Alternatives to an Open Outcry Market: An Issue of Supporting Cooperation in a Competitive Situation

Catalina Danis and Alison Lee
IBM TJ Watson Research Center, USA
{danis,alisonl}@us.ibm.com

Abstract. We present a design exploration for electronic futures exchange which is currently implemented a physical open outcry pit. The goal structure is characterized by competition at the individual level and cooperation at the group level. Individuals compete for trades in order to earn money, but must also agree to undertake a significant number of trades which do not earn them money in order to sustain the market. This goal structure makes the open outcry market an example of a social dilemma. We analyze the social interaction fabric that exists in the open outcry environment and identify a set of intents that characterize the system. We then discuss how the affordances of the physical environment support the satisfaction of the intents. In the design exploration we examine which of these intents are still applicable in an electronic implementation and discuss how the affordances of this medium shape possible designs.

Introduction

We have long recognized as naive our earlier assumption that conflict is necessarily absent among members of an organization, even within tightly knit groups working towards the same goal (e.g., writing a report, developing software) [2, 14]. Yet, conflict among collaborators and its impact on the design of applications that support them has been addressed incompletely within the CSCW community. Much has been written elucidating its causes, debating its impact, and discussing appropriate responses (see [12, 20, 22]). However, this work has addressed situa-

tions in which conflict is a by-product of the group interaction. Few[1] [4] have addressed collaboration in which conflict among the participants has been an accepted goal of the collaboration, one might say, its *raison d'être.*

Cohen et al. (2000) describe collaboration between opposing counsel in a legal case. They term it *adversarial collaboration* to indicate that the visible patina of professionalism characteristic of opposing counsel working towards settling a case should not blind us to the fact that the two sides are fundamentally opponents, each trying to secure a win for *their* client. The adversarial relationship, Cohen et al. (2000) argue, is clearly visible in how members of the two sides handle document creation, a central work product.

In this paper, we focus on a somewhat different case of adversarial collaboration. It exists in an open outcry market place in which individuals trade complex financial instruments, called derivatives, that derive economic value from underlying assets (e.g., farm commodities). These trades take place in a face-to-face setting called the pit. There is a great deal of money to be made trading these esoteric financial instruments based on rather prosaic products. Consequently, the traders compete strenuously with each other to win trades. However, they are bound as a group in that they are jointly responsible for maintaining the liquidity, or availability of trades, of the market place. Without liquidity, the market and the traders' opportunity to earn a living ceases to exist.

One can view this situation as being one in which "... individual rationality leads to collective irrationality" [18]. To maximize his profit, an individual trader should only engage in trades where he profits. But, if he doesn't undertake trades where he stands to not make a profit or perhaps even take a loss, liquidity will dry up and the market will cease to offer potential for individual profit. This *market-making*[2] function of traders in the pit will be a central theme in our discussion.

We had the opportunity to study this complex social situation when we undertook a brief, informal, consulting engagement with one of the member firms of the commodities exchange. The engagement took place during a period when the various exchange stakeholders were debating how to respond to a perceived threat to siphon off trade volume by electronic exchanges. Already, some of the new financial instruments were being offered for trade through various electronic competi-

[1] We would be grateful for any references which our search has missed.

[2] Heath et al. (1995) also studied this function in a London dealing room. Unlike our situation, the individuals in their study all worked for the same company and worked collaboratively to bring this function about.

tors, rather than in the confines of the raucous, face-to-face, open outcry pit. The central concern of the stakeholders was how to stem the outflow of trading volume from the pit. The exchange was exploring two alternatives: a modified, open outcry pit and an electronic exchange. The design problem faced by the futures exchange presented a rich design space to explore and analyze various CSCW issues that were relevant and could provide insights into the design alternatives being considered.

In this paper, we argue that the social fabric of the physical exchange can be understood in terms of a class of problems called *social dilemmas* [1, 5, 7, 10, 18]. These are social situations in which taking the long-term view demands that individual competition be tempered with collective cooperation. We present our analysis of the functioning of the open-outcry system and argue that its evolution and operation supports taking the long-term view, enabling cooperation in the face of highly charged competition. In the design exploration section of this paper, we examine how design elements for the online environment might be used to support the user requirements we identified during our field work. Our exploration of the electronic design will not be in terms of a finished product, but rather as a design discussion that brings to bear what is known from research in CSCW and social dilemmas that shed light on the viability of the electronic design.

Understanding CBOT

What is a Futures Exchange?

Various factors can affect the supply and demand of goods or services between the time they are produced and when they are delivered in the future. This causes price uncertainties. A case in point is grain production. Between the time it is grown and when it is delivered to market, factors like growing conditions, demand, floods, and economic downturns can impact the price it could fetch at market. Without a means to lay off or limit the risk of price fluctuations, producers would be hesitant to enter into the forward commitment required to bring the grain to market.

A futures exchange provides a forum for buying and selling futures contracts which are standardized on quality, quantity, time of delivery and location. The only variable in the contract is the price; this is discovered during trading. Price discovery is fueled by knowledge that traders have of the factors (e.g., weather, economic downturns) that will impact the price of the grain.

Producers and consumers use the futures exchange to manage the risk. Through the price discovery mechanisms of the exchange, they settle on a price at which they will deliver or accept the delivery of a contract for a commodity. Thus, the exchange enables them to enter into a contract now and promise to settle it in the future. This use of the futures exchange, known as hedging, provides producers and consumers with the means to manage the risk associated with their business and in turn, to gain a handle on the cost of doing their business.

For individuals to be able to lay off risk, there must exist individuals who are willing to bear the risk of price fluctuations. These individuals are called traders and they assume the risk in return for making money. Traders have no interest in owning the underlying assets (e.g., grain) but are involved in the practice of speculating; they have insights (i.e., access to certain information) that enable them to make educated guesses about future conditions and hopefully to profit on price movements. More importantly, these individuals function to add liquidity and capital to the futures market by making a market for the trading of the futures contracts.

The Chicago Board of Trade (CBOT)

The Chicago Board of Trade (CBOT) is a futures exchange. It is a self-governing, self-regulated, not-for-profit organization that serves its 3600 trading members (individuals and firms). CBOT has a governing board and an administrative staff that we will collectively refer to as the *management* to differentiate it from the members that it serves. It does not trade anything itself, but provides contract markets and oversees the integrity and development of the markets. To trade on the floor of its exchange, a trader must be a member or belong to a member firm. In addition, the trader must designate a member firm to perform clearing functions; that is, handle the financial aspects of the transaction. Finally, CBOT also has an independent entity known as a *clearing house* that acts as the counter-party to every trade to eliminate the credit risk for the parties engaged in the trade.

Trading is conducted through public auction in which buyers and sellers shout out and signal, through specialized hand gestures, the price and quantity they wish to buy or sell. This public outcry scheme ensures that no trading takes place surreptitiously between two traders; it ensures that everyone will be given the opportunity to participate. A pit observer records the price of the trade into a computer-based reporting system. Traders may either work for their own account (or, that of

a member firm) or on behalf of an outside customer (e.g., institutional investors). In the latter case, the trader is referred to as a *broker* because he is the middleman between the customer and the other trader.

Trading of contracts occurs in trading areas known as pits (see Figure 1). Pits are concave, octagonal platforms with steps descending on the inside. This structure contributes towards orderly trading because it permits buyers and sellers to see each other. Each pit trades in a particular commodity, with each side of the octagon forming a wedge where all traders and brokers who deal with contracts for a certain delivery month trade. Individuals who trade only for themselves stand in the center of the pit, while brokers stand at the edges of the pit. This allows them to access their support staff which move between the outside perimeter of the pit and the desks arranged around the perimeter of the trading floor. Related pits (e.g., soybean, soybean meal, and soybean oils in Figure 1) are placed close to each other to support and promote cross interests.

Arrayed around the perimeter of the exchange floor, located about one story above the floor, are large displays providing the current and the recent buy and sell prices. These displays, accessible to all the people on the floor, along with other electronic and human communication networks that a member firm may have on

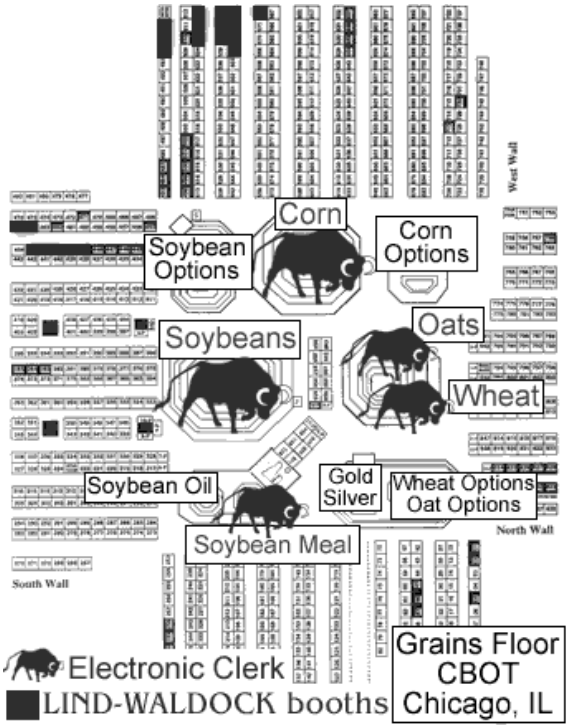

Figure 1. Layout of CBOT's agricultural exchange floor [19].

the exchange floor allows traders to keep abreast of developments throughout the exchange floor.

Our Field Work

Our field work was conducted over a two-day period while visiting as consultants to one of the clearing member firms. This firm was engaged with other exchange members and exchange management in exploring ways to address the threat posed by electronic exchanges. We talked with principals in the clearing member firm who were involved in trading, brokerage, and clearing activities. We also interviewed several self-employed member traders and a futures floor commentator working for a large member firm. The commentator was a former trader who provided commentary about the market to customers of his member firm. He culled information from news wires, market letters, and traders on the floor and provided periodic analyses and digests for a hot line and internal customer network.

We observed actual trading in various pits, both from the exchange floor as well as from the visitor's gallery, which gave a birds-eye view of the floor. In addition, we interviewed two traders who only traded through electronic exchanges. Finally, we visited, observed, and talked with market makers of the financial derivatives trading desks of a dealing floor of a securities house. This dealing floor and the hubbub of activities are very similar to the ones observed by Heath et al. (1995) at the equities desk of a dealing floor.

Patterns of Social Interaction

Our first impression of the exchange was one of chaos. We first glimpsed it from a glass-enclosed visitor's galley located two stories above the trading floor. Even with commentary provided by a 30 year veteran of the floor, the interactions looked like people engaged in arguments. People in ill-fitting jackets of outrageous colors (to distinguish among trading firms, our guide pointed out), separated by no more than an elbow's distance clustered in areas of the pit. They were engaged in rapid bursts of activities, gesturing excitedly, apparently screaming at each other, sometimes closing by scribbling on index-like cards. At other times, they closed by turning away in disgust.

Some others, wearing headsets, stood largely motionless at the periphery of the pits, occasionally gesturing to someone inside it. At times they turned outwards, and accepted a card from someone who emerged from the crowds surrounding the

pits. In contrast to this wild activity, a few stood motionless, apparently transfixed as they gazed up at the neon signs displayed overhead.

In contrast, when we walked the floor of the exchange later that afternoon and viewed the activities close-up, we began to identify purposive sets of social interactions. Piecing these observations with information from our informants, a picture emerged of a complex set of interlocking patterns of interactions in support of what Kraut et al. (1990) call the social and production aspects of work [15]. Production aspects of work are those related to creating the work products of the group. In the case of an exchange, one example is the trades; the wild gesturing and shouting in a small group, followed by scribbling on index cards by two or more people.

Social aspects of work are those related to social process at both the group and the individual level. With respect to the group, the goals include communication of the organizational culture, development and maintenance of the integrity of the group and development of relationships with other groups. The goals aimed at individuals include development of personal relationships, browsing of the social environment, and building personal networks. A surprising example of the social aspect of work for us was finding that traders would discuss sports or other extracurricular interests during breaks in the trading.

Identifying Intent from Patterns of Social Interaction

In doing field observations in support of a design project, it is important to discover the function a particular behavior plays in the situation being observed. This is particularly difficult if the observed behavior takes place in a different medium than the planned design (in our case, going from physical, face-to-face to electronic). One needs to guard against assuming that the literal behavior is critical to the situation and replicating it in the new medium. Since different media are characterized by different affordances and place different demands on its users, an implementation to support a replica of a situation will result in failure.

People have pointed out the importance of separating the intent[3] (also referred to as need or accomplishment) of a behavior from the implementation or mechanism which instantiates it in a given communication medium [8, 13, 15.]. Dourish et al. (1996) illustrate this point well with reference to a distributed desktop conferencing system in which looking at one's interlocutor in face-to-face communication was literally transferred into the electronic medium (as a person's face

[3]We use the terms intents and needs interchangeably in the paper.

captured as they stared into a camera) until it became clear that it was the function played by that behavior in the physical medium (paying attention) that was critical for regulating an interaction between co-workers discussing a document.

Below, we list the intents we discerned based on the various patterns of trader behavior that we observed and/or learned about through interviews. In all cases but one, the behaviors on which the intents were posited were easily identifiable because they were expressed verbally or through easily decipherable non-verbal signals. However, you will notice that one was very subtle and we only learned about it through interviews with some very knowledgeable traders.

Intents are presented in italics at the beginning of each bullet point below. The text that completes the bullet point describes the various interaction patterns we observed that lead us to infer the existence of the intent, and thus, by definition, satisfy the intent. It is significant to note that it is not uncommon for a given behavior pattern to satisfy multiple intents.

- *Making Money.* Trading to advance ones immediate, personal financial position. These are trades on which a trader makes money and are conducted through a combination of speech, hand signals and body movements.
- *Market Making, Group Cohesion/Social Bonding.* Participation in trades that exclusively contribute to the liquidity of the market, that is, those aimed at market making rather than enhancing one's personal financial position. These are trades on which a trader did not make a profit, either breaking even or losing money. A second function of this behavior pattern is to build cohesion within the group since traders told us that they view market making as being a responsibility of traders. They will use humor to chide traders (e.g., "Are you here to stand around or to trade?) who are solely participating in trades that make them money, thus not meeting their group-level responsibility.
- *Information Gathering, Group Cohesion/Social Bonding.* We observed traders discussing topics that provide fuel to the price discovery process (e.g, transportation costs, weather, monetary policies) with their colleagues. Upon questioning them, we learned that they differentiate two classes of conversation partners based on the value of information which they exchange. The first class is typically a large group with whom they talk about task-relevant topics, but the value of the information is low because it is already in wide circulation. An example is, "have you seen what the paper said about fuel costs"? The second is a much smaller group, perhaps only two or three people, with whom they practice a strategy they call "give to get". In order to obtain information they see as truly valuable information, they have to reciprocate with some that is equally valuable to their informant. They have identified this select group of individuals (different for every trader) to be sources

of this type of information which is not part of the common knowledge of the larger group.

- *Tension Release, Group Cohesion/Social Bonding.* As we noted earlier, traders interspersed their task-related activity with social banter about family, external activities and other topics. Some of the snippets we overheard clearly suggested that the current conversation was part of an ongoing series of conversations between those two individuals. For example, a question such as "How is your wife"? indicates that the person asking the question has some prior knowledge of the other person's marital status. Whereas, a question such as "How about those Cubs[4]?" does not presuppose any previous relationship. During our interviews, some traders told us that they have developed close, trusting relationships with other traders through interactions over long periods of time. At an earlier point we expressed surprise that the traders should make such light hearted remarks about sports teams in the midst of what is very serious, very tense work. Some of the traders clarified this during our interviews, noting that they "would go crazy" without this opportunity to relax their minds and release some of the tension that they build up during the trading day.
- *Making Money.* Experienced traders have developed many strategies to "gain an edge" on their opponents. These include trying to intuit private information about an opponent's position (e.g., does a trader seeking to buy 500 contracts of May corn really seek to buy 10x that quantity but is breaking up the purchase in order to gain a favorable price). One way some of them claim to do it is through observing the patterns in his trades and correlating them over time with a variety of subtle non-verbal cues. For example, one trader noticed that whenever a particular trader needed to dispose of a big order, he always stroked his tie. This ability to "read" their opponent was cited as a very important ability that gave experienced traders an advantage in making trades.
- *Market Making, Group Cohesion/Social Bonding*. Typically, when a trade is being offered, multiple traders will bid on it. If there are multiple bidders at the same price, the seller has latitude as to how he allocates the contracts. In our interviews, traders noted that they would use this flexibility to promote appropriate behavior, like market making. It could also be used to set up the opportunity for reciprocity to function.

Understanding Competition and Cooperation

The intents driving many of the traders' interactions reveal a strong, competitive undercurrent to many of their interactions. This is clearly evident as they contend

[4] A major league baseball team in Chicago.

for trades. Even in an informal social setting, away from the pit, conversations were very much choreographed to limit unnecessary exposure of information that could give other parties an edge; that extra knowledge that can enable one to predict and win out on price movements is closely guarded. However, many traders also publicly stated that they had to cooperate to create or make a market in order to maintain liquidity; even when it was clear that there was no profit in it for them. We saw this cooperation conflicting with their competition for trades. In exploring this tension further, we found that it could be well-understood in terms of a class of problems known as *social dilemmas*.

Social dilemmas were developed by sociologists and mathematicians as an experimental framework to study cooperation among individuals in situations which provide inducements for both competition and cooperation. This framework has enabled the experimental manipulation of relevant factors and the measurement of their impact on levels of cooperation. It provides a tool with which to begin to organize the complex set of inter-related factors that other social scientists have identified as being implicated in cooperation and competition. As Axelrod, an influential proponent of this approach notes, the method is an abstraction, which "puts aside many vital features that make any interaction unique" [1, p. 19]. However, the strength of this experimental framework is that it dovetails with work by researchers in the social sciences (particularly social psychology and sociology) who have identified relevant factors through observation of group behavior in the wild that is, outside the laboratory.

Social Dilemmas

Social dilemmas arise under conditions where there is a conflict between rational behavior dictated by an individual goal and that which is dictated by a group goal. If a member of a group were to behave rationally based on his individual goal, the outcome would, in the long-run, negatively impact the group as a whole (see 9, 10, 18 for good introductions to the subject). Axelrod summarizes this by saying "This basic problem occurs when the pursuit of self-interest by each leads to a poor outcome for all". [1, p 7]. This class of phenomena is frequently illustrated with respect to the depletion of natural resources. Individuals could pursue their self-interest by taking as much lumber as they need (to build with, or sell, or use in some other way), but if everyone does this, eventually the forest will no longer be able to regenerate itself, and no one will have access to the resource.

Of particular relevance to our discussion is a type of social dilemma that involves more than two people, the so-called N-person dilemma. Cross and Guyer (1980) differentiate two types of N-person dilemmas as a function of the pattern of costs and benefits to the individual and the group. According to this characterization, the situation in the face-to-face open outcry system fits the *social fence* dilemma. That is, an individual incurs a cost due to an unprofitable trade which produces the benefit of increased liquidity for the entire group. The social fence dilemma is frequently discussed in terms of a metaphorical story which discusses the problem of providing public goods. The notion of a public good, which Kollock (1998) defines as "a resource from which all may benefit, regardless of whether they have helped provide the good" aptly describes the situation in the open outcry market. Any trader may partake of the liquidity of the market, even if they only trade when it is beneficial to them.

Factors that Contribute to Cooperation

In order to understand the factors that lead to cooperation, it is useful to also consider what factors lead to competition; a counter-force to cooperation. We will not attempt to do an exhaustive examination of the literature here[5]. Instead, we have been very selective by focusing on factors that are relevant to the two system implementations we discuss later (the physical pit and the electronic system). In our conceptualization, these factors play a bridging function between the user needs we identified in the futures exchange domain and the characteristics of the system design. The social phenomena we discuss (communication, identity, repeated interactions, and group size) are factors that can be manipulated in a design which has the appropriate affordances and can thus satisfy certain intents.

Communication

In the literature on social dilemmas, communication is repeatedly found to have positive effects on rates of cooperation [18]. However, it is difficult to explain why this is so. One promising reason is that communication can create or reinforce a sense of group identity.

In looking elsewhere and in particular to research in CSCW, an important finding is the importance of informal communication for group cohesion and the smooth operation of a group in an organization. In particular, Kraut et al. (1990)

[5]Interested readers are referred to Easterbrook et al. (1992) for a discussion of conflict and to Kollock (1998) for a discussion of cooperation.

and Whittaker et al. (1994) found that increases in informal communication in an organization led to greater familiarity and mutual respect for each other and their work which can be powerful facilitators for successful working relationships and collaborations. Designers of CSCW systems have been greatly influenced by these findings in their efforts to develop ways in which informal communication could be supported.

Identity

Identity is a basic building block of social interaction. It is also, as Axelrod (1984) has pointed out, important for one to recognize the other party, to identify the other party based on past interactions and to remember the relevant features of those interactions; all of which is necessary to sustain cooperation. Identity enables one to hold the individual accountable, to enable the individual to reciprocate, or to be able to recognize prior defections. If people are anonymous or there is an inability to identify an individual then it is not even possible for the other party or a group to respond in an appropriate manner or to assert social control.

On the flip side, anonymity has some positive impact. Specifically, Reid [21] points out it is easier to take chances in interactions with people, to risk being evaluated negatively; you can extricate yourself from the situation if you do something that does not communicate the image you are trying to project. While this might be useful for purely social endeavours, total anonymity is not suitable in bilateral exchanges for reasons indicated previously.

However, how much information is needed to identify an individual is a pertinent consideration. In studies of trust in online exchanges [16], Kollock found that identity built through positive references (with several requisites about implementation) has a tangible value to not only other parties in a bilateral trade but also to its owner. They are less likely to shed their identify once they have built it up because of the cost associated with building it. While there is much to explore on this issue of what is pertinent, it is clear that identity need not be rich in every sense of the word but must be durable for others to recognize, track, and hold individuals accountable.

Repeated Interactions

In both the research on virtual communities and on social dilemmas, one oftencited means of encouraging cooperation is to have repeated interactions [1, 17, 18]. If people will not interact in the future, they will be motivated to behave in their

own self interest because they will not be accountable for their interactions. Yet another way of looking at it is "if you're not going to see them again, why bother?"

Looking to work on CSCW, frequent informal interactions have been found to be useful for getting people to know and like one another, for creating a common ground, and for supporting planning and coordination in group work [15]. Any single occurrence may not seem significant on its own but in aggregate, they serve to help achieve both the social and production aspects of their work.

Group Size

Studies have shown that cooperation declines as group size increases [18]. Several issues come into play as groups get larger. First, increasing the size allows the spreading of the negative impact of defection. This makes it harder to influence the behaviors of others and makes it easier to defect more or less anonymously. Larger group sizes also makes it harder to organize. It becomes harder to identify and track one individual's action and makes monitoring and sanctioning difficult. While all these reasons are not inevitable it does point out issues to consider.

On a more positive note, larger groups may be more likely to solve certain social fence dilemmas (those in which public goods are highly non-rival). The reason is that a larger group may contain a critical mass of people whose interests are served by the public good. This has been found to be the case in certain online newsgroups where it is the case that a small subset of the news group provides a substantial portion of the contributions that are benefited by the larger group.

Implementation of Intents in the Physical Outcry Pit

Characteristics of the Medium

Characteristics of the physical, open-outcry pit have important implications for the social processes that are likely to occur in it. These in turn have an significant impact on whether the intents we identified can be met by the design. We list the three most important characteristics briefly here and note which intents they support.

- Requirement that traders be physically present to participate. This ensures face-to-face interaction and with it a strong form of identity. Through stable identity, trust can develop. These social processes are useful tools for satisfying the intents of group cohesion/social bonding and information gathering.

- Human Allocation of Trades. Because traders have a choice how to allocate contracts to traders in the case of multiple bidders willing to pay the same amount, they have a powerful tool to institute reciprocity and peer pressure. These social processes are important tools in satisfying market making, group cohesion/social bonding as well as the intent of making money.
- Small, stable group. Many of the traders were brought into the market through family or friends. This factor promotes repeated interactions, the development of common ground, reciprocity, accountability, and trust. These are important for being able to satisfy the intents of group cohesion/social bonding and information gathering.

Design Explorations

In response to both the threat posed by electronic exchanges and the desire to grow its business, the management of the exchange was exploring a number of different options to improve the futures exchange. When we visited, they were considering two alternatives for these improvements: an electronic exchange and a modified, open outcry pit. In the next subsection, we present the requirements that motivated the request for improvements and examine the first alternative in detail using the intents structure that we developed in the last section based on the physical open-outcry pit.

Requirements for Improving the Futures Exchange

The improvements being sought in the alternatives were driven by three new requirements that the management had. First, new and more sophisticated forms of futures instruments were coming to market and they wanted to participate in these offerings. Participation was important for increasing their revenue stream because they were in the process of converting from a not-for-profit to a for-profit organization. It was also important for maintain their stature as the primary market for the trading of various futures instruments. Hence, they needed to be able to support new contract markets as they are created.

Second, they wanted to increase the volume of trades handled by the exchange. This was important for not only profitability as a corporation but it was also important for being able to provide liquidity to their larger portfolio of instruments that they wanted to be able to provide trading for.

Third, their outside customers wanted speed of execution and speed of notification of execution. At present, the process required an outside customer to place

their trades with a securities firm by phone, who must transmit the order to a clearing member on the exchange floor who then must relay it by human messenger to their broker in the pit for execution and then wait for it to be recorded before the results of the executed trade can be reported to the customer. They also need to do this in order to remain competitive with electronic exchanges whose processes were much faster than those of the pit.

Finally, their outside customers were also demanding to pay lower brokerage costs that they were being charged to execute their trades. Clearly, this could done if they could squeeze inefficiencies from their system and if they could generate revenues from greater volume and larger portfolio of product offerings.

Design Alternative 1: An Electronic Exchange

Meeting Management requirements

The first alternative is a screen-based electronic trading which provides direct electronic access to the products traded on the exchange. Instead of limiting trading to a physical location in the pit, members gain standardized access to the market from an electronic network. This provides both decentralized as well as global market access and members are no longer restricted by time, location, or borders.

From the standpoint of management, an electronic system is an obvious direction to explore. Their overriding goal is to reach a broader audience. By eliminating the physical barriers to participation posed by time and distance barriers, they are increasing the size of the pool from which participants may be drawn. Furthermore, as new instruments are created, they can be added easily unlike in the physical outcry system where space is limited. By electronically handling and automating many of the activities associated with trading, trade management, trade notification and trade settlement, the process is streamlined and offers the opportunity to provide quick turnaround. Finally, as has been demonstrated by the push in retail stock brokerages to the electronic domain, costs of trades to the end consumers have been cut dramatically (e.g., Charles Schwab offers electronic trading for $30 compared to more than $50 when handled by a broker). A compelling case can be made that an electronic exchange can effectively meet the additional requirements posed by the exchange management. The issue then is whether the terms and conditions embodied by the resulting system are supportive of the needs of the traders. If so, members of this larger pool should be eager to participate.

Examining Design Alternative 1

During our field work, we found that most of the traders were opposed to the replacement of the physical outcry system with an electronic trading system. They argued that going electronic would destroy the factors that promote market-making in the pit. We do not know for certain what factors are responsible for the operation of market-making in the pit. However, it is a fundamental tenet of the social dilemma approach that self-interest alone can lead the traders to "take the long-view" and at times engage in trades just to keep the liquidity of the market going. In our analysis of the open outcry system, we argued that characteristics of the physical design support various social processes that increase cooperation and thus may promote market-making.

We need to examine three questions. First, will the factors we believe are responsible for supporting market-making in the pit be eliminated when we go to an electronic design? Second, if so, do other factors emerge due to the affordances of the electronic medium which can be manipulated through design to meet the intents that characterize behavior in the open outcry implementation? An interrelated third question is, do the affordances of the electronic medium alter or eliminate some of the intents we identified in the analysis of the open-outcry implementation?

By an electronic implementation of the system we mean any of the class of implementations that can provide participants with standardized access to the market from an electronic network. We discuss three characteristics of such a medium that differentiate it from the physical implementation we have been discussing and which would be expected to have a significant impact on the social processes that it supports and, consequently, on the intents it can satisfy.

Characteristics of the Medium

Greatly Reduced Barriers to Participation: Its Negative Impacts

Ability to open access to traders irrespective of physical location is one of the main characteristics of a new design medium being sought by CBOT management. This has two important consequences: increased number of participants and introduction of a highly diverse population.

One of the consequences of the decreased homogeneity is that shared understanding brought about by common ground [6] among traders in the pit can no longer be assumed.Under these circumstances it is easier to allocate trades auto-

matically, rather than continue to have them controlled by humans. This represents an enormously significant change from the human-controlled allocation scheme in the physical pit. Traders had enormous latitude in the allocation of trades which was within the allowed rules of conduct specified for this body[6]. They would use this latitude strategically to forward any of a number of agendas. These include reciprocity for past allocations by the buyer; promoting market-making by rewarding/punishing buyers based on their contribution to market making and for purposes of social bonding.

The simple increase in the number of participants one might expect as a result of an electronic design would not be expected to bring about important negative consequences. Since trades are allocated automatically, the observed effect of increased group size on the dilution of social bonds would not impact market-making. One might, however, expect increased size and heterogeneity to weaken social bonds and thus impact the design's support of the social and information sharing intent. However, its impact could be lessened by another characteristic of this medium, namely its ability to support mobility for the participant.

Lessened Physical Constraints/Increased Mobility

Unlike the physical pit where a trader is largely dependent on his fellow traders in all ways, the user of the electronic implementation has much greater choice, not only in when to participate, but to what extent. While a participant who decided to trade in the physical pit, will do so exclusively for the duration of his trading day, the participant in the electronic system can easily explore other environments (both physical and virtual) while continuing to trade. Thus, if he is unable to satisfy his informational intents because he is unable to develop the social bonds necessary to trust the source, he can satisfy that need through a number of other means (e.g., other sites, animate and inanimate physical sources).

Potential Positive Impact of Lessened Barriers to Participation

It is possible to argue that the market making intent, which lost much of its social support in the electronic implementation due to the automatic allocation of trades, may actually be promoted by increases in the number of participants. It has been well documented that an overwhelming majority of participants in discussion groups do not contribute. However, many do and the question is why. Kollock [17]

[6]The CBOT exchange, as well as all other financial exchanges, are very closely regulated.

frames this as another case of a public good social dilemma: If individuals are not willing to incur the cost of contributing, the ability for the group to partake will be diminished. He believes that people will contribute because the digital medium greatly decreases the costs and increases the benefits associated with the provision of public goods (motivation and coordination). By virtue of having a large audience, motivations based on self interest (increased reputation, increased sense of efficacy, possibility for reciprocity) are more likely to be met. Similarly, the cost of coordinating people to contribute is lessened because its easier to reach everyone. The applicability of Kollock's argument is highly speculative, however, one might hypothesize that given a significantly larger group of participants in an electronic exchange market, there will be enough individuals who will fall into the group of willing contributors to create the critical mass required for market making.

System Sketches

If the dynamics that Kollock [17] describes would provide enough of a critical mass to produce some trades for the market making intent, then one can manipulate other factors to leverage this and further increase market making activities. One goal would have to be to increase "stickiness", that is, hanging around or enticing them to return, so that people might engage in repeated interactions. We know from past research that repeated interactions contribute to increased cooperation in several ways, including group cohesion and the ability for reciprocity to function.

The persistence of stable identities is another factor which could be manipulated to enhance cooperation. While anonymity is easily attained in an electronic forum, one can promote the use of stable identities by incorporating reputations into the application. The use of positive reputations has been shown to have value for people who use it [16]. One needs to figure out how to creatively use this factor.

In Summary

These sketches are design explorations and are therefore preliminary. They help organize issues that can be used to study existing electronic exchanges. This approach can be used to continue explorations of additional factors beyond the set considered in this study.

Concluding Remarks

In this paper, we have examined the futures exchange as an example of adversarial collaboration. We use social dilemmas as a framework for characterizing the situation. We segment the complex fabric of social interactions occurring in the physical design to identify the behavioral intents operating within the situation. The goal was to explore how these intents can be realized in a new medium; the electronic. We then discuss how the affordances of the physical environment support the satisfaction of the intents. In the design exploration we examine which of these intents are still applicable in an electronic implementation and discuss how the affordances of this medium shape possible designs.

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