ISOM 2700: Operations Management
Session 9. Best Practices in OM

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Two Paths of Best practice in OM

- What do customers want?

$$\text{Net Utility} = \text{Utility} - \text{Price}$$

- What does the firm want?

$$\text{Profit} = \text{Demand Rate} \times (\text{Price} - \text{Cost})$$

- There is a tension with Price
- So the best paths to business model innovation are
  - Increase consumers' net utility, so that the firm's demand rate increases
  - Lower the firm's cost

Learning Objectives

- Demand side business model innovations

- Supply side business model innovations

Best practice in OM

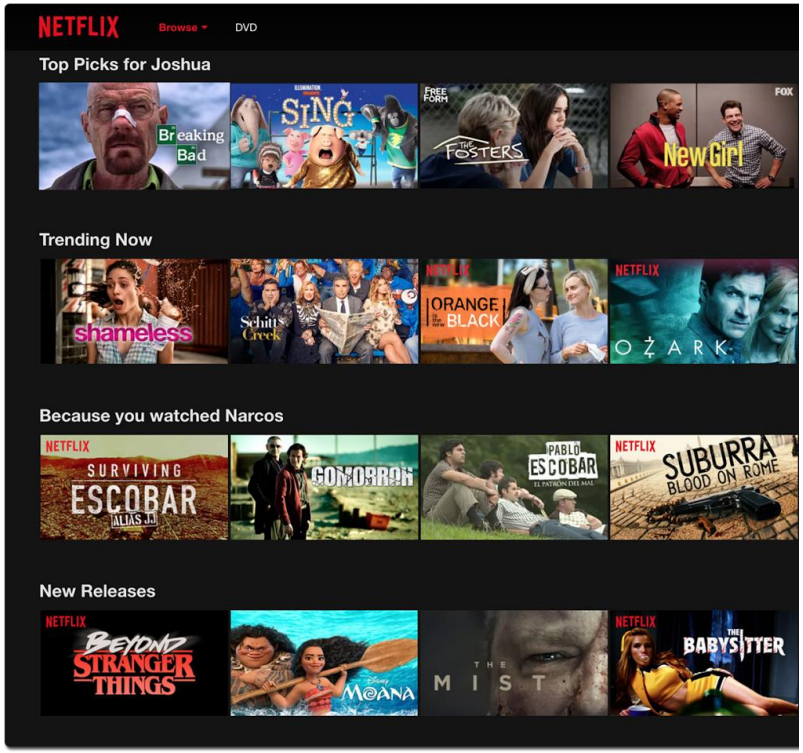
Demand side: **Four ways to increase a consumer's net utility**

- Lower your price
  - Not very creative and often not helpful for profit
- Increase preference fit
- Improve transactional efficiency
  - Reduce the effort a customer needs to exert to deal with you
  - Reduce the time a customer needs to commit to deal with you
- Enhance quality

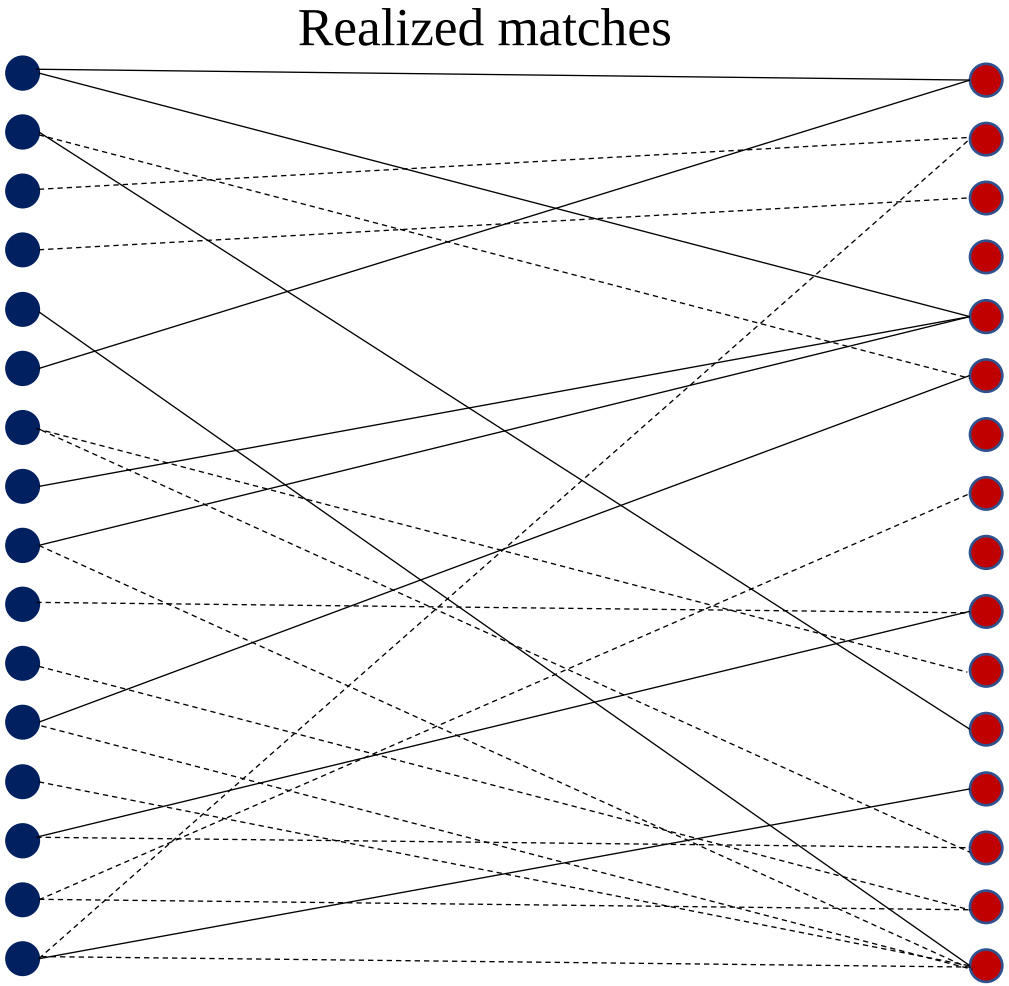
Example: Netflix

Year of foundation	1978	1997
Type of service	Video tape rental	Video streaming
Stores	5,000 stores in the US	60 fulfillment centers in the US
Price	Cheaper than buying the DVD	Cheaper than Blockbuster for frequent viewers
Selection of titles	Mostly popular videos due to the limit of shelf space	Unlimited
Transactional efficiency	Customers need to go to a rental store	Almost zero time from demand to fulfillment

Example: personalized recommendation



Undiscovered Contents



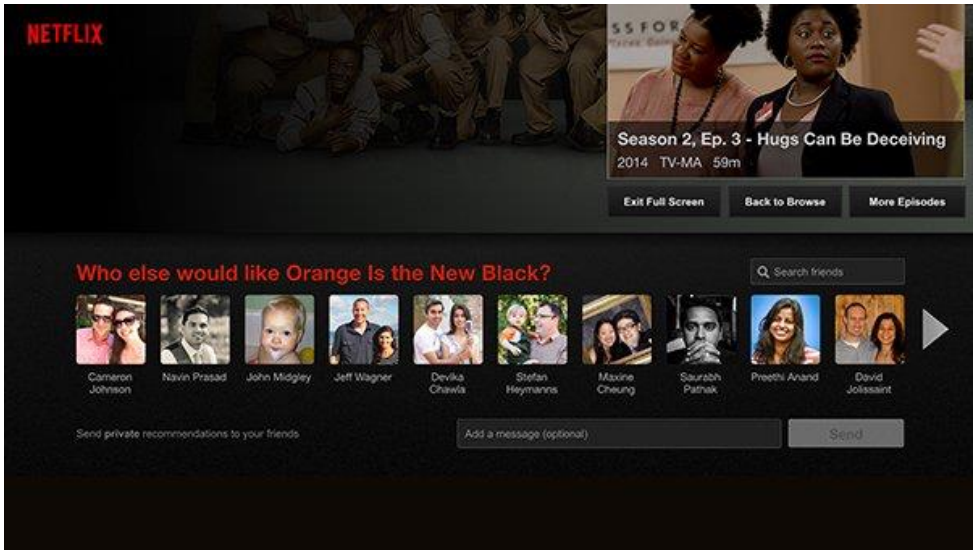
It's Fundamentally About Information

- Analytics is about leveraging information to identify and capture value

- How did Netflix use analytics to capture value?
  - Users give ratings (like or dislike) for movies they watched
  - If we can predict whether a user will like or dislike a particular movie based on historical ratings…
  - Netflix Prize: Open competition for the best algorithm to predict user ratings for films (held annually from 2006-2009)

Similarities Among Users

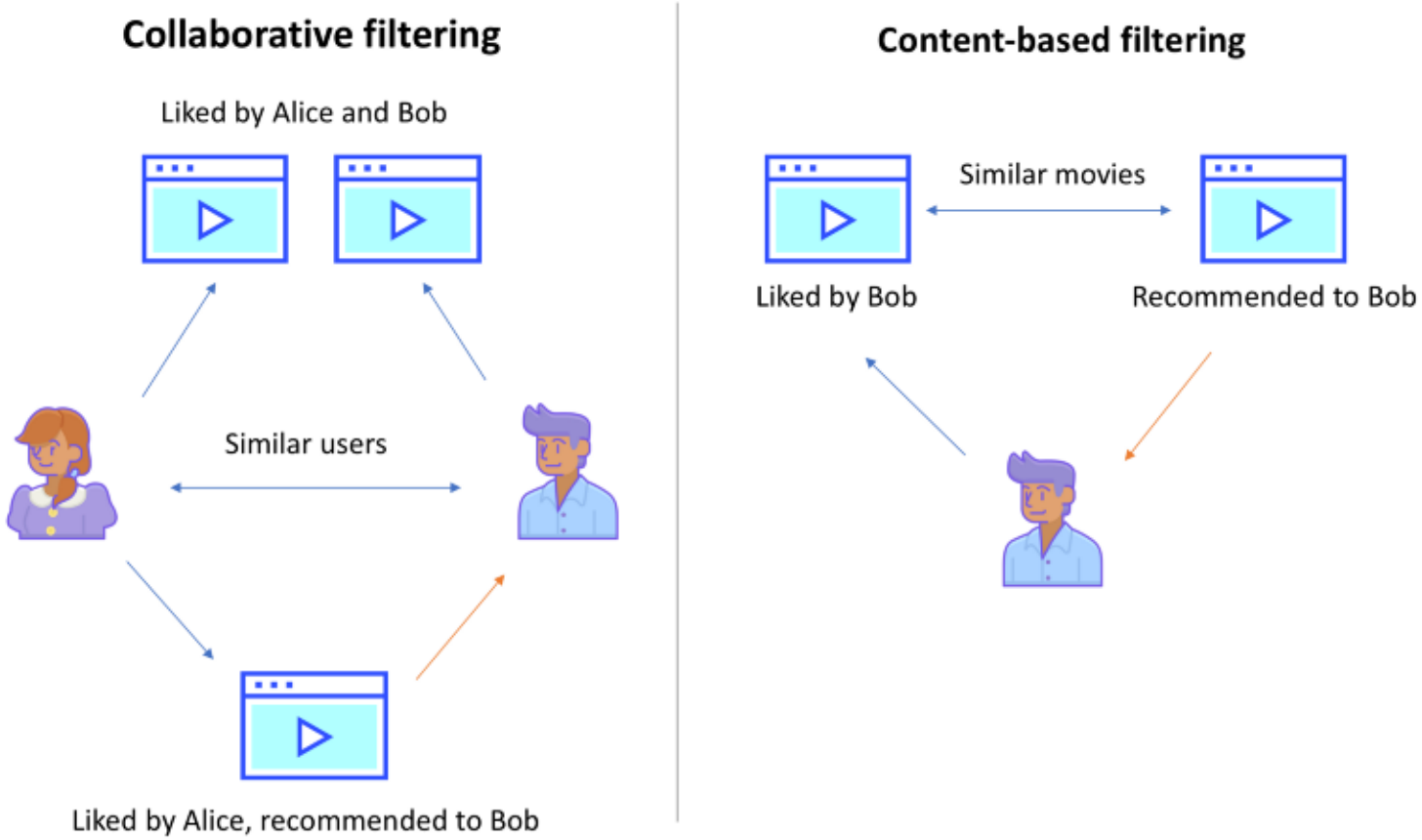
How does this work?



- Data: User ratings of content
- Find your "nearest neighbors"
- Prediction by looking at how your nearest neighbors rated content

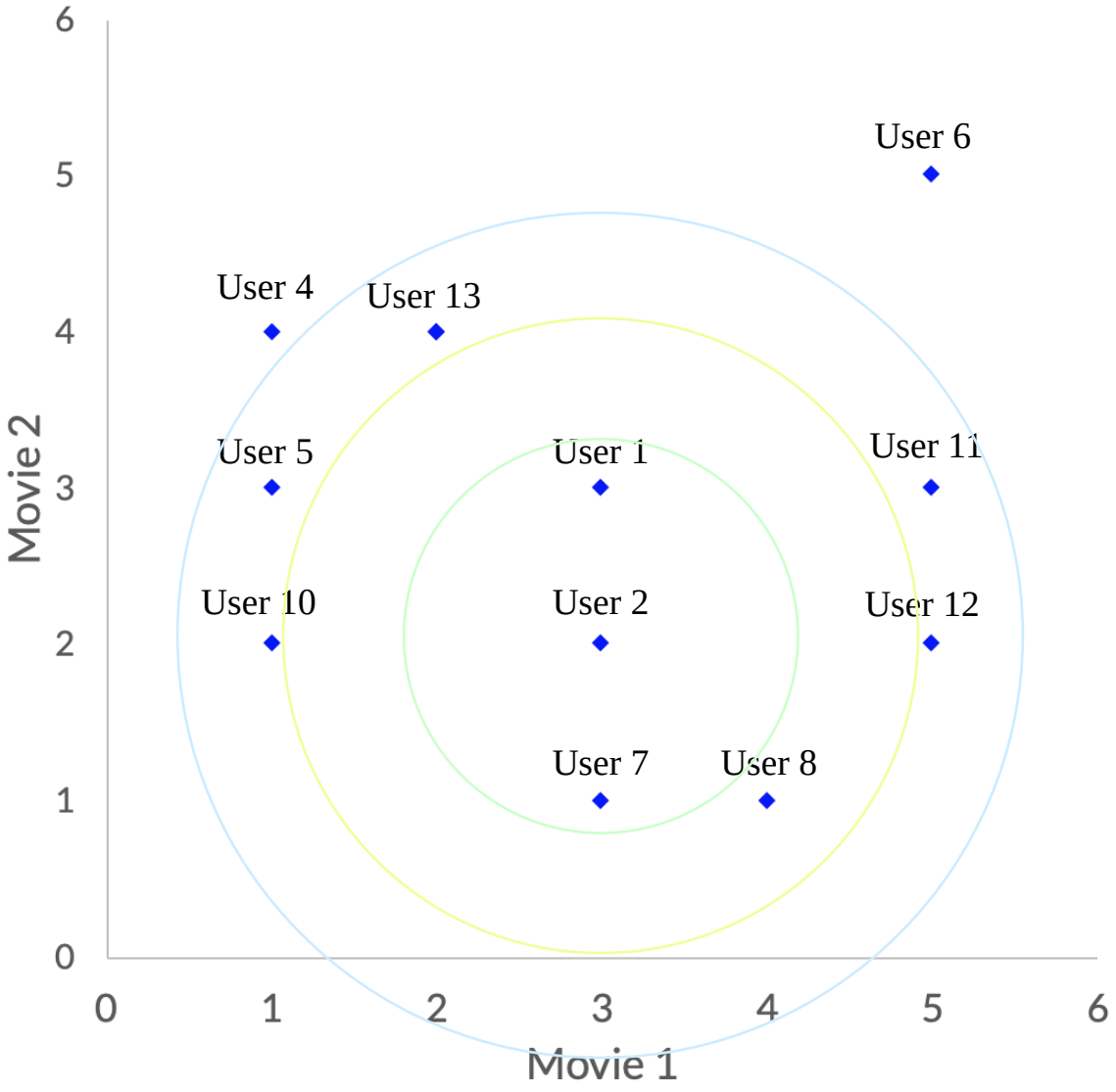
"Collaborative filtering"

Collaborative and content-based filtering



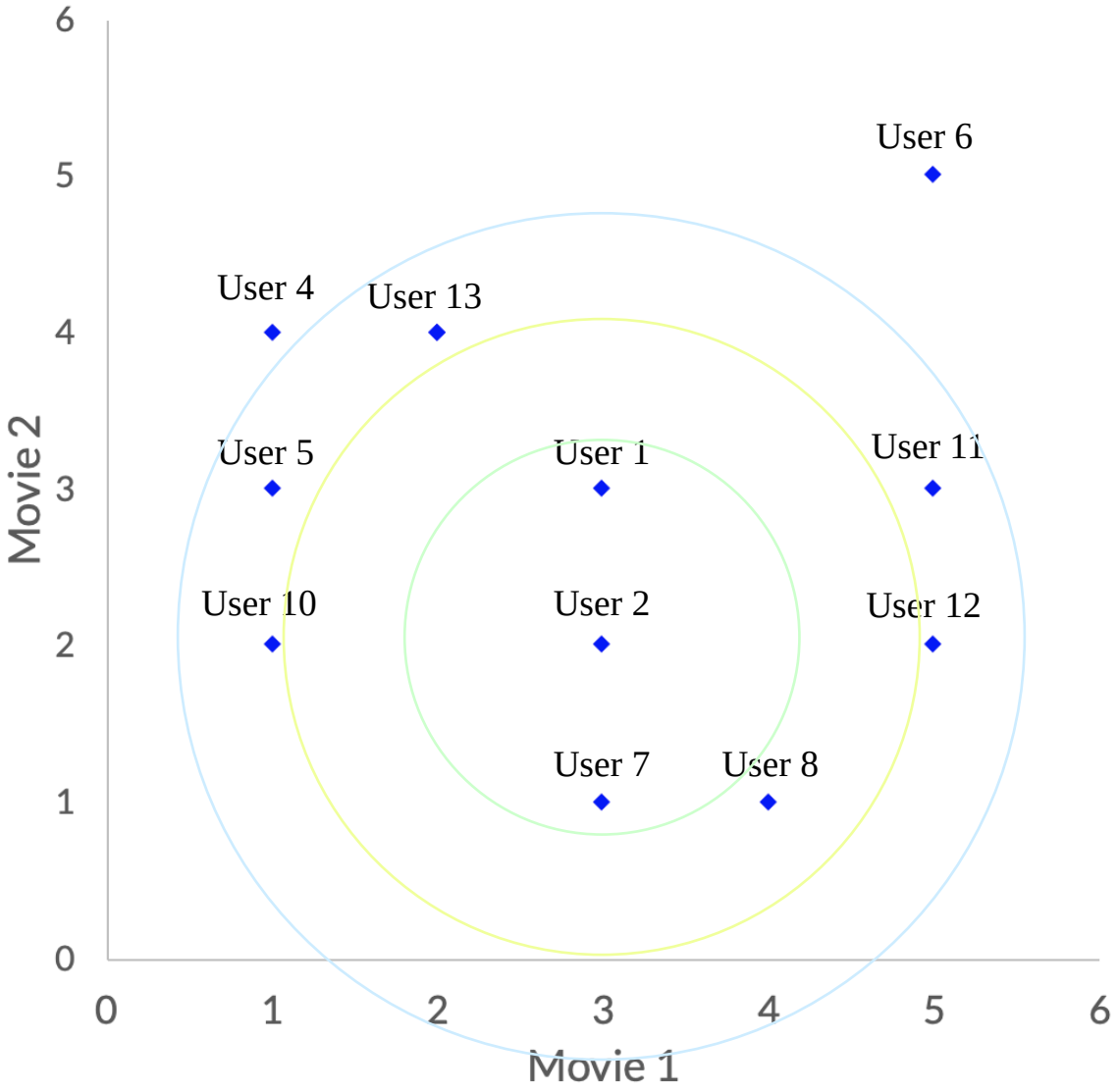
By Arthur Mello in Towards Data Science

User-based Movie Rating Prediction



- Goal: predict the rating of User 2 for Movie 3
- Who are the closest to User 2?
  - In order: Users 1 and 7, User 8, Users 10 and 12, …
- Movie 3 ratings
  - User 1 rates 3
  - User 7 rates 5
- For User 2, we can predict a rating of 4 (=(3+5)/2) based on two nearest neighbors

User-based Movie Rating Prediction

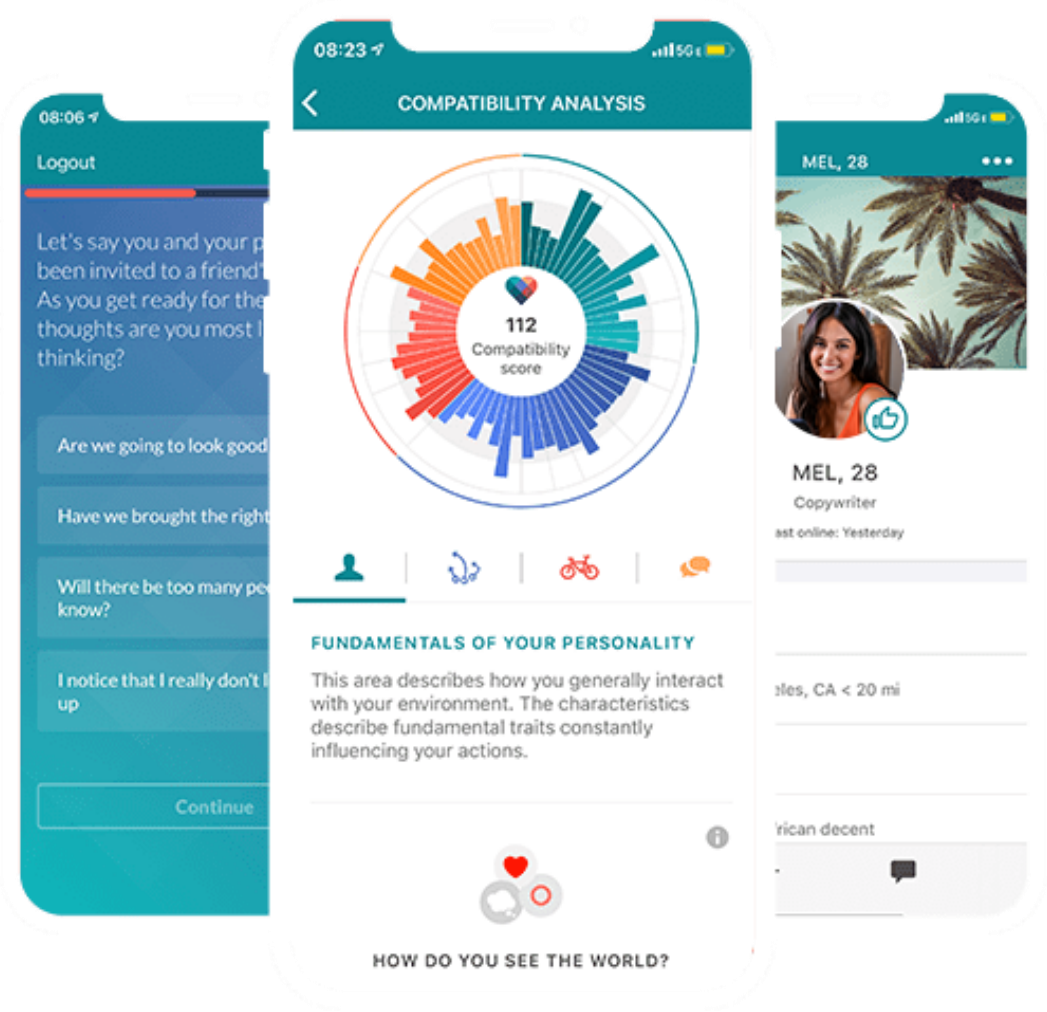


Who are the closest to User 2?

- In order: Users 1 and 7, User 8, Users 10 and 12, …
- Movie 3 ratings
  - User 1 rates 3
  - User 7 rates 5
  - User 8 rates 1
- For User 2, we can predict a rating of 3 (=(3+5+1)/3) based on three nearest neighbors

eHarmony


97
Matching
Points
PERSONALITY
HABITS
INTERESTS


08:06
Logout
Let's say you and your p
been invited to a friend
As you get ready for the
thoughts are you most
thinking?
Are we going to look good
Have we brought the right
Will there be too many pe
know?
I notice that I really don't
up
Continue
08:23
COMPATIBILITY ANALYSIS
112
Compatibility
score
FUNDAMENTALS OF YOUR PERSONALITY
This area describes how you generally interact with your environment. The characteristics describe fundamental traits constantly influencing your actions.
HOW DO YOU SEE THE WORLD?
MEL, 28
MEL, 28
Copywriter
ast online: Yesterday
les, CA < 20 mi
rican decent

About eHarmony

- Take a scientific approach to love and marriage and offer it to the masses through an online dating website focused on **long term relationships.**

- "Opposites attract, then they attack." (Dr. Neil Clark Warren)

- After years of counseling couples in failing marriages, he wanted to help people not only meet the people they would be **attracted** to, but also the people they are **compatible** with.

eHarmony's Approach

- Unlike other online dating websites, eHarmony does not have users browse others' profiles.
- Instead, eHarmony uses **analytics tools** to determine their users' best matches.
- Key question: **who should be introduced be to whom, and when?**
- System has to recommend people that
  - The user is compatible with (long term compatibility), and
  - The user is interested and who are also interested in the user

Predict Compatibility

Prospective eHarmony members must complete a questionnaire with over 436 different questions about their

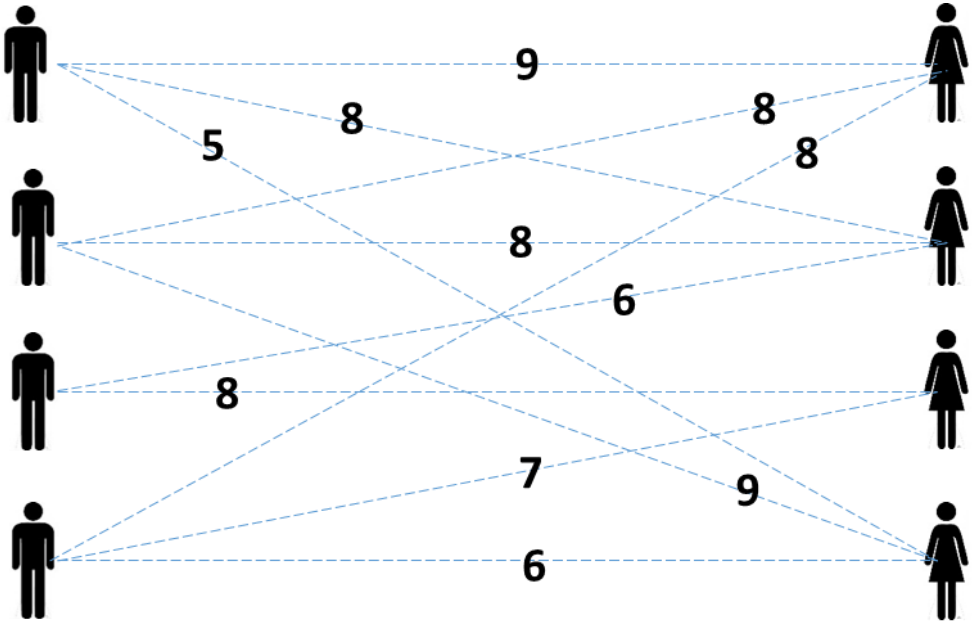
Character & Constitution:
Good Character
Dominance vs. Submissiveness
Curiosity
Industry
Vitality & Security
Intellect
Appearance
Sexual Passion
Artistic Passion
Adaptability

Emotional Makeup & Skills:
Emotional Health
Anger Management
Quality of Self Conception
Mood Management
Communication
Conflict Resolution
Kindness
Autonomy vs. Closeness

Family & Values:
Feelings about Children
Family Background
Education
Spirituality
Traditionalism
Values Orientation

Matching Optimization

- Who should be recommended to whom to maximize the likelihood of communications?



eHarmony's Success

- Founded in 2000.
- In 2005, 90 eHarmony members married every day.
- In 2009, 542 eHarmony members married every day.
- Nearly 4% of US marriages in 2012 are a result of eHarmony.
  - 14% of US online dating market.
- Divorce rate 3.86%.
- Cumulative revenue: Over $1 billion.

A Simplified Example

Each individual's scores for the 5 activities vary from -2 (strong dislike) to +2 (strong like) E.g.: match score between Laura and Ralph:

Score(Laura & Ralph) = 0*0+2*2+(-1)*2+0*2+2*(-1) = 0+4-2+0-2 = 0

Your online app shows 2 matches to each person on each day. Assume all of the individuals above would like to be matched to people of the opposite gender. What matches would you choose to maximize the aggregate match score?

Name	Gender	Sports	Theater	Religion	Outdoors	Eating Out
Laura	Female	0	2	-1	0	2
Jennifer	Female	0	2	-1	-1	1
Emma	Female	2	-1	2	0	2
Olivia	Female	0	2	0	1	1
Martha	Female	0	-1	-1	0	0
Isabella	Female	-2	1	1	1	-2
Mary	Female	-2	0	2	-1	2
Sophia	Female	2	0	-1	-2	-2
James	Male	0	-2	2	-1	0
Robert	Male	2	1	1	-1	0
Peter	Male	-1	2	1	0	0
Eric	Male	1	-2	-2	-2	2
Daniel	Male	2	0	1	1	1
Adam	Male	2	0	-2	-2	2
Carl	Male	1	2	-2	2	1
Ralph	Male	0	2	2	2	-1

Formulate the Problem

- Decision Variables:

  Which women to show to each man,

  Which men to show to each women

- Objective: Maximize the aggregate match score

- Data to be computed: match score between each woman and each man

- Constraints: Exactly 2 matches to show to each person

Formulate the Problem

- Decision Variables: for each pair (woman i, man j), define

$$X_{ij} = \begin{cases} 1, & if\ woman\ i\ is\ matched\ to\ man\ j \\ 0, & if\ woman\ i\ is\ not\ matched\ to\ man\ j \end{cases}$$

- Objective: Maximize $Z = \sum_{i=1}^{8} \sum_{j=1}^{8} C_{ij} X_{ij}$

- Data to be computed: define C_{ij} to be the match score between woman i and man j

- Constraints: $\sum_{i=1}^{8} X_{ij} = 2, \quad for\ each\ man\ j = 1, \ldots, 8$

$$\sum_{j=1}^{8} X_{ij} = 2, \quad for\ each\ woman\ i = 1, \ldots, 8$$

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Supply Side of Business Model Innovation

Innovation can take one of the following three approaches to the supply side

- Change the process timing
- Change the process location
- Change the level of process standardization

Process Timing

- Change when the process occurs relative to when the customer requests the good/service
- Mass customization/make-to-order
  - Start final assembly only after receiving the order
  - Dell and personal computers

- Delaying the process timing allows the firm to dramatically expand variety (high preference fit) without incurring high inventory costs
- Disadvantage: customers must wait longer for their product/service (low transactional efficiency)

Process Location

- Change where the process occurs relative to where the customer is

- Electronic commerce
  - Hold inventory in a warehouse far from customers and ship the inventory to customers upon order
  - This allows the firm to expand variety (high preference fit) – items with too little demand for a local store can be profitably carried in a warehouse that serves a large region
  - Customers can order from home (desirable transactional effort) but customers have to wait (low time transactional efficiency) and shipping costs must be incurred

Process Standardization

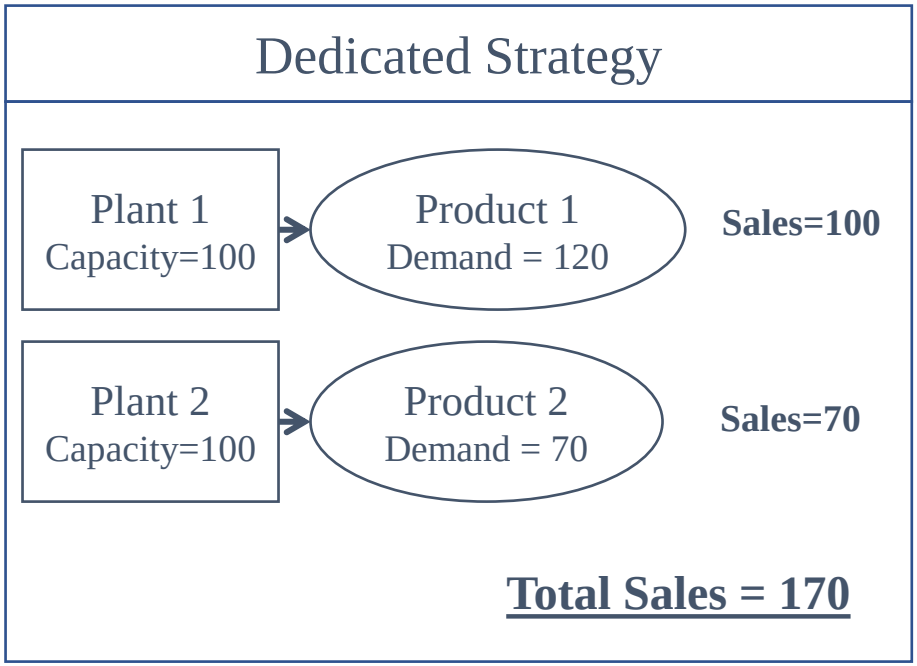
- Change how a process is done – in particular, change employee discretion in the process

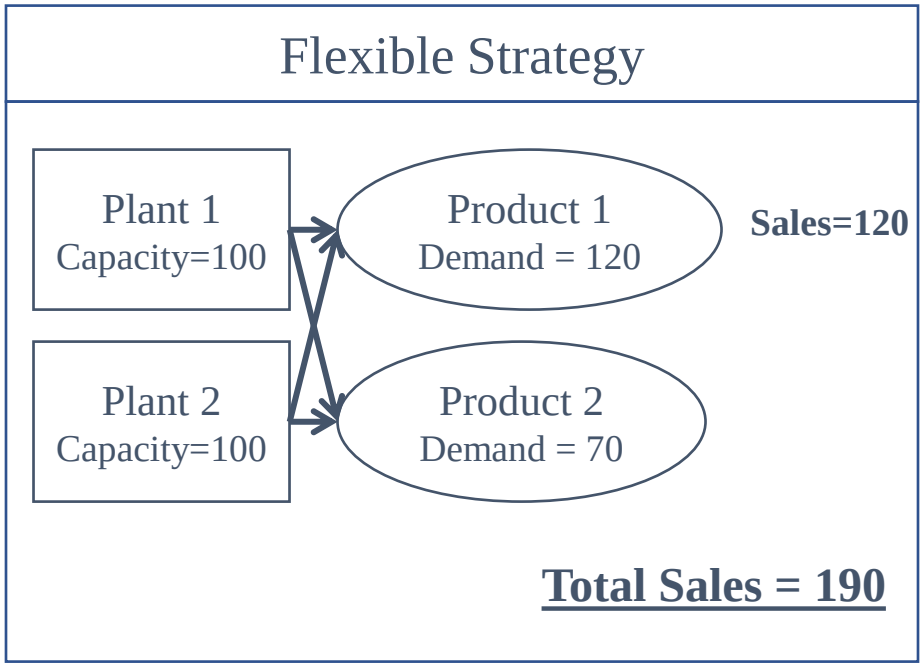
- Standardization
  - Allows the firm to hire lower skilled and less costly employees
  - Lowers employee training costs
  - Increase conformance quality
  - But probably reduces performance quality

- McDonalds produces hamburgers consistently but does not produce high quality cuisine

Dedicated vs. Flexible Strategy

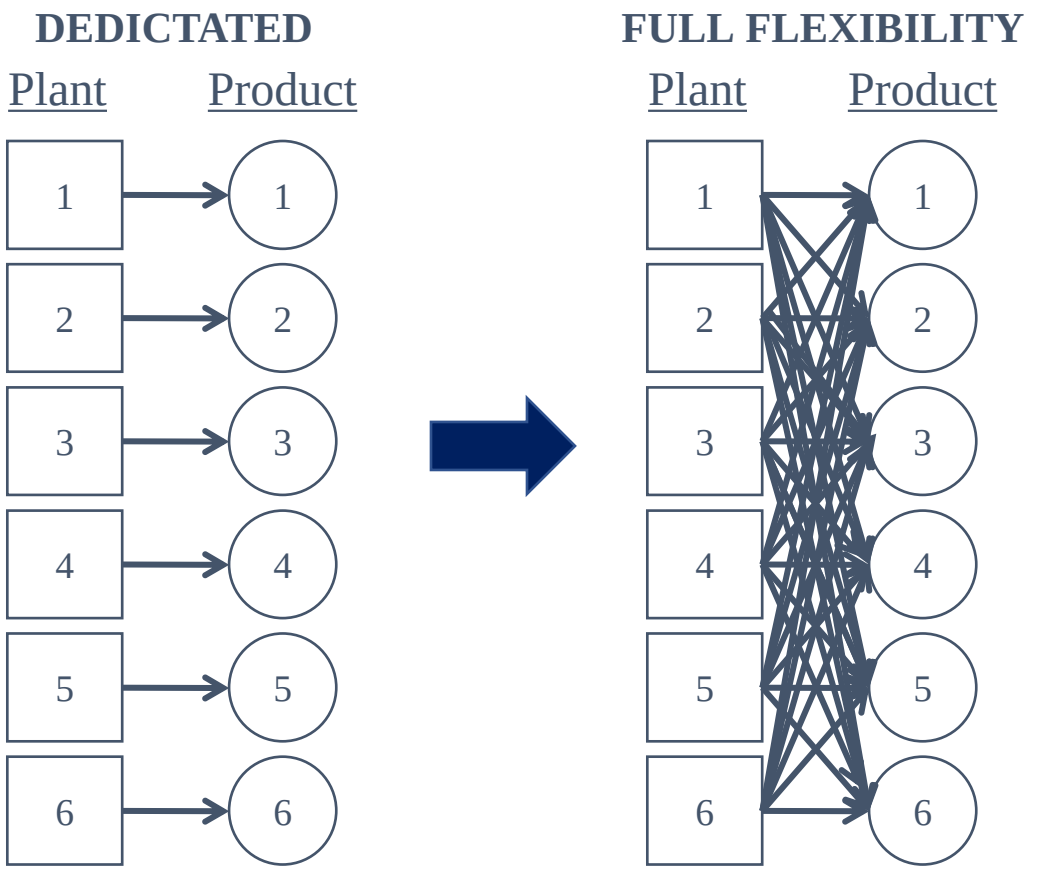
Flexibility reduces supply-demand imbalances by matching "excess" capacity to product shortages





Thought Experiment: What happens when product demands are (i) both less than 100; (ii) both higher than 100 ?

Dedicated vs. Flexible Strategy



Equal number of plants and products. Plant capacities all equal 100. Product demand all have mean 100 and stdev 30. No correlation.

8% increase in expected sales but high flexibility investment cost (adding 30 product-plant links)

Expected Sales = 528

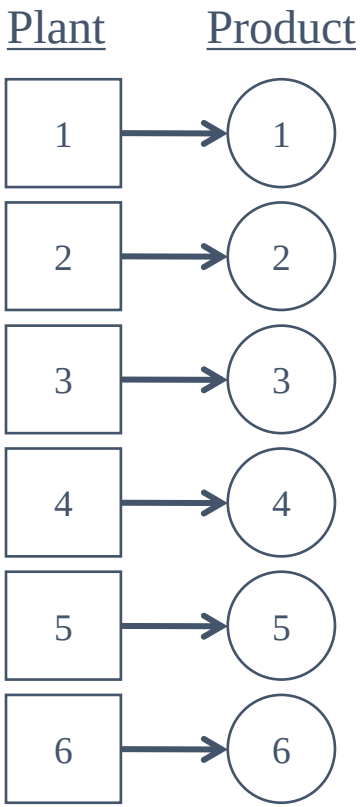
Number of Links = 6

Expected Sales = 571

Number of Links = 36

What would you do if you could only add 6 links?

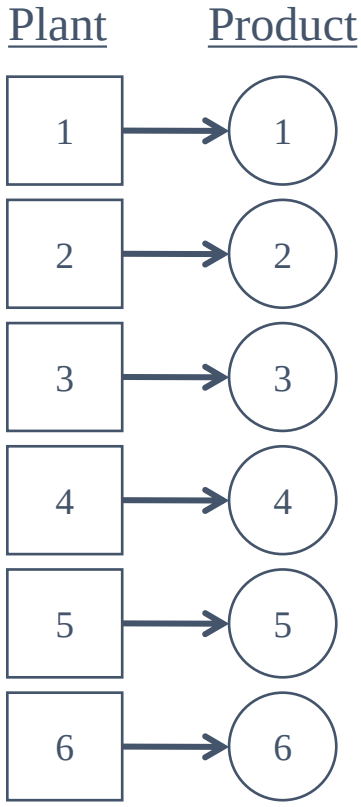
DEDICTATED



Expected Sales = 528

Number of Links = 6

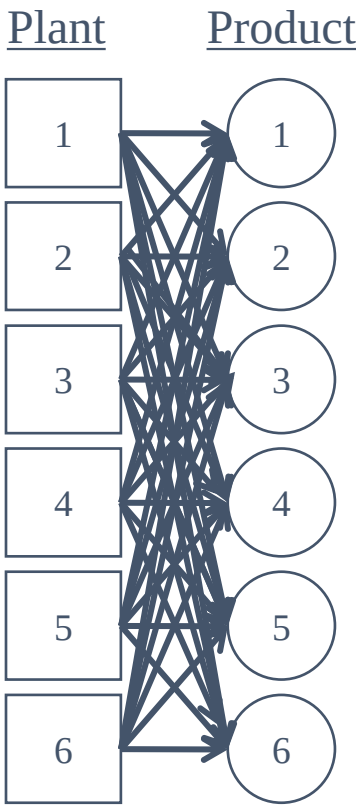
PARTIAL FLEXIBILTY



Expected Sales = ?

Number of Links = 12 (once you add 6)

FULL FLEXIBILITY

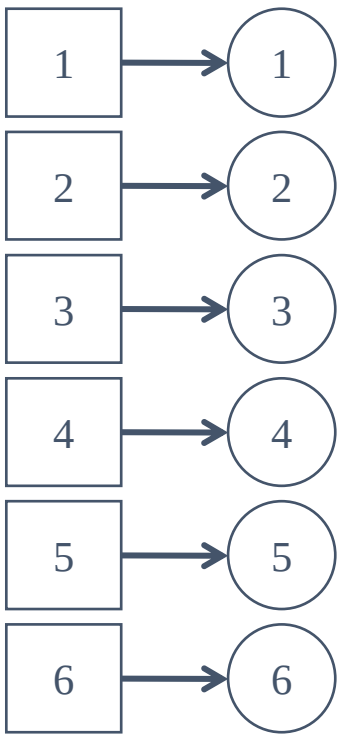


Expected Sales = 571

Number of Links = 36

How Flexible Should a Production Process Be?

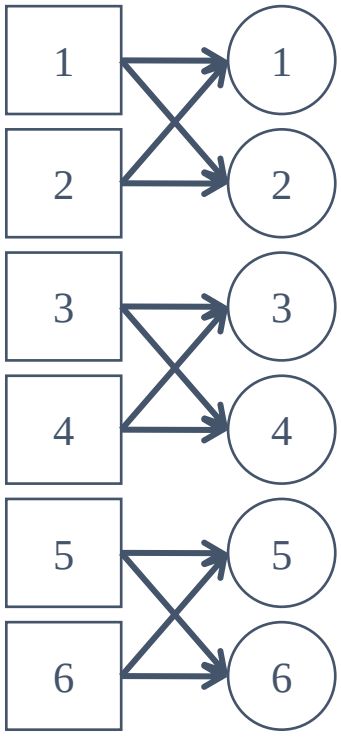
DEDICTATED



Expected Sales = **528**

Num of Links = **6**

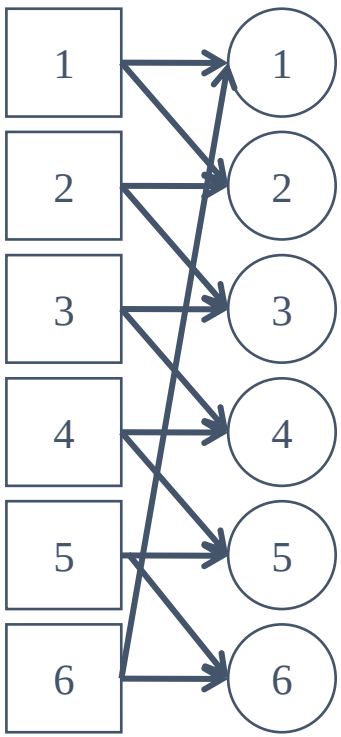
3 PAIRS



Expected Sales = **549**

Num of Links = **12**

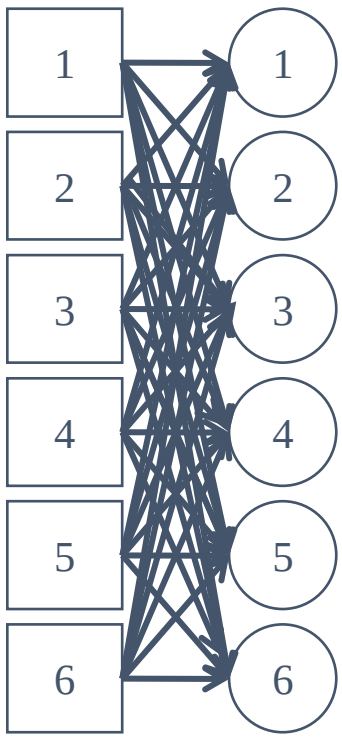
LONG CHAIN



Expected Sales = **570**

Num of Links = **12**

FULL FLEXIBILITY



Expected Sales = **571**

Number of Links = **36**

Take-away Messages

- If configured well, partial flexibility can deliver almost the same value of total flexibility
- Configure flexibility to create chains
- Strive to create fewer/longer chains