Evaluating Electronic Market Designs: The Effects of Competitive Arousal and Social Facilitation on Electronic Group Buying

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Abstract

This article presents an evaluation approach for alternative electronic market designs and examines the impact of competitive arousal under time pressure on market performance in a group-buying setting. Drawing on theory from economics, decision theory, and information systems, we present a competitive arousal model for a social buying setting that posits that introducing competitive arousal among buyers reduces buyer profits and that social facilitation can mitigate these costs through better task completion and time to completion rates. Using an economic experiment, we found that rivalry has a negative effect on buyer profits but also that competitive arousal increases the efficiency of social facilitation in terms of group formation. We discuss the implications of these results.

Keywords

Experimental economics, competitive arousal, group buying, group coordination, social shopping.

1. Introduction

Our research presents an evaluation of a specific electronic market design that is based on the principles of design science —designing an IT artifact (e.g., an IT-enabled market mechanism for electronic group-buying platforms), implementing it, and then evaluating it (using economic performance measures). We argue that combining design science [13] with experimental economics [37], offers a useful approach to systematically design and evaluate new electronic market mechanisms and technology features that is applicable for a large range of research problems. Using market experiments in the laboratory presents a powerful method to evaluate new market designs before deploying them in the real economy. As an example, this research explores specifically the impact of competitive arousal and social facilitation under time pressure on group buying performance in terms of buyer profits and task completion and time to completion. We conducted experiments in the laboratory using a variation of the buyer-initiated intra-auction group buying model [3]. The basic experimental environment was the same as the one used in [28].

Social buying platforms support social facilitation with features that help buyers form groups and coordinate group tasks (negotiating a joint group offer with an agreed upon price and submitting it to the seller). Group buying is different from individual buying in standard business-to-consumer electronic commerce in two important ways. First, buyers organize into groups in order to aggregate demand and leverage increased bargaining power to obtain price discounts from the seller. Second, group buying sites could offer features that facilitate social interactions among buyers. Using an electronic group buying setting is interesting for two theoretical reasons. First, buyers no longer act individually as they need to interact and coordinate with others in order to organize a joint offer for a deal with a seller. This raises bid interdependency in both private and common value auctions. Second, social buying platforms offer tools that support social facilitation among buyers at different levels, with possibly different impacts on group coordination and performance. The literature on individual auctions generally finds that competitive arousal leads to overbidding and profit loss and that social facilitation can increase competitive motivation.

However, we should also point out that the platform sponsors, who control the platform design, also need to be aware that offering too much social facilitation (and communication support for the buyers) may present a a serious risk of buyer collusion to sellers, and they could simply decide to defect and stop selling on the platform.

We present a competitive arousal model for decision-making under time pressure on a group-buying platform that is based on Ku et al [17]. However, we offer two critical extensions to Ku's model. We extend the decision-making problem from an individual to a group setting and we introduce an online communication channel as a social facilitation feature. Our experiment replicated the established finding from the auction literature that inducing competitive arousal (by introducing rivalry among buyers) lowers buyer profits. But more importantly, we also tested for effects of social facilitation on task completion and time to completion. Consistent with Ku et al. [17] and Malhotra [21] social facilitation, both in terms of presence of co-actors [1] and communication, reduced the efficiency of decision-making.

[1] We borrow the *co-actor* construct from the social facilitation literature where it is defined as "individuals all simultaneously engaged in the same activity and in full view of each other. [40, p. 270]"

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Importantly, though, we show that there are also significant interaction effects between competition and social facilitation that offset some of costs of competitive arousal with more efficient group coordination in terms of task completion and time to completion when buyers are competitively motivated.

Our study contributes to the auction and social commerce literatures. We show that while buyers under competitive arousal develop bidding behaviors that violate predictions of rational choice theory, buyers also obtain some benefits from competitive arousal when buyers act as a group with communication capabilities. Introducing competitive arousal allows us to study decision-making under pressure of online consumers (using a particular setting; an electronic group buying platform in our case).

2. Theoretical Background and Hypothesis development

We draw on two principle streams of research to theoretically ground our study and develop specific hypotheses. For one, we look at economics to theorize the relationship between buyer group size and surplus generated in the market. Second, we borrow from the decision making theory in psychology and in information systems, to theorize the effects of competitive arousal and social facilitation on group performance in terms of buyer profits, task completion, and time to completion.

Research on competitive interaction has shown that time pressure is a critical driver for competitive arousal as it increases the need to make quick decisions and decreases the consideration of the consequences [28, 29, 35]. Therefore, all the hypotheses we develop below assume the presence of time pressure.

2.1 Task completion

There is a long tradition in economics in studying competitive behavior, the competition for limited and contested resources. Generally, competition increases efficiency in market settings [14] Thus, we hypothesize:

H1: Increasing competitive arousal in buyers in a group-buyer model will tend to reduce the failure rate for task completion.

2.2 Buyer profit

While classic rational choice theory generally views competitive behavior as advantageous to the individual regarding the achievement of goals, behavioral research found that competitively motivated individuals tend to abandon rationally determined (optimal) decision rules when emotional factors (like competitive arousal) are present, especially under time pressure when (a series of) judgments and quick decisions need to be made and outcomes depend on others' decisions as well. In such situations competitive behavior can hurt the individual [10, 12]. The desire to win can overpower original goals based on utility maximization and individuals become willing to pay more than initially planned and take profit losses in order to secure the completion of the given task and beat the opponents [5, 20, 15]. Hence we theoretically predict the following.

H2: Increasing competitive arousal in buyers will tend to reduce buyer profits.

Recent research in social commerce suggests that social embeddedness of market transactions like social interactions with other and online communication features can mitigate the effects of competitive pressure [21, 28, 38].

H3: Increasing competitive arousal in buyers will tend to reduce buyer profits more strongly in buyer groups with a higher number of co-actors.

Recent research in social commerce embeddedness of market transactions suggest that social embeddedness of market transactions like social interactions with other and online communication features can mitigate the effects of competitive pressure [21, 28, 38].

H4: Increasing competitive arousal in buyers will tend to reduce buyer profits less strongly in buyer groups that have access to a communication channel where buyers can exchange private messages.

Pelaez et al. [28] found that communication in group settings is most effective in smaller groups. In large groups cognitive demands on information processing can offset the benefits of having access to more information. Hence we propose the following.

H5: Providing access to a communication channel where buyers can exchange private messages will save more profits in buyer groups with a smaller number of co-actors.

2.3 Time to task completion

Researchers have also suggested that under competitive arousal individuals will shift from focusing on original goals (e.g. profit maximization) to others like winning an auction and getting what they wanted in the first place. Such a reversal of preferences can lead to a more aggressive pursuit of secondary goals [2]. Hence we propose:

H6: Increasing competitive arousal in buyers will tend to speed up the time to task completion.

However, Pelaez et al. [28] found that offering communication capabilities tend to distract users as they exchange off-topic messages which can decrease the time to completing the set task. Their study also indicates that group size negatively affects group coordination. Thus, we predict the following two hypotheses.

H7: Providing access to a communication channel where buyers can exchange private messages will tend to slow down the time to task completion.

H8: Increasing the number of co-actors in buyer groups will tend to slow down the time to task completion.

Social facilitation in terms of presence of an audience (i.e., in our case, presence of co-actors) can heighten the effects of competitive arousal and increase dominant responses and enhance performance on salient tasks [17, 40]. Bigger audiences, or larger number of co-actors, exhibit this effect more strongly than smaller ones [11]. Hence, we posit the following.

H9: Increasing competitive arousal in buyers will tend to speed up the time to completion more strongly in buyer groups with a higher number of co-actors.

Increasing communication capacity should enable buyers to share more information and thus coordinate better with the member of their buyer group in comparison to groups without the added communication mechanism [6]. Enhanced communication should prove to make it easier for groups to form and complete their tasks. When individuals are competitively motivated and rely on others for achieving the desired outcome, more information and increased communication should result in more efficient group formation [34]. Thus, we expect that relationships form more readily in the presence of additional communication

H10: Increasing competitive arousal in buyers will tend to speed up the time to completion more strongly in buyer groups that have access to a communication channel where buyers can exchange private messages.

Finally, Chen et al. [3] have shown that technology provides effective communication in intra-auction bidding clubs but coordination becomes more difficult as the member base increases. Hence, we theorize the following.

H11: Providing access to a communication channel where buyers can exchange private messages will slow down the time to task completion more strongly in buyer groups with a higher number of co-actors.

3. Methodology

3.1 Experimental design

We designed and economic experiment that created an electronic market in the laboratory where participants were asked to coordinate group purchases of a single product from a monopolistic seller. While the basic experimental environment was the same as in [28]: Each individual buyer has a private, pre-assigned value for the same single product. Consumer valuations vary across buyers and each buyer needs to buy one unit of the product. The participants were recruited from an undergraduate student subject pool and were compensated with course credit. However, we made a number of important modifications and additions to the basic design as described next.

We used a 2×2×2 factorial design in which we manipulated three variables at two levels, competitive arousal and two factors of social facilitation (presence of co-actors and communication capabilities). We induced *time pressure* by limiting the auctions to two-and-a-half minutes each. This was held constant in all treatments. The specific time limit was determined after several rounds of pilot runs. This time window was sufficient for groups to complete their given tasks but short enough to make them feel that they needed to make decision quickly.

Competitive arousal (CA) was induced by creating rivalry. In one treatment (CA=low) only one group was present to negotiate bids with the seller. In another (CA=high) two rival groups were created. The members of the groups were pre-assigned. Buyers could either place an opening bid (proposed purchasing price offered to the seller) or join an existing bid within the group. Under the competition mechanism, for each group, only the buyers who are willing and quick enough to join a common offer with an agreed bid price have the chance to become the actual buyers (if the bid is successful). For the groups without the competition mechanism, all buyers are in the same group, and therefore, there is no competition from a rival group.

Social facilitation was represented by two variables, presence of *co-actors* (ACT) and level of *communication* (CC). First, we compared the presence of a small number of co-actors (ACT=1) with the presence of a large number of co-actors (ACT=3). The co-actors were represented by the other buyers in the groups. In other words, in the former treatment (ACT=1) the buyer groups were of size two, and in the latter (ACT=3) groups were of size four. Our operationalization of large and small groups is similar to those in prior research [5, 21].

The third manipulation compared low with high communication capacity among buyers. At the high level (CC=high) we included a communication channel as a feature on the buyer screen while no such communication channel was offered at the low level. We implemented the communication channel with a communication box, similar to an Internet chat box, where buyers could post and receive private messages from their fellow group members.

3.2 Procedure

Each session consisted of groups with 1 seller (monopolist) and either 2, 4 or 8 potential buyers. Upon entering the lab, the participants were randomly assigned to computer terminals with a seller screen for the seller and a buyer screen for the buyers. Once the participants were seated, they were asked to review a set of instructions [see Appendices 7.1 and 7.2] that provided information about the group buying mechanism and their

respective roles and tasks. Each session consisted of one practice period and 10 additional periods, where buyers worked to coordinate group offers to make bids to the seller. Each round lasted 150 seconds.

The buyer and seller tasks were similar across all eight treatments with some important differences. In the treatments with communication channel buyers could use a chat box to exchange private messages, which was not available in treatments without the communication channel. The manipulation of the number of co-actors changes the number of other buyers required for a group, but it did not affect the interface of the buyer screens or their principle tasks. In treatments without competition, participants were assigned to a group before the round (static groups). In treatments with completion rival groups were set up and buyers could join and switch groups depending on currently posted bids (dynamic groups).

Buyers could increase their joint offer or join a different offer if their bid was not accepted. The buyer screen was more complex [as illustrated in the two sample buyer screens in Appendix 7.3]. First, it showed them the assigned valuation of the product. Each buyer had a unique, private product valuation that was randomly selected from a uniform distribution (25,100). To reduce the potential for learning effects, the product valuation values were rotated every period. Except for the initial bid, which could be placed by any buyer, bids could only be changed in one dollar increments. Once bids were placed, the other buyers could "join" the bid if the bid price was below their product value, thus preventing overbidding. Once the requisite number of buyers (2 or 4) joined, group formation occurred and the bid would be submitted to the seller (task completion).

In the treatments with competition, buyers could join any bid, thus allowing for dynamically forming groups. E.g., a buyer could choose a bid for 20, but then decide to join another offer at 19, which could have been created by a different group of participants. By allowing buyers to join different offers, we establish competition between buyers. The interface only tells the buyer the number of buyers in the group but it doesn't indicate who the other buyers are. In the treatment with a private communication channel buyers were able to exchange messages via an instant message type of communication box.

The tasks and interface for the seller essentially remained unchanged across treatments. The seller received bids once a group formed and made a joint offer. The seller's screen showed the bid price, the number of people who joined in the bid and the cumulative amount of the offer [see Appendix 7.4 for an illustrative seller screen shot]. The seller then had the opportunity to accept the bid, terminating the current session, or take no action and leave the bid active, thus allowing time for other bids to form. Sellers only see the highest bid that meets the requisite number of buyers, therefore, only one bid at a time is visible to the sellers at any given time.

When a transaction occurred, i.e. a seller accepted an offer from the buyer group, both the seller's profit and buyer's profit was calculated and shown to the participants. Buyer profits (i.e., buyer surplus) were computed for each buyer as transaction price less product valuation No profits accrued when a round ended with no bids being accepted. The cumulative profit over all ten periods was used to compare how each buyer performed in the experiment.

3.3 Experimental variables

Table 1. Experimental variables

Independent Variables	competitive arousal (CA = low or high); Communication level (CC = yes or no) presence of co-actors (ACT= 1 or 3)
Dependent Variables	buyer profit (summed over all buyers and rounds) task completion (completing purchase) time to completion
Control Variables	time pressure (auction length = 150 secs) experimental periods (P1, P2, …, P10 = 0 or 1)

4. Data analysis

4.1 Descriptive analysis

The experiment was carried out with a total of 77 groups. One group included one seller and two, four or eight potential buyers. Data were collected from each group over 10 rounds of the collective bidding. The experiment represents a typical 2x2x2 factorial design with repeated measures.

Out of the 770 group-level biddings by the 77 groups, task completion occurred with 573 bids from 76 groups, that is, those bids that were successful and accepted by a seller. Table 2 shows the number of successful bids and the groups that generated them broken down by experimental treatments. Manipulating the three treatment variables competitive arousal (CA), presence of co-actors (ACT), and presence of communication channel (CC) at two levels each yields a total of eight treatments.

The descriptive analysis of the (successful) group bidding is summarized in table 3. We removed rounds with unsuccessful bids from the correlation analysis because for unsuccessful bids task completion could not occur and hence time to completion could not be measured.

Table 2. Successful bid summary

#bids (#groups)		Communication Channel	
		CC=yes	CC=no
CA=low	ACT=1	85 (11)	94 (13)
	ACT=3	75 (12)	42 (8)
CA=high	ACT=1	69 (8)	68 (8)
	ACT=3	70 (8)	70 (8)

Table 3: Descriptive Statistics

			Buyer Profit		Time to Completion	
		# Bid	Mean	SD	Mean	SD
CA	Low	296	43.1	13.5	23.2	22.7
	High	277	36.7	12.9	9.4	5.5
CC	No	299	40.1	14.1	15.2	14.4
	Yes	274	39.9	12.9	18.0	21.5
ACT	Small	316	40.6	15.2	14.3	14.2
	Large	257	39.3	11.2	19.3	21.7
Grand Total		573	40.0	13.6	16.5	18.1

CA .. competitive arousal; ACT .. number of co-actors; CC … availability of communication channel

A nonparametric Spearman's rho correlation analysis was conducted, summarized in table 4, to investigate the correlations between the three main treatments and the two dependent variables buyer profit and time to task completion (i.e. completed purchase).

The correlation analysis shows that competitive arousal is positively correlated with both buyer profit and the time for task completion, and both correlations are significant at the 0.01 level. Number of co-actors is positively correlated with the time for task completion, and the correlation is significant at the 0.05 level.

Table 4. Spearman's rho correlations

	Profit	Time	Period	CPT	CM
Profit					
Time	-.084*				
Period	-.061	-.210**			
CPT	-.231**	-.504**	-.033		
CM	-.009	.056	.018	.039	
GS	-.046	.104*	.032	.111**	-.077

*. significant at the 0.05 level (2-tailed).
**. significant at the 0.01 level (2-tailed).

4.2 Hypothesis testing

Main test 1—Logistic regression. When rival groups were created, increasing competitive arousal, the failure rate, *p*, for successfully completing the task making a group purchase in an experimental round significantly decreased from 0.342 when competitive arousal was low to 0.134 when it was high. The odds ratio of competition arousal (0 /1) is 0.298.

$$Odds\ ratio=[\ p_0/(1-p_0)]/[\ p_1/(1-p_1)]$$

A simple logistic regression test shows that injecting competition arousal can significantly reduce the failure rate for completing the task (table 5). This supports H1.

Table 5. Logistic regression

	B	S.E.	Wald	df	Sig.	Odds Ratio
CA	-1.19	.19	37.82	1	.00	.30
α	1.86	.16	129.16	1	.00	6.44
pseudo R-squares: Cox & Snell R Square=0.056 Nagelkerke R Square=0.082						

The unsuccessful bidding attempts were regarded as missing values for the remaining analysis, yielding an unequal sample size for our 2×2×2 factorial design with repeated measures. In order to control the effect of repeated measures for the unequal sample size, we applied two sets of statistical examinations, a multiple linear regressions as the main test, followed by a mixed model analysis with maximum likelihood estimation as a robustness test.

Main test 2—multiple linear regression. We employed dummy coding to convert the categorical variables competitive arousal (CA), presence of co-actors (CA) and communication (CC) into dichotomous variables. Specifically, for the treatment with weak presence of co-actors (1 other buyer in a group, or group size of two) ACT was coded as "0", and for strong presence of co-actors (3 other buyers in a group, or group size of four) ACT="1". Similarly, for the treatment without the availability of a communication channel CC was coded as "0", and with communication channel CM="1"; and for the treatment without competitive arousal, CA was coded as "0", and with competitive arousal, CA was coded as "1". An additional 9 dummy variables (P1, P2, …, P9) were generated to represent the experimental periods 1 to 9, while "period" 10 served as the reference measure. Two separate regression tests were conducted to analyze the proposed hypotheses on the two dependent variables "(buyer) profit" and on "time (for task completion)" respectively.

We combine the results of the two separate tests in one table (Table 6), one test for buyer profits, aggregated across buyers and rounds, and the other on the time for task completion. In order to examine the contribution of main effects and interaction effects, we did a hierarchical multiple linear regression in three stages, "Model 1", "Model 2", and "Model 3", in which we added the control variables, "period", the main effects "competition mechanism", "communication channel", and "group size",

and three two-way interaction effects respectively. The 9 dummy variables, P1 through P9 are included in the test in order to control the effect of repeated measurement (round effects). The coefficients of P1 through P9 indicate the differences in profit or time between a specific period and the reference period 10. By statistically controlling for the effects of repeated measures, we obtain more valid results regarding the treatment effects in the experiment.

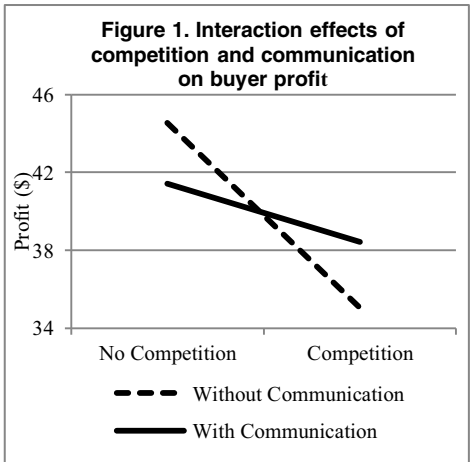
Table 6. Multiple linear regression

	Model 1		Model 2		Model 3	
	Profit	Time	Profit	Time	Profit	Time
α	34.9**	15.3**	38.4**	17.6**	39.9**	13.9**
P1	.4	10.5**	.1	10.6**	-.0	11.2**
P2	7.0**	1.7	7.0**	2.4	7.0**	3.2
P3	9.2**	3.2	9.2**	3.7	9.1**	4.6
P4	4.2†	-.8	4.3†	-.1	4.3†	.5
P5	4.3†	-.3	3.9†	-.5	3.7	.2
P6	11.4**	.1	10.9**	-.5	10.9**	-.5
P7	12.1**	.7	11.6**	.1	11.7**	.3
P8	3.2	-1.9	2.8	-2.7	2.7	-2.2
P9	-.7	-2.1	-1.3	-3.1	-1.3	-2.4
CA			-6.3**	-15.0**	-9.9**	-5.0*
CC			-.1	4.1**	-2.8†	6.0**
ACT			-.4	7.1**	-.1	10.8**
CA*CC					7.3**	-9.3**
CA*ACT					.6	-13.3**
CC*ACT					-2.1	7.2**
ΔR^2-Profit	.111		.055		.017	
ΔR^2-Time		.038		.196		.049

Unstandardized coefficients are displayed above.
Model 1 to Model 3: Control Variables, Main Effects, and Interaction Effects
†. significant at the 0.1 level (2-tailed).
*. significant at the 0.05 level (2-tailed).
**. significant at the 0.01 level (2-tailed).

Buyer profit (H2 – H5). In terms of buyer profit, the only significant main effect is competition mechanism, while the only significant two-way interaction effect is contributed by competition mechanism and communication channels. The results in "Model 2" show that the buyer profit of the groups with competitive arousal is $6.3 less than the buyer profit of the groups without it, which is significant at the 0.01 level, and which contributes 5.5% of explanatory power. In other words, introducing competition among buyers reduces buyer profits, benefiting the seller. This result supports H2.

The results in "Model 3" show that the interaction of competition and communication are positively related to group profit (at 0.01 level), contributing 1.7% of explanatory power. Figure 1 illustrates the interaction effects of competition and communication on group profit. Introducing competition, we observed the expected profit sacrifice, but we also found that making a communication channel available to buyers plays a positive role in mitigating the profit loss that results from the competitive arousal. This supports H4. Our hypotheses H3 and H5, however, were not supported.

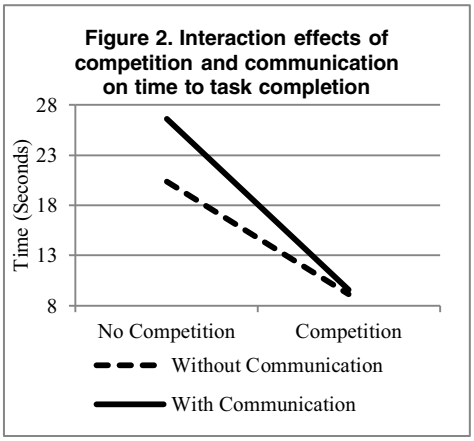


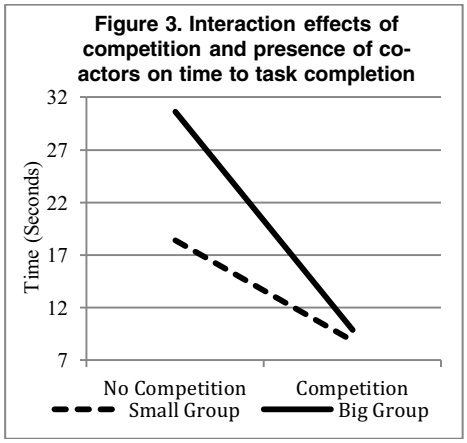
Time to Task Completion (H6 – H11). In terms of time for task completion, all three proposed main effects are significant, supporting H6-H8. According to the results in Model 2, competitive arousal reduces the time to task completion, making a group purchase, by about 15 seconds (significant at the 0.01 level). Making a communication channel available to buyers slows the time for task competing down by about 4 seconds while increasing the presence of co-actors slows it down by about 7 seconds (both effects are significant at the 0.01 level). The three main effects together contribute 19.6% of predictive power.

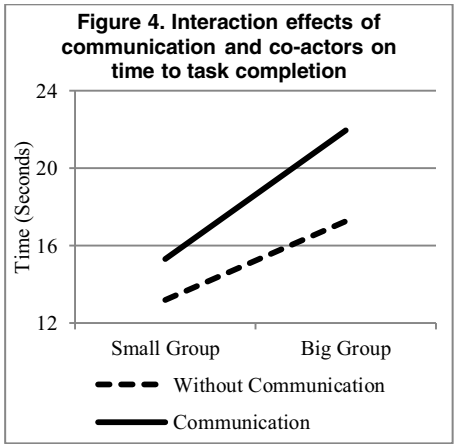
The two-way interaction effects of competition and communication (figure 2) and those of competition and presence of co-actors in terms of number of co-actors present in a group (figure 3) are negatively significant at the 0.01 level. The interaction effects of communication level and presence of co-actors (figure 4) are significantly positive at the 0.01 level. These two-way-interaction effects together contribute 4.9% of explanatory power. These results support hypotheses H9 to H11.

Our results indicate that competition can reduce the time for task completion and that offering communication channels can significantly enhance this effect (figure 2). The results of the interaction effects of competitive arousal and presence of co-actors show that competitive motivation helps groups with more co-actors to become more efficient than groups with fewer co-actors (figure 3). The interaction effects of communication level and

number of co-actors indicates that the two treatments could reinforce each other in slowing down the time for task completion (figure 4).







Finally, we also report that the three-way interaction of CA*ACT*CC was also statistically significant, but because of the general complexity of three-way interactions we refrain from attempting to offer a theoretical explanation for the effect in this paper.

Robustness tests. To check the robustness of the main tests, we also conducted a mixed model analysis on the two dependent variables. The test results for the two dependent variables, were highly consistent with the results of the main test.

Summary of hypothesis tests. The hypothesis testing results are summarized in table 9.

Table 9. Summary of Hypothesis Testing

#	DV / *Hypothesis*	
	Task Completion	
H1	Increasing competitive arousal in buyers in a group-buyer model will tend to reduce the failure rate for task completion.	sup
	Buyer Profit – Main Effect	
H2	Increasing competitive arousal in buyers will tend to reduce buyer profits.	sup
	Buyer Profit – Interaction Effects	
H3	Increasing competitive arousal in buyers will tend to reduce buyer profits more strongly in buyer groups with a higher number of co-actors.	n.s.
H4	Increasing competitive arousal in buyers will tend to reduce buyer profits less strongly in buyer groups that have access to a communication channel where buyers can exchange private messages.	sup
H5	Providing access to a communication channel where buyers can exchange private messages will save more profits in buyer groups with a smaller number of co-actors.	n.s
	Time to Task Completion – Main Effects	
H6	Increasing competitive arousal in buyers will tend to speed up the time to task completion.	sup
H7	Providing access to a communication channel where buyers can exchange private messages will tend to slow down the time to task completion.	sup
H8	Increasing the number of co-actors in buyer groups will tend to slow down the time to task completion.	sup
	Time to Task Completion – Interaction Effects	
H9	Increasing competitive arousal in buyers will tend to speed up the time to completion more strongly in buyer groups with a higher number of co-actors.	sup
H10	Increasing competitive arousal in buyers will tend to speed up the time to completion more strongly in buyer groups that have access to a communication channel where buyers can exchange private messages	sup.
H11	Providing access to a communication channel where buyers can exchange private messages will slow down the time to task completion more strongly in buyer groups with a higher number of co-actors.	sup

n.s. refers to 'not supported; sup. refers to 'supported'

5. Conclusions

This study has a number of limitations. While the experimental design was tested in some early pilot tests and subsequently refined and improved several times, a number of potential design limitations became only apparent after data collection had been under way or completed. The following are the most critical ones. (1) Level of time pressure was held constant across all treatments. Manipulating time pressure could yield additional insights on the effects of competitive arousal (2) The bidding mechanism that was implemented (bid changes in one dollar increments only) may have complicated price negotiation among buyers in case where the valuation spreads were high. (3) A small, linear time cost was incurred to buyers and sellers in each round that may have had an effect on some bidding decisions. (4) Participants were compensated with course credit, which may not have been sufficient to induce economic behavior in every case. (5) The experiment only implemented one specific type of (buyer-initiated) group-buying model, which limits generalization beyond this particular model. (6) It is unclear how robust our results are with respect to changes in the pre-assigned demand schedules (product valuations) for the buyers. Finally, (7), we did not analyze seller data in the present study.

Our study contributes a novel approach combining design science and experimental economics for the purpose of designing and evaluation electronic market mechanism and platform designs and applied it to an example case from electronic commerce, using a bidding mechanism in an electronic group buying setting as a specific example. The study also offers an elaboration on Ku et al.'s competitive arousal model for decision making [15] that introduces two novel features, the setting of a group-decision making problem the addition of communication level as an antecedent. The present research adds to our understanding of competitive behavior by considering the mitigating effects of offering communication capabilities on decision outcomes. Finally, we contribute to the emerging social commerce literature by offering a novel, competitive arousal model that helps explain bidding outcomes in electronic group buying.

Finally, the study has also some practical implications for designers of group buying platforms and operators of group buying sites. Our findings suggest that introducing competition among buyers and offering communication tools that support group coordination can help speeding up inventory turnover and also help to protect profit margins for sellers. We also suggest that group size matters and needs to be determined carefully, depending on the levels of competition and communication support.

6. References

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7. Appendix

7.1 Example Instructions for Buyers

General Overview

You will be presented with one item to place a bid. Each product has a specific value to you. A small time cost is assessed to you as the round progresses. During each round you will try to acquire each of the items for the best (lowest) possible price. You must work with other buyers to purchase the product. It requires two buyers to agree on a price before the seller can accept an offer. Your goal is to generate as much cumulative profit as possible, which is equal to the values of the products minus the sum of amounts you pay for them and your time costs. Each round will last two and a half minutes. There will be one practice followed by a number of "real" rounds. The total time for the entire exercise will be approximately one hour.

Bidding Rules

Any buyer may submit a bid. You may join a bid that is no greater than the value of the item. You may submit a new bid as long as it is greater than the highest bid. Start your bidding low to maximize potential profit. New bids can only be done in increments of 1; therefore they can be 1 dollar higher than the maximum bid or 1 dollar lower than the minimum bid. Once you join a bid you will not be able to remove yourself from that offer. Once two bidders join an offer, the bid is automatically submitted to the seller. If the value of the item drops below the current bid price, the offer will be removed. The value of an item may be different for each buyer.

Making Money

The profit you earn is equal to the value of the item bought, the bid you submit for the item, minus the time cost you spend for it. For example, if "item A" is worth $90 to you and you won the item at the end of the auction with a joint bid of $65, and your time cost spent is $5, you will earn a profit of ($90 - $65) - $5 = $20

Your total game profit will be equal to the total of all your ten individual round profits

Key Summary Points

- Your goal is to make money
- You have a cost associated with the time you spend in the auction.
- Keep a close watch on the clock especially as it counts down to the end
- Make sure you work with other buyers to get the best possible price.
- Remember you need at least two buyers to make an offer
- Start your bidding low to give yourself the best possible profit

7.2 Instructions for Sellers (Small Groups)

General Overview
You will be presented with two units of one item that you want to sell in an auction. You have a small cost associated with the time you spend in the auction. During each round you will try to sell your item for the highest possible price. Your goal is to generate as much profit as possible, which is equal to the price at which you sell the item minus the time cost you spend for it. Each round will last two and a half minutes. There will be one practice round and a number of "real" rounds. The total time for the entire exercise will be approximately one hour.

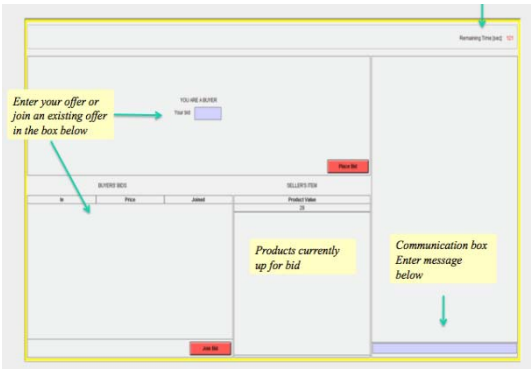
Bidding Rules
Your product is automatically entered into the auction allowing bidders to submit bids, which you may accept. A bid will only be submitted to you when 2 buyers join the offer. You may choose to accept the bid at anytime or allow the bid to expire. The auction will end once you accept an offer or at the end of, 150 seconds (two and a half minutes).

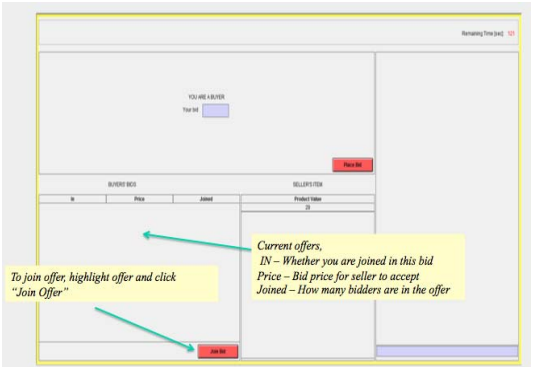
Making Money
The round profit you earn is equal to the highest offer you accept for the item minus the time cost for the item. For example, if the offer you accept is $90 at the end of the auction, and your time cost is $10, you will earn a profit of $90 - $10 = $80. Your total game profit will be equal to the total of all your round profits

Key Summary Points

- Your goal is to make money
- Try and get the largest profit possible
- You have a cost associated with the time you spend in the auction.
- Keep a close watch on the clock especially as it counts down to the end.

7.3 Example Buyer Screens





7.4 Example Seller Screen