Designing Online Exchange Platforms: Lessons from the Laboratory

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Introduction

Imagine a worldwide web-based platform where anyone can shop for anything at any time of the day or night; A place where buyers and sellers from all over the world get together to exchange anything they want: currency, stocks and bonds, commodities, art, digital products and even ideas; A truly frictionless market. We are getting somewhat close, but we are not there yet. Internet annual trading volume is still dwarfed by the daily trading volumes on the FX market or any major stock or bond exchange.

It is true that online exchange platforms and social media platforms bring together buyers and sellers who would have probably never transacted otherwise. However it turns out that once the buyer and seller have “met” online and have found that they have something to exchange, the mechanism that they use to decide on the price of the transaction is less economically efficient than that of the more mature traditional markets. So, if online market mechanisms are less efficient, how can we improve their efficiency and make online trading a more enjoyable and profitable experience?

Because of their complexity, market exchange systems have frustrated theorists for years. Most assumptions and therefore results of game-theoretic models of markets are too unrealistic. Data analysis of naturally occurring markets has also not yielded much insight into exactly how markets work. This is in part because traders’ true preferences are unknown and can never be observed directly in the data. Computer simulations can be helpful in creating and comparing thousands and even millions of preference sets and trading rules but they do not include the impact of naturally occurring human behavior and interaction on market transactions – sometimes a human “friendly handshake” is all you need to complete a transaction.

Laboratory experiments with human subjects offer computer scientists currently involved in the design of on-line platforms a way out. Since the experimenter can manipulate all the values and costs involved in trading, she can estimate exactly how much money is being lost during the trading process due to unnecessary waiting, mismatching of market bids and asks, or implementing inefficient trading rules. She can also observe actual human trading behavior directly. Through experiments it has been discovered that the most efficient trading mechanism is the so-called Continuous Double Auction (CDA) [1] which is somewhat like that of the NASDAQ stock market.

I witnessed the power of the CDA for the first time in 1997 when visiting the University of Arizona’s Economic Science Laboratory. There I saw student-traders staring intensely at their computer screens, typing away and clicking vigorously. Most of these undergraduate students had very limited knowledge of markets or exchange platforms and yet, by using the CDA, they were able to achieve market efficiencies averaging over 99.3% after only 15 minutes of trading. In comparison, undergraduate students achieved efficiencies of 85-88% after an hour of trading in an auction like the ones on eBay [2], and efficiencies of around 82% in an auction like Google’s keyword auctions [3]. CDA works so well that human participation might not be even necessary. Laboratory experiments have shown that most of the time the CDA achieves efficiency levels of over 95% even when all participants in the auction are the so-called ZIA (zero intelligence agents) [4]. As indicated above, we humans are doing much worse when trading in online auctions now.

Using the Continuous Double Auction as a guideline, I can come up with two suggestions outright on how to improve the efficiency of online exchange platforms. Market information is aggregated and exchanged in a centralized manner under a CDA mechanism. The current best bid and ask are displayed to everyone interested. If a buyer or a seller submits a competitive offer, then everyone in the market for that product can see that offer and react to it...
immediately. In contrast, if a bidder is interested in many single-unit eBay auctions that happen simultaneously she must click many times through many screens in order to know what the current competitive bid is each auction. She can bid in any one of these auctions, but she would never know if she won until the very end of each auction because the majority of bidder’s “snipe” [5]. One way to make this process easier for buyers is to introduce an exclusive “Or” option. If a bidder is interested in buying only one item from many simultaneous auctions, she should be able to link them together for easy supervision and then bid only once. The auction web site should make sure that her bid is consecutively used in all auctions that she chose to combine and that the bid is displayed for other auction participants to see. This would not only result in an improved service for the buyer but also in reduced costs for the sellers (Figure 1).

The Continuous Double Auction features strategic and informational symmetry. All buyers and sellers must follow the same rules: they have access to the same set of strategies, and they have access to the same message space. From a strategic point of view, eBay’s rules for buyers and sellers are not informationally symmetric. For example, only sellers can start auctions, but buyers cannot. Allowing buyers to start auctions as well is likely to improve the information symmetry and efficiency.

The Continuous Double Auction is a good benchmark for any kind of exchange but is not the best mechanism for trading everything. There are circumstances when other mechanisms might be better. Experiments have shown that the CDA does not do very well for products that have very high avoidable costs. These include purely digital products as well as airline tickets and electricity [6]. Simple CDs are also suboptimal when the traded products are more valuable if packaged together. Good examples are spectrum licenses for wireless services, airplane take-off and landing slots, some transportation services, and sponsored search auctions.

Of course, one can always test a new market rule or a new market mechanism in the laboratory first to see if expectations are met. If we follow CDA’s rules religiously we might think that allowing sellers to continuously change their Buy-It-Now price in an online auction would improve efficiency. I had a chance to test this idea in the laboratory and I found out that eBay’s auction mechanism can be improved by about 11.8% if sellers can change their Buy-It-Now prices once in the middle of the auction. However, if sellers can change their Buy-It-Now prices continuously as I initially proposed above, efficiency does not increase significantly [7]. The reasons are not entirely clear yet although we know that they are due to the human factor and not the technology or the market itself. This shows that lessons learned from the CDA cannot be applied directly to other auction markets because every market has its own unique characteristics.

When I was growing up, I did not appreciate the art and advantages of bargaining. This is because I was thinking of the occasional chaotic haggling at the farmer’s market in my small town as boring and useless. After participating in several auction experiments in the laboratory and making a total of about $60.00, I changed my mind. I now think that trading can be fun if the auction mechanism is easy to understand. Part of this easiness comes from aggregating market information in a centralized manner and from enabling buyers and sellers to be on equal footing.

I am certain that eventually the Internet will bring the joy and excitement of direct trading to every individual on the planet. We have the technology and a useful design approach to make this happen. What we need to do is include the study of laboratory-driven market design in the computer science, engineering, and economics curriculum and encourage online auction creators to include laboratory testing as part of traditional beta testing. This way we can make sure that the online trading mechanisms we implement, and use are just as good as or why not even better than those of traditional markets.

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