

How to Recognize Opportunities: Heterarchical Search in a Wall Street Trading Room

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Our task in this paper is to analyze the organization of trading in the era of quantitative finance. To do so, we conduct an ethnography of arbitrage, the trading strategy that best exemplifies finance in the wake of the quantitative revolution. In contrast to value and momentum investing, we argue, arbitrage involves an art of association - the construction of equivalence (comparability) of properties across different assets. In place of essential or relational characteristics, the peculiar valuation that takes place in arbitrage is based on an operation that makes something the measure of something else - associating securities to each other. The process of recognizing opportunities and the practices of making novel associations are shaped by the specific socio-spatial and socio-technical configurations of the trading room. Calculation is distributed across persons and instruments as the trading room organizes interaction among diverse principles of valuation.

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Introduction

In Novum Organum, one of the founding documents of modern science, Francis Bacon (1620/1960) outlined a new course of discovery. Writing in an age when the exploration, conquest, and settlement of territory was enriching European sovereigns, Bacon proposed an alternative strategy of exploration. In place of the quest for property, for territory, Bacon urged a search for properties, the properties of nature, arguing that this knowledge, produced at the workbench of science, would prove a yet vaster and nearly inexhaustible source of wealth.¹

Three centuries later, several recent innovations hold a similarly alluring promise for Wall Street traders and modern economies. The creation of the NASDAQ in 1971 and of Bloomberg terminals in 1980 has given Wall Street an electronic exchange three decades before the appearance of the commercial Internet. The development of formulas for pricing derivatives such as the Black-Scholes in 1973 has given traders precision tools previously reserved for engineers. And the dramatic growth in computing power since the introduction of the PC has given traders the possibility to combine these equations with powerful computational engines. The mix of formulas, data to plug into them, computers to calculate them, and electronic networks to connect it all has been explosive, leading to a decisive shift to “quantitative finance.” (Bernstein 1993; Dunbar 2000; MacKenzie and Millo, 2003). As a result, finance is today mathematical, networked, computational, and knowledge-intensive.

Just as Bacon’s experimentalists at the beginnings of modern science were in search of new properties, so our quantitative traders have, in their quest for profits, gone beyond traditional properties of companies such as growth, solvency, or profitability. Their pursuit has taken them to abstract financial qualities such as volatility, convertibility or liquidity, as different from accounting-based measures as Bacon’s search was from the conquest of new territory.

But, how are the new properties to be found? Bacon’s radical proposal, at least in the more standard reading, came with an equally novel strategy for its fulfillment, a program of inductive, experimentalist science that contrasted sharply with the method of logical deduction prevailing at the time. Is there a financial counterpart to Bacon’s program of experimentation?

¹ We owe this insightful reading of Bacon’s writings, including Novum Organum and his (often unsolicited) “advices” to his sovereigns, Elizabeth I and James I, to Monique Girard (Girard, nd).

Our task in this paper is to analyze how a Wall Street trading room is organized for this process of discovery. A trading room, as we shall see, is a kind of laboratory in which traders are engaged in a process of search and experimentation. At one level it would seem that their search is straightforward: they are searching for value. And it would seem that the means for this search are similarly obvious: use channels of high speed connectivity to gather as much timely information as possible and take advantage of sophisticated mathematical formulae to process that information. At the very elite of the profession, however, these means, in themselves, do not give advantage. You must have them to be a player, but your competitors are likely to have them as well. That is, the more that timely information is available simultaneously to all market actors, the more advantage shifts from economies of information to processes of interpretation. Moreover, what seems straightforward, value, is exactly what is at issue.

The challenge of search and experimentation must thus be re-specified: how do you recognize an opportunity that your competitors have not already identified? At the extreme, therefore, you are searching for something that is not yet named and categorized. The problem confronting our traders, then, is a problem fundamental to innovation in any setting: how do you search – when you don't know what you're looking for but will recognize it when you find it?

To explore this challenge, we conducted ethnographic field research in the Wall Street trading room of a major international investment bank. Pseudonymous International Securities is a global bank with headquarters outside the United States. It has a large office in New York, located in the World Financial Center in Lower Manhattan. With permission from the manager of the trading room we had access to observe trading and interview traders. Our observations extended to sixty half-day visits across more than two years. During that time, we conducted detailed observations at three of the room's ten trading desks, sitting in the tight space between traders, following trades as they unfolded and sharing lunches and jokes with the traders. We complemented this direct observation with in-depth interviews. In the final year of our investigation, we were more formally integrated into the trading room – provided with a place at a desk, a computer, and a telephone. The time span of our research embraced the periods before and after the September 11th attack on the World Trade Center (for accounts of the trading room's response and recovery, see Beunza and Stark 2003, 2004).

To anticipate the major lines of our argument and provide a road map of the sections of the paper: In the following section we introduce the practices of modern arbitrage – the trading strategy that best represents the distinctive combination of connectivity, knowledge, and computing that are the defining features of the quantitative revolution in finance. Arbitrageurs locate value by making associations among securities. At the sophisticated level of trading at International Securities there is a sharp premium on making novel, unexpected, and innovative associations. In subsequent sections, we examine how such associations are made at International Securities through heterarchical organization, a form whose features we elaborate in more detail below.

The cognitive challenge facing our arbitrage traders is the problem of recognition. On one hand, they must be adept at pattern recognition (e.g., matching data to models, etc). But if they only recognize patterns familiar within their existing categories, they would not be innovative (Brown and Duguid 1998; Clippinger 1999). Innovation requires another cognitive process that we can think of as re-cognition (making unanticipated associations, reconceptualizing the situation, breaking out of lock-in).

The trading room is equipped to meet this twin challenge of exploiting knowledge (pattern recognition) while simultaneously exploring for new knowledge (practices of re-cognition). Each desk (e.g., merger arbitrage, index arbitrage, etc.) is organized around a distinctive evaluative principle and its corresponding cognitive frames, metrics, “optics,” and other specialized instrumentation for pattern recognition (Hutchins, 1995). That is, the trading room is the site of diverse, indeed rivalrous, principles of valuation. And it is *the interaction across this heterogeneity that generates innovation*. Rather than bureaucratically hierarchical, the trading room is heterarchical (Stark 1999; Girard and Stark 2002). In place of hierarchical, vertical ties, we find horizontal ties of distributed cognition; in place of a single metric of valuation, we find multiple metrics of value; and in place of designed and managed R&D, we find innovations as combinatorics (Kogut and Zander 1992) that emerge from the interaction across these coexisting principles and instruments. The trading room distributes intelligence and organizes diversity.

Arbitrage, or the recombinant properties of modern finance

Arbitrage is defined in finance textbooks as “locking in a profit by simultaneously entering into transactions in two or more markets” (Hull, 1996, p. 4). If, for instance, the prices of gold in New York and London differ by more than the transportation costs, an arbitrageur can realize an easy profit by buying in the market where gold is cheap and selling it in the market where it is expensive. But reducing arbitrage to an unproblematic operation that links the obvious (gold in London, gold in New York), as textbook treatments do, is doubly misleading, for modern arbitrage is neither obvious nor unproblematic. It provides profit opportunities by associating the unexpected, and it entails real exposure to substantial losses.

Arbitrage is a distinctive form of entrepreneurial activity that exploits not only gaps across markets but also the overlaps among multiple evaluative principles. Arbitrageurs profit not by having developed a superior way of deriving value but by exploiting opportunities exposed when different evaluative devices yield discrepant pricings at myriad points throughout the economy.

As a first step to understanding modern arbitrage, consider the two traditional trading strategies, *value* and *momentum* investing, that arbitrage has come to challenge.² Value

² See especially Smith (2001), who refers to these strategies as *fundamentalist* and *chartist*.

investing is the traditional “buy low, sell high” approach in which investors look for opportunities by identifying companies whose “intrinsic” value differs from its current market value. Value investors are essentialists: they believe that property has a true, intrinsic, essential value independent from other investors’ assessments, and that they can attain a superior grasp of that value through careful perusal of the information about a company.

In contrast to value investors, momentum traders (also called chartists) turn away from scrutinizing companies towards monitoring the activities of other actors on the market (Malkiel, 1973). Like value investors, their goal is to find a profit opportunity. However, momentum traders are not interested in discovering the intrinsic value of a stock. Instead of focusing on features of the asset itself, they turn their attention to whether other market actors are bidding the value of a security up or down. Like the fashion-conscious or like nightlife socialites scouting the trendiest clubs, they derive their strength from obsessively asking, “where is everyone going?” in hopes of anticipating the hotspots and leaving just when things get crowded.

As with value and momentum investors, arbitrageurs also need to find an opportunity, an instance of disagreement with the market’s pricing of a security. They find it by making associations. Instead of claiming a superior ability to process and aggregate information about intrinsic assets (as value investors do) or better information on what other investors are doing (as momentum traders do), the arbitrage trader tests ideas about the correspondence between two securities. Confronted by a stock with a market price, the arbitrageur seeks some other security – or bond, or synthetic security such as an index composed of a group of stocks, etc. – that can be related to it, and prices one in terms of the other. The two securities have to be similar enough so that their prices change in related ways, but different enough so that other traders have not perceived the correspondence before. As we shall see, the posited relationship can be highly abstract. The tenuous or uncertain strength of the posited similarity or co-variation reduces the number of traders that can play a trade, hence increasing its potential profitability.

Arbitrage hinges on the possibility of interpreting securities in multiple ways. Like a striking literary metaphor, an arbitrage trade reaches out and associates the value of a stock to some other, previously unidentified security. By associating one security to another, the trader highlights different properties (qualities) of the property he is dealing with.

Like Bacon’s experimentalists, arbitrage traders have moved from exploring for territory (traditional notions of *property*) to exploring for the underlying *properties* of securities. In contrast to value investors who distill the bundled attributes of a company to a single number, arbitrageurs reject exposure to a whole company. But in contrast to corporate raiders, who buy companies for the purpose of breaking them up to sell as separate properties, the work of arbitrage traders is yet more radically deconstructionist. The unbundling they attempt is to isolate, in the first instance, categorical attributes. For example, they do not see Boeing Co. as a monolithic asset or property, but as having

several properties (traits, qualities) such as being a technology stock, an aviation stock, a consumer-travel stock, an American stock, a stock that is included in a given index, and so on. Even more abstractionist, they attempt to isolate such qualities as the volatility of a security, or its liquidity, its convertibility, its indexability, and so on.

Thus, whereas corporate raiders break up parts of a company, modern arbitrageurs carve up abstract qualities of a security. In our field research, we find our arbitrageurs actively shaping trades. Dealing with the multiple qualities of securities as narrow specialists, they position themselves with respect to one or two of these qualities, but never all. Their strategy is to use the tools of financial engineering to shape a trade so that exposure is limited only to those equivalency principles in which the trader has confidence. Derivatives such as swaps, options, and other financial instruments play an important role in the process of separating the desired qualities from the purchased security. Traders use them to slice and dice their exposure, wielding them in effect like a surgeon's tools – scalpels, scissors, proteases – to give the patient (the trader's exposure) the desired contours.

Paradoxically, much of the associative work of arbitrage is therefore for the purpose of “disentangling” (see Callon 1998 for a related usage) – selecting out of the trade those qualities to which the arbitrageur is not committed. The strategy is just as much not betting on what you don't know as betting on what you do know. In merger arbitrage, for example, this strategy of highly specialized risk exposure requires that traders associate the markets for stocks of the two merging companies and dissociate from the stocks everything that does not involve the merger. Consider a situation in which two firms have announced their intention to merge. One of the firms, say the acquirer, is a biotech firm and belongs to an index, such as the Dow Jones (DJ) biotech index. If a merger arbitrage specialist wanted to shape a trade such that the “biotechness” of the acquirer would not be an aspect of his/her positioned exposure, the arbitrageur would long the index. That is, to dissociate this quality from the trader's exposure, the arbitrageur associates the trade with a synthetic security (“the index”) that stands for the “biotechness.” Less categorical, more complex qualities require more complex instruments.

Arbitrageurs, do not narrow their exposure for lack of courage. Despite all the trimmings, hedging, and cutting, this is not a trading strategy for the faint-hearted. Arbitrage is about tailoring the trader's exposure to the market, biting what they can chew, betting on what they know best, and avoiding risking their money on what they don't know. Traders expose themselves profusely – precisely because their exposure is custom-tailored to the relevant deal. Their sharp focus and specialized instruments gives them a clearer view of the deals they examine than the rest of the market. Thus, the more the traders hedge, the more boldly they can position themselves.

Arbitrageurs can reduce or eliminate exposure along many dimensions but they cannot make a profit on a trade unless they are exposed on at least one. In fact, they cut entanglements along some dimensions precisely to focus exposure where they are most

confidently attached. As Callon (Callon and Muniesa 2002, Callon et al. 2002) argues, calculation and attachment are not mutually exclusive. To be sure, the trader's attachment is distanced and disciplined; but however emotionally detached, and however fleeting, to hold a position is to hold a conviction.³ In the field of arbitrage, to be opportunistic you must be principled, that is, you must commit to an evaluative metric. And, as we shall see, to engage in complex, high-stakes trading, you must also be able to collaborate with those who are attached to different metrics.

Heterarchy

How do unexpected and tenuous associations become recognized as opportunities? How could the traders at International Securities exploit the knowledge they had (to recognize patterns that it had identified) while also exploring for new opportunities (if you like, recognizing properties)?⁴ To do so, the trading room adopted an organizational form that we characterize as *heterarchy*. As the term suggests, heterarchies are characterized by minimal hierarchy and by organizational heterogeneity. Heterarchies involve a distributed intelligence (lateral accountability) and the organization of diversity (co-existing evaluative principles).

Mid- 20th century, there was general consensus about the ideal attributes of the modern organization: it had a clear chain of command, with strategy and decisions made by the organizational leadership; instructions were disseminated and information gathered up and down the hierarchical ladder of authority; design preceded execution with the latter carried out with the time-management precision of a Taylorist organizational machine. By the end of the century, the main precepts of the ideal organizational model would be fundamentally rewritten. The primacy of relations of hierarchical *dependence* within the firm and the relations of market *independence* between firms became secondary to relations of *interdependence* among networks of firms and among units within the firm (Kogut and Zander 1992; Powell 1996; Grabher and Stark 1997).

To cope with radical uncertainties, instead of concentrating its resources for strategic planning among a narrow set of senior executives or delegating that function to a specialized department, heterarchical firms embark on a radical decentralization in which virtually every unit becomes engaged in innovation. That is, in place of specialized search routines in which some departments are dedicated to exploration while others are confined to exploiting existing knowledge, the functions of exploration are generalized throughout the organization. In place of vertical chains of command, intelligence is

³ Zaloom (2004) correctly emphasizes that, to speculate, a trader must be disciplined. In addition to this psychological, almost bodily, disciplining, however, we shall see that the arbitrage trader's ability to take a risky position depends as well on yet another discipline – grounding in a body of knowledge.

⁴ We are re-interpreting March's (1991) exploitation/exploration problem of organizational learning through the lens of the problem of recognition. On a separate but related challenge in a new media startup, see Girard and Stark (2002).

distributed – laterally. With its flattened hierarchy, the absence of separate offices for the room’s few managers, its open architectural plan, and its collegial culture, the trading room at International Securities shows collaborative features of such distributed intelligence.

Heterarchies, however, are not simply non-bureaucratic. Heterarchies interweave a multiplicity of organizing principles. The new organizational forms are heterarchical not only because they have flattened hierarchy, but also because they are the sites of competing and coexisting value systems. They maintain and support an active rivalry of multiple evaluative principles. A robust, lateral collaboration flattens hierarchy without flattening diversity. The co-existence of more than one evaluative principle produces a creative friction (Brown and Duguid 1998) and fosters cross-fertilization. It promotes organizational reflexivity, the ability to redefine and recombine resources. Heterarchies are not simply tolerant of diversity among isolated and non-communicating factions; the organization of diversity is not a replicative redundancy but a generative redundancy. It is the friction at the interacting overlap that generates productive recombinations. The challenge is to create a sufficiently common culture to facilitate communication among the heterogeneous components without suppressing the distinctive identities of each. Heterarchies create wealth by inviting more than one way of evaluating worth.

This aspect of heterarchy builds on Knight’s (1921) distinction between *risk*, where the distribution of outcomes can be expressed in probabilistic terms, and *uncertainty*, where outcomes are incalculable. Whereas in neoclassical economics all cases are reduced to risk, Knight argued that a world of generalized probabilistic knowledge of the future leaves no place for profit (as a particular residual revenue that is not contractualizable because it is not susceptible to measure *ex ante*) and hence no place for the entrepreneur. Properly speaking, the entrepreneur is not rewarded for risk-taking but, instead, is rewarded for an ability to exploit uncertainty. The French school of the “economics of conventions” (Boltanski and Thévenot 1991,1999; Thévenot 2001) demonstrates that institutions are social technologies for transforming uncertainty into calculable problems; but they leave unexamined the incidence of uncertainty about which institution (“ordering of worth”) is operative in a given situation. In this light, Knight’s conception of entrepreneurship can be re-expressed: entrepreneurship is the ability to keep multiple evaluative principles in play and to exploit the resulting ambiguity (Stark 2000). Restated, entrepreneurship in this view is not brokerage across a gap but facilitating productive friction at the overlap of co-existing principles.

Distributing Intelligence and Organizing Diversity in the Trading Room

A desk with a view of the markets

The trading room at International Securities offers a sharp contrast to the conventional environment of corporate America. Unlike a standard corporate office with cubicles and a layout meant to emphasize differences in hierarchical status, trading room are open-plan arrangements where information roams freely. Instead of having its senior managers

scattered at window offices along the exterior of the building, the bank puts managers in the same desks as their teams, accessible to them with just a movement of the head or hand. Underscoring the importance of sociability, the bank has limited the number of people in the room to 150 employees and has a low-monitor policy so people can see each other. Computer programmers and other critical, technical support staff are not separated but have desks right in the trading room.

Whereas the traders of the 1980s, acutely described by Tom Wolfe (1987) as Masters of the Universe, were characterized by their riches, bravado, and little regard for small investors, the quantitative traders at International Securities have MBA degrees in finance, PhDs in physics and statistics, and are more appropriately thought of as engineers. None of them wears suspenders.

The basic organizational unit of the trading room is a “desk,” and it is here that the organization of diversity in the trading room begins by demarcating specialized functions. The term “desk” not only denotes the actual piece of furniture where traders sit, but also the actual team of traders – as in “Tim from the equity loan desk.” Such identification of the animate with the inanimate is due to the fact that a team is never scattered across different desks. In this localization, the different traders in the room are divided into teams according to the financial instrument they use to create equivalencies in arbitrage: the merger arbitrage team trades stocks in companies in the process of consolidating, the options arbitrage team trades in “puts” and “calls,”⁵ the derivatives that lend the desk its name, and so on. The extreme proximity of the workstations enables traders to talk to each other without lifting their eyes from the screen or interrupting their work. The desk is an intensely social place where traders work, take lunch, make jokes, and exchange insults in a never-ending undercurrent of camaraderie that resurfaces as soon as the market gives a respite.

Each desk has developed its own way of looking at the market, based on the principle of equivalence that it uses to calculate value and the financial instrument that enacts its particular style of arbitrage trade. Merger arbitrage traders, for example, keen on finding out the degree of commitment of two merging companies, look for a progressive approximation in the stock prices of two companies. They probe commitment to a merger by plotting the “spread” (difference in price) between acquiring and target companies over time. As with marriages between persons, mergers between companies are scattered with regular rituals of engagement intended that persuade others of the seriousness of their intent. As time passes, arbitrage traders look for a pattern of gradual decay in the spread as corporate bride and groom come together – i.e., a descending diagonal curve on their Bloomberg screens, not unlike the trajectory of a landing airplane.

Convertible bond arbitrageurs, by contrast, do not obsess about whether the spread between two merging companies is widening or narrowing. Instead, they specialize in

⁵ A put is a financial option that gives its holder the right to sell. A call gives the right to buy.

information about stocks that would typically interest bondholders, such as their liquidity and likelihood of default. At yet another desk, index arbitrageurs, in their attempt to exploit minuscule and rapidly vanishing misalignments between S&P 500 futures and the underlying securities, specialize in technology to trade in high volume and at a high speed. Thus, within each team there is a marked consistency between its arbitrage strategy, its visual displays, its mathematical formulae and its trading tools.

Such joint focus on visual and economic patterns turns each desk into a distinctive community of practice, with its own evaluative principle, tacit knowledge, social ties, and shared forms of meaning (Lave and Wenger 1990). This includes a common sense of purpose, a real need to know what each other knows, a highly specialized language, and idiosyncratic ways of signaling to each other. It even translates into friendly rivalry toward other desks. A customer sales trader, for example, took us aside to denounce statistical arbitrage as “like playing video games. If you figure out what the other guy’s program is, you can destroy him. That’s why we don’t do program trades,” he explained, referring to his own desk. Conversely, one of the statistical arbitrage traders, told us, in veiled dismissal of manual trading, that the more he looked at his data (as opposed to letting his robot trade) the more biased he becomes.

Homogeneity within a desk facilitates speed and sophistication to navigate crowded and fast-moving capital markets. But the complex trades that are characteristic of our trading room, however, seldom involve a single desk/team in isolation from others. It is to these collaborations that we turn.

Distributed cognition across desks

The desk, in our view, is a unit organized around a dominant evaluative principle and its arrayed financial instruments (devices for measuring, testing, probing, cutting). This principle is its coin; if you like, its specie. But the trading room is composed of multiple species. It is an ecology of evaluative principles. Complex trades take advantage of the interaction among these species. To be able to commit to what counts, to be true to your principle of evaluation, each desk must take into account the principles and tools of other desks. Recall that shaping a trade involves disassociating some qualities in order to give salience to the ones to which your desk is attached. To identify the relevant categories along which exposure will be limited, shaping a trade therefore involves active association among desks. Co-location, the proximity of desks, facilitates the connections needed to do the cutting.

Whereas in most textbook examples of arbitrage the equivalence-creating property is easy to isolate, in practice, it is difficult to fully disassociate. Because of these difficulties, even after deliberate slicing and dicing, traders can still end up dangerously exposed along dimensions of the company that differ from the principles of the desired focused exposure. We found that traders take into account unintended exposure in their calculations in the same way as they achieve association: through co-location. Physical

proximity in the room allows traders to survey the financial instruments around them and assess which additional variables they should take into account in their calculations.

For example, the stock loan desk can help the merger arbitrageurs on matters of liquidity. Merger arbitrage traders lend and borrow stock as if they could reverse the operation at any moment of time. However, if the company is small and not often traded, its stock may be difficult to borrow, and traders may find themselves unable to hedge. In this case, according to Max, senior trader at the merger arbitrage desk, “The stock loan desk helps us by telling us how difficult it is to borrow a certain stock.” Similarly, index arbitrageurs can help merger arbitrageurs trade companies with several classes of shares. Listed companies often have two types of shares, so-called “A-“ and “K-class” stock. The two carry different voting rights, but only one of the two types allows traders to hedge their exposure. The existence of these two types facilitates the work of merger arbitrageurs, who can execute trades with the more liquid of the two classes and then transform the stock into the class necessary for the hedge. But such transformation can be prohibitively expensive if one of the two classes is illiquid. To find out, merger arbitrageurs turn to the index arbitrage team, which exploits price differences between the two types.

In other cases, one of the parties may have a convert provision (that is, its bonds can be converted into stocks if there is a merger) to protect the bondholder, leaving merger arbitrage with questions about how this might affect the deal. In this case, it is the convertible bond arbitrage desk that helps merger arbitrage traders clarify the ways in which a convertibility provision should be taken into account. “The market in converts is not organized,” says Max, in the sense that there is no single screen representation of the prices of convertible bonds. For this reason,

We don’t know how the prices are fluctuating, but it would be useful to know it because the price movements in converts impacts mergers. Being near the converts desk gives us useful information.

In any case, according to Max, “even when you don’t learn anything, you learn there’s nothing major to worry about.” This is invaluable because, as he says, “what matters is having a degree of confidence.”

By putting in close proximity teams that trade in the different financial instruments involved in a deal, the bank is thereby able to associate different markets into a single trade. As a senior trader observed,

While the routine work is done within teams, most of the value we add comes from the exchange of information between teams. This is necessary in events that are unique and non-routine, transactions that cross markets, and when information is time-sensitive.

Thus, whereas a given desk is organized around a relatively homogeneous principle of evaluation, a given trade is not. Because it involves hedging exposure across different

properties along different principles of evaluation, any given trade can involve heterogeneous principles and heterogeneous actors across desks. If a desk involves simple teamwork, a (complex) trade involves collaboration. This collaboration can be as formalized as a meeting (extraordinarily rare at International Securities) that brings together actors from the different desks. Or it might be as primitive as an un-directed expletive from the stock loan desk which, overheard, is read as a signal by the merger arbitrage desk that there might be problems with a given deal.

Reflexivity

To see opportunities, traders use the mathematics and the machines of market instruments. We can think of traders as putting on the financial equivalent of infrared goggles that provide them with the trader's equivalent of night-vision. The traders' reliance on such specialized instruments, however, entails a serious risk. In bringing some information into sharp attention, the software and the graphic representations on their screens also obscure. In order to be devices that magnify and focus, they are also blinders. According to one, "Bloomberg shows the prices of normal stocks; but sometimes, normal stocks morph into new ones," such as in situations of mergers or bond conversions. If a stock in Stan's magnifying glass – say, an airline that he finds representative of the airline sector – were to go through a merger or bond conversion, it would no longer stand for the sector.

An even more serious risk for the traders is that distributing calculation across their instruments amounts to inscribing their sensors with their own beliefs. As we have seen, in order to recognize opportunities, the trader needs special tools that allow him to see what others cannot. But the fact that the tool has been shaped by his theories means that his sharpened perceptions can sometimes be highly magnified misperceptions, perhaps disastrously so. For an academic economist who presents his models as accurate representations of the world, a faulty model might prove an embarrassment at a conference or seminar. For the trader, however, a faulty model can lead to massive losses. There is, however, no option not to model: no tools, no trade. What the layout of the trading room – with its interactions of different kinds of traders and its juxtaposition of different principles of trading – accomplishes is the continual, almost minute-by-minute, reminder that the trader should never confuse representation for reality.

Instead of reducing the importance of social interaction in the room, the highly specialized instruments actually provide a rationale for it. "We all have different kinds of information," Stan says, referring to other traders, "so I sometimes check with them." How often? "All the time."

Just as Francis Bacon advocated a program of inductive, experimentalist science in contrast to logical deduction, so our arbitrage traders, in contrast to the deductive stance of neo-classical economists, are actively experimenting to uncover properties of the economy. But whereas Bacon's New Instrument was part of a program for "The

Interpretation of Nature,”⁶ the new instruments of quantitative finance – connectivity, equations, and computing – visualize, cut, probe, and dissect ephemeral properties in the project of interpreting markets. In the practice of their trading room laboratories, our arbitrage traders are acutely aware that the reality “out there” is a social construct consisting of other traders and other interconnected instruments continuously reshaping, in feverish innovation, the properties of that recursive world. In this co-production, in which the products of their interventions become a part of the phenomenon they are monitoring, such reflexivity is an invaluable component of their tools of the trade.

Innovation as recombination

Just as Latour (1987) defined a laboratory as “a place that gathers one or several instruments together,” trading rooms can be understood as places that gather diverse market instruments together. Seen in this light, the move from traditional to modern finance can be considered as an enlargement in the number of instruments in the room, from one to several. The best scientific laboratories maximize cross-fertilization across disciplines and instruments. For example, the Radar Lab at MIT in the 1940s made breakthroughs by bringing together the competing principles of physicists and engineers (Galison 1997; on the architecture of science, see Galison and Thompson 1999). Similarly, the best trading rooms bring together heterogeneous value frameworks for creative recombination.

How do the creativity, vitality, and serendipity stemming from close proximity in the trading room yield new interpretations? By interpretation we refer to processes of categorization, as when traders answer the question, “what is this a case of?” but also to processes of re-categorization such as making a case for. Both work by association – of people to people, but also of people to things, things to things, things to ideas, etc.

We saw such processes of re-cognition at work in the following case of an announced merger between two financial firms. The trade was created by the “special situations desk,” its name denoting its stated aim of cutting through the existing categories of financial instruments and derivatives. Through close contact with the merger arbitrage desk and the equity loan desk, the special situations desk was able to construct a new arbitrage trade, an “election trade,” that recombined in an innovative way two previously existing strategies, merger arbitrage and equity loan.

The facts of the merger were as follows: on January 25th, 2001, Investors Group announced its intention to acquire MacKenzie Financial. The announcement immediately set off a rush of trades from merger arbitrage desks in trading rooms all over Wall Street. Following established practice, the acquiring company, Investors Group, offered the stockholders of the target company to buy their shares. It offered them a choice of cash or

⁶ *Novum Organum* translates as “New Instrument.” Bacon contrasts the deductive method of “Anticipation of the Mind” to his own method of “Interpretation of Nature” (Bacon 1620/1960:37).

stock in Investors Group as means of payment. The offer favored the cash option. Despite this, Josh, head of the special situations desk, and his traders, reasoned that a few investors would never be able to take the cash. For example, board members and upper management of the target company are paid stocks in order to have an incentive to maximize profit. As a consequence, “it would look wrong if they sold them” John said. In other words, their reasoning included “symbolic” value, as opposed to a purely financial profit-maximizing calculus.

The presence of symbolic investors created, in effect, two different payoffs – cash and stock. The symbolic investors only had access to the smaller payoff. As with any other situation of markets with diverging local valuations, this could open up an opportunity for arbitrage. But how to connect the two payoffs?

In developing an idea for arbitrating between the two options on election day, the special situations desk benefited crucially from social interaction across the desks. The special situations traders sit in between the stock loan and merger arbitrage desks. Their closeness to the stock loan desk, which specialized in lending and borrowing stocks to other banks, suggested to the special situations traders the possibility of lending and borrowing stocks on election day. They also benefited from being near the merger arbitrage desk, as it helped them understand how to construct an equivalency between cash and stock. According to Josh., head of the special situations desk,

[The idea was generated by] looking at the existing business out there and looking at it in a new way. Are there different ways of looking at merger arb? ... We imagined ourselves sitting in the stock loan desk, and then in the merger arbitrage desk. We asked, is there a way to arbitrage the two choices, to put one choice in terms of another?

The traders found one. Symbolic investors did not want to be seen exchanging their stock for cash, but nothing prevented another actor such as International Securities from doing so directly. What if the special situation traders were to borrow the shares of the symbolic investors at the market price, exchange them for cash on election day (i.e., get the more favorable terms option), buy back stock with that cash and return it to symbolic investors? That way, the latter would be able to bridge the divide that separated them from the cash option.

Once the special situation traders constructed the bridge that separated the two choices in the election trade, they still faced a problem. The possibilities for a new equivalency imagined by Josh and his traders were still tenuous and untried. But it was this very uncertainty – and the fact that no one had acted upon them before – that made them potentially so profitable. The uncertainty resided in the small print of the offer made by the acquiring company, Investors Group: how many total investors would elect cash over stock on election day?

The answer to that question would determine the profitability of the trade: the loan and buy-back strategy developed by the special situations traders would not work if few investors chose cash over stocks. IG, the acquiring company, intended to devote a limited amount of cash to the election offer. If most investors elected cash, IG would prorate its available cash (i.e., distribute it equally) and complete the payment to stockholders with shares, even to those stockholders who elected the “cash” option. This was the preferred scenario for the special situation traders, for then they would receive some shares back and be able to use them to return the shares they had previously borrowed from the “symbolic” investors. But if, in an alternative scenario, most investors elected stock, the special situations desk would find itself with losses. In that scenario, IG would not run out of cash on election day, investors who elected cash such as the special situations traders would obtain cash (not stocks), and the traders would find themselves without stock in IG to return to the original investors who lent it to them. Josh and his traders would then be forced to buy the stock of IG on the market at a prohibitively high price.

The profitability of the trade, then, hinged on a simple question: would most investors elect cash over stock? Uncertainty about what investors would do on election day posed a problem for the traders. Answering the question, “what will others do?” entailed a highly complex search problem, as stock ownership is typically fragmented over diverse actors in various locations applying different logics. Given the impossibility of monitoring all the actors in the market, what could the special situation traders do?

As a first step, Josh used his Bloomberg terminal to list the names of the twenty major shareholders in the target company, MacKenzie Financial. Then he discussed the list with his team to determine their likely action. As he recalls,

What we did is, we [would] meet together and try to determine what they’re going to do. Are they rational, in the sense that they maximize the money they get?

For some shareholders, the answer was straightforward: they were large and well-known companies with predictable strategies. For example, Josh would note:

See... the major owner is Fidelity, with 13%. They will take cash, since they have a fiduciary obligation to maximize the returns to their shareholders.

But this approach ran into difficulties in trying to anticipate the moves of the more sophisticated companies. The strategies of the hedge funds engaged in merger arbitrage were particularly complex. Would they take cash or stock? Leaning over, without even leaving his seat or standing up, Josh posed the question to the local merger arbitrage traders:

“Cash or stock?” I shouted the question to the merger arbitrage team here who were working [a different angle] on the same deal right across from

me. “Cash! We’re taking cash,” they answered.

From their answer, the special situations traders concluded that hedge funds across the market would tend to elect cash. They turned out to be right.

The election trade illustrates the ways in which co-location helps traders innovate and take advantage of the existence of multiple rationalities among market actors. The election trade can be seen as a re-combination of the strategies developed by the desks around special situations. Proximity to the stock loan desk allowed them to see an election trade as a stock loan operation, and proximity to risk arbitrage allowed them to read institutional shareholders as profit maximizers, likely to take cash over stock.

Sociology of finance as a sociology of value

At mid-century, organizational analysts at Columbia University led by Robert Merton and Paul Lazarsfeld launched two ambitious research programs. On one track, Merton and his graduate students examined the origins and functioning of bureaucracy; on a second, parallel track Merton and Lazarsfeld established the Bureau of Radio Research to examine the dynamics of mass communication. Whereas our Columbia predecessors charted the structure of bureaucratic organizations in the era of mass communication, the research challenge we face today is to chart the emergence of collaborative organizational forms in an era of new information technologies.

Trading rooms provide an opportunity to explore the terms of that research challenge (Knorr Cetina and Bruegger 2002). Electronically connected to markets of global reach, the traders at International Securities reach out to colleagues only a few paces away to calibrate the tools of their trade. The trading room is an ecology of knowledge in which heterarchical collaboration is the means to solve the puzzle of value.

If trading rooms offer an opportunity for the sociology of finance to make contributions to organizational theory, the problem of value that is at the core of finance means that the sociology of finance can make a fundamental contribution to economic sociology as well. In its contemporary form, economic sociology arguably began when Talcott Parsons made a pact with economics. You, the economists, study value; we sociologists study values. You study the economy; we study the social relations in which economies are embedded. But the sociology of finance can ally with others who did not sign that pact (Boltanski and Thevenot 1991; White 1981, 2001; Thevenot 2001; Stark 2000; Girard and Stark 2002; Callon and Muniesa 2002; Callon et al. 2002). In doing so, we should put problems of valuation and calculation at the core of our research agenda. Just as post-Mertonian studies of science moved from studying the institutions in which scientists were embedded to analyze the actual practices of scientists in the laboratory, so a post-Parsonian economic sociology must move from studying the institutions in which economic activity is embedded to analyze the actual calculative practices of actors at work.

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