Auction or haggling – what should the seller choose?

A look at the interaction between price discovery and competition in Name-Your-Own-Price auctions.

(First draft)

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Abstract

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Contents

1 Introduction

Which price mechanism should the seller choose? This article focuses on the selling of unique objects or scarce goods, i.e. where multiple buyers compete for the same object. This has traditionally been the realm of auctions (art, antiques, collectibles, etc). But perhaps – and contrary to popular believe – the standard single-item auction formats are not the optimal selling methods. An alternative price mechanism is Name-Your-Own-Price (NYOP). In NYOP the buyer proposes a price. If the proposed price is above some threshold level, that is set by the seller, then the buyer gets the object at the proposed price. A previous experiment by Shapiro and Zillante (2009) shows that NYOP gives sellers higher revenue than a simple posted price mechanism. The experiment in this paper aims to answer; if using NYOP will also give higher revenue than an english auction? The natural follow-up question is then why. Why revenue is higher in NYOP, or why revenue is not higher? To try and answer the latter two questions, additional NYOP treatments are proposed. These treatments focus on the interaction between price discovery and competition, and how they affect the results.

This paper is structured as follows. First the various prices mechanisms (posted price, NYOP, haggling, english auction and buyout auction) are introduced. This section also includes a discussion of how the various price mechanisms relate to one another. This is followed by a short summary of the literature, previous experimental findings and some theoretical predictions. Hereafter follows the full description of the experiment; its design, treatments, recruitment, participant requirements and the technical implementation. The last sections of this paper includes a recapitulation of my hypothesis and expected results from the experiment, the shortcomings of the experiment, future extensions, as well as the conclusion.

2 Various price mechanisms

2.1 Posted Price:

The simplest and most common price mechanism is a posted price (also known as *listed price*, or *take-it-or-leave-it offer*). You encounter this price mechanism everyday when going to the supermarket or a retail shop. Here the seller proposes and sets the price. The price is visible to all, and buyers can only choose to buy the item at the posted price, or choose not to buy. The item is (usually) sold to the first buyer willing to make the purchase. There is often no official count down or time limit on the offer. However, 1) if only a single and unique item is put up of for sale, then the first-come-first-served (FCFS) allocation rule imposes a sort of time pressure on competing buyers to swiftly make their purchasing decision. (If multiple items are put up for sale, and buyers desire at most one item each, then competition would be less fierce and the time pressure weaker). 2) Occasionally assortments change and unsold items are removed[1]. While the individual seller might prefer no time limit, consumer-to-consumer marketplaces like DBA.dk, impose a limit. One motivation for this is undoubtedly that the marketplace tries to balance the buyers' signal-to-noise ratio in terms of desirable items when browsing through the marketplace. A time limit is a simple measure restricting the accumulation of unsold and hence undesirable items. Besides the simplicity, familiarity and generality of the posted price mechanism, a main advantage is that the seller has full control over the final price. If sellers are risk averse this may be the decisive feature when picking a price mechanism. A disadvantage for sellers is the unspecific transfer date, especially if the there are costs associated with storing the item or if the item is perishable. This of course ties into an other main disadvantage – the lack of a price discovery process. What is the optimal posted price that the seller should set? If the seller sets the price too low the item is sold very quickly, and if its set too high, the item is sold slowly or not at all. Often the seller will be uncertain about the value of the item, perhaps not the seller's own valuation or reserve price, but uncertain about what the the highest value is among all potential buyers. This problem is even more prevalent when selling a single and unique item. Because there is often no prior market price to guide the seller, and because individual buyers may appreciate and value the unique, far beyond the mere production costs of the item.

2.2 Name-your-own-price (NYOP):

The name-your-own-price mechanism (also known as *reverse pricing* or *name-your-own-price auction*) is an extension of the posted price mechanism. The seller decides the posted price and a threshold level at which he or she is willing to sell the item. *The threshold level bears some similarities with a reserve price in auctions and a price reduction in the posted price mechanism (see footnote 1).* Only the posted price and the buyer's value is shown to buyers, who now have one additional option besides 'buy', and 'don't buy'. The buyers can submit a bid. Their bid is rejected if its below the threshold level. And if above, the bid is accepted and the transaction is made with the buyer. This is the essential parts of the NYOP mechanism, but there exist numerous extensions and modifications. Before is discuss these I would like to briefly present one striking result of the NYOP.

Shapiro and Zillante (2009) finds that revenue is higher when using the a NYOP mechanism (similar to the one described above) instead of using a posted price mechanism. One might expect that revenue was lower since buyers that could afford the posted price, would instead use the NYOP option, and get the item cheaper. But what drives the result is 1) new buyers that could not afford the item at the posted price, and 2) buyers

[1] Often one or several price reductions are attempted before the unsold item is removed, but these dynamics are beyond the scope of this paper.

with values much higher than the posted price, that still use the 'buy' option. The latter also puzzles the two authors, since submitting a bid is a dominant strategy. It is dominant because buyers can choose the to 'buy' after their bid has been rejected in their particular NYOP setup. Their explanation is that there is some non-monetary mental cost or haggling cost associated with bidding (clicking more buttons, disutility of rejected bid, etc), that the buyers avoid if they just use the 'buy' option.

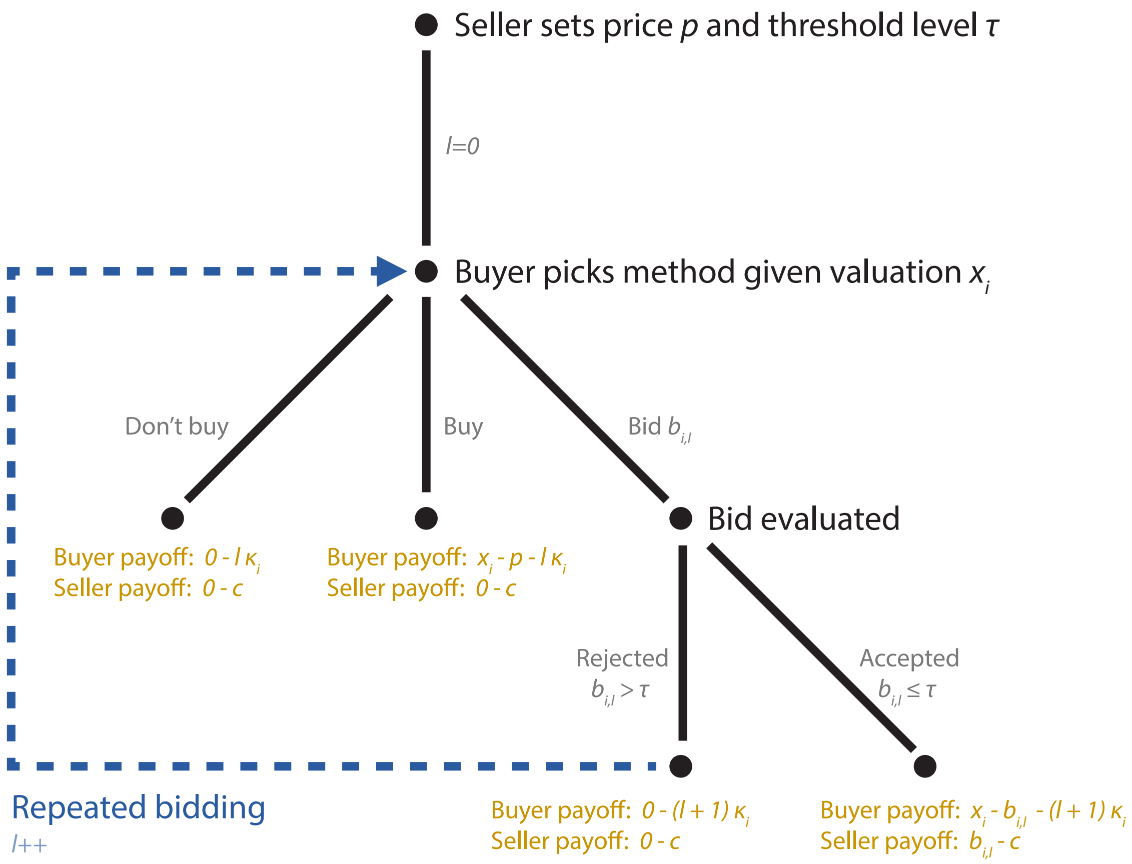
Thus one modification of the NYOP is the options presented to the buyers after their bid has been rejected. The case where buyers are allowed to bid again after a bid is rejected is discussed latter. Another modification is to remove the 'buy' option from the buyers initial set of choices. Such that the buyer can only 'bid' or 'do not buy', if the bid is rejected, then the buyer can 'buy' the item at the posted price. Shapiro and Zillante (2009) show that this modification also gives the seller a higher revenue than the posted price, but the increase in revenue is not as large. Another modification they try is hiding the posted price, but having less cues about the threshold level reduces the average bid. Clearly presenting the posted price has a sort of anchoring effect[2] or reference price. Yet another modification is the 'opaque feature'. Here the buyer is uncertain about the exact properties of the product purchased (i.e. the buyer knows that it is a three-star hotel in New York, but not which hotel). It will not discuss this in more detail, but just note that Shapiro and Zillante (2009, p.737) hypothesise that fears of buyers learning the threshold level might be the reason why marketplaces have an opaque feature (emphasis added):

> *... Priceline customers are more likely to purchase the same product many times (e.g. a ticket between New York City and Los Angeles) and consequently there is a substantial* **risk that customers might quickly learn the threshold range and decrease their bids**. *When this is not the case, as at http://www.prisminister.dk which sells consumer electronics, the NYOP website does not have the opaque feature. Indeed, it is simply* **less likely that one person would be buying a washer repeatedly and consequently the customer's information about the threshold is less precise** *...* (Shapiro and Zillante, 2009, p.737)

The NYOP mechanism has mostly been studied as a method to curb excess capacity/supply. On the internet Priceline.com has been the pioneer of the NYOP mechanism, selling excess hotel capacity and excess seats on planes (Shapiro and Zillante, 2009). Consequently the literature on NYOP assumes that there are items enough for every buyer willing to purchase. There is no constraint on the supply of items for sale and hence no competition among buyers for the items unlike auctions (Shapiro, 2011). In latter sections

[2] In the behavioural economics literature the 'anchor' generally does not add any relevant information to the agents decision – yet the irrelevant 'anchor' still affects the outcome of the decision. In the NYOP the posted price contains relevant information about the threshold level.

Figure 1: NYOP game tree



Note: Note: Where l is number of bids attempted, κ_i is haggling cost of buyer i, c is marginal cost, τ is threshold level, p is posted price, x_i is value of buyer i and where $b_{i,l}$ is the l'th bid of buyer i.

I will explain how my experiment will try to introduce competition in the NYOP and how it will study learning through repeated bidding.

One advantage of the NYOP is that seller maintains control over the final price. The lowest possible final price will be the threshold level. The other advantage is that the NYOP has a price discovery process. Buyers with values below the posted price, but above the seller's threshold level might purchase an item. The seller's uncertainty about the value, is less critical since they don't need to select an optimal price point, but select an optimal price range.

The NYOP could be further extended by allowing repeated bidding. If a bid is reject the buyer can then choose whether to 'buy', 'don't buy' or 'bid' an higher amount. In addition it is normal to assume that buyers endure a non-monetary mental cost or haggling cost from bidding (clicking more buttons, disutility of rejected bid, etc). As Terwiesch et. al (2005) note this implies that buyers will be balancing between bidding too much, giving the seller additional rents, and bidding too little, possibly enduring further haggling cost or worse wasting haggling cost. In the case with no constraints on the supply of items and significant haggling cost, the seller will (indirectly) price discriminates buyers based on their haggling cost. Buyers with higher willingness to haggle (lower haggling cost) will archive higher payoffs. Terwiesch et. al (2005) argue that fairness concerns as well as legal constraints prohibit the seller from price discriminating on other parameters. E.g. the seller cannot to change the threshold level based on the buyer, nor change the threshold based on the bidding sequence. Buyers purchasing an item at the same point in time must be charged the same price.

2.3 Haggling:

As already hinted at in the description above, the NYOP mechanism is not far from haggling or models of *bargaining*. In bargaining 1) agents can enter a mutually beneficial agreement, 2) there is a conflict of interest over the agreement and 3) an agreement cannot be reached without the approval of all agents (Terwiesch et. al., 2005). Bargaining can been formulated as a procedure where agents sequentially make decisions. The main difference from the repeated-bidding NYOP is that the seller does not initially set or commit to a threshold level, but instead the seller evaluates each bid. Hence the threshold variable τ is not necessarily constant, but could be a function of the buyer identity i, the number of attempted bids l, the sellers impatience, and the set of previously submitted bids by other buyers $b_{j,l}$. Often, even in simple bargaining models, multiple equilibria arise.

The NYOP haggling model proposed by Terwiesch et. al. (2005) assumes that the threshold level is constant. Further it assumes that all uncertainties (other buyers' value, other buyers' beliefs, etc) can be lumped together into a single distribution, this way the the problem of finding equilibrium simplifies to a problem of search. In this search problem buyers balance between search efforts (minimising haggling costs or bids) and choosing a bid that is just above the threshold level (bidding repeatedly and incrementally until a bid is accepted). A key requirement that allows sellers to charge a price above the marginal cost, is that haggling costs are non-zero.

2.4 English auction:

In standard auctions the buyer with the highest bids wins the item. In the first-price auction the winner pays his own (highest) bid. In second-price auctions the transaction price is the second highest bid. In the latter the buyer does not shade his or her bid, but in theory bids his or her true value. In both cases each buyer submits a single bid and the bids are sealed. In the english auction bids are open and visible to all. Buyers continue to incrementally outbid each other until their is no challenger, or until the clock runs out. The linkage principle tells us that revenue in the english auction is as least as large as in the second-price auction (Krishna, 2009). There are good theoretical results ranking the revenue of most standard auction formats. And many experimental studies have been carried out trying to confirm these results (Kagel and Levin, 2011).

Normally bidding will start at zero. However the seller may also set a reserve price or starting price. The seller should set the reserve price such that it exceeds his or her value, since the reserve price becomes the minimum revenue that the seller will receive. Bidding starts at the reserve price, and buyers cannot bid below this. In theory a reserve price can increase the revenue of sellers, since it can extract addition surplus from the highest bidder (Haruvy and Leszczyc, 2010)[3]. Empirical evidence however question this theoretical result. The reserve price implies fewer participants in the auction, which may in turn lead to lower prices and revenue. This could happen because of competing auctions, where participants choose the auction with the lowest or no reserve price (Haruvy and Leszczyc, 2010). An alternative explanation is that fewer participants, leads to less competitive arousal or less 'frenzy' and this is what gives lower prices and revenue. More on the latter below when the discovery process is discussed. The reserve price is visible to all.

Alternatively one can use a secret reserve price, where buyers only know that a reserve price exists, but not its value. Thus they form prior expectations about the reserve price. When the auction ends the buyer with the highest bid wins, but only if the bid is above the secret reserve price. Unlike the reserve price, the secret reserve price should not lead to fewer participants in the auction, but this has been disputed. And the empirical evidence on secret reserve price and revenue is not unanimous (Haruvy and Leszczyc, 2010). I mention the secret reserve price here, since it bear some similarities with the threshold level in the NYOP auction.

Buyout auctions or *buy-it-now* price is other modification to auctions that bears similarities with the NYOP mechanism. The buyout option has been popularised by internet marketplaces such as eBay. Besides bidding in the auction as describe above, buyers have the option to purchase the item at the posted price ending the auction before the clock runs out. Buyers will choose this option if their time-sensitivity, transaction costs or disutility from not winning the auction is sufficiently large (Haruvy and Leszczyc, 2010). The *buy-it-now* price has puzzled researchers since it places a maximum on the expected revenue of the seller. Temporary *buy-it-now* option can be found on eBay, here the *buy-it-now* option disappears once the auction receives its first bid. When buyers are risk averse then a carefully selected *buy-it-now* may increase revenue. It does so by extracting the risk premium buyers are willing to pay to avoid losing the auction (Kagel and Levin, 2011).

The duration of the auction is another important parameter, especially in internet auc-

[3]This is conditional on the item being sold. If set too high, such that the item is no longer sold, the reserve price may reduce revenue. This may happen when the exclusion principle no longer holds (Krishna, 2009).

tions that can stretch over several days. In long-duration auctions the individual buyer will take his or her time-sensitivity or impatience into account when bidding. Secondly, the duration of the auction will affect the discovery process of the auction. If one imagines that the process by which buyers discover the auction is random, then the longer the duration, the more buyers will find and participate in the auction, which should lead to higher revenue. Haruvy and Leszczyc (2010) summaries a field experiment conducted on eBay and at a local auction. The experiment finds that on eBay a longer duration results in higher revenue, while the opposite is true at the local auction and both relations are significant. Haruvy and Leszczyc (2010) argue that this is due to the random arrival process at eBay auctions, while the local auction attracts buyers via invitation and therefore longer duration does not lead to more participants, but just less competitive arousal and lower revenue.

Auctions with 'hard close' (a fixed announced end time) often see snipping behaviour. Buyers simply wait until the very last minutes or second of the auction before they submit bids. The rationale for this type of behaviour is that by submitting last-minute bids the buyer does not reveal information to other buyers, or at the very least gives they so little time to react to the information that it is in practice useless. Often it will only be a small subset of knowledgeable buyers that engage in sniping. Having a 'soft close' ending (where bids receive shortly before the end time extends the duration of the auction) is one way in which snipping behaviour can be avoided. Implementing a proxy bidding system, where buyers can submit a sealed max-bid is another way to discourage sniping behaviour. A computer then automatically out-bids others, until the max-bid is reached.

Auctions have many advantages, one is the price discovery process, that may lead to higher expected profits that the posted price mechanism. This is especially appealing when selling scarce goods, where the seller is uncertain about the value. Another advantage is that standard auctions are efficient, in that they allocate the item to the buyer with the highest value. Another advantage over the posted price, is that auctions have more or less fixed durations, and the seller is almost certain to get the item off his or her hands. A disadvantage is that the seller has no control over the final price. This may especially be problematic for risk averse sellers. Some solutions for this has been discussed above, such as a reserve price or secret reserve price.

I choose the english auction, because this format had the most features in common with the NYOP, hence it would be easier to interpret the results as *ceteris paribus*. And because it has an element of learning and competition build in, which is the main focus of my NYOP treatments. Learning in the english auction happens because bidders can bid repeatedly and see the bids of other buyers. And competition is present in all auctions, because of scarce supply and an allocation rule that says only the highest bidder will win the item. In this experiment I am not interested in studying the snipping behaviour of a subset of buyers, but rather learning and group learning. To discourage snipping my experiment will use randomly varying duration also known as a *candle auction*.

3 Literature review

In the section will review some of the theoretical and experimental results in the literature. The main focus will be on explaining the difference in revenue between the posted price, NYOP, and auction mechanism. And some focus will also be given to learning and competition in the NYOP.

Posted price vs auctions:

Posted price vs NYOP:

4 Experiment

Why use an experiment to investigate auctions and the NYOP mechanism? Wouldn't it be equally or more fruitful to set up models and then solve them analytically? There are two main problems with the analytically approach, that one avoids with an empirical or experimental approach. First, the analytical solution often lead to multiple equilibrium or is intractable due to the complexity of the model (see earlier discussion on bargaining models). Secondly, buyer's actual characteristics and hence behaviour is vastly unknown. The literature has well established concepts, such as 'risk aversion' or 'anchoring effect' – but whether, why or when buyers are risk averse remains a mystery in most settings. Haruvy and Leszczyc (2010 pp.61-62) touch upon these issues in their discussion of traditional auctions vs online auctions:

> *Traditional auction theory builds heavily on bidder rationality, in many cases risk neutrality, bidder symmetry, revenue and strategic equivalences, and other key properties that are ... known to be violated in traditional auction settings as well ... In our opinion, based on the research reviewed here, questions of optimal design choice in online auctions can often be addressed empirically and have as much to do with bidder preferences, bidder search, mental processing of information, and issues of trust and reputation as they do with the traditional focus on equilibrium predictions.* (Haruvy and Leszczyc, 2010 pp.61-62)

4.1 Design

To try and explain the resulting difference between auctions and NYOP, I will compare the NYOP results to three alternative NYOP treatments. My hypothesis is that in particular two counteracting factors effects the results of the NYOP mechanism:

1. **Learning** or **Price discovery**. Through experience and information about previously submitted bids buyers will learn and come to form correct expectations about the seller's threshold level. This will, everything else equal, result in buyers submitting bids that are significantly below the posted price, and thus will have a negative effect on the seller's expected revenue.

2. **Competition**. When there are fewer objects for sale, it pressures buyers into submitting earlier bids under the NYOP, because the first bid above the threshold level wins the object. The allocation rule in the NYOP is henceforward referred to as First-Come-First-Served (FCFS). The pressure to submit an earlier bid will, everything else equal, imply that buyers have less time available to discover the threshold level. And hence buyers will to a lesser extend try to shade their bids, or alternatively not at all engage in bid-shading but instead simply use the 'buy' option. This will have a positive effect on the seller's expected revenue[4]. As earlier noted Shapiro and Zillante (2009) found that an important factor increasing revenue in the NYOP, was the participation of new buyer that were not able to purchase at the posted price. Whether fewer objects lead to higher revenue, will likewise depend on whether it is mainly new buyers that manage to acquire the item.

Participants in the experiments will all play the role of buyers. Each session will have 5 participants. The actions of the seller is carried out by a computer. The seller chooses a posted price and threshold level. The buyers are always presented to the posted price.

The values of buyers, the seller's posted price and threshold level are all randomly drawn from uniform distributions, similar to Shapiro and Zillante (2009). In each period the buyers' values are drawn from $U(a_t, a_t + 400)$, where a_t is drawn in each round from $U(0, 1600)$. The lowest value distribution thereby becomes $U(0, 400)$ and the highest $U(1600, 2000)$, and values can range between 0 and 2000. Buyers only see their own value and the posted price, they don't receive any information on the distributions. The posted price is the midpoint of the value distribution $p_t = a_t + 200$, and the seller's marginal cost is a_t. Hence the posted price is the monopoly price. The threshold level is drawn from $U(a_t, p_t)$. In the auction only the buyers' values and posted price is used. There is no reserve price or secret reserve price, but bids have to be strictly positive.

Each session has 5 treatments, and 8 rounds per treatment. So each participant goes through a total of 40 rounds. The duration of each round in seconds is drawn randomly from the uniform distribution $U(60, 120)$. Participants will be told that the duration varies, and told that "each rounds may last a couple of minutes", but otherwise not be given any information about the distribution and there is no visible countdown. As mention earlier this is done to avoid snipping and encourage early bidding in the

[4]Likewise competition exists in auctions formats, since here the allocation rule determines that the buyer with the highest (HIGH) bid wins the auction.

auction. The NYOP treatments may also end when all items have been sold. The order of treatments will also vary with session. Sessions will use one of the following five orderings:

$$AUCTION_0, NYOP_0, NYOP_P, NYOP_S, NYOP_M$$

$$AUCTION_0, NYOP_M, NYOP_S, NYOP_P, NYOP_0$$

$$AUCTION_0, NYOP_P, NYOP_M, NYOP_0, NYOP_S$$

$$NYOP_M, NYOP_P, NYOP_0, NYOP_S, AUCTION_0$$

$$NYOP_S, NYOP_M, NYOP_0, NYOP_P, AUCTION_0$$

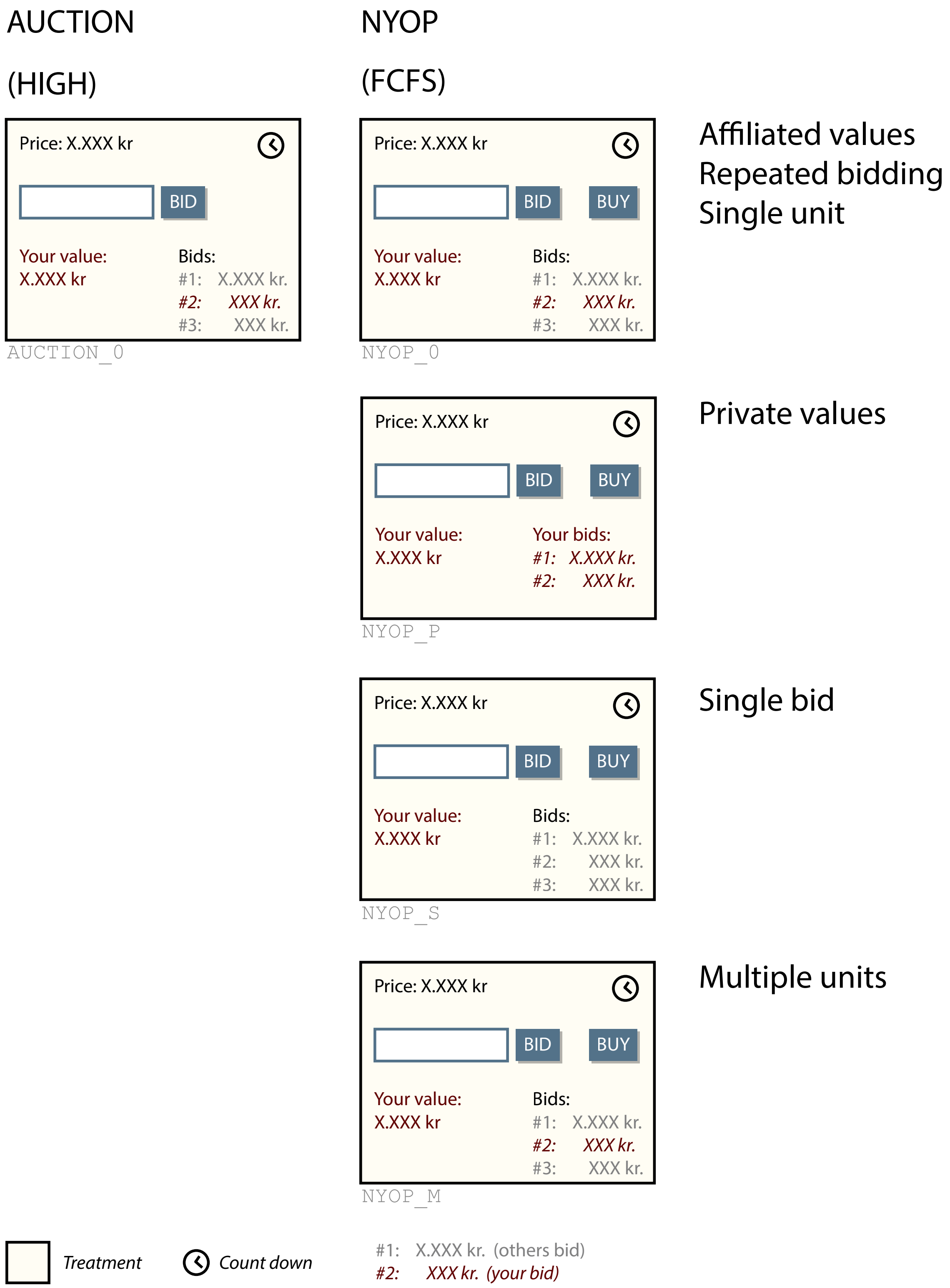
The experimental procedure is structured as follows; at the beginning the session participants are given instructions to either the first auction treatment or the first 4 NYOP treatments. Once these treatments are over, the participants are given instructions to the remaining treatment(s). Each new treatment is announced before it begins so participants are aware of the change in environment. At the end of the session two treatments are randomly drawn and participants are paid based on their total earnings (value minus bid/price) in those two treatments.

4.2 Treatments

The two main treatments are; english auction ($AUCTION_0$) and NYOP ($NYOP_0$). In both buyers can repeatedly submit bids (repeated bidding). In the auction buyers can submit a higher bid out-bidding others or oneself. The auctions ends when the clock runs out, and the winner is the highest bidder. In the NYOP a buyer can submit a bid, if the bid is above the threshold level, the buyer wins the object and the auction ends. If the bid is rejected, the buyer can resubmit a new higher bid. This is the individual channel in which learning can happen. The NYOP ends once the seller receives a bid above the sellers threshold level. If no bids submitted then NYOP ends when the clock runs out.

In both treatments all previously submitted bids are visible to all (affiliated values). Buyers can use this information to form and update expectations about the value of other buyers and about the seller's threshold level (in NYOP). This is the common channel through which learning can happen. Once the object is sold and the "auction ends", the posted price along with the winning bid is displayed to all buyers, before the next "auction" or round initiates. This is done to avoid any confusion about the final selling price, since our interest is learning and how buyers form expectations about the threshold level. Displaying this information hopefully helps us minimise the effects of expectation errors. In both treatments a single unique unit is put up for sale (single unit). This together with the respective allocation rule introduces competition into both treatments.

Figure 2: Overview of the five treatments



A comparison of these two treatments determines which mechanism gives the highest revenue. It is also possible to evaluate the efficiency of the two mechanisms[5]. However this seems unproductive as the NYOP would most likely be inefficient. Efficiency in the NYOP requires that the buyer with the highest value was fastest to evaluate the posted price, form expectations and the fastest to submit a bid above the threshold level. The FCFS allocation rule in NYOP does not promote efficiency.

The three additional NYOP treatments try to disentangle the counteracting effects of learning and competition, discussed earlier.

Multiple unit treatment ($NYOP_M$). By selling multiple units rather than a single unit the competition among buyers is reduced, while the learning and price discovery mechanism is unaffected. The latter part is archived by only displaying winning bids after the "auction end". In the single unit case the auction ends once this unit is sold, and hence buyers can't base their bids on a winning bid. Similarly in the multi unit case, only previously unsuccessful bids are displayed, winning bids are hidden until all units have been sold, and the the auction ends. Then the posted price and all winning bids are shown. The exact choice of number of units to sell is mostly arbitrary. A non-arbitrary choice is the same number or more units than there are buyers (excess supply), as this completely eliminates competition. Minimum competition is as attended by selling $N-1$ units, maximum by selling 1 unit. The multiple object treatment will sell $N/2$ units. In this way competition changes in the multi object unit case, while learning does not. And changes in revenue will be due to increased competition among buyers.

Single bid treatment ($NYOP_S$). In this treatment buyers are only allowed to submit one bid. If the bid is rejected they cannot resubmit a new. This restriction removes the buyer's ability to learn the threshold level through the individual channel (i.e. by repeatedly submitting incrementally increasing bids until the threshold level is reached). It is still possible to learn through the common channel. That is, buyers can still discover the threshold level, but it requires waiting for other buyers to submit their bids, and while waiting they risk that others win the object. The number of buyers might be crucially here, since faced with more competing buyers, one will be more hesitant to wait. Competition among buyers is not affected in the single bid treatment. Changes in revenue will be due to decreased price discovery, in particular no learning takes place through the individual channel.

Private value treatment ($NYOP_P$). Another way in which price discovery will change is by restricting the common channel. This the the purpose of the private value treatment. Here buyers can only see their own bids. Buyers still have the ability to learn

[5]An efficient allocation is when the object is allocated to the buyer will the highest value. This is an important consideration (for instance in government held auctions) where the seller also considers the subsequent surpluses. This could either be the winning bidder's surplus or customers of the winning bidder. This article is more aimed at art or antiques, were efficiency concerns are secondary to revenue concerns.

the threshold level though the individual channel, but they now have less information about competing buyers. Comparing the results from this treatment with the previous might help to answer how buyers discover the threshold level. Whether its by individually and repeatedly submitting bids or mainly through observing what others bid. When this treatment removes the option to observe others, do buyers then submit more individual bids? And are they further from guessing the true threshold level? And ultimately what are the effects on revenue?

4.3 Participants: sample size, motivation and incentive problems.

4.4 Technology and execution

The experiment will be built as a web-application. It will rely on Mozilla Labs' TogetherJS to enable simultaneous action of participants. The reason for building the experiment as a web-application is that it then becomes independent of the platform (PC, Mac, Smartphone, Tablet, etc). And thus the experiment is not strictly restricted to a 'lab' setting, but can be executed in classrooms, cafeterias, as well as over the internet. Participants are paid in cash, or using micropayment service (MobilePay, Paypal, etc). I would like to run the experiment three times; inside the lab, in-person outside the lab, online.

4.5 Evaluating experiment – interpreting results

5 Conclusion

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