The case of Netflix
The relevance of Netflix

Fabio Viola • 2°
Professor | Videogame Designer and Producer | Interactive Screenwriter | ...
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La serie tv Regina degli Scacchi è stata vista da oltre 60 milioni di abbonati Netflix divenendo il contenuto più visto in 63 nazioni. Oggi i media, soprattutto cinema e gaming, modellano comportamento e generano effetti duraturi:

- Su Google la ricerca del termine scacchi è raddoppiata
- Su Google la ricerca "come si gioca a scacchi" ha raggiunto picco degli ultimi 10 anni
- Su eBay sono cresciute del 215% le transazioni di scacchi
- Su Chess.com il numero di giocatori è quintuplicato
- Il numero di ore speso davanti alle partite di scacchi giocate online su Twitch è raddoppiato
- Il libro a cui la serie tv si ispira è entrato nella Top10 bestseller New York Time a 37 anni dalla sua pubblicazione

#netflix #cinema #movieindustry #gamification #chessgame #revenue #entertainmentindustry
Revenue generated by Netflix from 1st quarter 2013 to 3rd quarter 2022 (in million U.S. dollars)

Netflix’s quarterly revenue 2013-2022
Number of Netflix paid subscribers worldwide from 1st quarter 2013 to 3rd quarter 2022 (in millions)

Quarterly Netflix subscribers count worldwide 2013-2022
The beginning

In 1997 Reed Hasting, a computer scientist by profession had rented the movie Apollo 13 from a blockbuster video store. However when he failed to return the DVD on time, he was forced to pay late payment charges of $40. The incident set him thinking of alternative and better ways for renting movies.
From video rental company...

- Netflix (Net “the Internet”+ flicks - “films, movies”) was started in 1997 under the name Kibble - Rental DVDs $4 by DVD (plus $2 for the delivery service).

- In 1999 the company introduced a DVD subscription service → monthly fee $15 for 4 DVDs → digital request by customers (online queue/wishlist with the favourite titles) and an algorithm send back the information on the basis of the availability.

- In 2000 personalised movie recommendation. By 2000, Hastings had settled a business model charged users a monthly subscription and users settling up a queue of movies they wanted to watch and were mailed the DVDs by US postal service.
…To streaming provider...

- **2007** Offering unlimited access to movie and TV series

- By early **2008** Unlimited online streaming

- In July **2011** Netflix announced the largest price increase in its history and in September Netflix decided to divide and streaming operations into two separate independent companies
And content creator!

Number of content created

- 2012: 4
- 2013: 13
- 2014: 25
- 2015: 59
- 2016: 126
- 2017: 400
How Netflix changed the way we watch TV

1997: DVD startup
1999: Subscriber model
2000: Netflix queue
2006: Video recommendation algorithm
2007: Video streaming
2011: 1st Netflix Original
2011: Expansion outside of the US & Canada
2013: Binge watching
2015: #Netflix and Chill
2016: Expanding internationally & banning VPNs
Website evolution

1999

Featured DVDs for Sunday, January 17, 1999:

- Blade
  - Wesley Snipes is Blade, a half-human, half-vampire sworn to protect humanity by wiping out bloodsucking evil wherever he finds it. Can he stop an ambitious vampire (Stephen Dorff) who plans to magically summon the "Blood God" and make the world an inhuman feast?
  - Rent It - $4.00
  - Remind Me!

- Six Days, Seven Nights
  - Six Days, Seven Nights sounds like a vacation — but when Harrison Ford and Anne Heche crash on a South Seas desert island, it's anything but fun in the sun. Ivan Reitman directed this castaway couple comedy, with Ford and Heche as an unlikely couple in paradise.
  - Rent It - $4.00
  - Remind Me!

Check out more vampire tales like Bram Stoker's Dracula in our Bloodsucking Blockbusters Collection!

Young Cinematographer

The Mask of Zorro

First Time to NetFlix.com?

Get Your First DVD Rental Free!

Get a FREE DVD Rental from NetFlix.com. How? It's easy! The first DVD rental that you put into your shopping cart will be priced at $0. Let us tell you more!

(Offer limited to one per customer. The first time you rent from NetFlix.com. Regular Shipping and Handling charges apply. Offer not available for DVD rental reservations. Get more information about your free trial rental.)

It's The Easiest Way to Rent a DVD!

Order your DVDs, and they arrive via mail in 2-3 days. Keep the DVDs for 7 full-days. When you're finished, use the pre-addressed, pre-paid mailer, and drop them back in the mail. Find out more!

- 7-Day Rental for just $4. Send when you rent 4 or more!
- Virtually all DVD titles! Find them fast!
- Earn $55 as a NetFlix.com Associate!
- NetFlix.com vs. DVD comparison chart
Website evolution
2004
Website evolution
2008
Website evolution
2009
Website evolution
2012
Website evolution 2016
Number of Netflix Academy Awards nominations from 2014 to 2022
Business Model Innovation – home delivery
Business Model Innovation – multi devices
Business Model Innovation - subscription

- Easiness of unsubscriptions
- Importance of large base of subscribers
Business Model Innovation – original content creation
Business Model Innovation – value creation (recommendation and entire season releases)
Techno-economic dynamics

- Massive shift in consumer behaviour
- Growth of internet data usage
- Post TV era
- Use of multiple devices
Customers evolution in the video industry

The video world is evolving rapidly...

...and those who fail to keep ahead of the curve will be left behind
Interaction with the users

DVD renting mail delivery

N Catalogue

DB building

Preferences of customers
Interaction with the users

First recommendation system!

N Catalogue

Data-driven recommendation

DB usage for customisation

Preferences of customers
Internationalisation strategy

In 2010 – 2017, Netflix entered OVER 190 COUNTRIES

- Unavailable in Crimea, North Korea and Syria (US government restrictions), and has a licensing deal with iQiyi for China
- Physical offices only in 13 other countries: Mexico, Brazil, Netherlands, Germany, United Kingdom, Spain, France, Taiwan, Philippines, India, South Korea, Japan and Singapore.
Share of subscribing Netflix households in selected countries worldwide as of 2022

Penetration rate of Netflix worldwide 2022, by country

<table>
<thead>
<tr>
<th>Country</th>
<th>Share (%)</th>
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</thead>
<tbody>
<tr>
<td>Australia</td>
<td>65%</td>
</tr>
<tr>
<td>UK</td>
<td>57%</td>
</tr>
<tr>
<td>U.S.</td>
<td>53%</td>
</tr>
<tr>
<td>Canada</td>
<td>48%</td>
</tr>
<tr>
<td>France</td>
<td>29%</td>
</tr>
<tr>
<td>Spain</td>
<td>26%</td>
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<tr>
<td>Germany</td>
<td>24%</td>
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<tr>
<td>Mexico</td>
<td>23%</td>
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<tr>
<td>South Korea</td>
<td>23%</td>
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<tr>
<td>Brazil</td>
<td>22%</td>
</tr>
<tr>
<td>Italy</td>
<td>12%</td>
</tr>
<tr>
<td>Japan</td>
<td>11%</td>
</tr>
</tbody>
</table>
First mover advantage?

It bring the competition in «blue oceans», contributing to define a new market space, making the competition «irrelevant»

[Graph showing competitive advantage over time]

Netflix established a New dominant design!
Competitive landscape
Porter model applied to Netflix

<table>
<thead>
<tr>
<th>Five Forces</th>
<th>Who They Are</th>
<th>Level of Threat/Bargaining Power</th>
<th>Rationale</th>
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</thead>
</table>
| Supplier bargaining power | Content providers (e.g., movie studios) | High | • Exclusive rights to content may be difficult to obtain.  
• There is a limited number of suppliers who can provide high-quality content. |
| Buyer bargaining power | Viewers and potential subscribers | High | • There is low or non-existent switching cost.  
• Buyers are more informed and have access to many streaming services. |
| Rivalry among existing firms | Hulu, Amazon Video | Moderate | • The products have little differentiation (especially for old content).  
• There are few competitors (i.e., a high concentration ratio).  
• The U.S. market is already saturated (i.e., slow market growth). |
| Threat of new entrants | Multinational information technology companies | Low | • There is a high level of economies of scale.  
• Government and legal barriers exist in multiple countries. |
| Threat of substitutes | Local television providers, video file sharing websites, and other online entertainment companies | High | • Local television providers produce local content.  
• It may cost less to use a television provider.  
• Internet television and video streaming may be more convenient and provide faster service.  
• Consumers could be indifferent to lower-quality video file sharing services if content was provided without a fee. |
Technological Strategy

• Big data
• Artificial Intelligence
• Wisdom of the Crowd
• Infrastructures
Leveraging big data and subscribers data

- Location data
- Device data
- Number of times a program is paused
- Number of show incomplete
- Time (night/day)
- ...

With DVD no idea on the action between mail delivery and actions associated with the “consumption” of the movie. With streaming all the customer journey is detectable!!
Artificial Intelligence and product design

“AI profoundly transforms the context where innovation takes place. Why? **AI is inherently a decision-making technology**: it offers opportunities to automate many tasks relating to learning and devising solutions”.

Is the transformation of the context induced by AI changing the design process and the objects of the design actions? For example, which decisions can be automated and which ones cannot?”
Netflix started to leverage AI at least as early as 2010, to fuel its recommendation engine. In 2014, Netflix expanded its approach to invest extensively in understanding user behavior and develop a personalized streaming experience for each user.

The application screens that a user sees today are “designed in real time” by a machine. Many boundaries and parameters are specified by human designers at the outset of the process.

But the decisions about which movies to show, how to display them, which pictures to represent them with, and many other design decisions are done by algorithms embedded in the AI problem-solving loops.”
Supervised learning

Netflix uses supervised learning in a variety of scenarios.

For recommendations, Netflix has used labeled data sets made up of actions and results (e.g., movies chosen and liked) by people who are deemed by the algorithm to be similar to a given user. The richer the stream of data, the more the problem-solving loops are user centered.
Unsupervised learning

Unsupervised Learning

Unlabelled Data

Machine

Results

Netflix uses unsupervised learning to discover related groups of customers or to create different versions of the user interface that match different usage patterns. Even more advanced, Netflix uses data and AI algorithms to predict which content to create in the first place.

The first application of predictive analytics was back in 2013, to evaluate the potential of *House of Cards*, in collaboration with Media Rights Capital.
Netflix recognized that viewers have enormous diversity in taste and preferences. So, the Netflix team decided that each user should be shown a cover artwork specifically designed for her, drawn from the frames of a movie. The artwork would highlight the aspects of the title that are specifically relevant to that specific user (Chandrashekar, Amat, Basilico, and Jebara, 2017).

The problem was complicated, as the Netflix team needed to figure out which movie selection to present, and then, which artwork to combine with that movie to maximize the match between user and recommendation.

A single season of an average TV show (about 10 episodes) contains nearly 9 million total frames. Asking creative editors to efficiently sift through that many frames of videos to design an artwork that would capture the audience’s attention would be tedious and ineffective. Designing an artwork for each specific user according to his or her preferences would simply be impossible.
Netflix algorithm (early 2000s)

Cinematch → Netflix members were asked to rate at least 20 movies using five star system. 100 million user ratings for about 18,000 movies. Take any two movies and find the people who have rated both of them.

Then look to see if the people who rate one of the movies highly rate the other one highly, if they liked one and not the other, or if they did not. Now do this for all possible pairs of 65,000 movies.

60% of Netflix rentals were recommended by Cinematch. By 2006 the progress of Cinematch had stalled. Hastings knew that recommendation systems were extremely hard to improve on (a fact proved by Root Mean Standard Error).

Hastings did a back a calculation and come out that if the algorithm could be improved of 10% (against 4-5% of the past years), Netflix would generate between 60 and 89 million in annual revenue for the next four years.
Netflix algorithm relying on the wisdom of the Crowds

- Contest strategy to create its own platform relying on the Crowds

Contest rules

- RMSE as benchmark to win the prize $1 million for an algorithm that increases the Netflix Cinematch by at least 10%
- If no one reached that point 50,000$ to whomever made the most progress above a 1 percent improvement
Netflix algorithm relying on the wisdom of the Crowds

PROBLEMS/drawbacks

- Relising of data and customer privacy
- Tension between control and innovation
- Problems on IP rights → how to protect innovation if open to external?
- If the algorithm created during Netflix contest were not sufficiently protected newcomers could abruptly enter to the market.
- Risk of information disclosure by participants → usually anonymity of clients and participants is used to protect, impeding collaboration and communication (limiting information sharing)
Netflix algorithm relying on the wisdom of the Crowds

SOLUTIONS/adv

- Hastings decide to host internally the contest, taking care of infrastructure and facilities → this implies high costs but lower than internal development.

- The demonstrated advantage of crowdsourcing over internal development was in the quantity and diversity of solutions.

- The complexity of the challenge would require deep collaboration from many individuals.

- To guarantee rights to the winner Hastings had the idea to publish a coauthored paper on the winning algorithm → External disclosure to competitors.
Netflix and Cloud Computing infrastructures

Since 2016 with

Netflix Usage Profile

- 86M members
- 190 countries
- 150M hours of streaming per day
- 3 regions
- 12 availability zones
- 10,000+ streams start every second at peak times
- 100,000+ AWS instances
Netflix and Cloud Computing Infrastructure

Netflix is based on an over-the-top (OTT) media service model, i.e. bypassing traditional distribution systems and distributing directly via the Internet.

Netflix uses AWS as a cloud provider in a SaaS model for all processing, storage, recommendation engines, video transcoding needs (+100,000 temporary virtual servers).
Overview

When Netflix built a visual effects (VFX) studio in the cloud using Amazon Web Services (AWS), the entertainment company’s goal was to facilitate collaboration among artists and content creators around the globe through remote workstations.

Once Netflix’s artists and partners gained the ability to access secure, high-powered virtual workstations remotely, the company’s next step was to achieve low latency for its applications to reduce lag and offer a seamless content-creation experience closer to artists. In 2020, Netflix began using AWS Local Zones, a type of AWS infrastructure deployment that places compute, storage, database, and other select AWS services close to large population and industry centers. By accessing AWS compute services on Local Zones, Netflix can achieve low latency for applications and facilitate virtual workstations for its VFX studio users, fostering collaboration among artists.
Netflix data science culture

Most machine learning algorithms used in personalization and search, including deep learning algorithms, are purely associative. They learn from the correlations between features and outcomes how to best predict a target.

In many scenarios, going beyond the purely associative nature to understanding the causal mechanism between taking a certain action and the resulting incremental outcome becomes key to decision making. Causal inference gives us a principled way of learning such relationships, and when coupled with machine learning, becomes a powerful tool that can be leveraged at scale.

**Causal Inference** provides formal tools to tease out the true **incremental value of an impression** for each profile: Heterogeneous Treatment Effect (HTE)
Experimentation and causal inference is one of the primary focus areas within Netflix’s Data Science and Engineering organization. To directly support great decision-making throughout the company, there are a number of data science teams at Netflix that partner directly with Product Managers, engineering teams, and other business units to design, execute, and learn from experiments. To enable scale, we’ve built, and continue to invest in, an internal experimentation platform (XP for short).

The Netflix XP balances execution of the current experimentation program with a focus on future-looking innovation. It’s a virtuous flywheel, as XP aims to take whatever is pushing the boundaries of our experimentation program this year and turn it into next year’s one-click solution. That may involve developing new solutions for allocating members (or other units) to experiments, new ways of tracking conflicts between tests, or new ways of designing, analyzing, and making decisions based on experiments. For example, XP partners closely with engineering teams on feature flagging and experience delivery. In success, these efforts provide a seamless experience for Netflix developers that fully integrates experimentation into the software development lifecycle.

For analyzing experiments, we’ve built the Netflix XP to be both democratized and modular. By democratized, we mean that data scientists (and other users) can directly contribute metrics, causal inference methods for analyzing tests, and visualizations. Using these three modules, experimenters can compose flexible reports, tailored to their tests, that flow through to both our frontend UI and a notebook environment that supports ad hoc and exploratory analysis.
Netflix challenges

- Local markets
- Languages (only 20 languages in 190 countries)
- Local related contents (strong preferences for viewing domestic content)
- Local content providers
- Poor broadband penetration
- Expand typology of contents (e.g. sports?)
- Partnerships outside the entertainment industry (hotels, airline companies?)
- Different pricing models (adv?)
EMERGING LEADERS?
Number of Disney Plus subscribers worldwide from 1st quarter 2020 to 4th quarter 2022 (in millions)

Quarterly Disney+ subscribers count worldwide 2020-2022
Estimated number of subscribers worldwide from 2020 to 2027, by service (in millions)

SVOD subscriber count worldwide 2020-2027, by service
Has Netflix reached its peak?

- Big data bubble? (decreasing quality as a sign of the importance of time and human creativity?)

- From unconscious co-creation to more awareness of customer role in the process?

- New competitors from other markets? (attention and time scarce resources → Tik Tok/Short Video can capture the new generation interests?)
Food for thought

https://www.wired.com/2009/08/netflix-prize-continues/

https://netflixtechblog.com/

https://www.asc.ohio-state.edu/statistics/dmsl/GrandPrize2009_BPC_BellKor.pdf