connected via actors; actors are connected via objects. Such links across objects and actors give rise to a two-mode network structure. In developing an attention network approach to valuation, we exploit such two-mode network properties.
We start by the observation that actors are linked to the problems to which they pay attention (or, in more technical terms, the first order neighbors of actors are issues). In assessing a focal situation, actors can make associations, analogies, and comparisons with the other situations that are present in their field of view (considered here as a *portfolio of attention*). Specifically, a feature viewed as salient for evaluating one issue might be recognized as relevant for another. That is, the issues across which an actor allocates her attention will shape the properties that are selected as salient and worthy of consideration when assessing the focal situation.

Because valuators are led to privilege different elements of comparison – as they are primed by the features of the objects that they are contingently comparing (Denrell, 2012; Lamont, 2012) – we argue that the same issue will be viewed differently when seen against a different background of other issues. If this is the case, we expect that competitors that pay attention to the same problems will be more likely to independently make similar associations and, hence, come to more similar solutions on a given problem, at least with respect to another competitor who regards the same problem but does so with very different ones in her peripheral vision.

We refer to this as the *viewpoints effect*. Our first proposition is thus that valuation is perspectival: One's assessment of an issue is shaped by one's viewpoint, given by one's contingent portfolio of attention. We hypothesize, specifically, that two actors who assess a given situation vis-à-vis a similarly (differently) composed portfolio of other situations are more likely to autonomously converge (diverge) in their interpretations of the given situation.

Viewpoints are the first but not the only step in developing an observational network approach to valuation. Building on the second relational property of attention in a two-mode observational network (i.e., links among the competitors who pay attention to the same market issues), we expect that market actors are more likely to come across the assessments of the competitors who focus their attention on the same issues. When two competitors allocate their attention across more similar portfolios of problems, their views become prominently visible to each other. Associations made by one actor become noticeable to the other and vice-versa. Conversely, mutual exposure would be limited when two competitors are not in their respective fields of vision because they are allocating their attention to different market aspects.

Thus, our second proposition, referring to the *views effect*, is that valuation is doubly perspectival: actors' valuations are not only shaped by their contingent viewpoints, given by their fleeting portfolios of attention, but also by the views of others, which themselves are shaped by their changing viewpoints. We, therefore, further hypothesize that, the more (less) two actors have encountered the same third actors' views on the other situations to which they have not been attentive jointly, the more their interpretations of a given situation will converge (diverge).

We test our theory in the setting of securities analysts. In a given year, analysts are assigned to (or, depending on the broker's policy or status of the analyst, select) a certain portfolio of stocks to cover for which they write detailed reports presenting their reasoned assessments and evaluations. Our first test will be to ascertain whether two analysts who pay attention in the given year to a more similar portfolio of other stocks will issue more similar estimates on focal security *S* than two analysts who regard *S* from the perspectives of dissimilar portfolios. Analysts with more similar portfolios will leverage a similar viewpoint to value *S* (i.e., they will base their assessments on their similar, limited vision of what unfolds in the market) and will expose each other to their reciprocal views more often (i.e., they will mutually influence each other in how to interpret what is disclosed in the market).

To further test the contingent viewpoint effect, we leverage the exogenously induced demands for attention among analysts brought about by firms' quarterly earnings announcements. We find that two analysts who are exogenously induced to compare the focal stock *S* against a more similar background of other securities will have closer estimates of *S* than two analysts who observe *S* in a different field of view. To test the views effect, we leverage triadic cycles that connect the members of the dyad through firms that they do not evaluate jointly. We find that two analysts who come across the same third actor's views on background situations to which they did not jointly pay attention, will have closer estimates of *S* than two analysts who come across different third actor's views.

Attention Networks and The Viewpoint Effect

Consider an actor, let's call her *i*, who is evaluating a situation, solving a problem, or assessing an issue S. One way to think of how actor *i* is evaluating *S* is that *i* is singularly focusing on *S*. Actor *i* might collect and objectively process all the possible information about *S*, or, lacking confidence in her own judgments, she may wait for and imitate the interpretations that other actors have expressed about *S* (Granovetter, 1978; Rao, Greve, and Davis, 2001). Either way, *S* would be evaluated singularly, as a stand-alone situation. Another way of thinking of *i* assessing *S* is that she is putting *S* into perspective, i.e., that *i* is locating *S* in relationship to something else (Podolny and Hill-Popper, 2004). The most established way of conceiving this cognitive comparison is to think that *i* regards *S* from the perspective of a categorical prototype (Rosch, 1975). If *S* fits with the prototype, it gets a premium; if it does not, it gets penalized (Zuckerman, 1999; Hannan, Polos, and Carroll, 2007).

A burgeoning research effort in organization theory has built on this cognitive matching perspective to emphasize how market valuations are not performed in isolation but instead are interconnected through their common links to a particular categorical standard (Zuckerman, 2004, Hsu, Hannan, and Koçak, 2009, Pontikes, 2012; Smith 2011). It has done so building on the assumption that actors who specialize in the same category share a common, distinct, and stable representation of the categorical standard to which they compare the focal situation. Such an assumption seems ill equipped, however, to explore the dynamics (Ruef and Patterson, 2009) through which the categorical standard is re-negotiated in the market and, more importantly, how its conceptualization differs across the diverse actors that take part in the same categorical community.

One of the first approaches informing how valuations are contingently (re-)constructed and how this construction may differ across diverse actors is the categorical exemplar theory (Medin and Schaffer, 1978). This theory claims that the categorization process of a given situation depends not on reference to an abstract standard but on the sampling of instances to which each focal actor has been exposed in the past. The underlying rationale is that, to make sense of the specific situation, actors construct analogies based on their recollection of similar ones encountered in the past (Brooks 1987; Ross, 1984).
Recent streams in cognitive psychology move a step further. Instead of focusing on the recollection of prior encounters, this work stresses the importance of the situated context in which cognitive processes are performed (see Wilson, 2002 for a review; Smith and Semin, 2004; Smith and Collins, 2009; Robbins and Aydede, 2009). In an important development, new research within this situated cognition approach now emphasizes the importance of distributed attention and of the background situations encountered in

one's field of view. Stated in the form of analogy, this literature suggests that "as we navigate through the environment, we sometimes focus attention on a single object, such as a tree, and sometime spread it over a wide area to see the forest" (Chong and Treisman, 2005). "The forest," in turn, can yield information that affects the perception of the properties of the individual tree. Stated more prosaically, the sample of other objects in one's field of view (in the backdrop) raises the salience of certain features, while obscuring others, and thus affects how a focal object in the foreground will be interpreted.

Take, for example, lab experiments in behavioral economics which show that an actor evaluates her salary not from the standpoint of the level of the salary per se but from the perspective of other salaries to which it is compared. When asked to value their happiness with a salary of $70,000 dollars or a salary of $65,000, people answer differently if they are told that the other members of the organization for which they work would earn $100,000 or $45,000. Paradoxically, individuals would be happier with a lower salary of $65,000 dollars, if others earn $45,000, than with a salary of $70,000, if others earn $100,000. Similarly, valuation models have been shown to change according to the offers considered in the moment of valuation. Take, for instance, the case of "The Economist" that for a certain period of time offered 3 alternatives: the first offer, the Internet subscription only, was offered for $59, and the second option, the print subscription, for $125. The third option, the print and Internet subscription, was offered for the same price of the exclusive-print subscription, that is $125. When asked in a lab experiment which offer they would chose, 16% of the people chose the Internet subscription, and 84%, the Internet and print one. Smartly enough, no one chose the only print subscription. However, when the print option was excluded from the contingent alternative set, the results were radically different. 68% of the people chose the Internet-only option for $59, up from 16% before. And only 32% chose the combination subscription for $125, down from 84 before (Ariely, 2008).

Emphasizing the importance of the background situation contingently encountered when forming a judgment on a focal situation (Ariely, 2008; Denrell, 2012), we argue therefore that the process of assessing *S* is not simply a process of matching it with an abstract and stable conception of what it should ideally be or of relating it with the exemplar situations encountered in the past. It also involves a process of situating it in an evolving background space comprised by the other situations to which the focal object is contingently compared.

Thus, in addition to paying attention to focal situation *S*, actor *i* is also allocating attention to situations *T*, *U*, and *V*. In network terms, situations *S*, *T*, *U*, and *V* are linked through their common ties to actor *i*. In terms of the process of evaluation, the fact that actors allocate their attention across multiple situations raises the possibility that they make associations among them. In particular, we are attentive to the possibility that features that arise as salient in the assessment of one situation can become salient in the valuation of others within the actor's structure of attention. In short, although we commonly speak about an actor *allocating* attention, in fact, the very process of focusing on an object entails *locating* it in a field of other objects.

To move from a psychological to a sociological account we need to consider not only actor *i* and her viewpoint given by her relationship to the objects in her field of vision. We must also consider that actor *i* is operating in a field with other actors *j, k*, and *l,* for example, and the objects in their fields of vision. We cannot access the intra-subjective states in the minds of calculating agents *i* and *j*. But we can gain analytic leverage from the fact that other agents, *k* and *l*, for example, are also making assessments of *S* while allocating their attention across other objects that may be nearly the same as (or different from) those of actors *i* and *j*. For example, actor *i* is observing *S*, *T*, *U*, and *V;* actor *j* is observing *S*, *T*, *U* and *W*; meanwhile actor *k* is observing *S*, *A*, *B*, and *C*; and so on.

To develop this sociological account, we chart the network ties that are created when multiple agents allocate their attention across multiple objects. The resulting patterns yield a social structure of attention. Objects are located within a network structure of attention given by the actors who observe and evaluate them. Meanwhile, actors are also located within a structure of attention given by the ties that connect them through the objects they observe and evaluate. Note the peculiar feature of this network. There are no direct ties among the agents. They are not proximate because of some personal connection. Their location in the social space of attention – their proximity to or distance from each other – is a function of ties formed through objects. In mapping these networks, we chart socio-cognitive networks.

For all pairs of dyads we can construct a measure of cognitive distance based on their portfolios of attention. In the example above, *i* and *k* (who, with the exception of focal objet *S*, have no overlap in attention portfolio) are more cognitively distant than *i* and *j* (whose portfolios show a high proportion of overlap). To be clear, the proximity of *i* and *j* does not mean that they are somehow closer to focal situation *S*. Their proximity to each other is not given by their proximity to *S* but is, instead, a property of their location in a social space given by the entire ensemble of the situations in their portfolio. Consequently and emphatically, therefore, the closer proximity of *i* and *j* does not mean that they are exposed to more information about focal situation *S*. All of the actors scrutinizing situation *S* are presumably exposed to the same information *about S*. Instead, the more proximate *i* and *j*, the more they are exposed to information about a common set of *other* situations.

We can thus compare actor *i*'s and j's assessments of focal situation *S* with those of all other actors who evaluate that situation. In such dyadic comparison, we can compute the similarity or dissimilarity in the portfolios of attention (and hence the cognitive distance) for each pair of dyads. If we find that two actors will evaluate an issue *S* more similarly (differently) if the backdrop against which they view it is more similar (different), then we can draw the conclusion that the actors' valuations are shaped by associations made across the situations in their portfolios of attention.

Hypothesis 1. *The more two actors assess a focal situation from a similar viewpoint (i.e., the more they are paying attention to a similarly composed portfolio of background situations), the more similar their evaluation of a focal issue will be.*

ATTENTION NETWORKS AND THE EFFECT OF EXPOSURE TO OTHERS' VIEWS

A sociological account of observational networks must consider not only first-order neighbors (the actor's relations with objects, issues, and situations) but also the second-order neighbors (the other actors linked via these objects). In particular, it must include the fact that, in the very moment when actors are paying attention to objects, they are frequently encountering the views of other actors about these objects, issues, and situations. As advocates of the situated cognition approach have argued, sense-making processes are often "scaffolded" by others' interpretations rather than being based solely on inner representation resources (Clark, 1997). Sense-making is, in fact, a collective process, often reconciling diverse and dispersed subjective views (e.g., Michel, 2007; Kaplan and Orlikowski, 2012; Bingham and Kahl, 2013; Smith and Collins, 2009: 343).

By recognizing that people incorporate information about a target situation passed along by others, recent psychological research has embedded sense-making processes in social networks (Denrell and Le Mens, 2007; Smith and Collins, 2009). Like this recent stream in psychology, we also consider sense-making as embedded in networks. The networks we consider, however, have distinctive properties as observational networks. First, because there are no direct ties among the agents in an observational network (i.e., observational networks are two-mode structures linking people to situations), when we speak about actors being more or less socially proximate, we must stress that this social proximity is not because of some personal connections. The sociality to which we refer is a form of mediated, indirect sociality (see Beunza and Stark, 2012 for a description of this type of sociality in financial markets). We must emphasize, secondly, that we are not interested in interpretations that other actors are posting about focal issue *S*. Instead, our analytic attention is directed to the actors' peripheral vision: we are interested in measuring whether and how the actors' evaluations of *S* are affected by the views of other actors concerning the *other background situations that are in the actors' field of view*.

Our argument is that an actor's observational network is comprised not only of the *viewpoint* (given by the backdrop of other situations) through which the actor regards the focal situation, but also of the expressed *views* of others about those situations. Specifically, actors who pay attention to a more similar portfolio of situations do not only hold a similar perspective, but they can also encounter their respective views more frequently. The fact that actors are exposed to their reciprocal assessments does not automatically mean they will take their mutual views into account. However, the greater the exposure to these subjective views, the greater the opportunity for reciprocal influence (Cattani et al., 2008). When actors focus on the same set of issues, their reciprocal interpretations become more visible to each other, especially in a competitive context in which they might become purposefully more attentive to each other's moves (White, 1981). By paying attention to the decisions they make on their more overlapping portfolio of situations, two competitors may learn more from each other (Cohen and Levinthal, 1990; Mowery, Oxley, and Silverman, 1996), as well as more about each other (Tsai, Su, and Chen, 2011). Focusing on the same issues, competitors can develop a reciprocal absorptive capacity, i.e., a greater ability to recognize the value of their new reciprocal interpretations and a quicker capacity to assimilate and apply them in different contexts. At the same time, they increase their reciprocal competitor acumen (i.e., their capacity to understand each other's mental maps).

As the views of two actors become more similar in their mutually attentive co-evolution, their respective views will become more easily recognized by the other. As these views become more familiar, they grow more salient. Increasingly for actor *i*, the proximate views of another actor become more salient not simply because she is exposed to them more often. Because of their reciprocal influence, the opinions of *j* increasingly come into a comfortable fit with her conceptional schemata. They are recognized as salient because they resonate, they fit, they seem right.

The fact that actors might be affected not only by their individual viewpoints but also by others' views opens up the possibility for more complex patterns of influence in attention networks that go beyond the dyadic overlap of attention. If actors influence each other through their reciprocal views, two actors who encounter the same third actors' views more often should be closer in their estimate of *S* than two actors that encounter different ones.

By taking into account the location of the members of the dyad vis-à-vis third actors we can test the views effect. The analysis hinges on the situations that *i* and *j* are *not* monitoring in common. Notice that because of the two-mode structure of attention networks, two actors will always encounter the same third actors in the situations that they assess jointly. Our question, therefore, is whether the two actors encounter the same (different) third actors in those situations that are *not in their common field of view*.

Consider *i* (Ivana) evaluating situation S against the background of T, U, and V. Meanwhile *j* (Jana) is evaluating S against the background of T, U, and W. The cognitive proximity created by the commonality in the field of view of T and U should (by our reasoning in H1) bring Ivana and Jana closer in their estimates of S. But their viewpoints are not identical: while Ivana is monitoring V, Jana is monitoring W. All things being equal, this non-identity of viewpoints should contribute to some distance in their estimates on S. Now consider that Ivana while monitoring *V* and Jana while monitoring W are both exposed to the views of actor f (Fabian). That is, while paying attention to different situations, they are mutually exposed to the views of the same observer. If Ivana is influenced by the views of Fabian, and Jana is influenced by the views of Fabian, their estimates of focal situation *S* should become more similar.

Note that while Ivana and Jana are exposed to the views of Fabian, Fabian is exposed to the views of Ivana (while monitoring V) and is similiarly exposed to the views of Jana (while monitoring W). In such cases, when the members of a dyad share a common third actor, the result is triadic closure. Views can circulate through such closed triads. In fact, views can cycle through such attention network structures: it is not only that Fabian can influence Ivana and Jana, but also that the views of Jana can influence Ivana (via their influence on Fabian), just as those of Ivana can influence Jana.

Thus, dyads that are embedded in more open networks with less triadic closure (less "constraint" in Burt's terminology) should be more distant in their estimates on *S* than Simmelian dyads (i.e., dyads that are embedded in triads) (Krackhardt and Kilduff, 2002; Krackhardt and Tortoriello, 2010) because the members of the open dyad would be exposed to more diverse views: the assessments expressed about the situations they are not monitoring in common will come from more diverse viewpoints. Whereas open networks expose the dyad to discrepant, even dissonant messages, the recursive cycles of closed networks would expose the dyad to resonant views. When the dyad is embedded in a closed network (with more constraints imposed by greater triadic closure), diversity will be reduced because the members of the dyad will be mutually encountering resonant views by other actors who coexist with them in a relatively closed cognitive community. Because we contend that the views that others express in the other situations to which an actor is attentive play a role in how she assesses *S*, we propose that closure in observational networks will dampen exposure to diverse subjective views. Accordingly, we hypothesize that:

Hypothesis 2. *The more two actors come across the same third actor's views on background situations to which they did not jointly pay attention, the more similar their evaluations of a focal issue will be.*

METHODS

Empirical Setting: Networks of attention among Securities Analysts

Securities analysts are employed by organizations (i.e., investment banks, brokerage houses, etc.) to make assessments on specific market situations: they have to give or sell investment advices to individual and institutional investors who are the organization's clients. About the firms within their "coverage" portfolio, analysts write detailed reports. These reports contain important figures and measures, such as the analyst's estimate of a firm's future earnings per share, the firm's stock price target, and a summary recommendation to buy, hold, or sell. Analysts' reports, however, do not contain only figures but also sophisticated narrative arguments explaining the numbers presented (Beunza and Garud, 2007).

To track the analysts' portfolio of attention, we consider the stocks about which analysts have written reports (see Rao, Greve, & Davis, 2001; and Zuckerman 1999; 2001 for a similar view). We are confident that we are capturing a reliable proxy of the analysts' attention portfolio because writing such reports is an intensive, resource-consuming activity that requires deep scrutiny. For each of the firms in their coverage portfolios, analysts must collect and distill data on economic and accounting fundamentals as well as information on business strategy, corporate governance, senior personnel, product development, and operations. To do so, they must read and analyze firms' annual reports, attend conference calls, chart stock market prices, and make sense of an overwhelming barrage of information. Because of their limited attention capacity and the energies required to assess firms, analysts must focus on the stocks that are in their coverage portfolio.

The decision of what stock to cover is not taken in complete autonomy by the analyst. The analyst's stock coverage is indeed first and foremost the expression of the organizational attention structure (Ocasio, 1997). On the one hand, the industry-based departmental structure of the bank channels the attention of the individual analysts toward stocks that are classified in a certain industry. On the other hand, the research director of the department either assigns or decides along with the industry-specialized security analyst what stocks the analyst is going to cover. Such a decision is typically negotiated every year during the definition of the analyst's individual budget. The resulting list is the stock coverage portfolio that will hold that analyst primary attention for that year.

As the different organizational attention structures of the different banks channel the attention of the individual analysts toward certain stocks, they form a broader attention network in the market, in which competing analysts would be closer to each other depending on the overlap in their coverage portfolios. Analysts who are closer in such attention network would have a similar perspective on the market. We also argue, however, that the position that analysts hold in the network of attention delineates the portfolio of competing interpretations to which they will be more prominently exposed. There are, indeed, many occasions when, because of the reciprocal attention allocation to the same assets, analysts can encounter each other's arguments. By covering the same stock, two analysts attend and ask questions at the same conference call, see each other's interviews in articles in the financial press or on TV talk shows, and track each other's commentary on specialized blogs or other web-based venues. Most importantly, they actually read each other's reports. In addition to having a similar viewpoint on the market, therefore, analysts who are closer in an attention network may also be more likely to gain salience in each other field of view, and thereby to be more likely to understand and be influenced by their reciprocal views.

Data Sources and Sample

Our analysis is based on a sample of analysts' earnings per share (EPS) forecasts included in the Institutional Brokers' Estimate System, or I/B/E/S from October 1993 to October 2011.[1] A large and representative sample of analysts, from the largest global houses to regional and local brokers, enters their EPS forecasts and recommendations directly into this electronic system. We extract, from this database, all the estimates issued by US securities analysts on the yearly earnings per share of firms that are listed in the three major US stock exchange markets (i.e., NYSE, AMEX, NASDAQ) for which we can collect stock price and trading volume data through the Center for Research of Security Price, or CRSP. We also extract from COMPUSTAT firms' earnings per share announcement data to complement the information provided by I/B/E/S, and collect the All-America research team rankings developed by the Institutional Investor magazine as an indicator of the status hierarchy in the financial analyst community.[2] Our final sample is composed of a total of 11,445 different analysts issuing estimates on 10,350 different firms.

Measures

Dependent variable. To capture the degree of similarity in two analysts' interpretations of a common situation, we measure the difference, in absolute value, between the yearly earnings per share forecasts of each pair of analysts who has a still valid forecast on focal firm *S*[3] on the day *d* in which at least one analyst changes an estimate on *S*. We weight this distance for the maximum dyadic distance across all the pairs of analysts' valid forecasts, and subtract it from 1 so as to have a measure of similarity instead of distance.

$$\text{Valuation similarity (i, j, s, d)} = 1 - \frac{|\text{F(i, s, d)} - \text{F(j, s, d)}|}{|\text{Max[F(s, d)]} - \text{Min[F(s, d)]}|}$$

Our dyadic measure of evaluation similarity ranges between 0 and 1.[4] The minimum value (0) indicates that the dyad (*i,j*) has at the *d* day the highest absolute distance between

[1] October 23, 2000 the SEC's fair-disclosure regulation was introduced to prohibit firms from providing private disclosure of material information to particular analysts or investors. As a robustness check we run our models also on a sample after that date. Our main results do not qualitatively change.

[2] Selection to the All-America Research Team ranking is a coveted award associated with professional reputation and financial reward (Groysberg, Healy, and Maber, 2011), and commonly used in the sociology literature as a proxy for status among securities analysts (Phillips and Zuckerman, 2001; Rao, Greve, and Davis, 2001; Hayward and Boeker, 1998, Burt, 2007).

[3] To identify the forecasts that are still valid at a given day we leverage the Stopped estimate and excluded estimate files provided by I/B/E/S and the procedure suggested by Garfinkel (2009), and implemented in the SAS code of WRDS (Glushkov, 2010).

[4] We also run our analysis by using a logit transformation of our dependent variable. As the results do not qualitatively change we report our result with the simple measure.

their earnings per share forecasts of firm *S*. A value of 1 indicates that the dyad *i,j* fully coincides on their estimates on firm *S* earnings-per-share (while some other dyad who focuses on *S* does not).

Independent variables. To calculate the similarity in the portfolio of background assets between two analysts we first leverage the two-mode clustering coefficient (Latapy, Magnien, and Del Vecchio, 2008). The clustering coefficient measures the overlap between neighborhoods of nodes (i.e., the proportion of stocks the two analysts are simultaneously paying attention to). Specifically, it measures the intersection between the first-order neighbors of *i* in her present network of attention with the first order neighbors of *j*, and scales it for the union of the two actors' first-order neighbors. Because we are interested in the overlap in the portfolio of background assets when assessing S, our measure excludes S from the calculation.

$$\text{Attention network proximity}\ (\mathrm{i,j,s,y}) = \frac{|[\mathrm{N(i,y)} - \mathrm{S}]\ \cap\ [\mathrm{N(j,y)} - \mathrm{S}]|}{|[\mathrm{N(i,y)} - \mathrm{S}]\ \cup\ [\mathrm{N(j,y)} - \mathrm{S}]|}$$

The variable thus calculated equals zero when *i* and *j* do not have any other neighbor (i.e., firm) but *S* in common in their network. It equals one when they have the same neighborhood (i.e., their yearly coverage fully overlaps). Such a variable measures how much two analysts share a similar viewpoint from which they observe the market as well as how much they are exposed to each other's views in the given year. Our goal with the following two measures is to test whether both the views and the viewpoints have independent effects.

We introduce first our measure for testing a *viewpoints effect*. In constructing this measure, we seek to identify the contingent viewpoint from which a given analyst is assessing the focal stock *S*, understanding contingent as follows: what are the other firms that the analyst is considering *at the same time* that she is making an assessment of *S*? The first step, then, begins with the question: When can we be confident that analyst *i* is paying attention to *S*? To address this question we exploit the fact that our data provide the precise dates on which analysts issued their estimates. Our interviews with securities analysts suggested that analysts need an average of at least 7 days to develop a security's report. They do so for their estimate of *S* as well as for the other firms for which they issue estimates. That is, each firm is considered to grab the attention of the analyst for the 7 days that precede the analyst's estimate on it. Adopting this procedure, we can recreate the specific set of firms that are in the contingent field of view of an analyst as those firms for which the analyst issued an estimate within a +/- 7 days window from her estimate on *S*.

To avoid any endogeneity issue, we exploit situations in which firm are brought to the attention of the analyst by exogenous events. Specifically, we consider the firms about which analysts express their evaluations in response to firms' quarterly earnings announcements – so doing within the same time window in which they assess *S*. Such events, the finance literature suggests, are among the most important for analysts (as well as for investors), and affect therefore the priorities/agenda of analysts in a particular moment in time.[5]

$$\text{Viewpoint effect (i,j,s,d)} = |[N(i, d_{s+/-7}) \cap N(j, d_{s+/-7})]|$$

Our measure of the viewpoint effect thus takes advantage of exogenously induced demands on the analysts' attention. These demands produce the specific temporality structuring the analyst's networks of attention. Attention networks, therefore, have temporal properties (Stark and Vedres 2006): in addition to being embedded in structural networks of attention (made by their yearly stock coverage portfolios), analysts are also embedded in fleeting, more temporal networks of attention comprised by the attention ties that are activated at particular moments in time.

To identify whether others' views on background situations have an effect on the evaluation of a focal situation (i.e., our H2), we adopt a different strategy. We take advantage of the patterns of influence that emanate from the views expressed on firms that the two analysts are not covering jointly. In such a manner, we can identify the effects on a dyad of being exposed to a similar portfolio of others' views from the effect of paying attention to a similar portfolio of other stocks. We thus construct a variable that builds upon Burt's dyadic constraint measure (1992) and calculate the proportion of background stocks that *i* and *j* do not have in common in their field of vision but they are covering together with the same third actors.

Our measure identifies first of all the actors (*f*) that create a two-mode network triadic closure between *i* and *j*, i.e., those actors whose stock coverage create a four-step length path between *i* and *j* (Opsahl, 2011). For any of these third actors *f*, we calculate the proportion of neighbors that they intersect with either *i* or *j*, but not simultaneously with both *i* and *j*. We then sum each obtained value for the number of *f*s.

$$\text{Views effect (i, j, y)} \sum_{f} \frac{|[N(i,y) \cap N(f,y)] \cup [N(f,y) \cap N(j,y)]| - |N(i,y) \cap N(j,y)|}{|N(i,y) \cup N(j,y)| - |N(i,y) \cap N(j,y)|}$$

[5] The finance literature argues that analysts (as well as investors) must be particularly attentive to firms' earnings announcements. Until several years ago, the quarterly earnings press release and accompanying conference call were not regulated activities, and the firm could autonomously decide if and when to release its quarterly earnings. Growing regulation following the Sarbanes-Oxley act of 2002 has increased the legal requirement of quarterly earnings disclosure. While now public firms must announce their quarterly earnings, they have margins to decide the exact day of announcement. For analysts (and investors) the firms' earning announcement is one of the most important market event, which they must follow and quickly interpret. Empirical analysis shows indeed that the large majority of analysts' EPS forecasts are given within a few days of new quarterly earnings. It seems reasonable, therefore, that at any specific point in time the firms that are about to announce new quarterly earnings are more prominent in the attention space of the analyst.

This measure has value 0 when *i* and *j* do not share any of the stocks that they do not cover together with the same third actor *f*. That is, there is no triadic closure between *i* and *j*. The measure is higher, the higher the proportion of the not overlapping stock coverage between *i* and *j* is overlapping with the same third parties *f*, and is higher the more the number of third parties *f* that intersect stock coverage with *i* and *j*.

Control variables

A large body of literature, especially in finance, has studied how securities analysts form their estimates. The bulk of this literature has been primarily focused on the question whether analysts herd (Scharfstein and Stein, 1990). In particular, scholars have tried to identify the individual characteristics that promote confidence in one's own judgments against the reliance on those of others. The most important variables that have been studied in this literature are *professional experience* (Hong, Kubik and Solomon, 2000), *analysts' status* (Stickel, 1992; see also Phillips and Zuckerman, 2001), and analysts' *prior accuracy* (Hilary and Menzly, 2006). We include these variables in our analysis. Specifically, we construct a set of dummy variables in which i) analyst *i* is regarded as high status whereas analyst *j* is not, ii) *j* is high status but *i* is not, and iii) both analysts are considered high status. We apply a similar logic for the differences in professional experience of the two analysts as well as for their accuracy with respect to the consensus (i.e., the median estimate across all the analysts who issued an estimate on *S*) in the prior year.

Our *categorical mismatch* variable controls for the proportion of *i*'s and *j*'s portfolio coverage in the industry of focal stock *S*. We include this variable to account for the possibility that in making their estimates about a firm's earnings, analysts would interpret the barrage of present information revolving around the firm through their categorical schemas (Zuckerman, 1999; 2004; Benner, 2007). This literature is based on the (untested) assumption that analysts who specialize in the same category (i.e., industry) would employ a common lens to estimate the earnings of the firm. To control for the difference between two analysts' categorical expertise with respect to the focal firm, we calculate a variable measuring the dyadic categorical mismatch. This variable is equal to 0 when the two analysts that compose the dyad allocate the same percentage of their current year coverage to the industry in which the firm is categorized, it is higher the greater the difference in the two analysts' specialization with respect to the firm's industry category.

To interpret current information about *S* analysts may, moreover, also recollect and leverage their prior evaluative experiences. Such expectation resonates with several theoretical approaches in cognitive psychology and organization theory, such as the exemplars based theories in categorical learning (Medin and Shaffer, 1978) and the garbage can model (Cohen, March and Olsen, 1972). Because analysts could leverage old solutions to solve new problems (Ross, 1984), we might expect that analysts whose "garbage cans" are filled with a more similar pool of solutions could interpret more similarly a contingent problem. To account for this possibility, our *garbage can* variable measures the dyadic overlap in attention between the two analysts the prior year.[6] Other factors that could bias our results are related to the timing of the estimates. To control for the different set of information on *S* that analysts could leverage in forming their estimate, we include a variable measuring the number of *days to* the actual yearly earnings per share announcement by the firm, and one accounting for the number of *days elapsed* between the two analysts' estimates on *S*.

MODEL

We employ a dyadic analysis to test our hypotheses. Because several factors, besides those we control for, may affect a dyad's similarity in stock coverage and evaluations, our analysis may be affected by endogeneity. For example, two analysts who are cognitively similar in the first place could independently decide to follow the same stocks. Because their cognitive similarity could also affect their evaluations, our results might be spurious. To tackle such endogeneity problems we, first and foremost, control for any fixed unobserved heterogeneity that might induce two analysts to pay attention to the same stocks (as well as to issue similar estimates) by using two-way (analysts *i* and analyst *j*) fixed effects models. Furthermore, as we argued above, for our test of Hypothesis 1 we take advantage of exogenous events (i.e., the timing of quarterly earning per share announcements) that grab the attention of analysts. In so doing, we can exclude that the temporary similarity in attention patterns that we capture to test our H1 would be influenced by some endogenous factor that we cannot control for. Finally, as a further control for endogeneity, we also run models including a lagged dependent variable. Such Granger-test of causality (Granger, 1969) allows us to filter out most of the effect of missing variables that will affect y_t and y_{t-1} in equal measure. Because, for example, the effect of previously existing schemas between two analysts should be captured by their lagged distance in estimates at time *t-1*, the two analysts' reciprocal position in attention network should influence how much similarly they interpret *S* at time *t* only if the two analysts' schemas are adopted according to their positioning.

As a further robustness check, we also run several alternative models that account for non-independence across observations within the dyads. In dyadic analysis, indeed, observations in individual rows or in individual columns of the matrix tend to be highly correlated because of the repeating observations for each actor in several dyads. To address this problem, we leverage recent findings in the literature (Lindgren, 2010) and run models with robust standard errors clustered on both *i* and *j* (see Kleinbaum, Stuart, and Tushman, 2011 for a similar approach, based on Cameron, Gelbach, and Miller, 2011). These models' results are not qualitatively different from the fixed effects models and are not reported here.

[6] As a robustness check, we also measure the overlap in the prior 3 years. Results do not change.

FINDINGS

How do analysts form their predictions about the future earnings of a firm? Our first, baseline model in Table 1 includes variables related to theories from the finance literature on herding as well as from the sociological literature on the role of categories in valuation. With reference to herding biases on *S,* our dyadic approach provides some evidence, albeit not conclusive, that analysts with different experience, status, and prior accuracy behave differently.[7] The negative sign associated to our measure of dyadic categorical mismatch supports the categorical view on market valuations (Zuckerman 1999, 2004). Specifically, it shows that two analysts who share similar proportions of their coverage in the same industry as focal firm *S* tend to issue more similar estimates.[8]

[Insert Table 1 and 2 about here.]

With model 2 we begin to test our theory of how the evolving network structure of attention shapes valuation. Here we introduce our *attention network proximity* variable measuring the extent to which two analysts share a similar portfolio of coverage in the current year (current year structural clustering). The positive sign on attention network proximity supports our theory at a highly general level. The more two analysts are allocating their attention across similar portfolios of stocks in the given year, the more they would observe the market from a similar viewpoint. Yet, at the same time, by assessing a similar portfolio, the two analysts would also encounter each other's views more often. In short, our findings regarding model 2 provide evidence suggesting that the individual viewpoint effect (i.e., a similar exposure to what unfolds in the market) as well as the others' views effect (i.e., a mutual exposure to interpretations of what unfolds in the market) might play a role in market valuation. But, in itself, this finding does not allow us to disentangle the two.

We take on this challenge in models 3 and 4. Model 3 introduces our variable measuring the specific perspectival effect of the background of securities against which the analyst is observing the focal stock. Our effort here is to capture such a *viewpoint effect*, net of other attention portfolio effects (current and past year structural clustering) – that is, to identify the effect of the specific securities that are in the analyst's field of view *at the time* she issues an earnings estimate. As already presented, we take advantage of the exogenously induced demands on attention that are provoked by firms' quarterly

[7] These results however are not conclusive as the difference in status, professional experience or prior accuracy might capture endogenous differences across security analysts that have a bearing on their estimates.

[8] Model 1 also controls for several other factors. It shows that the more days elapse between the two analysts' estimate on S, the higher their difference in the two analysts' estimates. They also show that the closer the estimate to the actual earnings announcement of the firm, the lower the distance between two analysts' predictions.

earnings announcements. Our findings for model 3 indicate that viewpoint matters: two analysts who are exogenously induced to compare the focal stock *S* against a more similar background produce closer estimates of *S* than two analysts who observe *S* in a different field of view. This finding thus provides support for Hypothesis 1.

Whereas Hypothesis 1 posited an effect for viewpoints within attention networks, Hypothesis 2 identified the effects of exposure to the views of others within attention networks. Our effort in model 4 is to capture a *views effect,* net of other attention portfolio effects. To do so, we take advantage of the firms that are not in the dyad's mutual field of view. Recalling our argument, we ask, where viewpoints are not similar, are the members of the dyad exposed to similar or dissimilar views? Our triadic cycle variable answers this question by measuring the extent to which the members of the dyad are exposed to the views of the same others on the firms that are not in their overlapping field of view. The positive sign for this variable indicates that the more two analysts are exposed to the views of the same third actors on the firms that they do not evaluate jointly, the more their estimates on *S* are similar. This finding thus provides support for Hypothesis 2.

DISCUSSION

Our analysis has shown, in the first instance, that an analyst's estimate of the end-of-year earnings per share of a given security is shaped by the other securities in her field of view. In terms of Podolny and Hill-Popper's (2004:91) insight that valuation takes place from the "particular orientation of an individual to an object of exchange," we found that, when evaluating a given security, an analyst is not facing that security alone. In place of a singular relationship – a given analyst to a given security – we found a more multi-sided set of relations. The security is not alone. As our findings indicate, it is evaluated in terms of the other securities that are in the analyst's field of view.

Our analysis further demonstrated that analysts' estimates are influenced by the views of other analysts with whom they shared stock coverage and that these effects are amplified when individuals shared attention patterns with the same third parties. How does a given analyst search when she knows that she has limited cognitive abilities? Our answer began with a simple proposition: The analyst is not alone. Again, the relationship between analyst and security is not a singular one – there are multiple analysts evaluating that security, each of whom is simultaneously evaluating other securities. Given limited individual cognitive abilities, analysts leverage this multi-sided relationship. Just as the view of the focal stock is not only shaped by the information on that security but also by the other securities that form the background, so we argue that the view of the focal stock it is not shaped only by the views of others about that security but also by their views of other securities that are not shared. If my views are shaped by my peripheral vision and yours are shaped by your peripheral vision, then to the extent that we mutually influence each other, we can say that my views are shaped, in part, by your peripheral vision.

The socio-cognitive networks we have explored are thus a form of collective sense-making. But we must emphasize that this is not a singular, global collectivity sharing an univocal schema. And, if it is multiple, its facets are not groups that are cooperating for some common purpose on the basis of their personal ties. These are impersonal networks, linked not face-to-face, but face-to-screen, comprised not of partners in a common endeavor but of rivals in competition (Beunza and Stark, 2012).

Our findings provide therefore a novel theoretical approach to study cognitive processes across competitors (Kaplan, 2011), which is consistent with a more dynamic view of cognition emerging in social psychology (e.g., Smith and Semin, 2004). To date, the study of cognition in competitive markets has largely relied on boxologies (e.g., biases, heuristics, scripts, etc.) (Mitchell, Randolph-Seng, and Mitchell, 2011). This is particularly true for the literature on social valuations that strongly relies on the notion of categories (Zuckerman, 2004; Hannan, Polos, and Carroll, 2007; Pontikes, 2012) and on the assumption that markets are composed of segmented and stable communities with strong cognitive boundaries built around them. Specifically, this literature suggests that actors who specialize on the same category (typically within the same industry) should share a common, distinct, interpretive framework (Porac et al., 1995). Consequently the “candidates” for valuation which are positioned across different interpretive communities should be penalized for their “categorical mismatch” (Zuckerman, 1999) and, for similar reasons, exhibit greater price volatility (Zuckerman, 2004).

Following the new developments in psychological research recently introduced in organization theory, we recognized that a categorical approach “fails to include meaningful situations or to manipulate situations as a variable. The implicit assumption of this (categorical) work is that categorization is primarily a bottom-up stimulus based process, (whereas) many findings across diverse literature indicate powerful top-down effects of situations on conceptual processes” (Yeh and Barsalou, 2006). Embracing a situated cognition approach, we thus argued that one’s valuations are not simply the result of matching the focal “candidate” with a stable ideal-type but they are always contingent to the evolving background through which one puts things in perspective. In short, rather than positing that it is the “structure of *classification* that guides valuation” (Zuckerman 2004: 411), we argue that it is the structure of *attention* that guides valuation.

This does not mean, however, that we abandon the notion of category. Instead of rejecting it, we highlight temporal properties of the notion of category. In our usage, the concept of category refers to temporary and network-embedded constructs[9] rather than

[9] "In this sense, in human cognition, categories are seen as linguistic constructs used to store temporary associations built up from the integration of knowledge from several neural subnetworks. The categorization process, driven by language and conversation, serves to bridge together several distributed neural networks, associating tokens of knowledge that would not otherwise be associated in the individual networks." (Rocha 2001: 18).

to shared and already-established taken-for-granteds. As a temporary container of knowledge, a category integrates knowledge from several information sources and is shaped by the pragmatic interests of its interacting users.[10] By charting how analysts make new associations across securities, we are able to make a contribution to a network-analytic approach that examines how categories emerge and evolve (Ruef and Patterson, 2009).[11]

Our network analytic approach differs, however, from the established one in at least two main aspects. First, contrary to the prevailing social network literature, we do not focus on the interdependencies that emerge among actors sharing direct social ties. The preponderant network literature has built networks through ties of direct sociality or patterns of advice-seeking (Hargadon and Sutton, 1997, Tortoriello and Krackhardt, 2010). Also in its two-mode connotations, the literature often implies direct social links. Thus, networks across firms are built upon ties of ownership (Stark, 1996; Kogut and Walker, 2001), shared directors (Mizruchi and Brewster Stearns, 1988; Davis, 1991), alliances (Powell, Koput, and Smith-Doerr; 1996, Gulati and Gargiulo, 1999; Stuart, 2000) or mobility of organizational members (Rosenkopf and Almeida, 2003). Similarly, networks across scientists are linked by the direct social ties of co-authorship (Newman, 2004; Palla, Barabasi, and Vicsek, 2007). We differ from this approach because we suggest that actors are linked not only by inter-personal ties but also, through the particular problems, issues, and situations that command their attention. Such two-mode networks can be found among firms evaluating potential markets (Tsai, Su, and Chen, 2011), among scientists assessing inventions or referring to the same citations (Podolny, Stuart, and Hannan, 1996; Murray, 2002), among critics reviewing works of art (Durand, Rao and Monin, 2007), or among investors evaluating assets (Zuckerman, 2004)

Based on the notion of structural equivalence, a fundamental, albeit lately neglected network literature, argued that, besides their direct interpersonal ties, actors might be affected in their decisions by their common (mediated) relationships to (through) third entities (e.g., Lorrain and White; 1971). Our main contribution to network theory provides new lenses to study the role of impersonal ties in networks by highlighting the neglected temporal aspect of structural equivalence. We do so by recognizing the importance of the ephemeral inter-subjective linkages that actors create via their joint attention toward the

[10] Our concept of category thus resembles transient, context-dependent knowledge arrangements characterized by Clark (1993, 1999) as "on the hoof" category constructions. Such "short-term categories bridge together a number of possibly highly unrelated contexts, which in turn creates new associations in the individual information resources that would never occur with their own limited context" (Rocha 2001:25).

[11] In short, our view suggests that categorical exemplars are not necessarily a stable mental representation formed by the individual actor, or a common conception univocally shared by a community. They are cognitive constructs whose stability and commonality depend on i) the renewal of the portfolio of objects available in the market; ii) the structure of attention created by the attention allocation of actors across objects.

same entities. Our attention to temporality thus stresses the importance of tie activation in network structures. In contrast to the extant literature that has largely argued that individuals are embedded in, and influenced by their resilient ego-networks (e.g., Granovetter, 1985), we notice that not all the ties forming an individual's ego-network are activated at the same time. Because attention ties are transient, certain ties become more relevant in a particular moment and less relevant in others. In pointing to temporal structural equivalence, we argue that ties that are contingently activated in an attention network illuminate, (i.e., bring to the foreground) certain issues.

Finally, our approach provides an intermediate position that reconciles the strong and weak cognitivism put forward respectively by economists and sociologist. For economists, the main drivers of market actors' valuation processes are first-order beliefs, that is, the beliefs that derive from autonomous and independent calculative efforts. Rejecting the conception of individuals as "the instantaneous ego of a sort of singular cognitio," sociologists view individuals as the "individual trace of a socialized subjectivity" (Bourdieu 1990: 91). What matters in sociology are second-order beliefs that emanate from mechanisms of social influence.

Our theory proposes a dynamic model of cognition in which first-order and second-order beliefs are deeply intertwined. Market agents, in our perspective, are neither autonomous rational agents that apply pre-existing valuation models nor simply mechanical conveyers of social influence who apply valuation models that radiate from direct social relationships (Granovetter 1985) or that spring from institutional pressures (DiMaggio and Powell 1991). Rather, we suggest that market actors constantly compete to seek opportunities in the market that others fail to see. They do so, however, in a limited field of vision defined by the objects to which they pay attention and in a networked social structure of attention that influences the alternative valuation models to which they are exposed.

CONCLUSION

Thirty years ago Nobel Prize winner Herbert Simon suggested that, in the increasingly information-rich world in which we live, the wealth of information we face "creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it" (Simon 1971: 40-41). The key idea in Simon's thinking pointed to the limitations of individual cognitive capabilities. Departing from neo-classical assumptions, Simon stressed that we cannot all pay attention to everything. Even within a particular market or a particular organization, no individual can process all of the relevant information. For Simon and his collaborators, organizational forms can partially address this problem. Hierarchy, for example, is a form of distributed cognition, allocating or distributing attention across the units in which various problems and tasks are decomposed. In that sense, organizations can be analyzed as attention structures (Ocasio, 1997).

Our study also begins with the limitations of individual cognition. But the attention structures we examine span organizational boundaries. We do so because we want to highlight that among the cognitive scaffolds that prop up, support, and aid the cognitive work of calculation we find not only organizational infrastructure, research departments, models, algorithms, and instrumentation. If attention structures are a means within organizations for dealing with the limitations of individual cognition, attention networks that span organizations can also be a resource for action in the face of bounded cognitive abilities.

The securities analysts that we studied confront the problems of limited cognitive abilities on a daily basis. Like actors in many other domains, they are relentlessly searching. At times, it is a search to find what others have already seen but you are missing. At other times it is a search for innovative insights to find what others have not yet seen. The moral of the story is, if you like, an ancient one: "Fix not thy mind on one place only" (Dante Alighieri - *The Divine Comedy: Purgatory* canto 10). The market is seen not only through the lenses of a categorical schema but also through the perspective given by your peripheral vision.

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Table 1. Descriptive Statistics and Correlation Matrix.

	Mean	Std. Dev.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Valuation similarity	.61	.32	0	1																
Views effect	4.53	3.84	0	36	.08															
Viewpoint effect	.08	.42	0	12	.01	.04														
Attention network proximity	.25	.24	0	1	.05	.08	.15													
Garbadge can similarity	.19	.24	0	1	.04	.10	.12	.63												
i expert / *j* no expert	.20	.40	0	1	-.01	-.02	-.02	-.10	-.13											
i no expert / *j* expert	.21	.41	0	1	.00	-.02	-.01	.05	.00	-.26										
i expert / *j* expert	.48	.50	0	1	.02	.05	.04	.06	.19	-.48	-.49									
i status / *j* no status	.12	.33	0	1	-.01	-.01	.02	.05	.07	.07	-.12	.09								
i no status / *j* high status	.12	.32	0	1	.02	-.01	.03	.12	.11	-.11	.08	.08	-.15							
i high status / *j* high status	.03	.17	0	1	.01	-.03	.03	.13	.15	-.04	-.05	.11	-.07	-.07						
i accurate / *j* no accurate	.17	.38	0	1	.01	.02	.01	.02	.04	.04	-.05	.04	.04	-.02	.01					
i no accurate / *j* accurate	.18	.38	0	1	.02	.01	.02	.04	.04	-.05	.04	.03	-.02	.04	.01	-.24				
i accurate / *j* accurate	.07	.25	0	1	.03	.04	.02	.04	.08	-.02	-.02	.06	.02	.02	.02	-.14	-.14			
Categorical mismatch	.15	.20	0	.99	-.05	-.30	-.06	-.28	-.21	.01	.01	-.01	-.01	-.02	-.04	-.02	-.02	-.03		
Days to the actual announcement	200	91	2	365	-.05	-.02	-.02	-.02	.02	.00	-.01	.02	.00	.01	.00	.02	.02	.04	.01	
Days between analysts' estimate	32	32	0	104	-.23	-.02	.04	-.03	-.02	.00	.00	.00	.03	-.03	-.01	-.01	-.01	-.01	.03	-.18

Table 2. Two-Way analysts (*i* and *j*) fixed effects regression of attention network positions on valuation similarity.

	1a	1b	2a	2b	3a	3b	4a	4b
Views effect							.0017***	.0011***
(Current year triadic cycles)							(.0000)	(.0000)
Viewpoint effect					.0076***	.0052***	.0075***	.0052***
(Contingent structural clustering)					(.0002)	(.0002)	(.0002)	(.0002)
Attention network proximity			.0076***	.0045***	.0059***	.0031***	.0095***	.0056***
(Current year structural clustering)			(.0006)	(.0007)	(.0006)	(.0007)	(.0006)	(.0007)
Garbage can similarity	-.0028***	-.0017**	-.0059***	-.0036***	-.0063***	-.0037***	-.0072***	-.0042***
	(.0005)	(.0005)	(.0005)	(.0006)	(.0005)	(.0006)	(.0005)	(.0006)
Prior experience								
i expert / *j* no expert	.0129***	.0075***	.0130***	.0076***	.0128***	.0074***	.0123***	.0071***
	(.0004)	(.0005)	(.0004)	(.0005)	(.0004)	(.0005)	(.0004)	(.0005)
i no expert / *j* expert	.0120***	.0065***	.0120***	.0065***	.0119***	.0064***	.0112***	.0060***
	(.0004)	(.0005)	(.0004)	(.0005)	(.0004)	(.0005)	(.0004)	(.0005)
i expert / *j* expert	.0248***	.0135***	.0249***	.0136***	.0246***	.0133***	.0232***	.0124***
	(.0004)	(.0005)	(.0004)	(.0005)	(.0004)	(.0005)	(.0004)	(.0005)
Status								
i status / *j* no status	-.0009	.0006	-.0008	.0007	-.0008	.0006	-.0007	.0007
	(.0004)	(.0005)	(.0004)	(.0005)	(.0004)	(.0005)	(.0004)	(.0005)
i no status / *j* status	-.0011†	-.0008*	-.0012*	-.0009	-.0012*	-.0009	-.0012†	-.0008
	(.0005)	(.0005)	(.0005)	(.0005)	(.0005)	(.0005)	(.0005)	(.0005)
i status / *j* status	-.0026***	-.0006***	-.0028***	-.0007	-.0030***	-.0008	-.0025***	-.0004
	(.0007)	(.0008)	(.0007)	(.0008)	(.0007)	(.0008)	(.0007)	(.0008)

Prior accuracy								
i accurate / *j* no accurate	.0087***	.0050***	.0087***	.0050***	.0087***	.0050***	.0087***	.0050***
	(.0002)	(.0003)	(.0002)	(.0003)	(.0002)	(.0003)	(.0002)	(.0003)
i no accurate / *j* accurate	.0120***	.0120***	.0120***	.0072***	.0120***	.0071***	.0119***	.0071***
	(.0002)	(.0002)	(.0002)	(.0003)	(.0002)	(.0003)	(.0002)	(.0003)
i accurate / *j* accurate	.0290***	.0291***	.0291***	.0177***	.0290***	.0176***	.0289***	.0175***
	(.0004)	(.0004)	(.0004)	(.0004)	(.0004)	(.0004)	(.0004)	(.0004)
Categorical mismatch	-.0087***	-.0072***	-.0072***	-.0043***	-.0072***	-.0042***	-.0022***	-.0010
	(.0006)	(.0006)	(.0006)	(.0007)	(.0006)	(.0007)	(.0006)	(.0008)
Days to the actual earnings announcement	-.0003***	-.0003***	-.0003***	-.0001***	-.0003***	-.0001***	-.0003***	-.0001***
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
Days elapsed between analysts' estimates	-.0022***	-.0022***	-.0022***	-.0023***	-.0022***	-.0023***	-.0022***	-.0023***
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
Lagged valuation similarity		.3176		.3176***		.3175***		.3174***
		(.0003)		(.0003)		(.0003)		(.0003)
Analyst *i* dummies	(yes)	(yes)	(yes)	(yes)	(yes)	(yes)	(yes)	(yes)
Analyst *j* dummies	(yes)	(yes)	(yes)	(yes)	(yes)	(yes)	(yes)	(yes)
R^2	.1236	.2407	.1237	.2407	.1238	.2408	.1240	.2409
No observations	10,933,662	6,803,100	10,933,662	6,803,100	10,933,662	6,803,100	10,933,662	6,803,100

†<0.05; *p<0.01** p<0.001; ***p<0.0001

Note: Columns 1b, 2b, 3b, and 4b present results including the lagged dependent variable. Such tests represent a Granger test of causality.