Ascending Auctions

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Ausubel and Milgrom observed that the Vickrey auction is not prevalent in practice. We discuss some advantages of open-outcry, ascending (*a.k.a.* English) auctions over sealed-bid auctions. We then characterize ascending auctions in general, and describe several specific instances.

1 *Single-Parameter Ascending Auctions*

"The Lovely by Lonely Vickrey Auction" is the title of a paper by two prominent economists, Ausubel and Milgrom,[1] who note that the Vickrey auction is indeed lovely in theory but rarely used in practice.[2] On the contrary, most auction houses sell their wares via an open-outcry, ascending (*a.k.a.* English) auction. Why is this?

One likely reason is the fact that bidders rarely have a precise number in mind that articulates what a good might be worth to them. Indeed, for companies bidding on contracts of some sort, it may be computationally intensive to compute such a number. On the other hand, even without knowledge of a precise number, it may be still be possible to answer (so-called demand) queries of the form, "Are you willing to pay x for a good?". Hence, such auctions may be less challenging and hence more inviting to bidders; and remember, zattracting bidders is essential to running a profitable auction.

Second, and arguably even more powerful, bidders tend to engage in bidding wars during English auctions. Even if bidders knew their precise value for the good at hand, they still might bid beyond that value. This behavior is rooted in our psychology; in particular, "losses loom larger than gains".[3] Applied to auctions, this maxim suggests that someone can become attached to a good while they are winning that good, and might therefore be willing to bid higher than their value to hold on to their tentative winnings. Furthermore, some might associate shame with losing, and pride with winning, especially when auction results are made public.

Remark 1.1. It has been said that "the only thing worse than losing an auction is winning." Regardless of whether they know their own precise value for a good, winning bidders often regret having won an auction, because upon winning, it is revealed to them that their bid was greater than everyone else's value. If indeed their own value is not definitively greater than their bid, then they may experience **buyer's remorse**—a feeling of post-purchase regret, stemming from the fact that other alternatives are no longer available (for example, because of a reduction in puchasing power).

[1] Lawrence M. Ausubel and Paul Milgrom. The Lovely but Lonely Vickrey Auction. Discussion Papers 03-036, Stanford Institute for Economic Policy Research, August 2004

[2] A notable exception were stamp auctions during the 19th century, in which bids were sent via post to auctioneers in sealed envelopes.

David Lucking-Reiley. Vickrey auctions in practice: From nineteenth-century philately to twenty-first-century e-commerce. *Journal of Economic Perspectives*, 14(3):183–192, September 2000

[3] Amos Tversky and Daniel Kahneman. Loss aversion in riskless choice: A reference-dependent model. *The Quarterly Journal of Economics*, 106(4):1039–1061, 1991

Finally, if ever there are doubts about an auctioneer's trustworthiness, an English auction would be preferable to a sealed-bid auction. Since they are more transparent, bidders can trust the outcome of an open-outcry mechanism much more readily than that of a sealed-bid mechanism. Although auctioneers can, and sometimes do, hire shill (i.e., fake) bidders to artificially raise the price of a good, it is riskier to do so in an open-outcry rather than a sealed-bid environment, as these shill bidders would be on display for all to witness.

In sum, the following three phenomena help explain why English auctions are more common than Vickrey auctions:

1. greater transparency
2. potentially more revenue, because bidding wars can arise
3. less information revelation of bidders' values (potentially to bidders and the auctioneer alike)

Since the Vickrey auction is rarely used in practice, an alternative model of auctions is needed. In search of such an alternative, we now turn our attention to indirect mechanisms, specifically ascending auctions, in which prices are adjusted over time.

For our purposes, an ascending auction is an iterative algorithm that abides by the following rules:

- The auction proceeds in discrete rounds, $t \in \{0, \ldots, \}$.
- **Prices** are per good (as opposed to per bundle). This vector of prices is initialized at zero (i.e., $\mathbf{p}^0 = \mathbf{0}$), and can only increase as the auction proceeds (i.e., $\mathbf{p}^{t+1} \geq \mathbf{p}^t$, for all $t \in \{0, \ldots, \}$). The amount by which the price increases at round t is called the **price increment**, and it is denoted ϵ^t. So, if the price of good j increases during round $t+1$, then $p_j^{t+1} = p_j^t + \epsilon^t$. Note that the price increment need not be constant across rounds.
- An **allocation** $\mathbf{x}^t$ at round t is an assignment of goods to bidders.
- At each round t, the auction maintains a **state** $\boldsymbol{s}^t = (\mathbf{x}^t, \mathbf{p}^t)$, consisting of the current (tentative) allocation $\mathbf{x}^t$ and price vector $\mathbf{p}^t$.
- An **information revelation policy** determines what part of the state is revealed to each bidder. For example, only the current prices might be revealed to all bidders, while the tentative winners might be revealed only to the winners themselves.
- Given the current state, queries can take the form of **demand queries**, in which bidders are asked what bundle of goods they prefer, or **value queries** (common in sealed-bid auctions), in which bidders are asked their value(s) for a() bundle(s) of goods.

- **Allocation and pricing (i.e., payment) rules** determine the next state (i.e., allocation and price vector), given the bidders' replies to their demand queries. An example allocation rule might be to allocate each good to a bidder that demands it. An example pricing rule might be to increase prices on all overdemanded goods (i.e., goods for which the total demand exceeds supply).
- The auction's **termination rule** determines when the auction ends, which is usually when at most one reply to the demand queries is non-empty: i.e., no further goods are overdemanded.
- There may be some additional **activity rules**, such as a bidder cannot exit the auction and then re-enter again later. The auction may also terminate if none of the replies to the demand query are valid, meaning they do not satisfy the activity rules.
- The final allocation and prices may be any (even randomized) function of the auction's history (i.e., the sequence of states).

We depict the rules for three ascending auctions for a single good in the tables below—specifically, for a vanilla English auction, for a modified English auction with an activity rule that forbids bidders from coming and going, and for a variant of the eBay auction. We assume a price increment ϵ^t at round t, but we do not elaborate on how this increment is determined, as it may be at the discretion of a seasoned auctioneer (i.e., heuristic!).

Rules	Vanilla English Auction
Information Revelation	All outcome information is public
Query Rule	Demand query: "Do I hear \$x?", where \$x = p^{t+1}
Allocation Rule	A bidder who responds in the affirmative (If no bidders respond in the affirmative, it is a tie)
Pricing Rule	The broadcast price, \$x
Activity Rule	None
Termination Rule	At most one reply

Rules	Modified English Auction
Information Revelation	All outcome information is public
Query Rule	Hold your hands up if \$x is acceptable, where \$x = p^{t+1}
Allocation Rule	A random bidder with their hand up (If no bidders have their hands up, it is a tie)
Pricing Rule	The broadcast price, \$x
Activity Rule	Once a bidder's hand goes down, they forfeit
Termination Rule	At most one hand up

Rules	eBay Auction
Information Revelation	The current price and the tentative winner are public
Query Rule	Value query: "What is your value for this bundle?"
Allocation Rule	A highest bidder
Pricing Rule	The second-highest bid plus ϵ^t
Activity Rule	None (so bids can oscillate up and down)
Termination Rule	At a set time, or after a set number of rounds

All auctions need a tie-breaking rule. We assume ties are broken uniformly at random among the most recent bidders in the English auctions, and among the highest bidders in the eBay auction.

References

[1] Lawrence M. Ausubel and Paul Milgrom. The Lovely but Lonely Vickrey Auction. Discussion Papers 03-036, Stanford Institute for Economic Policy Research, August 2004.

[2] David Lucking-Reiley. Vickrey auctions in practice: From nineteenth-century philately to twenty-first-century e-commerce. *Journal of Economic Perspectives*, 14(3):183–192, September 2000.

[3] Amos Tversky and Daniel Kahneman. Loss aversion in riskless choice: A reference-dependent model. *The Quarterly Journal of Economics*, 106(4):1039–1061, 1991.