Auctions and Emotions

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Outline

- Background Auction Theory and Predictions
- Experimental tests
- The Role of Emotions

Figure 1: Auction Winner

Auction Assumptions

- Seller auctioning item to a set of buyers (bidders)
- Bidders are competing to win an object
- There are N players (bidders)
- Each bidder (i) has an intrinsic (true) value for the item being auctioned (will not bid or pay a higher price)
- Private Values: Each bidder knows only their value and not the values of others
- Only winner recieves the item and must pay bid price b

Auction Types

- Ascending-bid (English Auctions)
- Descending-bid (Dutch Auctions)
- First-Price Sealed Bid Auctions
- Second-Price Sealed Bid Auctions (Vickery Auctions)

Auction Types

Ascending-bid auctions (English auctions)

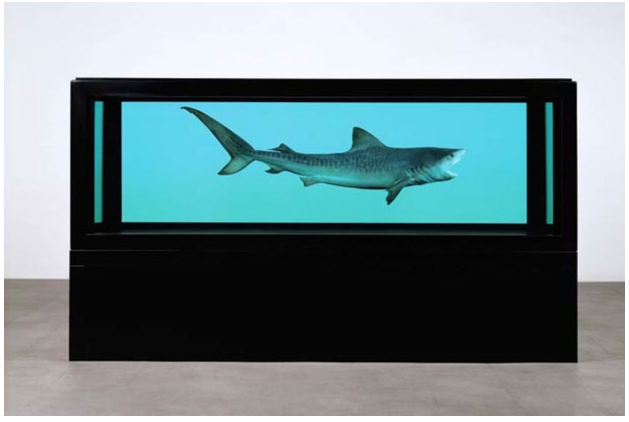


Figure 2: Damien Hirst: The Kingdom ($15,300,000)

- Carried out interactively in real time, with bidders present either physically or electronically.
- Seller gradually raises the price, bidders drop out until finally only one bidder remains
- Remaining bidder wins the object at this final price.

Auction Types

Descending-bid (Dutch Auctions)

Figure 3: Fruit Auction

- Interactive auction format
- Seller gradually lowers the price from some high initial value until
- First moment when some bidder accepts and pays the current price.

Auction Types

First-Price Sealed Bid Auctions

Figure 4: Brady Jersey ($50,000)

- Bidders submit simultaneous "sealed bids" to the seller.
- Highest bidder wins the object and pays the value of her bid.

Auction Types

Second-price sealed-bid auctions (Vickrey Auctions)

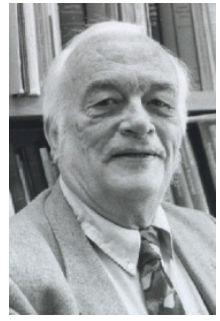


Figure 5: Vickery (1996 Nobel Prize)

- Bidders submit simultaneous sealed bids to the seller
- Highest bidder wins the object and pays the value of the second-highest bid.

Example:
New Zealand, Radio Spectrum

Auction Bid Strategies

- Bidders want to win items but are not willing to pay more than their value
- Difference between the amount paid and value is the bidder surplus
- Bid strategies the same in some of the auction types
  - Descending Bid and First-Price Auctions
  - Ascending Bid and Second-Price Auctions

Auction Bid Strategies

Ascending Bid and Second-Price Auctions

- Winner of the auction is the last bidder remaining, and she pays the price at which the second-to-last bidder drops out.
- Should only drop out when the price exceeds your value. (Not before: Why?...)
- Implication: People should bid their true values. (Simple Nash Equilibrium)
- Pay the bid of the second-highest value...

Auction Bid Strategies

Descending Bid (Dutch) and First-Price Auctions

- Seller is lowering the price from its high initial starting point
- No bidder says anything until finally someone actually accepts the bid and pays the current price.
- Bidders therefore learn nothing while the auction is running, other than the fact that no one has yet accepted the current price.
- For each bidder i, there's a first price b_i at which she'll be willing to break the silence and accept the item at price b_i.
- The process is equivalent to a sealed-bid first-price auction: this price b_i plays the role of bidder i's bid; the item goes to the bidder with the highest bid value; and this bidder pays the value of her bid in exchange for the item
- Optimal bid amount a function of your value and the number of other bidders, value distributions. . . . Why?

Auction Bid Strategies

Descending Bid (Dutch) and First-Price Auctions

Nash Equilibrium

- Assume (Vickrey 1961) that all bidders are:
  1. Risk Neutral
  2. Draw their true values (v_i) from a uniform distribution
  3. Are certain only of their own values - and only the distribution of others.
- Then the Nash Equilibrium bid (b_i) for both Descending an First Price Auctions is:

$$b_i = \frac{N-1}{N} v_i \tag{1}$$

Descending Bid and First-Price Auctions

Experimental Tests

Bids tend to be lower in Dutch auctions than in 1st price auctions despite theoretical predictions that they should be identical (Coppinger et al 1980 and Cox et al 1982).

Why???? Role of Emotions...

The Role of Emotions

- Smith and Dickhaut (2005) find that heart rate helps predict bidding in Dutch but not English auctions.
- Adam et al (2011) use galvanic skin response and heart rate to learn bidders in auctions with fast clocks are more excited and remain in the bidding process longer.
- Astor et al (2013) measure galvanic skin response and heart rate and show that bidders in first price auctions find that the joy of winning is stronger than the pain of losing.
- Breaban, Deck, Johnson: Examine role of emotions in an experimental setting

Experimental Design

- Subjects complete 25 first price and 25 Dutch auctions
  - Fixed group of N=4 bidders
  - Different auction order blocks
  - Examine *within subject design*
- Sessions at Chapman University
  - 8 sessions with 12-24 subjects per session
  - 172 subjects
  - 90 minute study: paid \$7 flat + \$10.09 (average)

Breaban, Deck, Johnson

Market Parameters

Values drawn with equal probability from

$$0, 8, 16, \ldots, 232, 240$$

Given $N = 4$, risk neutral equilibrium bid is $\frac{3}{4} v_i$

- Dutch Clock Starting Price $= 240$
- Dutch Clock Tick Increment $= 3$
- Dutch Clock Speed $= 0.5$ second

Bids in 1st Price were restricted to [0, 3, 6, 9, 12, ..., 237, 240]

Session

Figure 6: BDJ Session format

Face Reader

- Noldus analyzes face 30 times/sec (big, big, dataset)
- 7 human emotions (scored 0 - 1)

1. Anger
2. Contempt
3. Disgust
4. Happiness
5. Scared
6. Sadness
7. Surprise

- Neutrality: Absence of other emotions
- Valence: Positiveness of Emotions (-1 to 1)
- Arousal: Intensity of Emotions (0 to 1)

Face Reader

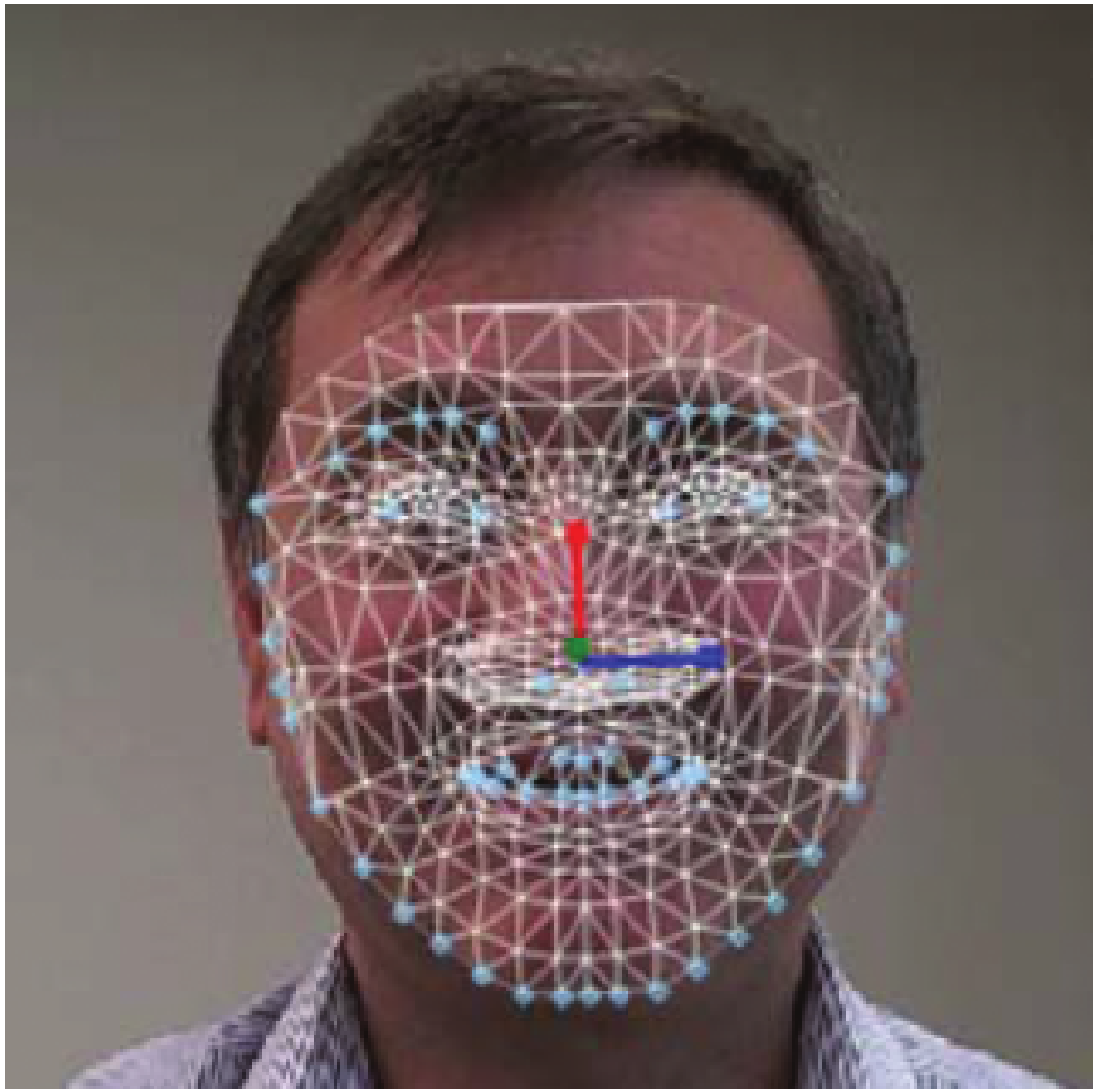


Figure 7: Face Reader

Auction Results

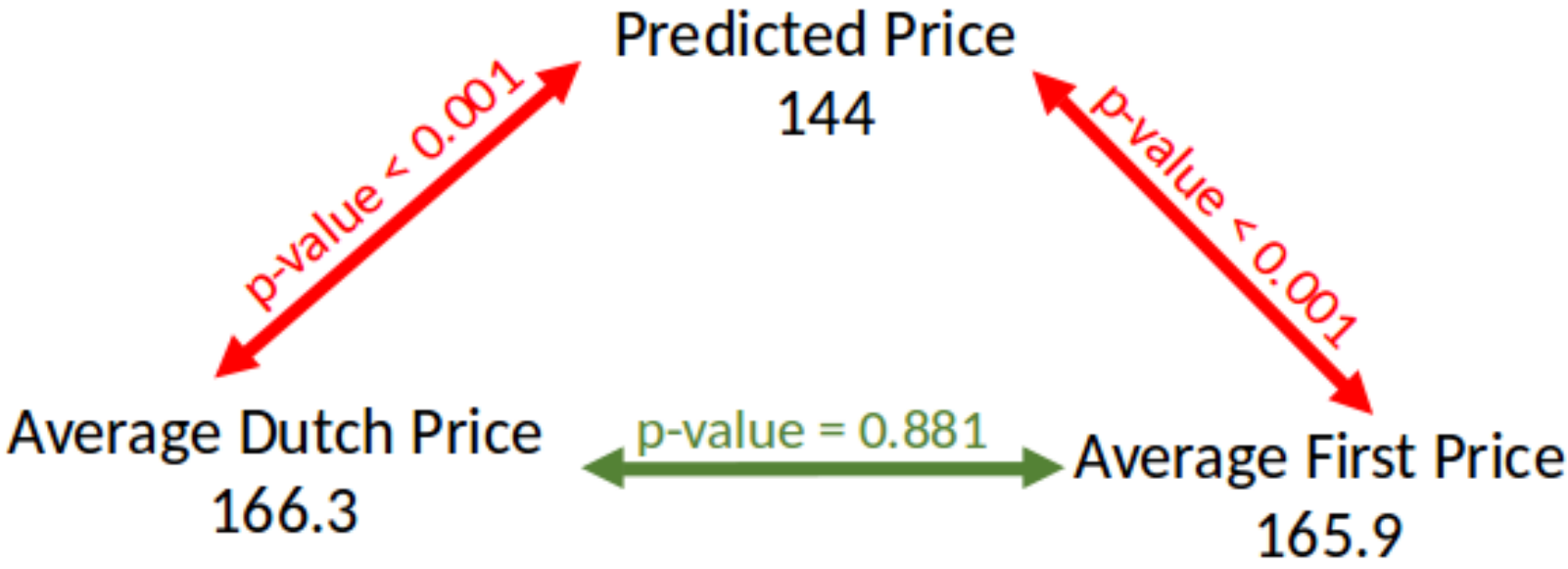


Figure 8: Auction Results: Bid Prices in 2150 Auctions

Auction Results

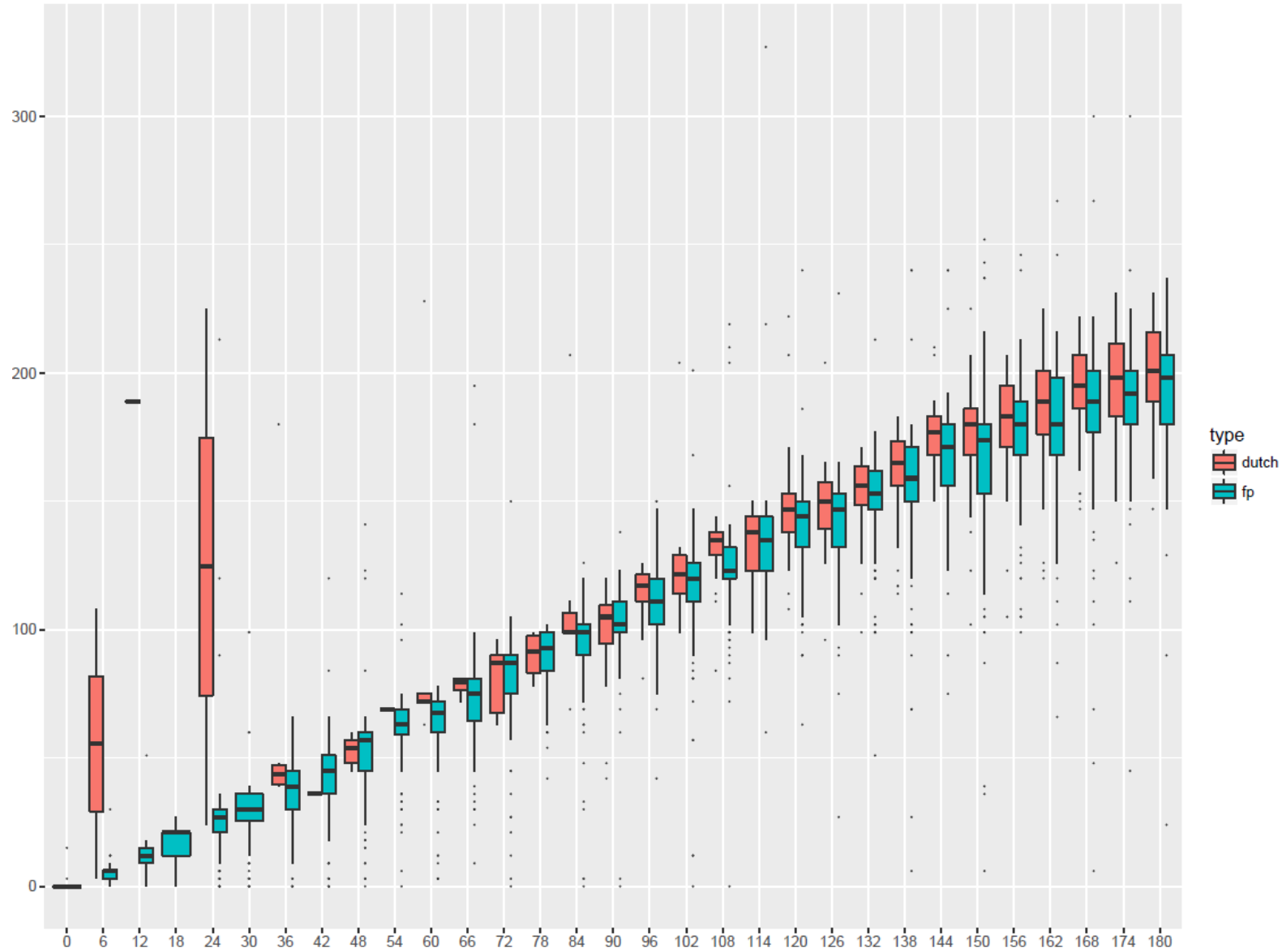


Figure 9: Auction Results: Bidding Behavior by Value

Auction Results

	Estimate	Standard Error	t-statistic	p-value
constant	40.54	14.502	2.80	0.027
Value	0.67	0.073	9.19	$<$0.001
Dutch	-17.63	20.438	-0.86	0.417
Value $\times$ Dutch	0.09	0.10	0.87	0.412

Table 1: Comparison of Winning Bids by Auction Type

	Estimate	Standard Error	t-statistic	p-value
constant	-0.75	1.358	-0.55	0.599
Value	0.85	0.011	74.92	$<$0.001

Table 2: All bids in First Price Auctions

Emotional Responses

	First Price	Dutch Clock
Anger	0.2517	0.2334
Contempt	0.0906	0.0947
Disgust	0.0924	0.0702
Happiness	0.0440	0.0409
Neutrality	0.3542	0.3933
Sadness	0.0499	0.0566
Scared	0.0114	0.0079
Surprise	0.1143	0.1009
Arousal	0.2876	0.2884
Valence	-0.3129	-0.2886

Figure 10: Emotional Responses: Average Emotions in Auction

Emotional Responses

Coefficients

	Anger	Contempt	Disgusted	Happy	Neutral	Sad	Scared	Surprised	Arousal	Valence
Value	-0.00003	0.00004	-0.00001	-0.00002	-0.00002	-0.00002	0.00001	0.00002	0.00001	0.00002
Dutch	-0.03540	0.00720	-0.01961	-0.00749	0.03279	0.00083	-0.00035	0.00081	0.00162	0.03621
Value × Dutch	0.00029	-0.00010	0.00001	-0.00002	-0.00007	-0.00001	-0.00003	-0.00008	0.00003	-0.00025

t-statistics

	Anger	Contempt	Disgusted	Happy	Neutral	Sad	Scared	Surprised	Arousal	Valence
Value	-5.40	13.87	-1.86	-6.12	-4.29	-7.08	7.43	5.01	3.47	2.39
Dutch	-31.29	12.14	-27.30	-13.69	32.50	1.28	-1.38	0.85	3.76	25.04
Value × Dutch	35.33	-22.88	2.48	-4.49	-9.70	-2.33	-16.70	-11.30	11.27	-24.18

Figure 11: Emotional Responses: First 5 seconds

Emotional Responses

Coefficients

	Anger	Contempt	Disgusted	Happy	Neutral	Sad	Scared	Surprised	Arousal	Valence
Value	0.00018	-0.00001	-0.00004	-0.00004	-0.00006	-0.00002	-0.00001	-0.00004	0.00005	-0.00017
Dutch	-0.01880	0.00039	-0.01993	-0.00781	0.03591	-0.00136	-0.00293	-0.00495	0.00740	0.02531
Time	0.00090	-0.00066	0.00100	-0.00019	-0.00100	-0.00046	-0.00019	-0.00011	0.00003	-0.00118
Time × Dutch	0.00098	0.00030	-0.00052	0.00010	-0.00064	0.00083	0.00006	-0.00017	-0.00060	-0.00139

t-statistics

	Anger	Contempt	Disgusted	Happy	Neutral	Sad	Scared	Surprised	Arousal	Valence
Value	65.34	-10.25	-21.34	-31.56	-26.54	-15.91	-17.01	-20.08	44.56	-47.95
Dutch	-35.44	1.48	-57.17	-30.10	78.18	-4.75	-25.22	-11.47	36.46	37.36
Time	37.84	-55.50	63.90	-16.37	-48.58	-35.36	-35.64	-5.67	3.72	-38.80
Time × Dutch	20.44	12.60	-16.64	4.37	-15.40	31.96	5.46	-4.48	-32.72	-22.84

Figure 12: Emotional Responses: During Auctions

Emotional Responses

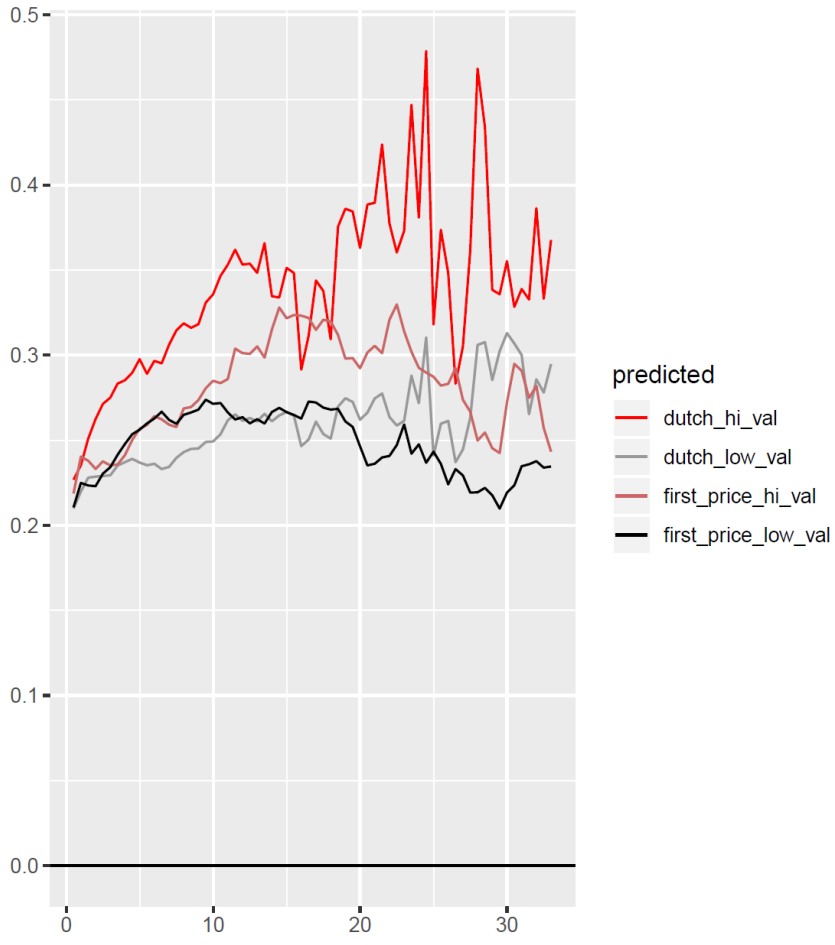


Figure 13: Emotional Response: Anger During

Emotional Responses

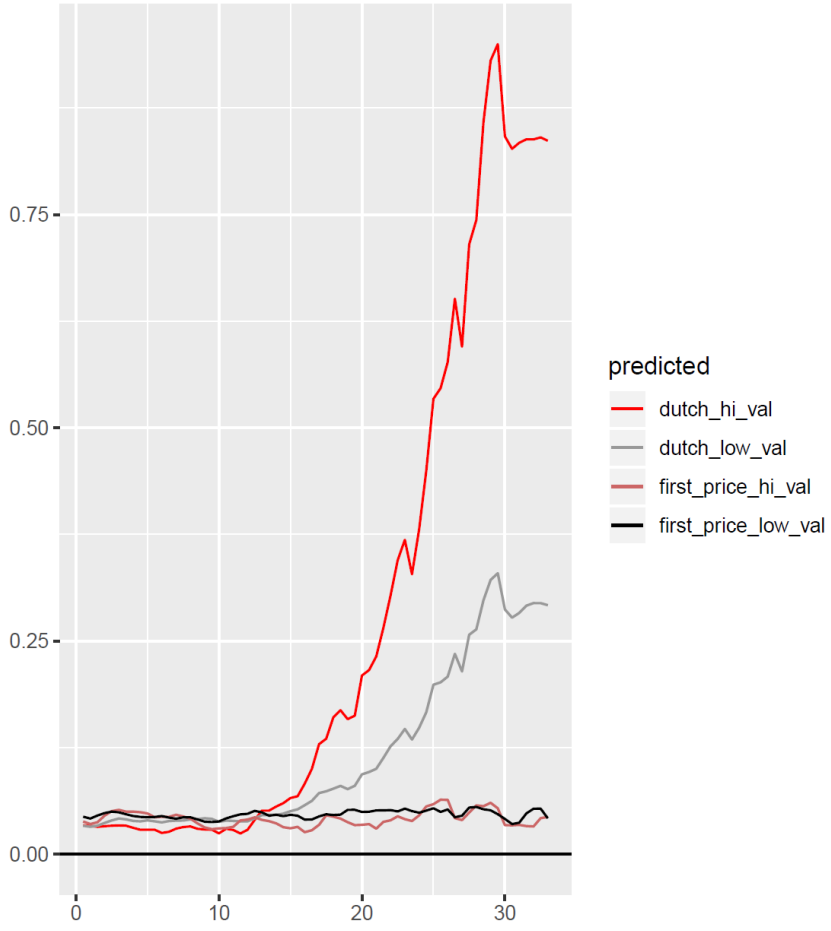


Figure 14: Emotional Response: Happiness During

Emotional Responses

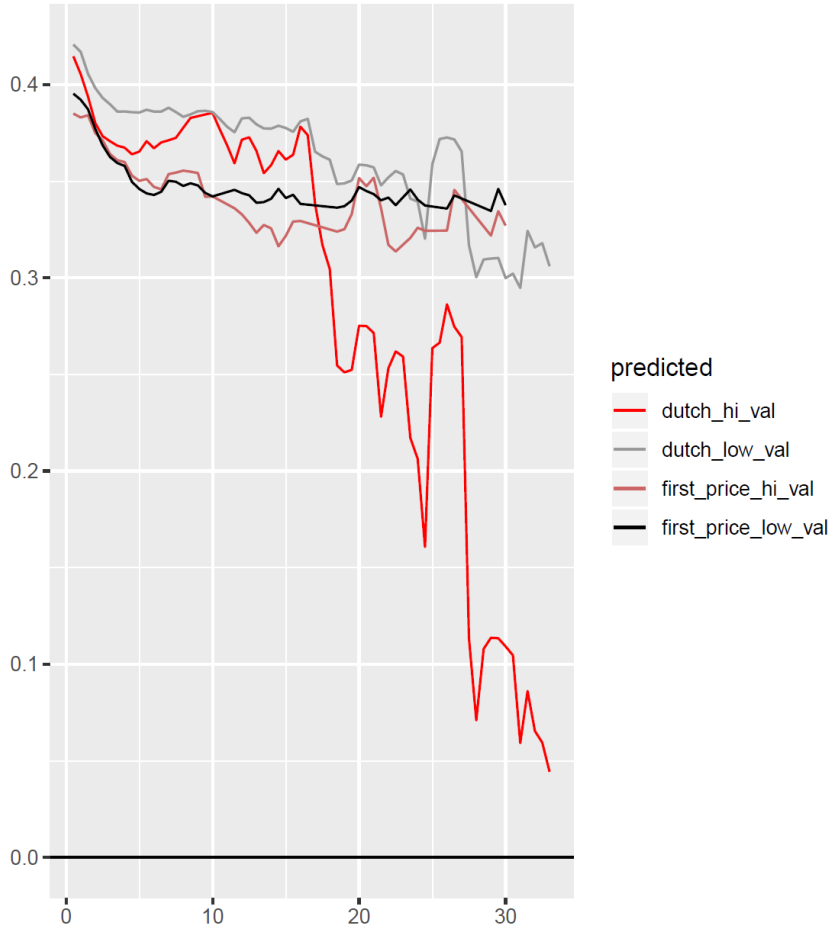


Figure 15: Emotional Response: Neutrality During

Emotional Responses

Coefficients

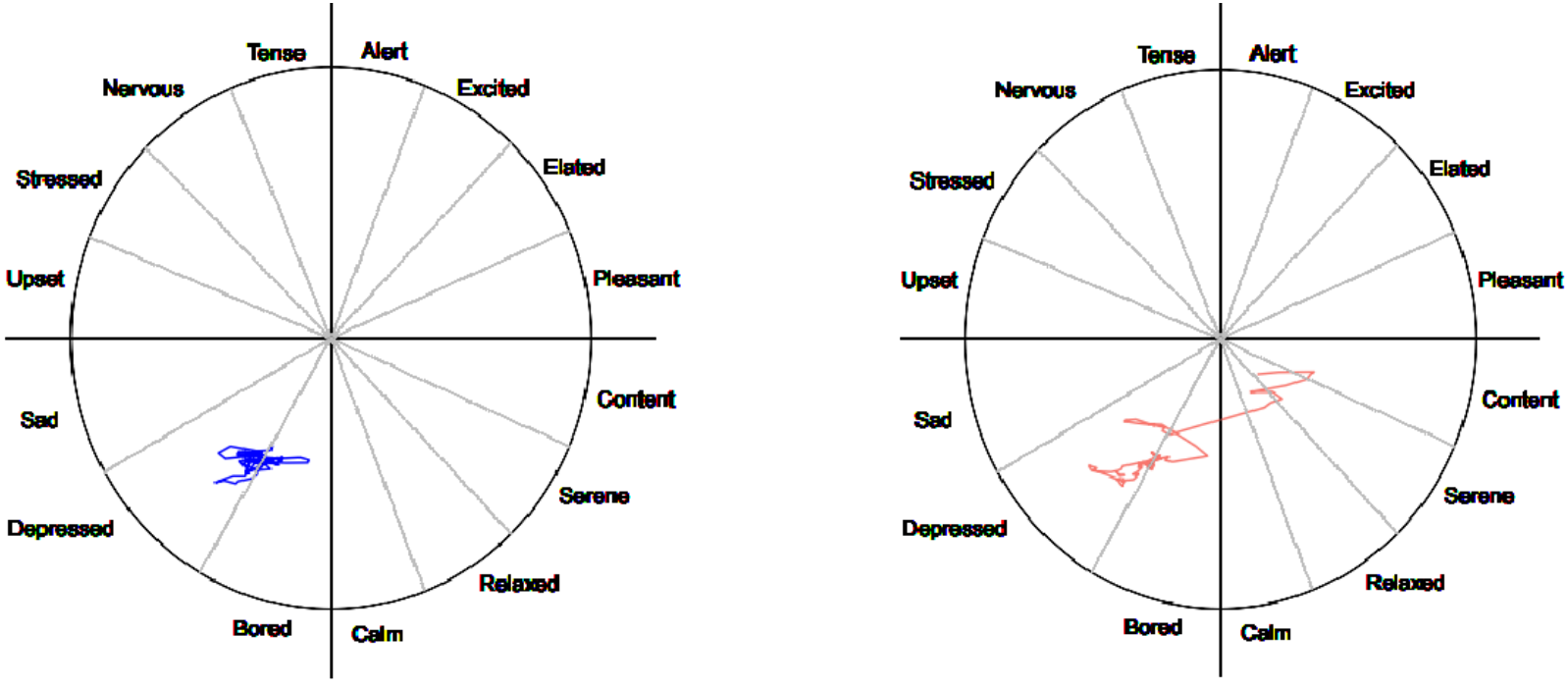
	Anger	Contempt	Disgusted	Happy	Neutral	Sad	Scared	Surprised	Arousal	Valence
Dutch	0.00150	0.00345	-0.02540	-0.00713	0.03758	-0.00620	-0.00261	-0.01143	0.01856	0.01585
ITMLoser	-0.01159	0.00208	-0.01331	0.00096	0.01522	0.01272	-0.00301	-0.00119	0.01353	-0.00171
ITMLoser × Dutch	0.03129	-0.00023	0.01715	0.00624	-0.03062	-0.00789	0.00126	-0.01906	-0.03370	0.01012
ITMWinner	-0.00003	0.00454	-0.01711	-0.00380	0.02247	-0.00128	-0.00107	-0.00834	0.01162	0.00335
ITMWinner × Dutch	0.01249	-0.00507	0.00114	0.00310	-0.00848	0.00073	0.00105	0.00206	-0.01269	0.00642

t-statistics

	Anger	Contempt	Disgusted	Happy	Neutral	Sad	Scared	Surprised	Arousal	Valence
Dutch	4.96	21.72	-128.65	-48.34	131.61	-34.28	-32.75	-40.95	47.45	127.86
ITMLoser	-22.66	7.71	-39.84	3.84	31.50	41.57	-22.34	-2.52	20.44	-8.16
ITMLoser × Dutch	36.94	-0.52	31.01	15.11	-38.28	-15.58	5.63	-24.39	-30.76	29.15
ITMWinner	-0.08	24.42	-74.15	-22.07	67.32	-6.03	-11.46	-25.58	25.41	23.11
ITMWinner × Dutch	22.15	-17.10	3.10	11.28	-15.93	2.17	7.09	3.96	-17.39	27.78

Figure 16: Emotional Response: After Auctions

Emotional Responses



First Price Auction

Dutch Auction

Figure 17: Circumplex model of Emotions

BDJ Conclusions

1. Subjects do not like being in auction experiments.
2. Dutch auctions make people angrier, especially as their values are high and/or the auction runs.
3. In 1st price auctions higher values lead to more anger as well.
4. High value bidders become much happier as the Dutch auction runs. Low value bidders do as well, but to a lesser degree.
5. After the auction, in-the-money losers are sad in both formats but those in the Dutch are angrier and less surprised.
   In-the-money winners are less disgusted and those in the Dutch are angrier.

Overall Conclusions

1. Reproducibility. . . .
2. Always an interesting way to examine your data. . .
3. Questions/Discussion???