Online Display Advertising: Practice ➔ Theory ➔ Practice

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based on joint work with Jon Levin
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Is Every Ad Impression Unique?

- Google, Yahoo, and many ad networks conduct separate auctions for each ad opportunity.
  - But for many other goods, minimizing distinctions has been critical for creating thick, successful markets.

- Background
  - Arrow-Debreu distinguishes goods by physical attributes, place and date:
    - “Number 5 red winter wheat in Chicago.”
  - Taken to extremes, this means every item is a unique good.
  - Organized markets exploit standards and conflation
Lessons from Other Markets?

- What principles govern standards and conflation?
  - From *The Book of Wheat* by Peter Dondlinger, 1908:
    “...for each transaction they would analyze a sample to determine its value. The measurement costs were very high.”
  - Online search advertising supposedly prices each impression separately, but...
    - Price per click is independent of position (Overture ➔ Google)
    - Traditionally, no search targeting based on demographics, etc
    - Exact match, phrase match, broad match
Uncut Diamonds & Radio Spectrum

- BHP Billiton conducts a uniform price auction for uncut diamonds, selling “slices” from several categories.
  - Slices assigned randomly to buyers.
  - Seller determines relative quality of slices and adjusts the auction price accordingly.
- UK spectrum auctions, 2.6GHz bands
  - Initially, some number of MHz are assigned to each bidder in ways that satisfy certain constraints.
  - If there are multiple feasible assignments, an extra bidding phase decides among them.
Some recent academic papers have emphasized move from first-price to generalized second-price rules
  - Analyses are conducted as if …
    - pricing were on a per-impression basis
    - advertisers value clicks directly

But the move from price-per-impression to price-per-click may be even more important.
  - CPC complements simplification/conflation
Simplification and Equilibrium

- Auctioning ad positions on search page (Milgrom, 2009)
- Option #1 (based loosely on Overture)
  - Each bidder bids a price for showing in a particular one among $N$ ad positions
  - Second price auction
  - Full information pure equilibrium + small positive bid cost $\Rightarrow$ equilibrium revenue is zero
- Option #2 (based loosely on Google)
  - Generalized second price auction with ONE bid per bidder
  - Full information pure $\Rightarrow$ positive
FaceBook’s “Success Story”

- Producer with excess inventory of Chicago Cubs pants, usually sold at the ballpark.
- Producer targeted advertising to Chicago residents who were part of a Cubs interest group.
- Success! Pants sold quickly.
- *Success??* Facebook earned almost zero in ad revenues.
A Three-Way Trade-off

- **Matching**
  - Match ads to opportunities
    - Use appropriate targeting

- **Safety**
  - Reduce measurement costs & adverse selection
    - McDonald’s “Happy Contract” to place ads when the sun is shining and the Dow is up.
    - Use appropriate conflation, classification, adjustments
  - (Protect publishers and brands from devaluation)

- **Market thickness**
  - Ensure competition for ad opportunities
    - Use appropriate bundling
Two Easy Theory Models

- Measurement/Adverse selection and conflation
  - Each ad opportunity has two value-determining characteristics: consumer interest and consumer value
  - Observed: imperfect indicator of interests + “demographics”
  - Theory question: should demographic targeting be allowed?

- Thin markets and bundling
  - Two categories: Cubs fans and baseball fans.
  - Should targeting Cubs fans be allowed?
  - What is the optimal pricing-and-targeting policy with unknown demand?
End