

# Ambiguous numbers:

## Trading technologies and interpretation in financial markets

### ABSTRACT

Financial markets and information technologies are key issues for contemporary social theory and the anthropology of globalization. Drawing on fieldwork in Chicago and London, I examine the interplay between processes of technological rationalization and the situated actions of traders in two financial futures markets—one that operates on open-outcry, or “pit” technology and the other process online\*\* Both technologies represent the market in numbers. Traders use these symbols to read and interpret the market. Yet each technology configures numbers differently. The technologies influence traders’ practices by shaping this basic unit of financial knowledge. [*finance, globalization, knowledge, numbers, technology, United States, England*]

In this article, I analyze the production of economic rationality at two sites in global financial markets, each operating under a different technological regime—the Chicago Board of Trade (CBOT) and a London futures dealing firm (LDF).<sup>1</sup> Information technologies underpin traders’ daily practices of economic judgment by shaping the available informational resources. Yet these foundations of financial knowledge and action are rapidly changing. New electronic trading technologies and all-digital exchanges have begun to supplant the traditional open-outcry pits\*\* where traders meet to exchange contracts in financial futures. For traders, this shift from face-to-face to screen-based technologies has transformed the relationship between trading skill and exchange technology.<sup>2</sup> For anthropologists, this transition makes financial futures markets instructive sites in which to examine the tensions between ideals of progressive rationalization and the norms and practices of contemporary financial capitalism.<sup>3</sup> Futures traders on both technologies enact a specific form of modern economic rationality that combines technological acumen with financial interpretation. Their actions are based in a form of reasoning that is far from strict calculation. Futures traders act under highly uncertain and rapidly changing conditions. Their techniques focus on creating fragile scenarios that account for the constant shifts in the market. These scenarios identify the specific social information within the bid and offer numbers for financial contracts.<sup>4</sup>

Financial markets and information technologies have come to occupy important places in contemporary social theories and the anthropology of globalization. The futures traders discussed here act within and on what Appadurai (1996) calls “financescapes” and Castells (1996) names “the space of flows,” and they take part in time–space compression (Harvey 1989). The predominant literature on finance markets in anthropology, geography, and cultural studies is marked by tropes of flow, speed, and chaos (Comaroff 1999; Comaroff and Comaroff 2000; Harvey 1989, Jameson 1997; Maurer 2000). Often, these markets are evoked with a sense of danger and disapprobation and likened to a “global casino” (Strange 1986). The amplified pace of transactions, heightened flows of capital, and expansion of global market interconnection made possible by new information technologies have spurred scholarly concern over the cultural effects of speed and linkage in capital circuits (Hutton and Giddens 2000). And, indeed, these financial markets now

work “in real time on a planetary scale” (Castells 1996). Although the relationship between technology and finance is a critical component of globalization (Held et al. 1999; Sassen 1996), the consequences of this technological change for the specific forms of economic action and the fine grain of financial practice have not been fully explored (Boden 2000).

A group of scholars working within social studies of science framework has begun to make inroads in this area. Some focus on the objects used in calculation and the shaping of financial technologies by economic theory and professional actors (Callon 1998; MacKenzie 2001; MacKenzie and Millo 2001; Muniesa 2002), and others analyze the new forms of sociality made possible by information technologies (Knorr Cetina and Breugger 2000, 2002; Preda 2002). Working in an ethnographic mode, anthropologists and sociologists have focused on the social technologies that produce capitalist subjects in financial and commercial practices (Abolafia 1996b; Hertz 1998; Maurer 1995; Miyazaki and Riles in press; Ong 1999 and 2001; Smith 1999; Zaloom in press). Others have focused their attention on the social construction of markets (Abolafia 1984; Adler and Adler 1984; Baker 1984a, 1984b; Carruthers and Stinchcombe 1999; White 1981) and on the critique of economists’ notions of rational action (Abolafia 1996a; Grannovetter 1985). Anthropologists have only scratched the surface of the vast and complex field of finance, however, and have yet to fully grasp the significance of new information technologies for forms of sociality and knowledge.

The task of understanding market action under different technological regimes requires examining the role of numbers in traders’ knowledge practices. Traders base their interpretations of financial conditions on the numbers that represent the market. From the invention of number-based accounting practices such as double-entry bookkeeping, numbers have been a cornerstone of economic calculation, providing the essential tools for rationalized action. Yet the practice of economic judgments in futures markets challenges this representation of economic action and requires a shift in the way \*\*analysts think about numbers. Numbers have often been considered elements of knowledge *production* that increase objectivity and certainty. The fluid numbers of futures markets invite us to examine the *consumption* of numbers more closely. Traders look for clues to the direction of the market by observing the numbers. At the same time, the short time frames of futures trading introduce a fundamental instability and uncertainty into economic judgments based on these numbers. The provisional nature of market numbers and the approximate character of traders’ conclusions suggest that traders’ practices are best characterized as interpretation rather than exacting calculation. But scholarly theories of numbers and quantitative representation are insufficient to provide a full reading of the power of numbers in financial futures markets.

In a discussion of 19th-century credit ratings, Carruthers and Cohen (2000) characterize the ways in which numbers acquire the status of definitive statements as “firming up.” Such solid numbers are, in their ideal form, stable in time and meaning, and they add to a transparent presentation of knowledge. These “firm” numbers that scholars have pointed to as a foundation for accounting and scientific knowledge contrast in character from the fluid numbers of the pit and screen. Firm numbers work in the service of accountability and objectivity, acting as tools of standardization and commensuration. As scholars Ted Porter (1995), Michael Power (1997), and Mary Poovey (1998) have shown, such numbers act to (1) establish expertise and authority, (2) make knowledge impersonal, (3) portray certainty and universality, and (4) contribute to resolving situations of doubt, conflict, and mistrust. To use Poovey’s phrase, numbers perform ideally as representations of “noninterpretive facts.” As stable objects, numerical units resist conjecture or theory and serve in the production of systematic knowledge.

The pace of trading in futures markets undermines this stability. Traders at the CBOT and LDF practice trading techniques called “scalping” and “spreading” that focus on the profits to be made in the intraday fluctuation of futures markets. In these trading styles, numbers that represent bids and offers for financial contracts are the material traders use to interpret market conditions and orient their profit-making strategies. A bid is a price at which a trader is willing to buy a financial commodity, and an offer, or ask, is the price at which he is willing to sell.<sup>5</sup> These numbers represent the “needs and expectations of hedgers and speculators” (CBOT 1997:13).<sup>6</sup> They are not established price facts. Rather, they are temporary assessments of market conditions, momentary markers of approximate valuation.

Bid and offer numbers surge into the market and fade away in an instant.\*\* The tempo of the market speeds and slows as the number of contracts on bid or offer increases or diminishes and one set of possible trades slides into the next. The trader will not always “get ’em,” or be able to turn his evaluation into a completed purchase or sale. He may add or withdraw his bids and offers as time alters market conditions. Traders develop styles of interpretation that incorporate the fluidity of numbers at the same time that they construct explanations for market fluctuations.

The technological transition from open-outcry pit to trading screen reconfigures these foundations of market knowledge by reconstituting the bid and offer numbers. Each technology represents the market in numbers. But the numbers are not all alike. The structure and design of the pits and the trading\*\* screen influence the ways that traders apprehend and act within the market, shaping participants’ techniques for managing quantitative information, for fashioning their calculations, and for understanding the dynamics of competition and emotion that are central to financial action.

I divide this article into three sections. First, I analyze the role of numbers in financial markets, both as elements of technological design and as materials for economic interpretation. I discuss how numbers constitute a crucial dimension of the *informational transparency* that characterizes open-outcry and screen-based trading technologies. Second, I explain what traders understand about numbers as objects of interpretation, noting the strong contrast between numbers as elements of market knowledge and tools of objectivity. Third, I examine the practices of interpretation both in the Chicago pits and at LDF. At the CBOT, traders come to understand the numbers of the market as connected to the bodies and voices of their trading partners. The technology of exchange shapes the vision of the market. Traders apprehend and interpret the market through this representation. Developing this analysis for online markets, I examine the interaction between the conscious designs of software developers and market planners and the trading practice of online traders at a London dealing firm.

### **Fieldwork**

The article is based on fieldwork I conducted on the financial trading floor at CBOT and in the digital dealing room of an LDF. I worked as a clerk at CBOT for six months in 1998. I arrived at work each morning at 6:45 a.m. and donned an oversized trading jacket. I placed my notebook in a pocket alongside a stack of trading cards, where I could easily pull it out to jot down observations when the pace of the market slowed. I acted as a runner and a clerk, recording orders on paper and delivering them with hand signals to brokers inside the pits. I learned to understand the markets, as most CBOT traders do, by working within them.

I continued my apprenticeship in financial markets in London. Because simple observation of screen-based trading yields thin results, I arranged to join LDF as a recruit, among ten new traders. Each morning before sunrise, in the fall and winter of 2000, I arrived by tube to the heart of the *\*\*City*, London's financial district. Along with my fellow trainees, I studied formal trading techniques in a classroom, and on the trading floor adjusted them to my own risk-taking proclivities. After the training I traded German Treasury bond futures on an LDF account. I interpreted the market relying on my new skills and gained direct experience of risking money that is central to traders' experience of their own work. I spent nine hours a day with eyes fixated on my screen and fingers lying lightly on my mouse, poised to click the second I identified an opportunity for profit. To supplement my work and observations in these arenas of exchange, I interviewed officials at the exchanges and technology companies and attended meetings on the reorganization of the industry.

### **Informational transparency**

Open-outcry pits and electronic trading screens are information technologies shaped and constructed in alignment with particular ideals of economic information. The representation of market action—whether in the pit or on the screen—relies heavily on the capacity of numbers to convey abstract and objective information. Both trading technologies are founded in highly rationalized techniques of exchange and information delivery. Modern financial markets are predicated on an idea of informational transparency that presents market information as self-apparent facts free from the distortions of social information. The numerical foundations of financial markets belie a desire for “correct representations” of economic information (Rabinow 1996).<sup>7</sup> By supplying these economic truths, the market technologies lay the foundations for traders' calculations. In 1869, the CBOT introduced the pit to create a unified market space where all participants could see each other and hear all of the bids and offers available.<sup>8</sup> About a century and a half later, designers of online trading systems have also used technology as a tool to shape traders' knowledge context. These architects of financial exchange self-consciously distill the economic content of the market by removing the social information so readily available in the pits.<sup>9</sup>

The designers and the market managers that hire them rely on a narrative of rationalization that rests on a particular idea of the way that market data are constructed, transmitted, and received. In an ideal competitive arena, market information must have self-evident meaning. For informational transparency (as I will call it) to be realized, all information must lie visible on the surface; interpretation would thus be unnecessary because the data are objective and clear. In the pit, this information is transmitted through the bodies of traders and received by their colleagues, who challenge and help them\*\* in face-to-face competition. Yet the numbers shouted in the pit have the same claim to “clean” representation. The designers of electronic dealing systems seek simply to *purify* the transparent representation that already exists in open-outcry.<sup>10</sup> Alan Lind, an ex-official at the German-Swiss Eurex futures exchange and the designer of the LDF Graphic User Interface, championed the connection of technological rationalization and democratizing access to information: “The truth comes out in the electronic world. There are no physical crutches required.” A trader needs only a set of eyes to read the market on the screen and a finger to click commands on the mouse.

The presentation of the market as a set of numbers is critical to the production of informational transparency. The visual and auditory contexts of open-outcry pits create different opportunities and ambiguities than the graphic user interface of a digital exchange. In the transition from face-to-face markets to electronic technologies, the contrasting representations of market demand that traders de-

velop new strategies for using numbers to understand its\*\* operation.

In both technological contexts traders undermine the rationalizing effects of technology. The tensions between the rationalized technology and situated action emerge on the trading floor and in the dealing room as the social is displaced and reconfigured.<sup>11</sup> As my observations and participation in the market show, traders search out social information contained within the bid and ask prices that anchor their knowledge of the market. They interpret the market numbers through the particular framing of each technology and thereby unearth the specific social dimensions of market conditions. Traders bring questions about the social content of the market to their calculations no matter how much software designers try to remove such cues from their programs. Who are the competitors? What are their individual styles? Are they scared, stolid, eager, or anxious? Traders avidly pursue this information, and when they do not have it they often fabricate it. Social contextualization and interpretation are critical parts of traders' calculations.

What constitutes "the social" differs between face-to-face and face-to-screen contexts. The technological context changes the scope and content of the social in economic life. In the pits, social information is founded in deep knowledge of the local environment. Traders organize trading strategies with the situations and motivations of their particular competitors and compatriots in mind. On the screen, traders imagine and identify competitors within the changing numbers. They construct a digital landscape of social information. These competitors are cloaked in the abstracted numbers of the market, but traders assign personalities and motivations to the characters behind them. But in the London dealing room where I worked, traders do not construct these visions in isolation. They reach out to their coworkers to help form an interpretation of the social dimensions of the electronic marketplace. Software designers may attempt to excise social information from their technologies. But traders create new social contexts to replace the ones they have lost.

The profit-making strategies of traders are based on the multivalent nature of market information. Through their particular technological framings, quantitative objects that seem straightforward gain a complexity that conveys information far beyond what they apparently describe.<sup>12</sup> Located in the interaction between the presentation of market data and the technology of exchange, the layered information of market numbers inspires each trader to interpret their meaning.

### What traders know about numbers

Traders, in both open-outcry and online markets, exploit the informational ambiguities of numerical information.<sup>13</sup> The changing bids and offers of futures markets demand an

interpretive agility, and traders learn that numbers have contradictory roles in the market. What traders "know" about numbers lie between the representation of the market and the decision to buy and sell futures contracts.\*\*

The first thing traders learn is that *numbers tell very little*. Although the full number of a bond futures price is five digits long, traders use only the last one or sometimes, two digits, playing the differences between fractions of a point in the price of a bond. Numbers, in this sense, are simply placeholders in a sequence leading from 1 to 9. Once a price passes 0, traders refer to their bids and offers as 1s or 9s again without specifying the larger change. The number is only a symbol in what could be any sequential set.

For short-term traders, larger numbers do not indicate potential for profits. Rather than always "going long" or buying contracts anticipating that the price will rise, futures traders play both the rise and fall of intraday volatility. Traders can also profit by "shorting" the market, selling contracts in advance of a drop in price. If their predictions prove correct, they can then buy the contracts back at a lower cost and pocket the difference. Traders have the opportunity for profit as prices both ascend and descend the scale.

Traders know that numbers stand on their own without reference to events outside the immediate bids and offers. Events external to the immediate market, such as rate cuts, election news, economic reports, or the intervention of a large buyer, can storm the market unexpectedly. The immediacy of the market dictates that attention remain on the bid-ask figures that represent the position of the market at that second. Outside news is supplemental to the information available in the bid-ask numbers. Government announcements are some of the most powerful forces that alter market conditions. A surprise intervention that occurred during my time at LDF, described below, shows the attenuated connection between trading in second-by-second markets and the fundamentals of their underlying assets. Traders can act with little information or understanding of the instrument they trade or the economic conditions of the countries that issue them.

On November 3, 2000, the LDF dealing room was relatively calm. The market was steadily ticking up and down. Suddenly, shouts erupted from behind computer terminals as routine patterns snapped and the market for all European products spiked upward. Traders who had bought contracts rode the move upward. Traders holding short positions cursed as the market pummeled their bearish expectations and forced them to take losses. The market move took only about thirty seconds, but reversed the downward trend in bond prices denominated in the ailing European currency, which had dropped toward \$0.80 to the U.S. dollar. Once the action ebbed and the traders had regained their composure, they leaned toward their neighbors and asked each other what had caused the move. The first trader to lift himself from his seat and find a terminal with a Reuters wire,

scrolled down the screen until a headline appeared on the electronic tickertape. It read, “C-bank intervenes in Euro.” The traders buzzed about how Citibank had intervened in the Euro until an older trader pointed out, nonchalantly, that “c” bank meant *central* bank. Whereas this kind of basic misattribution would make any economist squirm, to these traders who deal in a time frame of seconds, it is immaterial if it is Citibank or the European Central Bank that takes action. The market prints the result before the news comes through the news wires. Knowing the cause is more important for satiating an after-the-fact curiosity than for organizing market action. The news wire can supply the reason, but it does not necessarily cause the reaction or even precede it. All the necessary information for these second-by-second traders is in the bid–ask numbers.

Traders also learn that numbers have particular personalities and effects on the human mind. This is especially so for traders who practice a technique called “technical analysis.” This interpretive strategy bases predictions of future market movements on historical trading patterns. Technical analysts are also known as “chartists” for their use of graphs and other visual tools that describe the past movements of the market. In technical analysis, individual numbers gain strength or weakness, positive or negative potential, as points of support and resistance to the overall trend of the market. Numbers that halt a decline in the market are called “support levels,” and numbers that “turn back a price advance” are attributed powers of resistance. The numbers in these statements are themselves agents.

According to the bible of the chartists, *Technical Analysis of the Financial Markets*, numbers gain further significance for technical analysts because “traders tend to think in terms of important round numbers, such as 10, 20, 25, 50, 75, 100 (and multiples of 1,000), as price objectives and act accordingly” (Murphy 1999:64). Traders invest these numbers with both their own psychological significance and the expectation that the numbers are significant to other traders.<sup>14</sup> Numbers develop greater solidity as support or resistance as more traders invest in a particular price area. According to Murphy, “The more trading that takes place in that support area, the more significant it becomes because more participants have a vested interest in the area” (1999:60). The variation around a modal price defines a “trading range.” Trades build up around the fair value or modal price. When the market sharply departs from oscillation around the mode, or between points of support and resistance, technical traders call a “range break” and seize the opportunity to buy into or sell that swing.

It is not only by watching the investments in certain prices that traders assess the quality of a number. Traders identify the significance of an individual number as the depth of bids or offers builds up around a price. The larger the number of offers, the greater the expectation the market will begin to decline in price. The greater the number of

bids, the more likely the price will extend upward from there. Weighty numbers create an informational gravity attracting other traders to the price. For short-term traders the perceived judgments of other market participants contained in the bid–ask hold an opportunity for making money. As critics of technical analysis point out, this continuous evaluation of others’ perceptions of the weight of the bid–ask creates a self-fulfilling effect that validates the circular judgment of traders in relation to the numbers they trade.

Because of the multivalent character of numbers in futures markets, numerical information and technological presentation are inextricably bound. Traders mine the crevices of the technology for specific context that will tell more about the numbers than they represent on their own. The next section describes how traders’ tactics for delivering and reading unstable numbers change as the pits give way to dealing rooms filled with the glow and hum of computer terminals.

## In the pit and on the screen

### *Bodies and voices*

Standing on the trading floor of the CBOT, noise and color swamp\*\* the senses. A roar from inside the raised octagonal pits follows the electronic screech of the opening bell. Traders stand in tiered pits, each one dedicated to a single contract, some based on the U.S. Treasury bond complex, others on the Dow Jones Industrial Average or other indexes. Individual voices pierce the din, shouting “50 at 3” or “5 for 100,” indicating the quantity and price they are selling “at” or paying “for” futures contracts. Each call indicates how many contracts the individual trader is willing to buy or sell at their price.

These shouts—which represent the key technology of the open-outcry system—are the main mechanism for conveying bids and offers in the pit. Open-outcry technology in Chicago has relied on the same mechanisms for 150 years. These face-to-face interactions constitute a technology that delivers market information in orderly, routinized ways even as they are brought to life in the din of the trading floor. The pit creates a physical arena for financial competition.

The tiered steps of the pits organize the physical space of open-outcry trading. Most importantly, the stepped structures create a unified space of financial competition where each trader can see and hear all of the bids and offers in the market.<sup>15</sup> Every bid or offer is legally required to be shouted to the competitive market. In this regime of exchange, shouts are most often accompanied by hand signals, the hands turned toward the body, palms possessively pulling inward to show a desire to buy and hands thrust forward, palms out, to sell. Numbers from 1 to 5 are shown predictably with the fingers on each hand extended upward,

and fingers are turned sideways to show numbers 6 to 9. Zero is indicated with a closed fist.

In a simple transaction, a trader makes an agreement with another trader by meeting his eye in response to a bid or offer. The selling partner in the operation yells, "sold." The two jot down the price, quantity, and one another's three-letter code on a paper card, and each trader hands it over to his clerk, who will hunt down his counterpart and confirm that each party agrees that the trade took place.

By design and by regulation, all trades must enter into the space of competitive bidding and offering. Rules 332.01A and 332.00 of the CBOT handbook state that

bidding and offering practices on the Floor of the Exchange must at all times be conducive to competitive execution of orders. . . . All orders received by any member of this Association, firm or corporation, doing business on Change, to buy or sell for future delivery any of the commodities dealt in upon the floor of the Exchange must be executed competitively by open outcry in the open market in the Exchange Hall during the hours of regular trading. [CBOT 1993:20–22]

The accountability and competitiveness of the market is located in these shouted quotations. Any trades that happen outside of this arena, either outside of trading time or through whispers between trading neighbors, are, therefore, illegal. Each bid and offer in the market must be outwardly presented for all participants to see and hear.<sup>16</sup>

#### *Physicality of market numbers*

Physical strategies for delivering and receiving bids and offers in the pits are part of the traders' financial strategies. For pit traders, both delivering and receiving the bids and offers of the pits are full-body\*\* experiences. The pit requires stamina and strength. Although there is only one ex-Chicago Bears player on the floor, many traders compete in height and width for his physical presence. Those who do not have the natural stature of a professional athlete can visit the cobbler in the basement of the CBOT, who will add lifts to their shoes. Traders from the CBOT and the nearby Chicago Mercantile Exchange can be identified walking the streets of the western Loop not only by the loud oranges, blues, reds, and yellows of their trading coats but also by the extra inches of black foam affixed to the soles of their shoes.

Traders' physical location in the pit can limit or expand their access to other traders' bids and offers. Traders may have difficulty or particular ease being seen or heard when they deliver their bids and offers to market. They may have obstructed sight lines providing them access only to what lies between visual obstacles or clear angles of vision enabling transactions with a large area of the trading arena.

Because of the physical and emotional information conveyed with numbers, not all bids and offers are equal. Every bid or offer that pit traders emit or engage in the day-

to-day operations of exchange is received through the voice and bulk of another trader. The information conveyed in these numbers cannot be divorced from the bodies through which they are conveyed and received. The tone of voice, the body language of the trader, who may be steadily and confidently holding his hands forward in engagement with the market or yelling his bids, spittle flying and eyes wide, in desperation to get out of a trade, are crucial inflections that traders draw on to form market judgments.

In a pit bursting with 600 screaming traders, arms slashing the air, strategies for penetrating the physical strains of the arena are crucial to a trader's calculative repertoire. Delivering bids and offers into the market requires acquiring the physical and emotional techniques for transmitting and receiving market information conditioned by the pit. Leo, a trader whose voice is hoarse and scratchy from 20 years of use in CBOT markets, described training himself for the vocal and emotional demands of open-outcry trading, "When I first got in the business, I had to go in front of a full-length mirror every night and practice screaming, looking at myself."

The intricacy of physical strategy in the pit becomes especially clear when smaller traders must compensate for their stature by manipulating other resources to get the attention of potential trading partners. It is not enough to be on the right side of the market; each trader needs to attract the attention of others—to have another trader *receive* the numbers he shouts into the market. Victor, an ambitious young broker, who is physically short and slight, described how he creates a presence in the pit that will attract attention to his bids and offers:

Voice is number one. . . . You have to be a controlled loud. You can't be like a panic loud because once the panic comes out of your mouth you're pretty much admitting to whoever wants to assume the other side of the trade with you that that's not a good trade. . . . Tones of your voice are very important. A lot of guys have higher voices . . . and they can really be heard throughout the pit. . . . A lot of it is hand gestures, being able to kind of like offer your hands out at just the right pace to catch people's attention. . . . Sometimes it's jumping up. People watch me sometimes when I start to catch air and they go, hey, there's Victor, you know, bidding them.

In addition to orchestrating the presentation of bids and offers, timing the delivery is key. Victor described how he attracted the attention of one of the "big dog" traders:

Just at the right time, I mean literally it was within a second, a split second—I literally caught a little pause in his offer where he was just kind of looking in all directions, I just happened to jump and bid and scream at him at literally—I mean I'm not even going to say tenths of a second—I'm going to say hundredths. . . . If I didn't

jump and jump\*\* a foot and a half off the ground and bid fours at that guy *just as I did and the way I did it*, he wouldn't have seen me.

The presentation of market numbers in voice forces the traders to cope with the immateriality of the bid or offer. A number is rarely shouted once. Because each bid or offer hangs for only a second in the air, the trader barks the number into the pit repeatedly to make sure he is identified with it. At the same time, the trader extends his hands in numerical signals to bring a concrete, visual presence to his bid or offer. The sounds of repeated numbers that form the cadence of the market can convey urgency or boredom. In receiving the numbers that others bring to the market, traders appeal to “feeling.” This word, encompassing all sensory information, is one traders use to characterize their knowledge of the market.

The body is a key interpretive instrument for the pit trader. Listening to the rhythms of the numbers as they run in the pits leads traders to judge the market as “heavy” or “light,” that is, according to their sensory estimations, as likely to rise or fall. Beyond creating the basis for individual traders' economic judgments, the ambient noise of the pit affects the market as a whole. Economists studying the CBOT pits found that increased sound levels lead to higher trading volumes and foreshadow periods of high volatility in the pits (Coval and Shumway 1998). Just as numbers cannot be divorced from the bodies that deliver them, noise cannot be divorced from the numerical content that it conveys. Traders monitor the changing bids and offers of the pits, receiving them into their bodies through their eyes and ears. Numbers, in the context of the dense arena of exchange, produce emotional states in the traders that are integral parts of their predictions. Rather than functioning as obstacles to normatively rational decision-making, these signals that work on an intuitive level are a central trading tool. Traders described formal calculation as a hindrance to their job and to their ability to react. In training their bodies as instruments of both reception and delivery of the underlying information of market numbers, the first step is learning *not* to calculate.

Sean, a lawyer by training and a second-generation member of one of the CBOT trading families, assessed the effects of his legal education on his habits of mind and trading practice: “I am prone to get set in my ways. I'll reason to a particular conclusion based on assumptions that I've got built into the market. . . . Just like I'd craft an argument. I'm crafting a plan and then all of the sudden my plan is this and boy the market had better listen.” It rarely did. Sean argued that his deliberative skills lead him to conclusions that may be theoretically correct according to the system he has established. His words suggest that in formulating arguments he loses the ability to play on the indeterminacy of market movements. Explicit construction of logical systems inhibits

his ability to adapt his positions to rapidly changing market conditions. Sean identified the premium on interpretive agility in financial markets by using his own calculative rigidity as a foil. Constructing elaborated systems can hinder a trader's ability to quickly adapt to swerving bids and offers.

Other traders described the technique of noncalculation in interviews:

**Leo:** In the commodity [futures] business . . . you do the thinking away from the market. . . . If you start thinking too much during the course of the day when the battle is on, it is really a disadvantage.

**Jack:** It's just like you're in there and you know—sometimes you just don't want to be buying or you don't want to be selling. I presume like you could figure out after trading off the floor for a long time and really watching things and charting—but nothing like knowing—nothing like standing there and having that feeling.

The immediacy of the market requires that traders interpret every present moment. The importance of sensory cues in both delivering and receiving numerical information in the pit makes use of all of a trader's wits and physical skill.

#### *Eyes on the screen*

In contrast to the overpowering sensory information attached to numbers in the pits, screen-based technologies actually narrow the scope of information available to traders. The representation of the market as a set of changing numbers on the screen is the primary source of information for traders in electronic markets. At the same time, traders try to gain contextual clues from their interactions with other traders by calling across the dividers that separate them, offering interpretations of market movements. In addition to drawing contextualizing interpretations from their co-workers, traders search within the numbers to find social reasons for the movement of the market. They craft identities for their competitors and construct motivations for these illusory actors in the online arena. Fashioning a social narrative for abstract information helps traders create understandings of market fluctuations that direct their decisions to enter and exit the market. Traders create stories around the shifting direction of numbers that many economists consider a “random walk.”<sup>17</sup>

#### *Design*

The E-trader graphic user interface (GUI) is the point of contact between LDF screen traders and the market. The GUI hones the representation of the market in numbers. In his design, Alan Lind, the creator of E-trader, framed a numerical and visual representation of the market.<sup>18</sup> Fulfilling his role as a “pragmatic technician” of economic rationality, Lind created a design that cleaves to the dictates of informational transparency (Rabinow 1995). The GUI design pre-

sents all market action and information as available in plain sight, introducing the closest thing to a noninterpretive format possible. The transparency of the GUI design pares market data down to a minimum—boldface numbers in rectangular boxes. Lind’s central concern was to use the design to reduce the distance between the trader and the market. For him this meant assembling the simplest visual cues to represent market action rather than creating a platform for displaying every piece of information or technical trick available. The outward simplicity of the user interface illustrates well its numerically rationalized representation of the market.

The GUI organizes the market for each financial product into a vertical or horizontal strip. The trader can drag each block to drop it where he likes on the screen next to records of his filled orders, a record of all the orders he has placed in the market, and the box that displays profit and loss (P and L). A casual glance at a trader’s screen can show if he has made or lost money that day. If the numbers in the P and L box are a profitable green, then he is “up for the day.” If the numbers are red, the trader often slides the box off to the right of the screen so the numbers are invisible to him and to any curious bystanders. The most important information, the bids and offers and the “depth” of the market, how many bids and offers and the price levels, is shown in black lettering against blue and red backgrounds.

The design crystallizes a form of simplicity that displays the ideals of informational transparency. This spare visual depiction enacts a commitment to reducing the intermediation between trader and market. The engineer’s transparent designs mark a commitment to a simple and unadorned numerical representation of the market. The use of numbers as techniques of transparency draws the trader toward a distilled idea of the market where disembodied actors display supply and demand for futures contracts.

This attempt to suture traders into the market by reducing the interface to bare, numerical representation shapes the traders’ informational environment by elevating numbers to the status of the market itself. Numbers gain a synecdochial power in their relationship to the market. On the GUI, numbers that represent the bids and offers are supposed to raise all hidden information to the surface of the GUI, delivering the total of market information into the numbers. In a sharp break from the complex information system in the pit, where fathers and sons, friends and allies pass information through tightly controlled networks, the screen displays the market in simple terms available to the eyes of any trader with access to it. In addition to spanning social and physical distance between actors bound into a global network of exchange (Porter 1995), numbers are, in Lind’s design, a technology of *proximity* drawing traders toward the market. Lind’s strategy endeavors to cast aside the intermediation of the social information of the pits in favor

of honing an ideal of “pure” information based in a representation of the market in numbers.<sup>19</sup>

Lind created direct contact between traders and market information through the numbers of his GUI. As he explained to me, his plan was to “strip down the chassis” of the exchange technology:

[Traders] don’t care about German economic status or European economic status. What they’re looking at typically are numbers. They’re trading numbers, using numbers to make decisions all day long. I would say that it’s like a motor racing driver that doesn’t look at the scenery as he’s doing two hundred miles an hour going down the track. He’s looking at the hazy outline of the road. He’s looking at the numbers on his dial. That’s it. He’s focused.

The organization of the trading industry places many intermediaries between participating traders. The mechanisms of exchange are located in the clearing firm, the material technology itself, and the CBOT and Eurex and their programs for completing trades. In the technological framing of E-trader, however, these intermediaries become virtually invisible (Brown and Duguid 2000), producing an experience of direct connection between the trader and the market.

The technology of E-trader holds the informational frame steady while it delivers the constantly changing bids and offers to the trader’s eyes fixed inches from his screen. Using these data to form interpretations, the electronic trader can leap into the market with a click of his mouse. Understood in the terms of informational transparency, the design works to eliminate not only institutional intermediaries but also intervening tools of evaluation. Lind told me:

[I want to communicate] ultra fast prices. In other words, I want to show you the real market quicker than anyone else so that you can make the decision to trade. I’m not going to give you analytics, fancy recommendations because my recommendations may need some explanation or they may need to be mathematically complex. . . . The Spartan approach with technology today is still the best one. Keep it down to the absolute minimum; get rid of the stuff you don’t ever look at. . . . Only observe the market that you want to.

In E-trader, Lind created a system of information delivery that provides austere data of bids and offers. Although reducing the market to a few printed numbers, Alan Lind also opens the possibility of interpretation based on the very simplicity of the GUI presentation.

#### *In the dealing room*

In the dealing room, Alan Lind’s design comes into contact with the training methods of the LDF managers and daily practices of LDF traders. To enter the dealing room floor,

traders pass through a set of three doors leading from the elevator bank. At each door they swipe their key cards through a security lock. Swaths of gray dividers partition the space. Each bank of trading desks is split again into four individual workstations, personalized by bits of decoration that are pinned into the fabric walls. Light filters through the cloudy overhang of London’s sky, supplementing the blue-tinted glow of the computer screens. A beige, plastic-encased terminal sits centered on each trader’s desk. A thin, extra layer of glass screwed to the beige box shields the trader from the screen’s radiation.

Walking down the left-hand corridor of the dealing room reveals soccer club posters, images of hot cars, baby photos, and girly pix cut from magazines. Spare copies of Rupert Murdoch’s tabloid, the *Sun*, are strewn about the room. The traders joked that the nipples of the topless page-three girl were sure indicators of daily market direction. Traders program their computers to make noise when Eurex fills their trades. During busy markets, tinny speakers attached to the computers fill the room with the simulated sounds of breaking glass and ricocheting bullets.

Despite the raucous atmosphere, the LDF managers insisted on discipline from their new recruits. The managers required us to keep a journal that showed a running log of observations and trades. Each entry created an abbreviated record of the new trader’s reasoning process. Excerpts from my own trading journal, which documents part of a morning’s trading activity, show the focus on the patterns and rhythms and the problem of learning to make sense of the numbers.<sup>20</sup>

Trying to go long the spread at 7 or 8.	Bought 62s
Long at 8.	Going 1/2/3 seems like upward pressure
Very slow moving—trying to sell 9 now	Scratched.
0 after shift in Bobl	Buying the Spread at 61, Spread 0/1/2
Back to 9s, out at 9	Bought 9s trying to scratch
Looks like the spread is moving down.	Bought 0s**
Bobl moving up again. A steady Shaz.	

These spare representations of a new trader’s learning process show the trader’s focus on numbers. The managers tried to supplement the weak sensory information available through the GUI with a program called Market Sound, which augments the visual data of the screen. This software replicates the aural dimensions of the pit by re-creating ambient noise levels linked to the size of bids and offers in the market. A trader can hook into the program by plugging an earpiece into the speakers on his computer. Yet hardly any of the traders used it. The algorithm that replicates the noise

of open-outcry trading re-creates only a sliver of the total body experience of the pits. Although there are demonstrated effects of noise on trading activity in the pits, without the context of face-to-face interaction, the noise of Market Sound was more distracting to the screen traders than it was illuminating. The sort of sensory information helpful to pit traders’ interpretations was inappropriate to the context of the screen. Instead, the LDF traders created other cues that oriented them to the direction of the market.

For example, at the same time that the other new traders and I were developing our basic trading skills, we were learning to develop a narrative around the patterns of the market by listening to the calls and responses of the more experienced traders. “Market chatter,” as I call it, is an important device for forming interpretation about market fluctuations. I use the word *chatter* because of the ephemeral nature of the conclusions that such talk engenders. This background communication is part of the “ecologies of evaluative principles” of the trading room (Beunza and Stark 2002). The importance of market chatter lies in the collective construction of unstable interpretations. These weak narratives supply interpretive logics for the market’s movements.

In my cohort, Jason and Paul were the most prolific chatters. In a process that was at once competitive and cooperative, they exchanged commentary and tips back and forth across the aisle that separated them. They assessed and reassessed the market’s movements in relation to their positions: “I’d get out of there, the bid’s about to disappear”; “The offer is weak”; “The Bund is moving, watch out in the Shaz.” They commented on the pace and depth of the numbers, trying to evaluate the forces shaping the rise and fall of the digits. Market chatter does not produce a definitive explanation of the action on the screen. The uncertainty and instability of the commentary paralleled the constant fluctuation of the market.

Comparing positions is a central part of market chatter. Traders compare positions with each other or simply tell the other traders their positions to confirm their decisions or seek help in recalibrating their interpretations. This information is not usually shouted across the room, but shared between traders at the same desk. At the desk across the aisle from my own, Freddie, an ex-pit trader, was flailing through the transition to screen-based trading. The three traders who shared his desk were helping Freddie sharpen his skills in interpreting the market. They would identify actors and significant changes in the market. They showed Freddie how to spot big traders in the market by watching how the bid–ask increased or decreased. If a trader changed his opinion of the market’s direction and moved his orders, the bid number would drop by a large, round amount, such as 500 contracts. The more experienced traders encouraged Freddie to accumulate knowledge of the strategies of other players in the market by watching the changing quantities.

Jason and Paul would pick up on their remarks and discuss them between themselves. The younger traders would most often simply reproduce the interpretations of Martin, the room's most successful trader, as their own. The chatter at the desk assisted Freddie, Jason, and Paul in forming their own interpretive strategies.

Market chatter does not always assist the traders who listen to it. It can also be used as a tactic to undermine others' confidence. The confinement of an individual to his own screen and the faceless nature of screen-based trading create opportunities for savvy traders to supply misinformation to the room. The trades on the screen are anonymous, so a trader can simply misrepresent his interpretations in chatter to gain information about others' positions and opinions. Martin, the object of most LDF traders' envy, fed his coworkers his own exaggerated reactions. He would gasp as if his gains had been decimated by a market move, only to reveal minutes later, as he headed triumphantly out the door for the day, that he'd pocketed enormous profits on the trade. He faked panicked reactions to market events, hoping to fluster the other traders into chattering about their own positions. His status in the room meant that his opinions could confirm or cast doubt on the others' abilities to read market action.

Despite hints available from the environment of the LDF dealing room, the information located within the boundaries of the terminal retained the focus of traders' interpretive energies. This absorption is pronounced in LDF's Chicago dealing room. Joshua Geller, the head of trader training, called me in, worried that the London room had given a distorted picture of the market chatter and social nature of online dealing. When I arrived at the Chicago office, he led me to the trading floor where about thirty traders sat in silence staring at their screens. "I try to get them to make some noise," he told me. Their attention remained concentrated on their screens. During my visit, Alan Greenspan was scheduled to talk to Congress, and Geller turned on the trading room television set. The traders shrieked at him to turn it off and then compromised for a lowered volume. The preference of this set of traders is for the informational environment to remain restricted to the screens in front of them. The screen provides the primary source of information for electronic trading.

For both the London and Chicago screen traders, the majority of players with whom the LDF traders exchanged were located beyond the boundaries of the LDF room. Traders on the screen are anonymous, each individual's actions represented within the aggregate numbers of the bids and offers. This aggregation narrows the opportunities to understand the intentions of other individual traders. There is no access to individuals' strategies that traders can leverage for their own profits. Yet the social context of competition is crucial for traders to form narratives that offer explanations for the market's behavior. When denied the social informa-

tion of competition and strategy so easily available in the pits, the LDF traders constructed social scenarios to explain the movements of the market.

#### *Who plays in the numbers?*

The LDF traders learned to look for key players who hide in the rhythms and the sizes of the changing bids and offers. The traders at Freddie's desk were trying to help him notice and collect this kind of information about the social content of the market. Key characters most often represent ideal types that traders construct on the basis of the trading styles and risk-taking strategies they display. Traders locate these characters in the swiftly moving bid and offer numbers, creating a conceptual sketch of the market as a field of specific competitors. Drawing this field establishes a narrative space of competition into which they can insert their own strategies.

The most recurring character was called the "Spoofers." The Spoofers used large quantities of bids or offers to create the illusion that there was more demand to buy or pressure to sell than the "true" bids and offers represented. The Spoofers manipulated the weight of the numbers to force the market to go in his favor. Traders learned to identify a spoofers by watching changes in the aggregate number of bids or offers on the screen creating a novel strategy for profit. By riding the tail of a spoofers, a small trader could make money on market direction. Traders who dealt in large contract sizes aspired to "take out" the Spoofers by calling his bluff, selling into his bid, and waiting for him to balk. There was great symbolic capital attached to "taking out" a spoofers by matching wits with this high-risk player. Taking out the Spoofers showed the prowess of a trader in one-to-one combat.

Eliminating the Spoofers has the effect of enforcing the informational transparency of the bid-ask numbers. Although there would be nothing illegal about the Spoofers' maneuver of supplementing the numbers with the weight of his bid or offer, the perceived deception of the Spoofers' tactic lies in the fact that he undermines the verisimilitude of the bid-ask representation. The trader who takes out the Spoofers returns the market to the "true" bid and offer by eliminating the distortion. The Spoofers attempts to post bids and offers to manipulate the market, an intention that disrupts the abilities of other traders to interpret market numbers with their usual tools. With the Spoofers eliminated, traders can once again use their interpretive techniques with confidence.

But the LDF traders had a special respect for this character who tried to bend the market to his will. One LDF trader chattered about a figure he believed to be particularly skillful: "The Spoofers knows what he's doing. He's good. He's a real trader. He must be an Essex boy." His statement links skill and an aggressive style of trading to the Spoofers' membership in a group to which most of the LDF traders belonged—the residents of Essex County. In the 1980s many

newly wealthy traders moved to this region just to the east of London after the City began to open the doors of their trading rooms to working-class men from east and south London. Essex was a locus of identity for LDF traders who understood their trading prowess to be connected to their social origins.

Traders identified a second set of characters within the bid and offer numbers. These characters were based on the groupings of traders they perceived as their closest competitors. In the market for German bond futures, the groups with which the “Essex boys” competed were “the Germans” and “Chicago.” English Essex boys constructed daily nationalist battles with their German and Chicago counterparts. They drew on their own national and urban identities as Essex boys, or streetwise London lads, to do combat with their Chicago and Frankfurt counterparts in a market that operates on foreign territory—the German Treasury bond futures market.

The language that the traders used to identify these groups linked local identities with trading styles. The Germans were closely associated with an imagined set of national qualities such as dishonesty and inflexibility. The Essex boys suspected them of collaborating with their government to gain market advantages because they perceived the Germans as lacking “street-smart” trading skills. The LDF traders often griped that the timing of market movements conveyed that the Germans had inside information from the Bundesbank or the banks of the Konsortium, the group that sets rates for German bonds. The Germans were the subjects of the LDF traders’ narratives in the morning hours between 7:00 a.m. and 1:00 p.m.\*\*. London time, when the Essex boys and the Germans constituted the majority of players in the market.

This changed daily at 1:00 p.m.\*\*, when Chicago “woke up.” Unlike the Germans, Chicago was not identified with the national government of the United States. Instead, the Essex boys identified Chicago traders collectively by the name of the city where financial futures trading originated. LDF traders admired the Chicago group for their aggressive style of speculation and often said the markets were “more interesting” after 1:00 p.m. Several of the most successful LDF traders had license to work whenever they wanted as long as they continued to turn in large profits. They opted to arrive shortly before 1:00 p.m. and trade in the afternoon until four, when the Essex boys at LDF and other firms started to leave their trading terminals for the day. Such traders claimed that the afternoon hours gave the best opportunities for competition because Chicago brought larger volumes and more skillful trading to the market.

Chicago’s involvement in the market also gave clues to the identities and strategies of yet another set of actors in the markets. In the LDF dealing room, a cable line connected LDF to the pits in Chicago. When the bond futures pits in Chicago were open for business, a speaker on the

LDF floor funneled the bids, offers, and final prices into the dealing room. A man with a flat-voweled Midwestern accent called out the bids and offers and occasionally the identity of a bank. The LDF traders derided the predictability of the big financial houses’ strategies. When the nasal voice called out, “Merrill’s a seller,” the reaction was jaded. “Did you hear that, Billy, Merrill’s selling.” Billy responded in mock surprise, “Yeah, fancy that.” In fact, Merrill Lynch’s selling became an ongoing joke in the room. This information oriented the LDF traders to the players in the market and added to the notion that these actors were consistent. These clues helped traders imagine and identify the patterns of action in the market.

The social information that traders construct is not limited to identifying individual actors and their strategies. Traders considered the market as a whole to have convictions and sentiments, and they searched within the numbers to understand states of market affect. For LDF traders, the first task of the morning was trying to understand the mood of the market. They gained access to this information by “testing” the market, that is, selling into the bid to see how easily the market would absorb their trades. A market with strong conviction would be able to absorb the pressure from the sale without a shift in the bid–ask. Competing traders remained convinced that their interpretation of the market was correct and were willing to ignore a signal that another trader believed that the market would fall. If the test did not change the composition of the bid–ask, the trader established that there was confidence that the market would rise and would likely buy contracts in anticipation of this climb. If other traders immediately withdrew from the bid, the LDF trader discerned that there was only a fragile belief that the market would rise.

Although traders took short-term losses to make these tests, the managers of LDF valued this method as a way of gaining information about market sentiment. They trusted that the method would help traders make correct interpretations of the market’s direction and, therefore, secure profits. Andrew Blair, the LDF risk manager, said that he is always nervous when he sees that the company is making money in the early hours of any market. Traders must “pay the price of admission” to understand what lies beyond the surface representation of the bid–ask.

Losing money to gain information was not unique to the morning test. A trader who bought a large number of contracts in expectation of a market rise was said to “get run over” when the market reversed its direction. But such loss was also not entirely negative. A loss produced by a strong trend could signal the market sentiment that the contract was overpriced. The trader then had an opportunity to take advantage of this information. In the words of Joshua Geller, losing money provides a “free look” at dimensions of the market that are not visible in the market numbers. The market may be skittish or stolid, immediately giving in to pres-

sure to sell or standing firm. This metaphor of sight exposes the contradictions within the ideal of informational transparency. Based on the methods Joshua taught, traders use the numbers of the market embedded in the technological design to unearth information about the strategies and characters that populate the market. Although the surface of the interface reduces the market to a set of visual cues, traders can use the patterns of the market and strategies for gathering social information to understand more about the bids and offers than the numbers alone can show.

### Interpretation and technology

Technology shapes the foundations of financial knowledge. The recent transition from pit to screen-based technologies forces futures traders to retool their skills for reading and interpreting the market, because each technology creates a particular informational matrix in which some techniques and strategies of action are more effective than others.

Traders do not passively consume the representations of the market that pit and screen technologies provide. Market representations are shaped within the conflicts and tensions among market ideals, technologies, and the problems of practice. The designers of market systems work to give material form to the ideal of informational transparency by stripping market technologies of social content. Software design and market architects aim to purify the practice of exchange through microlevel market planning. Yet, because traders rely on their knowledge of competitors to create profit-making strategies, they search out specific information about the other actors in the market. These can be their neighbors in the pit, the Chicago and German traders whom London speculators imagine in the numbers, or the market itself as an actor with affect and intention. The form of technology defines not only where traders look for this social information but also what they can find in the numbers.

Tensions between technological rationalization and situated action are fertile ground for ethnographers. These intersections contain the materials for a more grounded approach to the analysis of technological influence and reach. There are dangers in this kind of investigation. Narratives of progressive rationalization from social theory fit neatly with the ideals and aims of technology designers and financial exchange managers. There is reason to be suspicious of this neat fit. A close examination of traders' practices and information technologies can break down the analytical complexity with native discourses of rationalization, illustrating instead how technologies and forms of creative action animate economic life.

At the same time, discourses and strategies of rationalization are seminal artifacts for the design and implementation of information technology systems and financial markets. As I demonstrate in this article, numbers operate as critical materials for rationalization. As I also show, num-

bers are not always consumed as designers of technological systems intend. Traders who use financial technologies do not take up numbers as objective descriptions of supply and demand. In the context of both open-outcry and screen-based technologies, traders seek out nonquantitative information that is located within the market numbers. They find and exploit the social where there seem to be only noninterpretive facts. Traders prosper from constructing knowledge strategies at the junction of market numbers and their material presentation.

The tensions between rationalization and situated action are central to calculations in financial markets and other sites of modern economic activity. Although it is outside the scope of this article, several other areas could provide parallels where numbers, technologies, and narrow time frames shape interpretation and action. Productive comparisons could be made with air traffic control, venture capital, car racing, and combat aviation.

Flexible interpretation rather than formal calculation characterizes the styles of reasoning common in financial futures markets, both in the pits and on the screen. In contemporary trading rooms, sentiments, actors, and market numbers are always in flux. Traders know that market numbers carry social content that cannot be computed. Searching for the hidden values and phantom figures that lurk behind the numbers is the anchor in a global marketplace where the only certainty is instability.

### Notes

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1. Futures contracts are standardized, binding agreements to buy or sell a commodity at a given future date and price. They are *derivatives*, contracts that gain their value from a market in an underlying product. The traders at the CBOT and LDF I discuss here trade in futures on government bonds.

2. Using the term *technology* for a system that does not have a material form, like open-outcry, could cause some confusion. The steps of a trade can be understood as a technology because they comprise a specifically designed, *single and precise* procedure embedded in particular motions that accomplish a task. Throughout this article, I draw on Claude Fischer's user-centered approach for understanding technological systems. In his book about the introduction of telephones in the United States, Fischer (1992) argues against technological determinist framings, showing that information technologies do not have qualities of their own that operate

independently of users. Similarly, the speed and transparency of financial technologies do not inhere in information technologies that support them. Technologies are always imbricated with the day-to-day practices of users.

3. The narrative of progressive rationalization is, of course, most familiar to us from the work of Max Weber. In *Science as a Vocation* he bluntly states that “the fate of our times is characterized by rationalization and intellectualization” (Gerth and Mills 1946:155). Simmel (1990) also famously wrote of the rationalizing nature of money. For this article, it is important to make a distinction between the power of rationalization as an ideal in the financial industry that parallels Weber’s and Simmel’s accounts of progressive rationalization, and an anthropological analysis of rationalization that takes this ideal as a social fact.

4. The social context of financial interpretation is evident in the friendships and feverish affect of pit traders. Looking first at the face-to-face context of open-outcry markets, where the density of social life is overwhelming, analysts can observe and become attuned to the social dimensions of online calculations. This sensitivity is especially important where self-conscious rationalization has actively sought to eliminate the social as an element of economic calculations. The problem is not one of a dualistic division between face-to-face and online transactions. Rather, the problem lies in how rationalized technological systems create a specific context for financial calculation.

5. I use the masculine pronoun for gender realism. The overwhelming majority of traders at the CBOT and LDF are men. In the time that I worked at the CBOT, the largest pit held 600 traders. Two were women. At LDF, before my training group entered the dealing room, there was one woman and 60 men.

6. The difference between the bid and ask is called the *spread*. Ideally, the trader can make money buying at the bid and selling the offer, pocketing the difference, but this method of making money is not always available. Bids and offers theoretically represent the totality of supply and demand for a product in a given moment. Market participants must be able to see all of the bids and offers in the market to evaluate market conditions accurately.

7. See Paul Rabinow’s “Representations are Social Facts” (1996) for a critique of epistemology in the social sciences. In the case of financial markets, the epistemologies of financial designers themselves become social facts as they direct the construction of technologies.

8. The CBOT created the pit structure to solve problems that arose as the market space became overcrowded with eager speculators. Originating in the agricultural trade of the Midwest, the CBOT was established by men trading certificates of ownership of grain to be delivered several months down the line from farms in Nebraska, Iowa, or Illinois to the Chicago grain elevators (Cronon 1991). By 1869, trading at the CBOT had become so popular and crowded that the speculators could not see all of the bids and offers available. Market reporters complained in the pages of their daily papers that traders in search of better sight lines were climbing onto their desks and obstructing the reporters’ vision. After trying out several shapes for a raised structure that would provide better views of the traders in the market, the CBOT introduced the octagonal pits in 1869 (Faloon 1998).

9. In this sense designers resemble Rabinow’s (1995) depiction of technicians of general ideas by putting into practice normative ideas of economic action. They are self-conscious intellectuals gravitating to and instantiating ideals of rationalization and designing economic abstractions to facilitate practices more closely resembling perfect competition.

10. In *We Have Never Been Modern* (1993), Bruno Latour discusses purification, the division of the social from the natural, as a hallmark of the modern constitution. Here, the numerical representation

helps to rid the financial arena of social influence. With numbers, the economic sphere is construed as a space of natural competition.

11. In *Plans and Situated Actions* (1987), Lucy Suchman critiques the use of planning models of human action in technological design. She argues that designers should take into account that purposeful action is “situated” and not the outcome of a process of abstract planning (Suchman 1987).

12. I use *technological frame* to indicate the way that technology shapes the content it provides to the user. Wiebe Bijker has used the concept differently. In Bijker’s work technological frame describes “the ways in which relevant social groups attribute various meanings to an artifact” (Bijker et al. 1999:108).

13. Frank Knight, in his classic work *Risk, Uncertainty and Profit* (1971), defines uncertainty as the condition of judgment and of entrepreneurial profit. He states that, “With uncertainty entirely absent, every individual being in possession of perfect knowledge of the situation, there would be no occasion for anything of the nature of responsible management or control of productive activity” (Knight 1971:267). Knight’s use of uncertainty highlights problems of prediction in economic action. I prefer to use *ambiguity* rather than *uncertainty* to underscore the many possible interpretations of a present situation. Traders could be considered *informational entrepreneurs* because they create interpretations of market direction out of this ambiguity. This follows Pat O’Malley’s (2000) description of the *uncertain subjects* of neoliberalism rather than appealing to older formulations of entrepreneurship that fit within a paradigm of rational modernization.

14. Differences in opinions and interpretation yield opposing views. These contrasting outlooks on the future direction of the market allow for every buyer to meet a seller and every seller to find a buyer. At the same time, anticipating and acting on the presumed interpretations of other traders in the market is a widespread profit-making strategy. This common practice can create a self-fulfilling prophecy in price action.

15. Wayne Baker has shown how, in large pits, traders break up into trading areas within the pit, undermining the ideal of competitiveness. The noise of trading and potential errors of trading with a physically distant partner encourages traders to focus their attentions on the area closest to them (Baker 1984a).

16. This organization around ideals of pure competition and associated notions about rational calculation is not restricted to the pits at CBOT. Ira O. Glick (1957) showed how these principles worked in the egg futures market at the Board of Trade’s cross-town rival, the Chicago Mercantile Exchange. The Chicago model of pit trading spread with the financial revolution of the 1980s and formed the basis for markets in other financial centers (Kynaston 1997).

17. See Burton Malkiel’s *A Random Walk down Wall Street* (1999) and Peter Bernstein’s *Capital Ideas* (1986) for a synopsis of the “random walk” in stock and commodities pricing and its implications for traders, investors, and financial theory. According to Malkiel, “a random walk is one in which future steps or directions cannot be predicted on the basis of past actions. In the stock market, it means that short-run changes in stock prices cannot be predicted” (1999:24).

18. The GUI that traders use at LDF is not the only GUI available. Members of Eurex have access to the exchange’s stock GUI, a screen device that is also numerically based but visually more rigid than the E-trader model. Earlier GUIs, like those for the now defunct CBOT Project A trading system, tried to replicate the face-to-face environment of the pit by associating names and personal trade histories with each exchange. The precursor to the Eurex exchange, the DTB, never operated with a pit system. Their electronic markets have always relied strictly on numbers.

19. The term *disintermediation* came into vogue in the 1980s as a way of describing the development of new instruments, such as

mortgage-backed assets, that allowed companies to borrow directly from the market rather than going through a commercial lender. The techniques of disintermediation removed institutional linkages and drew companies to the "core" processes of the market. The same rationality is operative in the logic of reducing the market representation to numbers.

20. I was practicing a technique called spreading in ten-, five-, and two-year German Treasury bond futures nicknamed the "Bund," "Bobl," and "Shaz," respectively. Spreading is a technique that takes advantage of the difference in volatility among bonds of different durations. The price of a ten-year bond is more volatile than that of a two-year bond because the longer time frame introduces more opportunities for changing economic conditions and greater uncertainties. A spreader takes opposite positions in each of two instruments, using the more stable instrument to limit the loss potential of a position in the more volatile contract.

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