Presentation by Bar Light

ONLINE MARKETPLACES: Part I: Introduction

Bar Light

- Born in Israel. BA and MSc in Math/Econ at Tel Aviv University.
- PhD at Stanford University in Operations.
- Research focus on online marketplaces.
- After PhD, spent two years at Microsoft Research New York City.
- Focus on designing auctions in digital advertising and other topics in marketplaces.

Rise of Online Marketplaces

Market Cap December 30 2025 (US based companies)

COMPANY	MARKET CAP (IN BILLION $)	MAIN BUSINESS
Alphabet (Google)	3790 (top 6 S&P 500)	Digital Advertising Marketplace
Amazon	2480 (top 6 S&P 500)	E-Commerce Marketplace
Meta (Facebook)	1670 (top 6 S&P 500)	Digital Advertising Marketplace
Uber	169	Transportation Marketplace
Airbnb	82	Hospitality Marketplace
Upwork	2	Freelance Marketplace

Apple (top 6 S&P 500) 24B 2024 revenue from App Store + growing revenues from Apply Pay, Apple Music, etc.
Microsoft (top 6 S&P 500) 13B 2024 revenue from Bing Ads + growing revenues from LinkedIn, Azure Marketplace.

Top 6 US Companies in S&P 500 (2005)

20 years ago, top 6 companies included energy sector, financial sector, consumer staples, etc.

RANK	COMPANY
1	General Electric
2	Exxon Mobil
3	Microsoft
4	Citigroup
5	Procter & Gamble
6	Wal-Mart

Unicorn “Niche” Marketplaces

COMPANY	MAIN BUSINESS
Zillow / PropertyGuru	Real Estate Marketplace
Rover	Pet Service Marketplace
StockX	Sneakers Marketplace
Care.com	Childcare Marketplace
Carousell	Second-Hand Goods Marketplace
Whatnot	Collectibles Marketplace (with live streaming twist)
OpenSea	NFT (Non-Fungible Tokens) Marketplace
AAVE (DeFi)?	Financial Marketplace on the Blockchain

Class Grades Breakdown

Final Assessment Components

Final, in class, multiple choice questions, closed books, which encompasses all course material. 30% of the final grade.

Final project presentation (more details will be provided later). 30% of the final grade.

Two assignments, with each contributing 15% to the final grade.

Participation in class discussions additional 10%.

Course Topics (subject to change)

Class structure: 70 min lecture, 15 min break, 65 min lecture (overall 150 min).

Number	TOPIC	DESCRIPTION
1	Introduction to Online Marketplaces	Overview
2	Marketplace design	Various of examples of marketplace design with a focus on ride-sharing.
3	A/B testing in online marketplaces	Focus on specific problems in online marketplaces like network effects
4	Dynamic experimentation and online learning (Multi Armed Bandit algorithms)	Techniques and examples of use in online marketplaces (pricing, recommendations, etc).
5	Mechanism Design and Reputation Systems	Basics of mechanism design, reputation, adverse selection
6	Digital Advertising	Focus on digital advertising in online marketplaces such as Google ads
7	Ad-auctions	Allocation of ads based on ad-auctions and automated bidding systems.

Traditional Marketplaces

Marketplaces are a very old phenomena (e.g., Market of Trajan in the ancient Roman Empire)

Key features:

Location: Physical location, limited by geography, face-to-face interactions.

Market Design: Limited capability for designing markets: they mostly self-organize.

Decisions: Decision-making largely based on personal judgment, experience, and negotiation.

Big malls turn into Amazon fulfillment centers

The Digital Revolution

Moving beyond physical limitations.

The rise of e-commerce platforms: eBay, Amazon, etc -- connecting sellers and buyers worldwide.

This lecture:

- Key characteristics of online marketplaces.
- Major operational consequences of the rise of online marketplaces.

Modern Marketplaces

The rise of online marketplaces caused major consequences.

Key characteristics?

Key Features of Online Marketplaces

Scalability

Online marketplaces can support a growing number of users and transactions.

Consumers have access to a broad range of products and services.

Algorithmic Decisions

Online marketplaces use experimentation and data-driven algorithms / AI to make decisions.

Location Independence

Users can access markets from anywhere, enabling global trade and commerce.

Market Design

Online marketplaces can use the massive data collected on users to improve welfare and revenues through better marketplace design.

Summary of Key Changes

CHARACTERISTIC	TRADITIONAL MARKETPLACES	ONLINE MARKETPLACES
Physical Location	Yes	No
Market Design	Limited	Extensive control
Decisions	Humans	Combination of humans and automation.
Scalability	Limited	(Almost) Unlimited

Value of Digital Platforms: Transaction Costs

Reducing Transaction Costs

Digital platforms lower transaction costs, thereby improving efficiency and user experience.

Which transaction costs digital platforms reduce?

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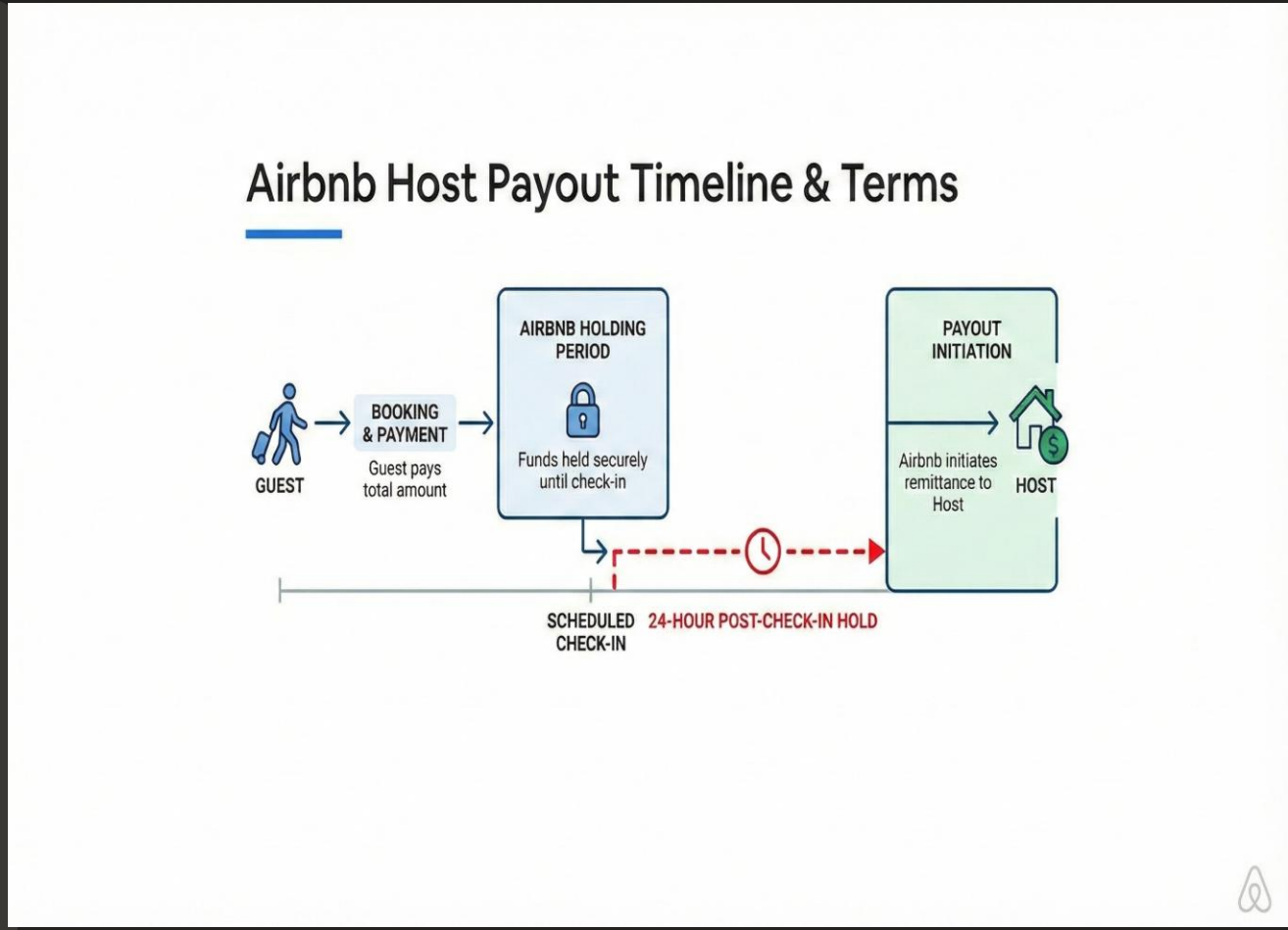
Which transaction costs digital platforms reduce?

Transaction Costs	Example
Search Costs	Almost every marketplace
Monitoring Cost	Amazon tracks shipping status, ensures order fulfillment, etc.
Enforcement Cost	Airbnb payment holding.
Contracting Cost	Upwork predefined contracts
Bargaining Cost	Automated or posted prices.

Enforcement Cost: Airbnb Payments

""Part of what has helped build trust … [is] our safe and secure payments platform … **adding security for guests, as hosts are not paid until 24 hours after guests arrive" Airbnb Blog (2016).**

Compare to Craiglist



Search Costs: Paw Patrol Toy

“Buy Now” in one click

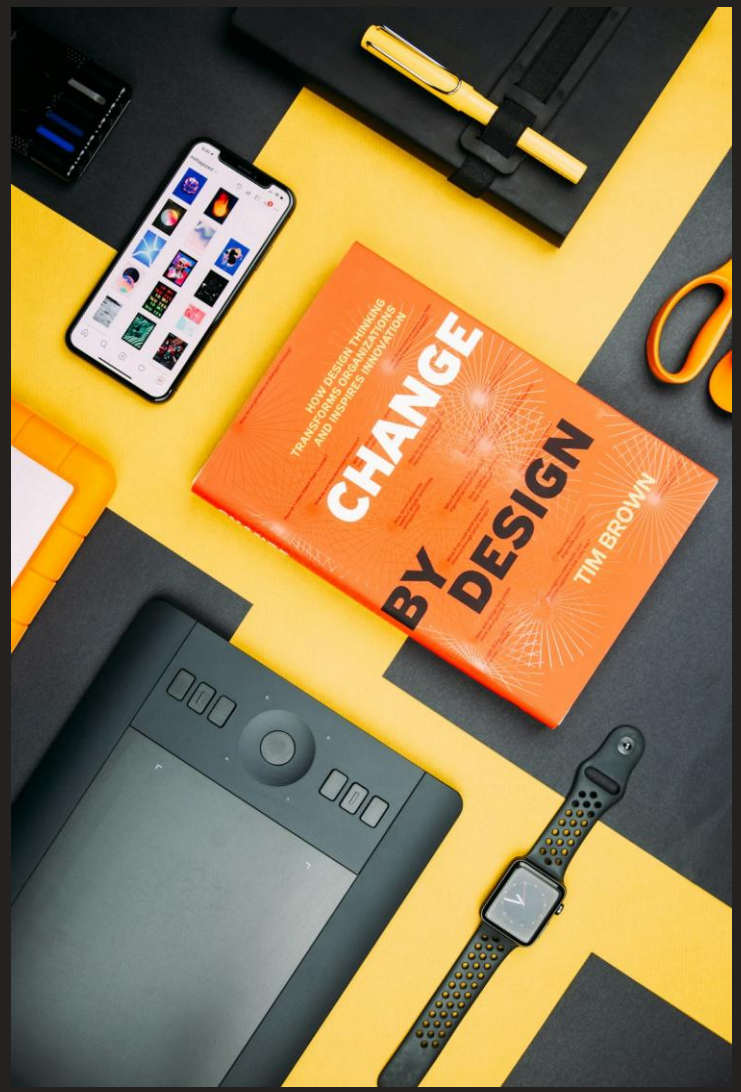
Delivery from Germany to Singapore (1 week)

Transparent Price

Delivery Date

Brand

Ratings



Major consequences of the rise of online marketplaces: 1. Market Design

Platforms as “market designers”: dictating rules, policies, information sharing, pricing, matching, and mechanisms for transactions.

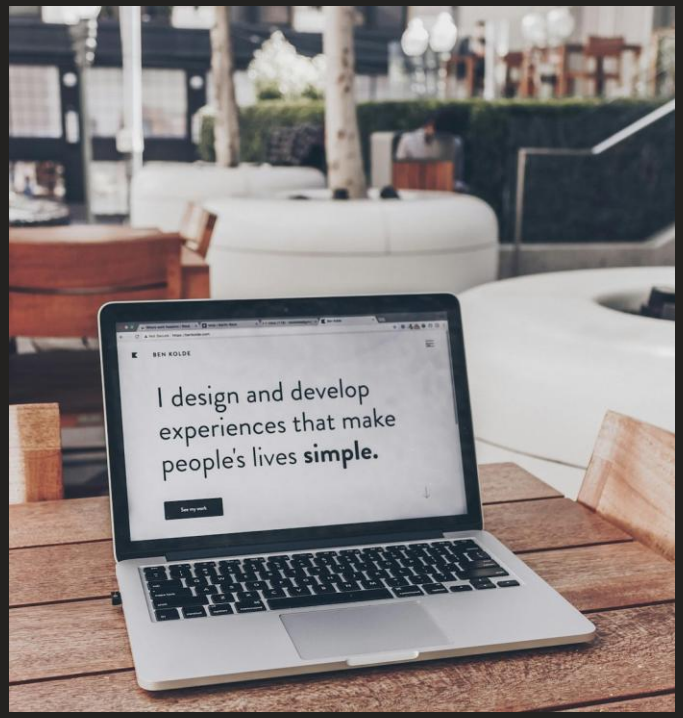
Platforms as Market Designers

Pricing Mechanisms

Platforms use pricing mechanisms to balance between supply and demand and optimize revenues.

Information Mechanisms

Platforms use information design to impact users' behaviour.



Dictating Marketplace Rules

Platforms determine policies and rules.

Matching Mechanisms

Platforms use sophisticated matching algorithms that connect the two sides of the market effectively.

Assortment/Search Mechanisms

Platforms use assortment optimization based on rankings and reviews.

Example: Assortment Algorithms

Role in Inventory Management

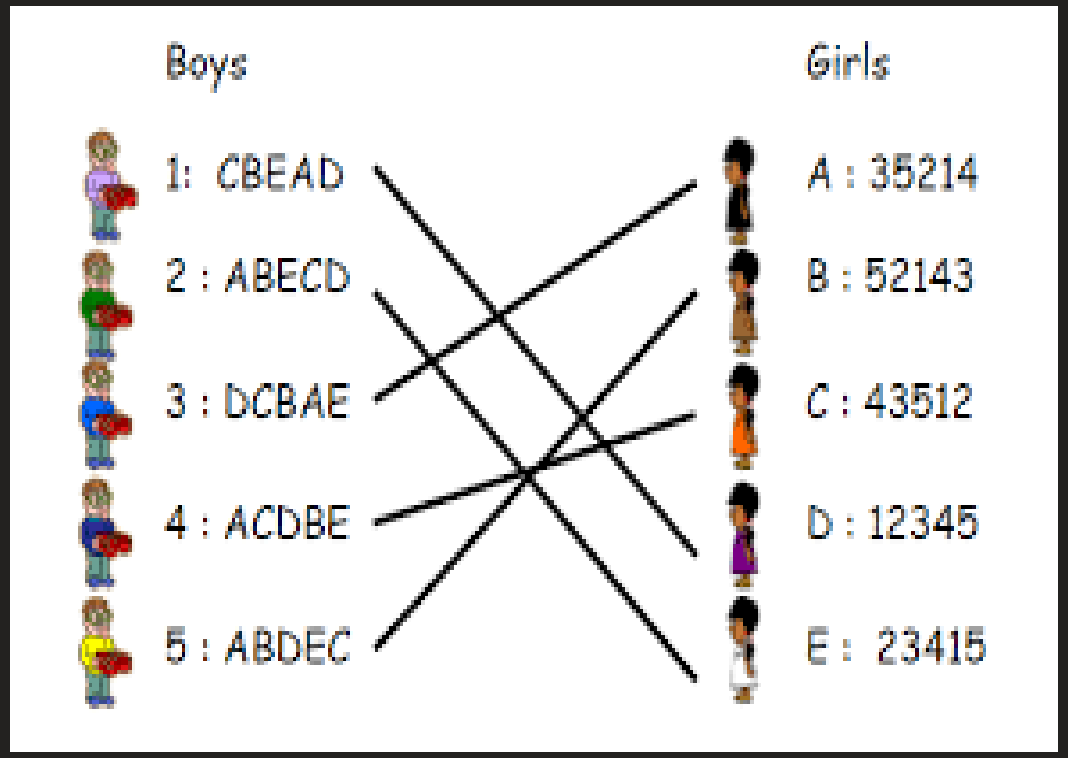
Assortment algorithms help platforms choose the right products to display based on user preferences and market trends.

Assortment algorithms can also help in inventory management by shifting demand from low inventory products to high inventory products.

Benefits for Users

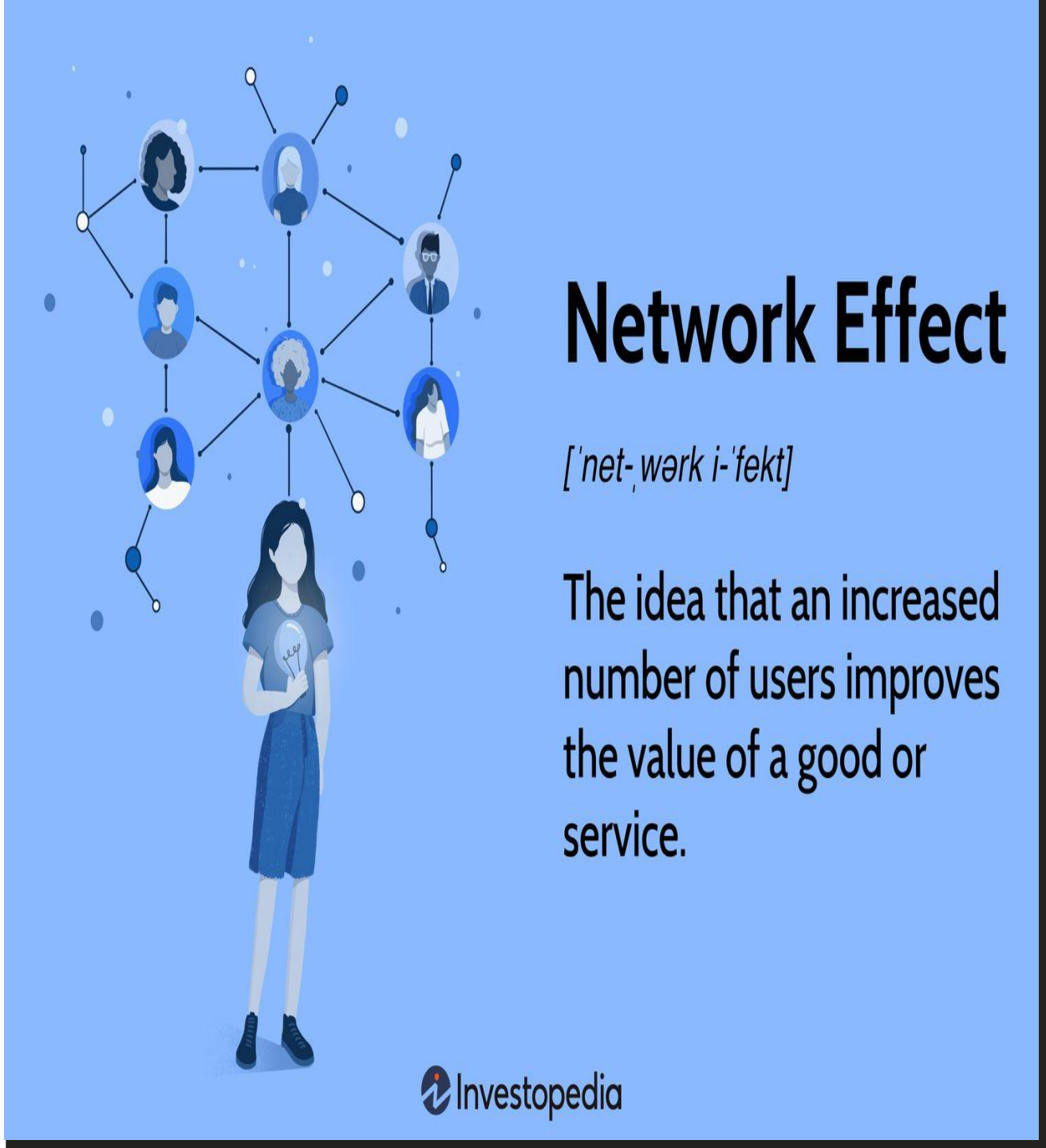
They ensure users see relevant products, enhancing their shopping experience and increasing sales opportunities.

Example: Matching Algorithms



Ride-sharing exemplifies matching algorithms, which also apply to sectors like job placement and online dating.

These algorithms improve matches, balancing supply and demand, maximizing resource utilization, and driving revenue growth, making them invaluable for market efficiency.



Network Effects

The value of many platforms increase as more users join, leading to better experiences and increased engagement.

Why?

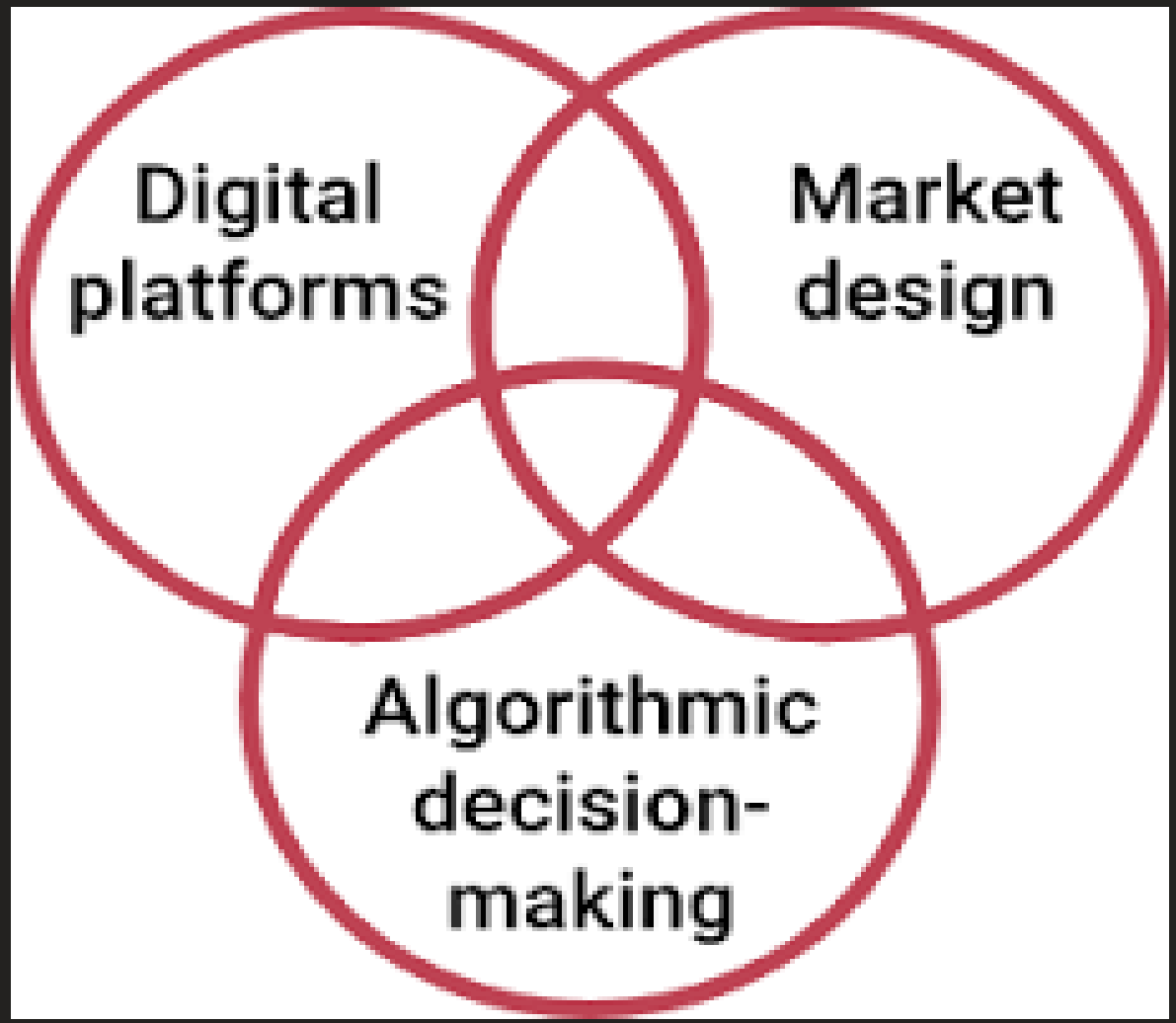
E-commerce:

Ridesharing:

Chicken and Egg problem

Value Generation from Market Design

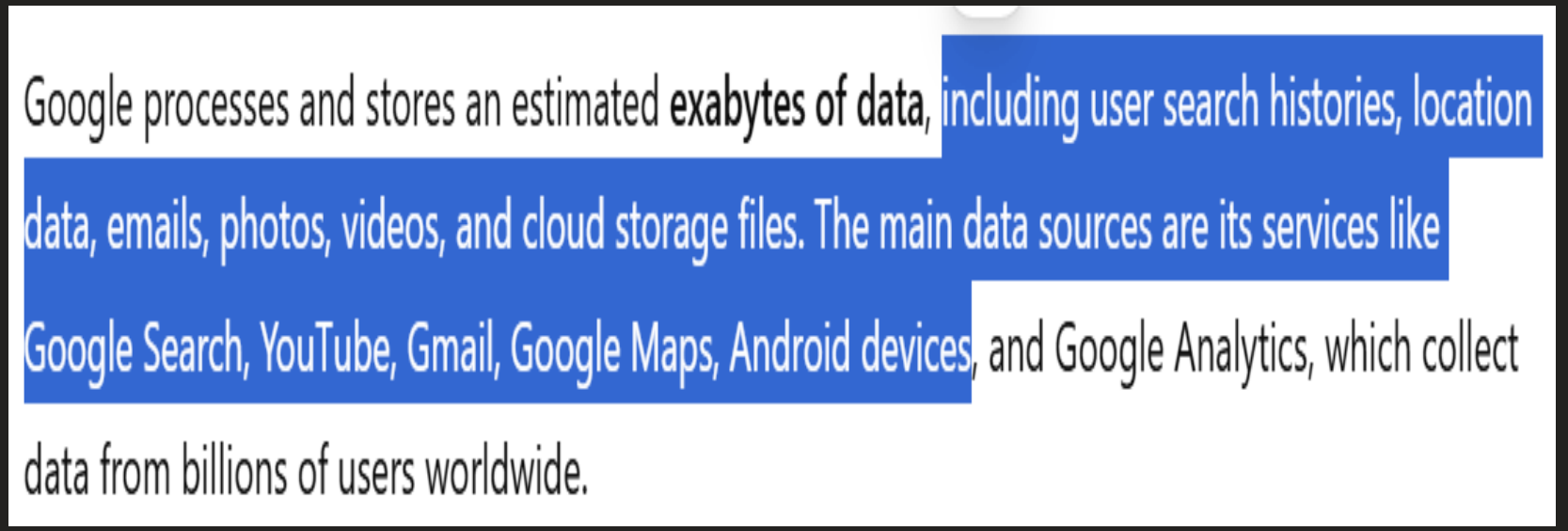
Key Message:
Well-designed platforms generate significant value by enhancing efficiency and providing better services.



Major consequences of the rise of online marketplaces:

2. Harnessing Massive Data

Online marketplaces encounter vast volumes of data daily, including transaction histories, user ratings, and search queries.



Power of Data

Tracking Trends

Insights gained from data enable platforms to predict trends and adapt offerings accordingly.

Predicting future supply and demand.

Predicting willingness to pay.

Understanding Behavior

Data analysis helps platforms tailor experiences to individual preferences and needs.

Data is used for improved decision making

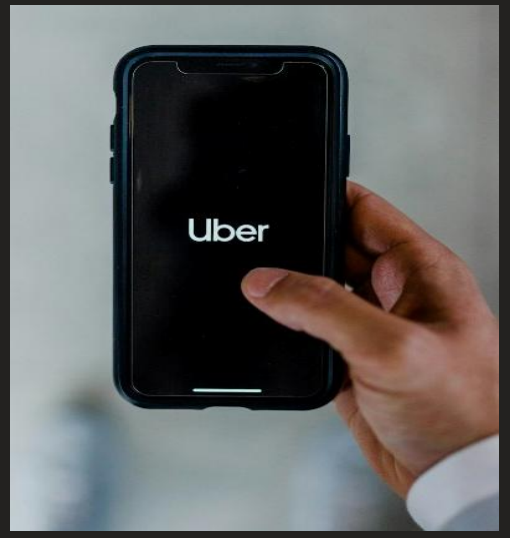
Real-time Processing

Speed and Relevance

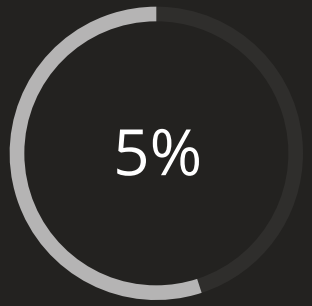
Real-time data processing is crucial for online platforms, allowing them to adapt swiftly to shifts in user behavior or emerging market conditions, unachievable in conventional marketplaces.

Data Utilization Examples

USE CASE	DESCRIPTION	IMPACT
Personalized Recommendations	Tailoring product suggestions based on user history	Increased sales and customer satisfaction
Demand Prediction	Using huge data sets and advanced machine learning to predict demand	Improved decision making
Seller Performance	Colleting extensive data on seller performance (reviews, return rate, shipping times, order accuracy, etc)	Sharing information to improve efficiency



Finding Correct Market Metrics

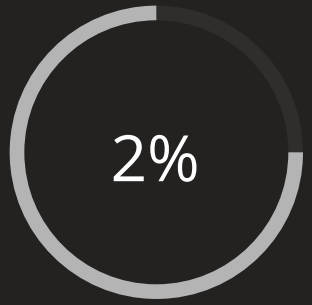


Click-Through Rate (CTR)

Number of clicks / Number of impressions. Crucial for ad placements by platforms such as Google Ads.

Retention Rate

Users at End of Period / Users at Start of Period



Match Rate

Successful Matches / Total Requests (e.g., dating apps).

Correct metrics are crucial for evaluating and optimizing decisions.

North Star Metric

Finding The North Star Metric

The North Star Metric (NSM) is the one key metric that a platform identifies as the most critical to optimize, reflecting its core value to users and aligning all teams toward a single objective.

E.g., for Airbnb, it can be represented by the number of nights booked.

NSM needs to be simple and measurable.

NSM helps guide decision-making and focus.

Why revenue may not be a good NSM?

Data-Driven Decisions

Major Consequences:

3. Algorithmic Decision-Making

Shift from human-driven decisions to algorithmic-driven decisions.

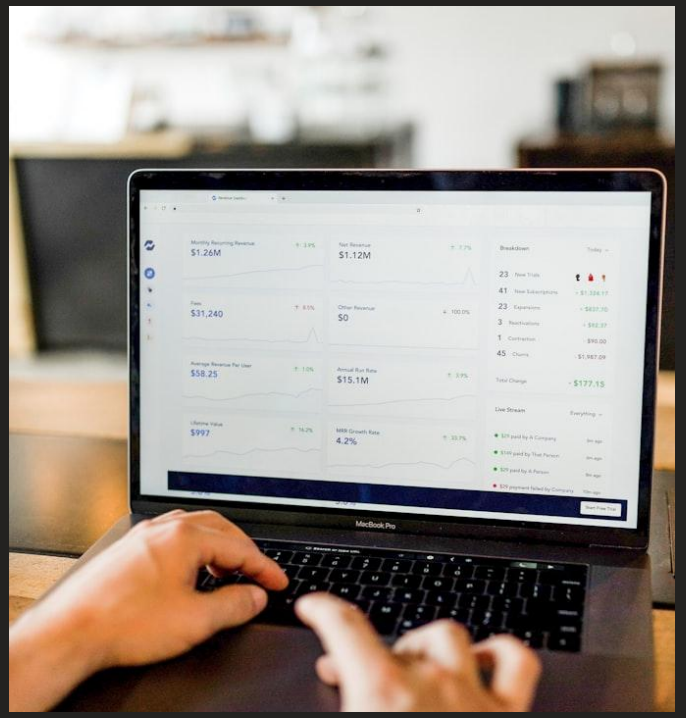
Data driven methods equip decision-makers with insights derived from historical and real-time data.

Optimization

Dynamic Pricing Algorithms

Platforms use automated pricing mechanisms to balance demand and supply and optimize revenue.

Multi Armed Bandits learning algorithms are a key tool..



Digital Advertising ad-auctions

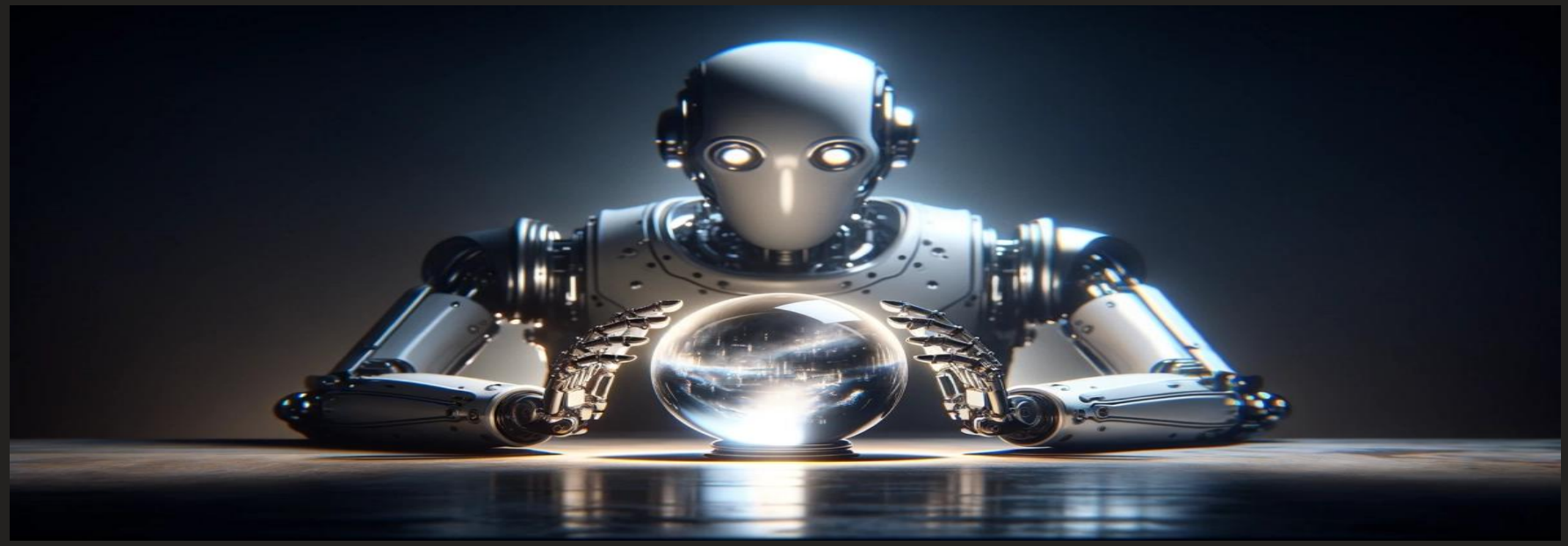
In digital advertising, platforms design automated auction mechanisms and automated bidding for advertisers.

Mechanism design is a key tool..

Matching Algorithms

Matching algorithms are extensively used in labor platforms and ride-sharing services.

Impact of AI



Use of machine learning and AI: Predicting demand and supply, click-through rate estimation in ad-auctions, fraud analysis, review summarization, etc.

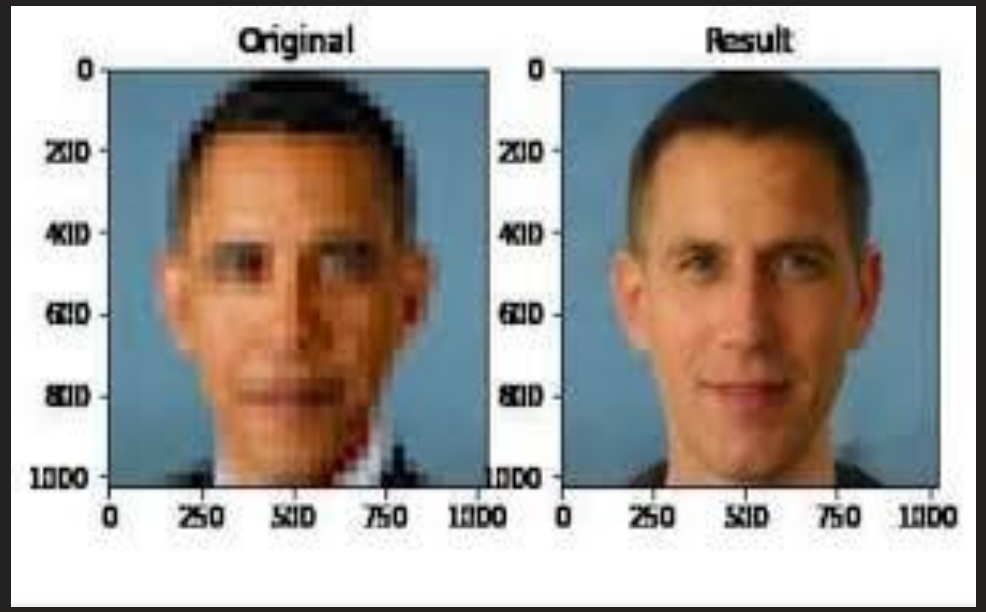
AI is already heavily used in most advanced marketplaces. Recent applications include “agentic AI” (e.g., eBay, Amazon). With the November 2025 update, Amazon Rufus uses agentic AI to buy products automatically when the price drops below a target you set. Automated actions as opposed to just explanations (traditional LLMs).

How will AI impact decision making and data science?

Automation & Biases

Risks of Algorithmic Bias

Despite the advantages of automation, algorithmic decisions can inadvertently perpetuate biases found within training data. Companies must address fairness issues to ensure ethical use of AI.



Efficiency Gains Achieved

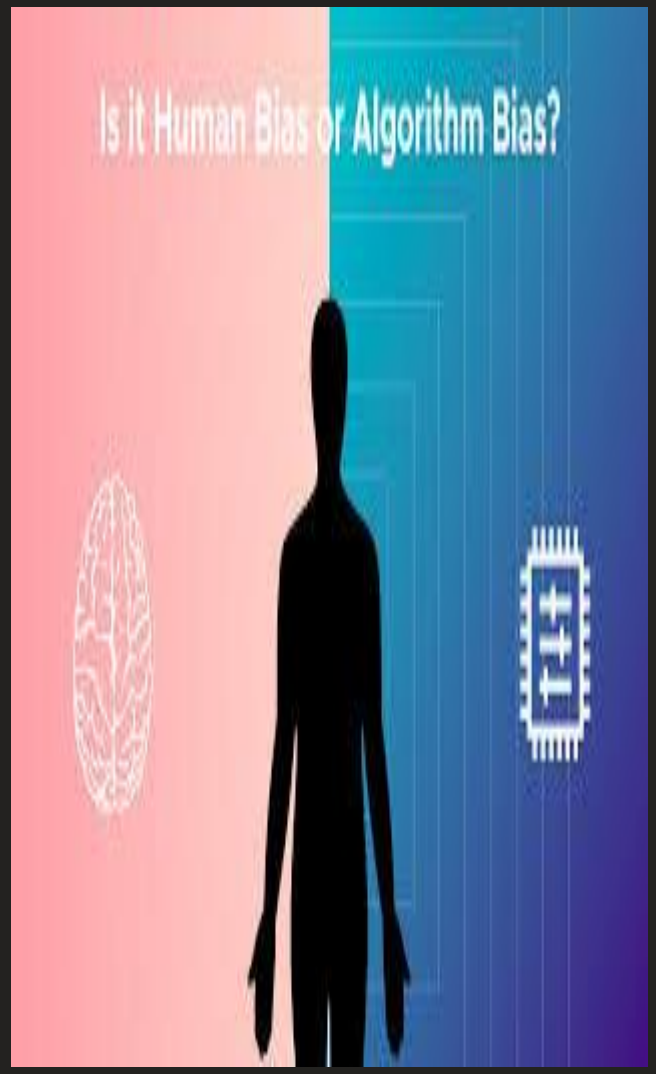
Automation optimizes decision-making processes, significantly increasing operational efficiency. Platforms can accomplish tasks faster, with a higher accuracy and reduced human error.

Automation & Biases

Other Biases

Gender Bias

Recommendations can reinforce stereotypes by pushing gender-specific products, limiting exposure to diverse interests.



Group Segmentation Bias

Users may be categorized incorrectly based on past behavior, causing them to miss relevant options aligned with their current preferences.

Price Discrimination

Algorithms may set different prices based on user profile or location, often favoring those in areas with less competition.

Geographic Bias

Algorithms often favor users, sellers, or products from certain regions based on data representation.

Discussion Questions

Data Sharing Concerns

Why are users often willing to share their data for free with online platforms?

Future of Online Marketplaces

How do you think emerging technologies like AI and blockchain will shape the future of online marketplaces?
Can you envision entirely new types of online marketplaces?

Next Lecture: Marketplace Design with a Focus on Ride-Sharing