Online Appendix to

"Survivor Auctions"

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This appendix reports results comparing the Ausubel auction with no drop-out information using clinching instructions versus using sealed-bid instructions. Both sets of instructions form a natural basis for explaining the auction rules. The instructions are provided as well. One session of each auction type is reported. Both employed 20 human subjects. In both cases the first 13 auctions had 3 computerized rivals, followed by 14 auctions with 5 computerized rivals.

Valuations were drawn iid from a uniform distribution with support [0, $7.50]. Bidders with single unit demands were represented by computers programmed to submit bids equal to their valuation. Bidder *h* was played by human subjects drawn from a wide cross-section of undergraduate and graduate students at the University of Pittsburgh and Carnegie-Mellon University.

Each human (*h*) operated in her own market with her own set of computer rivals. *h*s knew they were bidding against computers, the number of computers, and the computers' bidding strategy (but not the logic underlying this strategy). Supply, *m*, was set at two in all auctions. Each *h* had flat demand for two (2) units based on their random draw form the interval [0, $7.50].

In the Ausubel auctions with no drop-out information bidders are only informed if they have clinched an item and what other bidders' dropout prices are *after* the auction is over. As such there is no way to tell at what price rivals have dropped out of the bidding, or how many rivals are still active, until the auction is over.

All of the auctions employed a "digital" price clock with price increments of $0.01 per second. *h*'s were informed of having clinched an item (and the price paid) following dropouts.[10] Ausubel auctions with no drop-out information maintained the pause in the price increases following *h* dropping out on a single unit, thereby keeping procedures as close as possible to the Ausubel auctions with bid information, but eliminated the pause or any dropout information prior to the price having reached its maximum value of $7.50.

Data are taken from the working paper "Comparing Efficient Multi-Object Auction Institutions" by John H. Kagel, Scott Kinross and Dan Levin, Ohio State University, 2001.

[10] *h* could drop out on a single unit by hitting any key other than the number 2 key. The first stroke of the key pad dropped out unit 2. Hitting the number 2 key, or hitting a second key during the price pause, permitted *h* to drop out on both units at the same price.

Table 4
Ausubel Auction with No Drop-Out Information

	Unit 1		Unit 2				
n=3	Sealed-Bid Instructions (S_m)	Clinching Instructions (S_m)	Sealed-Bid Instructions (S_m)	Clinching Instructions (S_m)		Sealed-Bid Instructions (S_m)	Clinching Instructions (S_m)
Won and earned negative profit[a]	0.217 (0.055)	0.074 (0.030)	0.046 (0.026)	0.095 (0.055)	Bidder Earnings[b]	-0.191 (0.046)	-0.132 (0.034)
Bid $> v_h$ with possible negative profit[a]	0.301 (0.056)	0.167 (0.054)	0.087 (0.024)	0.039 (0.025)	Efficiency[c]	98.0% (0.51)	98.6% (0.39)
Bid $< v_h$ [a]	0.228 (.058)	0.449 (0.096)	0.527 (0.081)	0.566 (0.087)	Revenue[b]	0.166 (0.125)	-0.178 (0.140)
n=5					n=5		
Won and earned negative profit[a]	0.223 (0.063)	0.051 (0.025)	0.141 (0.070)	0.080 (0.050)	Bidder Earnings[b]	0.159 (0.054)	-0.065 (0.021)
Bid $> v_h$ with possible negative profit[a]	0.187 (0.041)	0.111 (0.043)	0.049 (0.016)	0.050 (0.027)	Efficiency[c]	98.6% (0.48)	99.5% (0.18)
Bid $< v_h$ [a]	0.134 (0.039)	0.353 (0.090)	0.426 (0.073)	0.528 (0.099)	Revenue[b]	0.247 (0.110)	-0.074 (0.084)

[a] Frequencies
[b] Difference from sincere bidding: sincere bidding less actual bids
[c] As a percentage of sincere bidding
S_m = standard error of the mean

Ausubel No Dropout Information:

This is an experiment in the economics of market decision making. Various research organizations have provided funds for conducting this research. The instructions are simple, and if you follow them carefully and make good decisions, you may earn a CONSIDERABLE AMOUNT OF MONEY which will be PAID TO YOU IN CASH at the end of the experiment.

In this experiment, we will create a market in which you will act as bidders in a sequence of auctions.

In each auction:

1. Each bidder will be assigned values for two (2) units of a commodity they wish to purchase. The values of both units will be the same. These values represent the value of the good to you - what we will pay you for any items purchased.

2. Each bidder bids for each of the two (2) units assigned to him/her.

3. Each of you will be bidding in a separate market along with three (3) computerized bidders. Each computerized bidder will be assigned a value for one (1) unit of the commodity which they will be bidding on. Thus, in each auction there will be a total of 5 units being bid on (your 2 units and the 3 computer units).

4. Values for all bidders (including the computers) will be randomly drawn from an interval whose lower bound is $0 and whose upper bound is $7.50. Any value within this interval has an equally likely chance of being drawn and being assigned as a value. Note, it is possible (but unlikely) that you will have the same value in a given period as one of the computer bidders. New values will be drawn before each auction.

5. There will be two (2) units for sale in each auction.

Assignment rules and profit calculations:

Items will be allocated using the following "English clock" auction procedure:

Prices will start at 0.00 and will rapidly increase using a "clock" counter located at the bottom of your screen. You are counted as actively bidding on an item until you have dropped out or have "clinched" an item. Dropping out is not reversible so that once you have dropped out of bidding for an item you can no longer bid on that item. Once you have clinched an item, it is yours and you pay the "clinching" price.

Before discussing clinching let's discuss dropping out.

1. All computer bidders are programmed to drop out when the price equals the value of their item. You will not know the computers' drop out prices until the auction is over.

2. You can drop out of bidding for an item by hitting any key on your key pad. One key stroke drops you from bidding on one item. To stop bidding on the second item hit any key again. If you want to drop out of bidding for both items at the same time (price) you have two options: (i) hit the number 2 key at the top of your key pad or (ii) hit a second key during the pause in the clock price that follows dropping out of bidding on the first item.

Clinching works just like in a football, baseball, or basketball league when a team clinches a spot in the playoffs, only in this case clinching involves earning an item, and the price paid for the item..

Once you have clinched an item it is yours and the price you pay is the drop-out price which assured you of clinching the item.
Clinching is easiest to explain via some examples:

Suppose you and the computer(s) have drawn the following values for items (we've ranked the computers' values from highest to lowest) (Remember, the values for your two items are always the same.)

Example 1:

Computers' values	Your values
5.10	7.08
4.31	7.08
3.07	

The clock (price) will start at 0.00 and will increase very rapidly.

Suppose the price hits 3.07 and you have not dropped out of the bidding. The computer with value 3.17 is programmed to drop out at this point. Once the computer drops out at 3.07 there will be 4 items still being bid on (your two items and the two remaining computer bids) and 2 items for sale so nothing has been clinched yet (you are still not assured of earning an item).

Suppose the price hits 4.31 and you have not dropped out of the bidding. With the second computer dropping out there are now 3 items being bid on and 2 items for sale. Since you are bidding on 2 of the 3 items, and there are 2 items for sale, you are assured of earning 1 item (you have clinched one item). With clinching you pay the drop-out price which assured you of clinching the item, 4.31. You would earn profits for that one item of 7.08 (your value) less 4.31 (the clinching price) = 2.77.

There are now 2 items being bid on (the remaining computer bid and your remaining item) and 1 item remaining to be sold.

If you drop-out before the price hits 5.10 (the remaining computer's drop-out price) the computer clinches the remaining item and your total earnings from the auction would be 2.77 (what you earned on the first item).

If the computer drops out before you do, you earn the second item and pay the clinching price for that item, 5.10. This would produce profits on the second item of 7.08 (your value) less 5.10 (the clinching price) = 1.98. In this case your total earnings for this auction would be 2.77 + 1.98 = 4.75.

Note, since you will not know the prices at which the computers have dropped out of the bidding you will not know, until the auction is over, if you have clinched an item or the price you will have to pay for any items clinched.

Of course you can't always earn money in the auction and it is possible to lose money as the following example illustrates.

Example 2:

Computers' values	Your values
7.20	5.75
6.80	5.75
3.07	

As before the clock starts at 0 and the first computer drops out at price 3.07. There are now 4 items being bid on and 2 items for sale. Suppose the clock price hits 5.75 and you decide to remain active bidding on an item until you've clinched one. When the clock price hits 6.80 you have clinched an item, but the clinching price is now above your value so you earn 5.75 (your value) less 6.80 (the clinching price) = -1.05.

There are now 2 items being bid on (the remaining computer bid and your remaining item) and 1 item remaining to be sold.

If you drop-out before the price hits 7.20 (the computer's drop-out price) the computer clinches the remaining item and your total earrings from the auction are -1.05 (what you earned on the first item)

If the computer drops out before you do, you earn the second item and pay the clinching price for that item, 7.20. This would produce profits on the second item of 5.75 (your value) less 7.20 (the clinching price) = -1.45. In this case your total earnings for this auction would be -1.05 - 1.45 = -2.50.

Any negative profits earned will be subtracted from your starting cash balance (or positive profits earned in other auction periods).

Of course there is no reason you have to lose money in a case like this. Had you dropped out on both items when the price reached your value, or at least before you clinched an item at a price above your value (a price of 6.80 in this case), the computers would have clinched the two items and you would earn 0.00 for the auction rather than losing money.

Additional Remarks:

1. You are free to bid whatever you think will bring you the most earnings. In thinking about bidding, earning an item is of no intrinsic value. Your sole objective should be to maximize your earnings.

2. You will all be given a starting capital balance of $5.00. Any losses will be subtracted from this balance, any profits added to it. Your final balance will be paid to you in cash at the end of the experiment.

3. Each of you will be operating in your own market with 3(different) computerized bidders. You will not know a computer's bid/value until it has dropped out of the bidding.

4. We will conduct 3 dry runs to familiarize you with the procedures and accounting rules. This will be followed by 27 periods played for cash.

Are there any questions?

Ausubel No Dropout Information - Sealed Bid Instructions:

This is an experiment in the economics of market decision making. Various research organizations have provided funds for conducting this research. The instructions are simple, and if you follow them carefully and make good decisions, you may earn a CONSIDERABLE AMOUNT OF MONEY which will be PAID TO YOU IN CASH at the end of the experiment.

In this experiment, we will create a market in which you will act as bidders in a sequence of auctions.

In each auction:

1. Each bidder will be assigned values for two (2) units of a commodity they wish to purchase. The values of both units will be the same. These values represent the value of the good to you - what we will pay you for any items purchased.

2. Each bidder bids for each of the two (2) units assigned to him/her.

3. Each of you will be bidding in a separate market along with three (3) computerized bidders. Each computerized bidder will be assigned a value for one (1) unit of the commodity. Each computerized bidder will submit a bid on its one unit. Thus, in each auction there will be a total of 5 values and 5 bids (2 of yours and 3 of the computers).

4. Values for all bidders (including the computers) will be randomly drawn from an interval whose lower bound is $0 and whose upper bound is $7.50. Any value within this interval has an equally likely chance of being drawn and being assigned as a value. Note, it is possible (but unlikely) that you will have the same value in a given period as one of the computer bidders. New values will be drawn before each auction.

5. There will be two (2) units for sale in each auction.

Assignment rules and profit calculations:

1. Bids will be set using the following “clock” auction procedures: There will be a “clock” counter located on your computer screens (just below your values) whose initial value be 0.00 and will increase very rapidly in 1 cent increments. Think of the clock as specifying the price you are willing to pay for an item. When the counter hits the price you are willing to pay for an item hit any key. This price will be recorded as your bid for that item.

2. Once the clock counter reaches its maximum possible value - $7.50 - bids will be ranked from lowest to highest with the two highest bids each earning an item. The price you will pay for any items earned will be described in the next page.

2. Any unit earned at a price below its value results in a positive profit; any unit earned at a price above its value results in a negative profit. Positive profits will be added to (negative profits subtracted from) the owner's capital balance. If you do not earn an item you neither earn or lose money.

3.The computers’ bids will always equal their values.

The following examples will illustrate the prices you will pay for any items earned and how profits are calculated. There are two cases to consider:

Case 1: You earn a single item. In this case what you will pay for the item will be equal to the second highest computer's value.

Example 1:

Bid	Value	Subj
7.06	7.08	*
5.10	5.10	C
4.31	4.31	C
3.07	3.07	C
2.50	7.08	*

Note bids have been sorted from highest to lowest, values are shown next to the bids. A * under the Subj column indicates the human's bids and a C indicates a computer's bid (note that the computers always bid their value).

In this case both the human bidder (*) and one of the computers each earned an item. The second highest computer's bid is 4.31, so that is what * will pay for the item earned. This would yield profits for * of:

Unit 1: 7.08 - 4.31 = 2.77
and nothing on unit 2.

Example 2:

Bid	Value	Subj
7.06	7.08	*
5.10	5.10	C
5.00	7.08	*
4.31	4.31	C
3.07	3.07	C

Once again the human bidder * and one of the computers each earned an item. Once again the second highest computer's bid is 4.31, so that is what * will pay for the item earned. This would again yield profits for * of:

Unit 1: 7.08 - 4.31 = 2.77
and nothing on unit 2.

Case 2: You earn both items. In this case what you will pay for the two items will be equal to the sum of the first and second highest computer's values.

Example 3:

Bid	Value	Subj
7.06	7.08	*
7.05	7.08	*
5.10	5.10	C
4.31	4.31	C
3.07	3.07	C

The first and second highest computer's values are 5.10 and 4.31. So that *'s total profits are:
Total profits = 14.16 - 9.41 = 4.75 [(7.08 + 7.08) - (5.10 + 4.31)].

These pricing rules are designed to enforce the following general principle: What you pay will be equal to the value(s) of the computer(s) that would have earned an item had your bids been deleted. One outcome of this rule is that you will only pay what you bid in the unlikely event that one of the computers has the same value as your bid.

Of course you can't always earn money in the auction and it is possible to lose money as the following examples illustrate:

Example 4:

Bid	Value	Subj
7.20	7.20	C
7.00	5.75	*
6.80	6.80	C
5.75	5.75	*
3.07	3.07	C

In this case both * and one of the computers each earned an item. So * will pay a price equal to the second highest computer's value which is 6.80. This would yield profits for * of:

Unit 1: 5.75 - 6.80 = -1.05
And nothing on unit 2.

Example 5:

Bid	Value	Subj
7.00	5.75	*
6.90	5.75	*
7.20	7.20	C
6.80	6.80	C
3.07	3.07	C

In this case * earns two items. The highest and the second highest computers values are 7.20 and 6.80 so that *'s total profits are:

Total profits = 11.50 - 14.00 = -2.60 [(5.75 + 5.75) - (7.20 + 6.80)]

Any negative profits earned will be subtracted from your starting cash balance (or positive profits earned in other auction periods).

Additional Remarks:

1. In case of ties among the high bids - for example the 2rd and 3rd highest bid are the same - the computer will randomly determine which of the two bids is the second highest and earns an item.

2. You are free to bid whatever you think will bring you the most earnings. Iin thinking about bidding, earning an item is of no intrinsic value. Your sole objective should be to maximize your earnings.

3. You will all be given a starting capital balance of $5.00. Any losses will be subtracted from this balance, any profits added to it. Your final balance will be paid to you in cash at the end of the experiment.

4.Each of you will be operating in your own market with 3 (different) computerized bidders.

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