

SOCIAL COMPUTING: BRIDGING THE GAP BETWEEN TECHNOLOGY AND HUMAN INTERACTION

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RESEARCHER, UNIVERSITY OF ZURICH

DSI PROFESSOR PRESENTATIONS: ZÜRICH, FEBRUARY 28, 2023



University of
Zurich ^{UZH}

THE SOCIAL COMPUTING GROUP DEPARTMENT OF INFORMATICS, UZH



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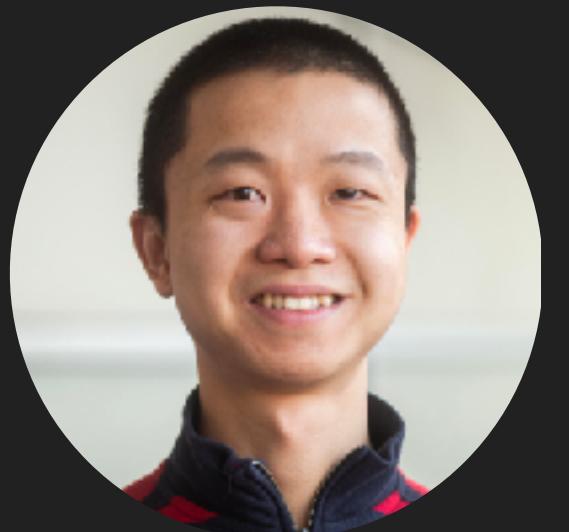
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Joachim Baumann
(DSI fellow, also at ZHAW)



Azza Bouleimen
(also at SUPSI)



Desheng Hu



Leonore Röseler
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Data Analytics Group)

ABOUT ME



Dr. Nicolò Pagan

- ▶ 2021 - present: Postdoctoral Researcher at the Social Computing Group
- ▶ 2016 - 2021: Ph.D. at the Automatic Control Laboratory, Department of Information Technology and Electrical Engineering, ETH Zürich
- ▶ 2013 - 2016: Software Engineer & Research at Ascomp AG
- ▶ 2011 - 2013: M.Sc. in Computational Science & Engineering, EPF Lausanne
- ▶ 2007 - 2010: B.Sc. in Applied Mathematics, Politecnico di Torino (Italy)

WHAT IS SOCIAL COMPUTING?





SOCIAL COMPUTING is a field of Computer Science, at the intersection between COMPUTING SYSTEMS and SOCIAL BEHAVIOUR

COMPUTING SYSTEMS are the combination of hardware and software which accomplish one or more specific tasks

SOCIAL BEHAVIOUR is a set of actions performed by individuals of the same species when they interact with each other

SOCIAL COMPUTING RESEARCH AREAS AND APPLICATIONS

Recommender Systems



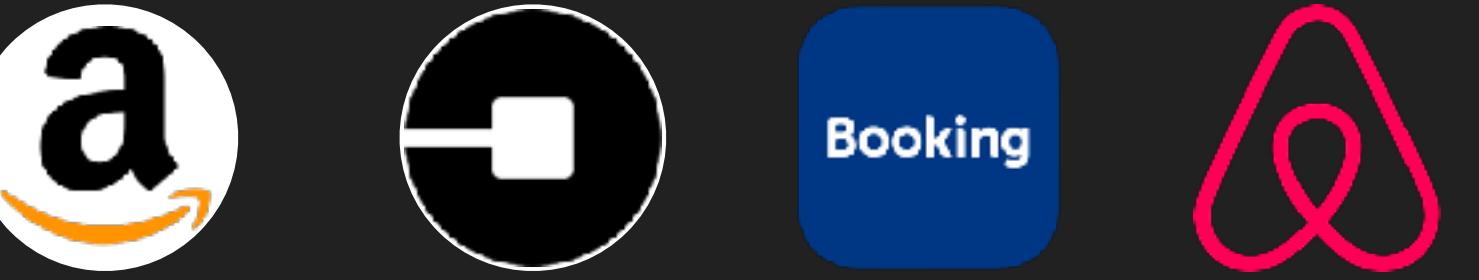
Social Networks



Search Engines



E-commerce



SOCIAL COMPUTING

OBJECTIVES: A TIME-LINE

How TO build a Social
Computing Service



SOCIAL COMPUTING

OBJECTIVES: A TIME-LINE

How TO build a Social
Computing Service

WHAT MAKES a Social
Computing Service
USEFUL and SUSTAINABLE?

SOCIAL COMPUTING

OBJECTIVES: A TIME-LINE

How TO build a Social
Computing Service

WHAT MAKES a Social
Computing Service
PROFITABLE?

WHAT MAKES a Social
Computing Service
USEFUL and SUSTAINABLE?

SOCIAL COMPUTING OBJECTIVES: A TIME-LINE

How TO build a Social Computing Service

WHAT MAKES a Social Computing Service PROFITABLE?

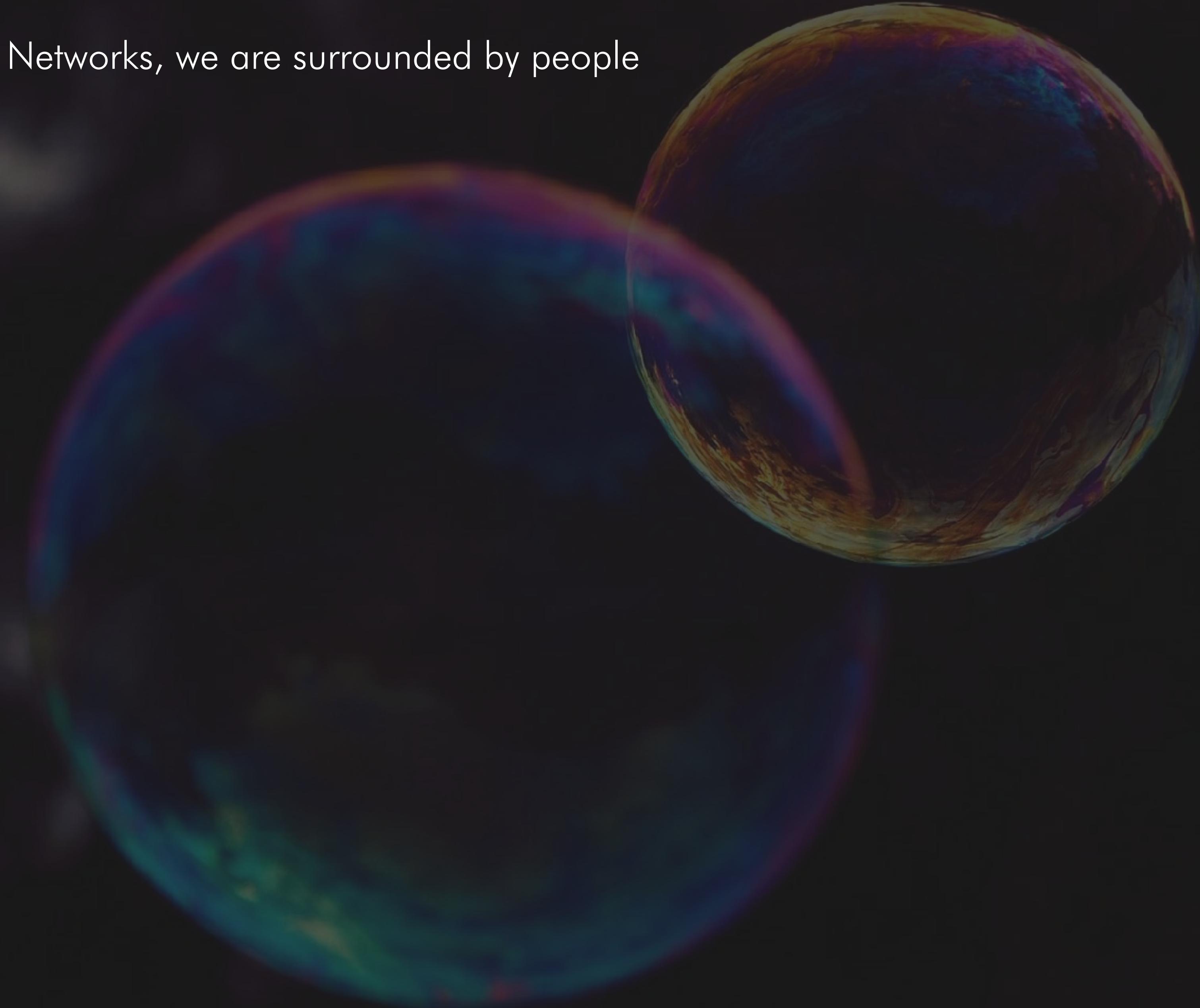


WHAT MAKES a Social Computing Service USEFUL and SUSTAINABLE?

WHAT ARE THE EFFECTS AND RISKS of a Social Computing Service to individuals and society?

EXAMPLES OF DOWNSIDE EFFECTS

FILTER-BUBBLE effect: in social Networks, we are surrounded by people thinking alike.

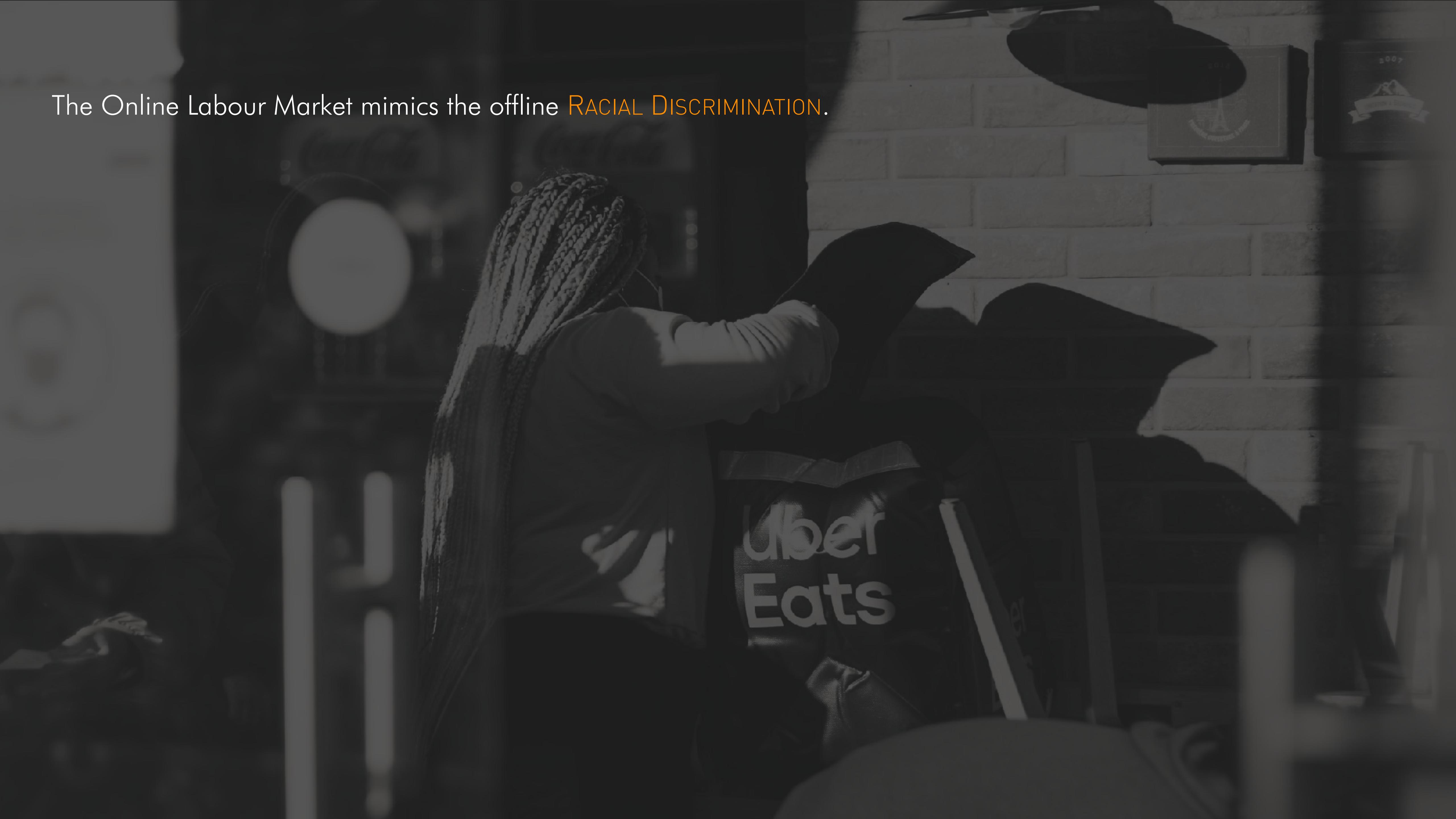




Search Engines amplify this ECHO-CHAMBER effect.

POLITICAL POLARIZATION has dramatically increased in the past 10-20 years.

The Online Labour Market mimics the offline RACIAL DISCRIMINATION.



The Online Labour Market mimics the offline RACIAL DISCRIMINATION.

Non-black hosts are able to charge approximately 12% MORE than black hosts, controlling for location, rental characteristics, and quality.



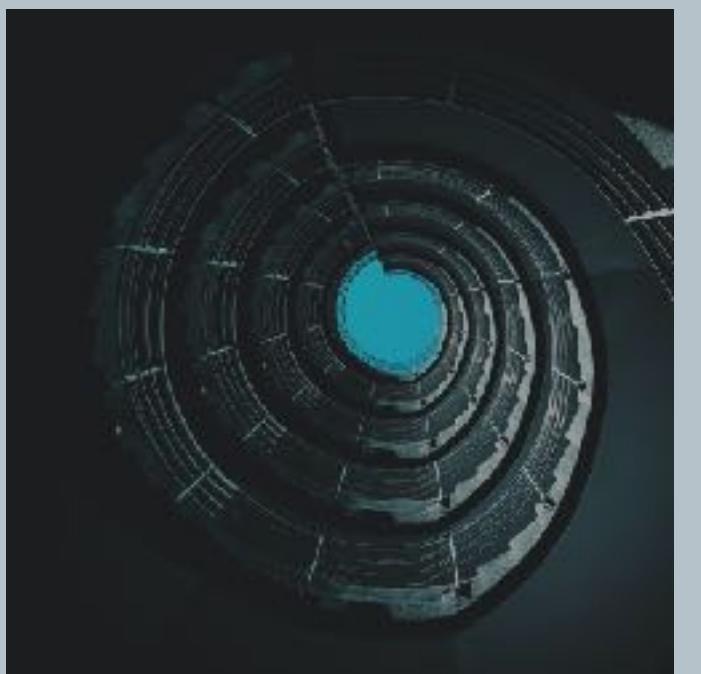
SOCIAL COMPUTING ISSUES: MEDIA-COVERAGE

- ▶ The Wall Street Journal: [On Orbitz, Mac Users Steered to Pricier Hotels](#) (2012)
- ▶ The Washington Post: [Google's algorithm shows prestigious job ads to men, but not to women. Here's why that should worry you](#) (2015)
- ▶ The New York Times: [Discrimination by Airbnb Hosts Is Widespread, Report Says](#) (2015)
- ▶ The New York Times: [Study Finds Some Uber and Lyft Drivers Racially Discriminate](#) (2016)
- ▶ The Guardian: [Facebook charged with housing discrimination in targeted ads](#) (2019)

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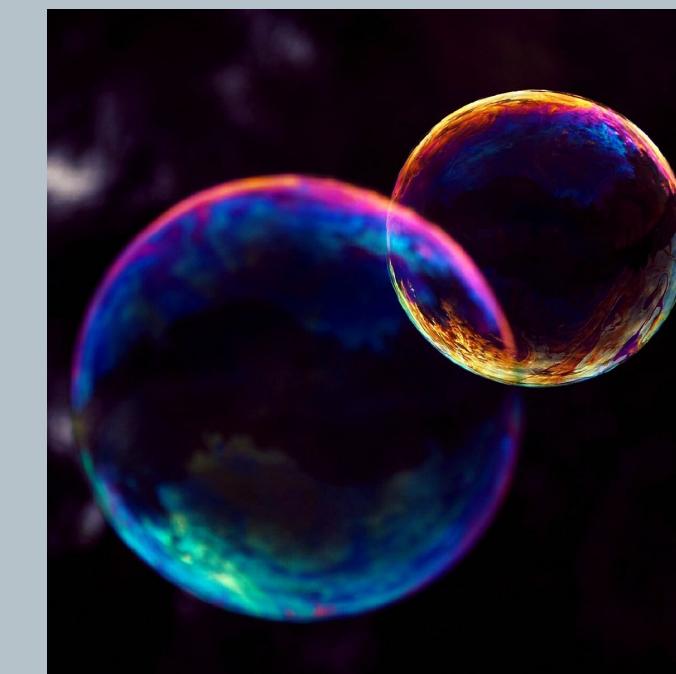
1. CONTENT CREATORS
IN SOCIAL MEDIA
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2. FEEDBACK LOOPS IN
ML-BASED AUTOMATED
DECISION-MAKING
SYSTEMS



3. POLARISATION
AND HATE SPEECH



4. BIAS IN
SEARCH ENGINES

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1. CONTENT CREATORS IN SOCIAL MEDIA PLATFORMS

MOTIVATION:

- ▶ Social media platforms are increasingly being leveraged as a means of making a living.
- ▶ The Creator Economy has seen tremendous growth over the past decade:
 - more than **50 MILLION CONTENT CREATORS** and a market worth over **\$104 BILLION**.
- ▶ However, social media platforms do not always provide fair opportunities and compensation for these creators.

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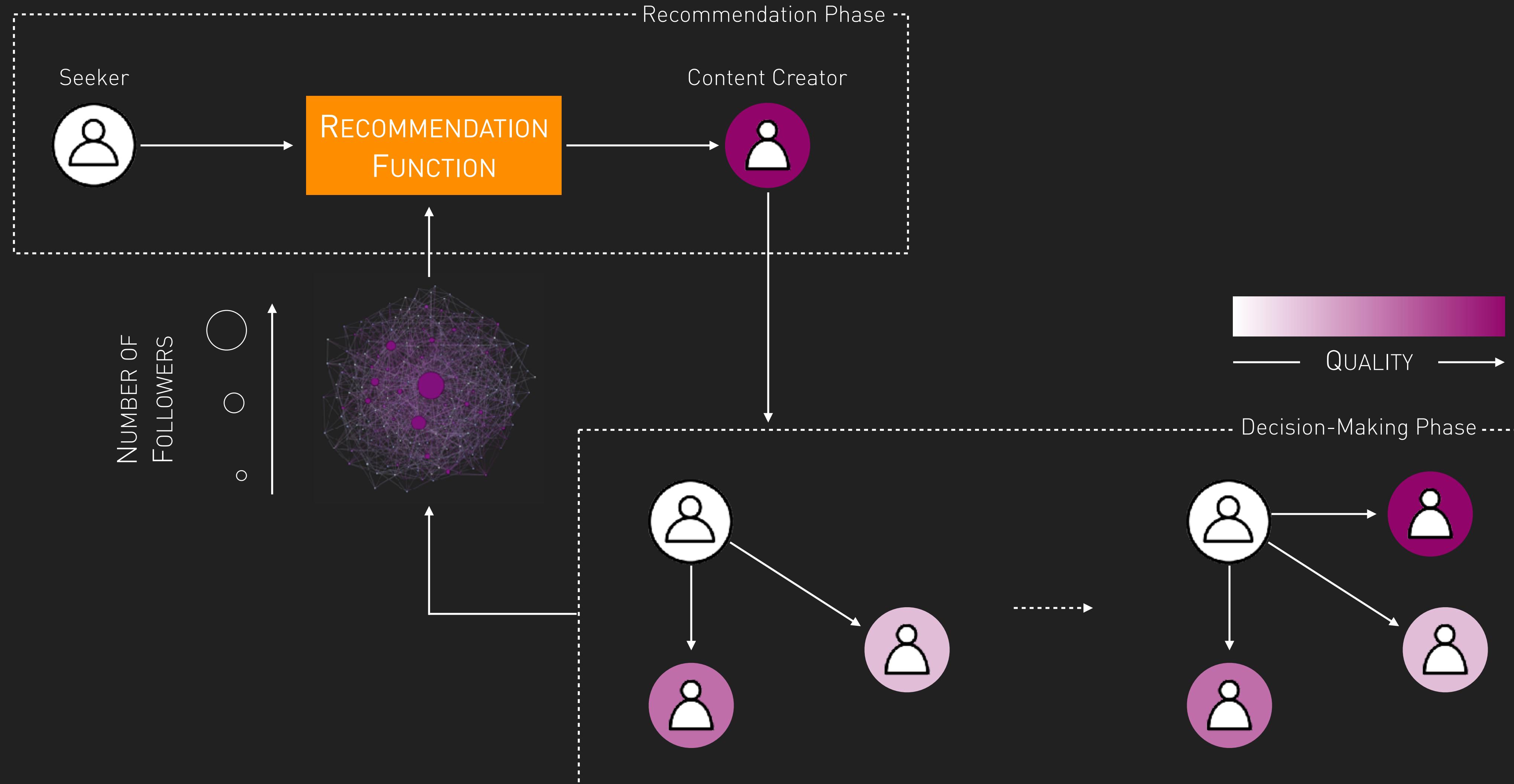
RESEARCH QUESTIONS:

- ▶ What is the impact of the Recommender Systems on Content Creators **FAIRNESS**?
- ▶ And what is the role of users' **HOMOPHILY**?

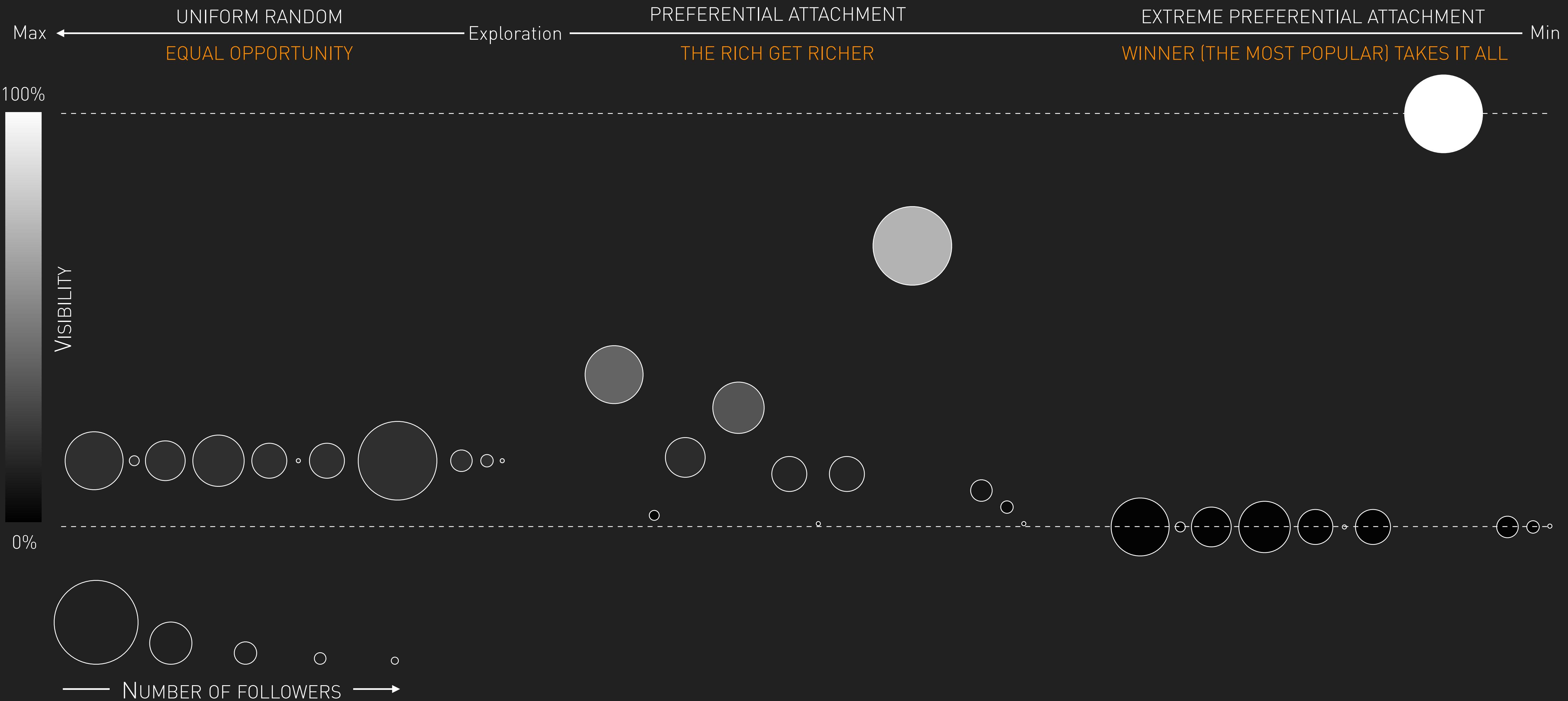
METHODS:

- ▶ Network Theory, Agent-Based Modelling

STEP 1: THE MERITOCRATIC NETWORK FORMATION MODEL

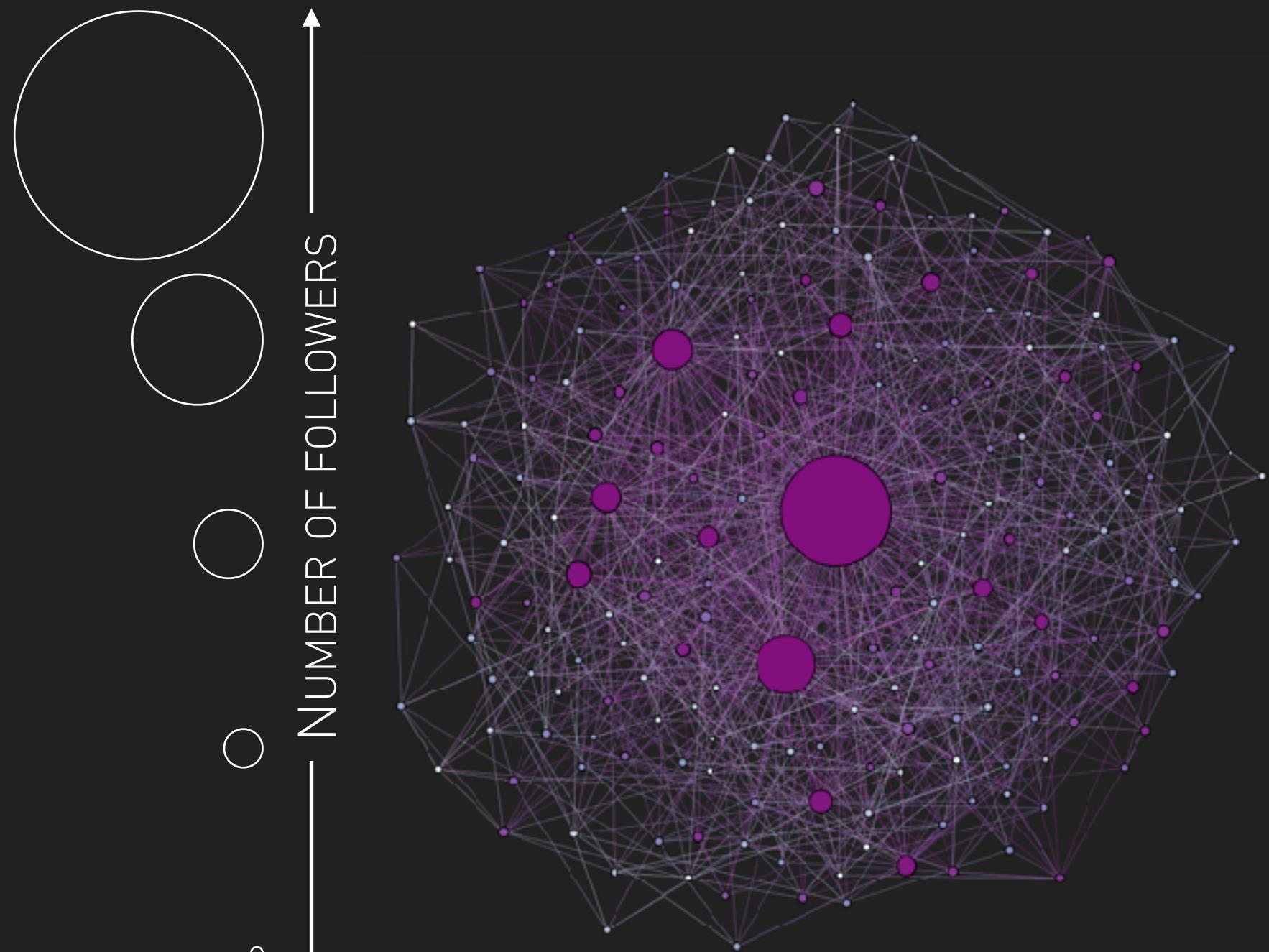


STEP 2: RECOMMENDATION FUNCTIONS



Max ← Recommendation System's EXPLORATION → Min

UNIFORM RANDOM



PREFERENTIAL ATTACHMENT

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EXTREME PREFERENTIAL ATTACHMENT



Max ← Recommendation System's EXPLORATION → Min

UNIFORM RANDOM

PREFERENTIAL ATTACHMENT

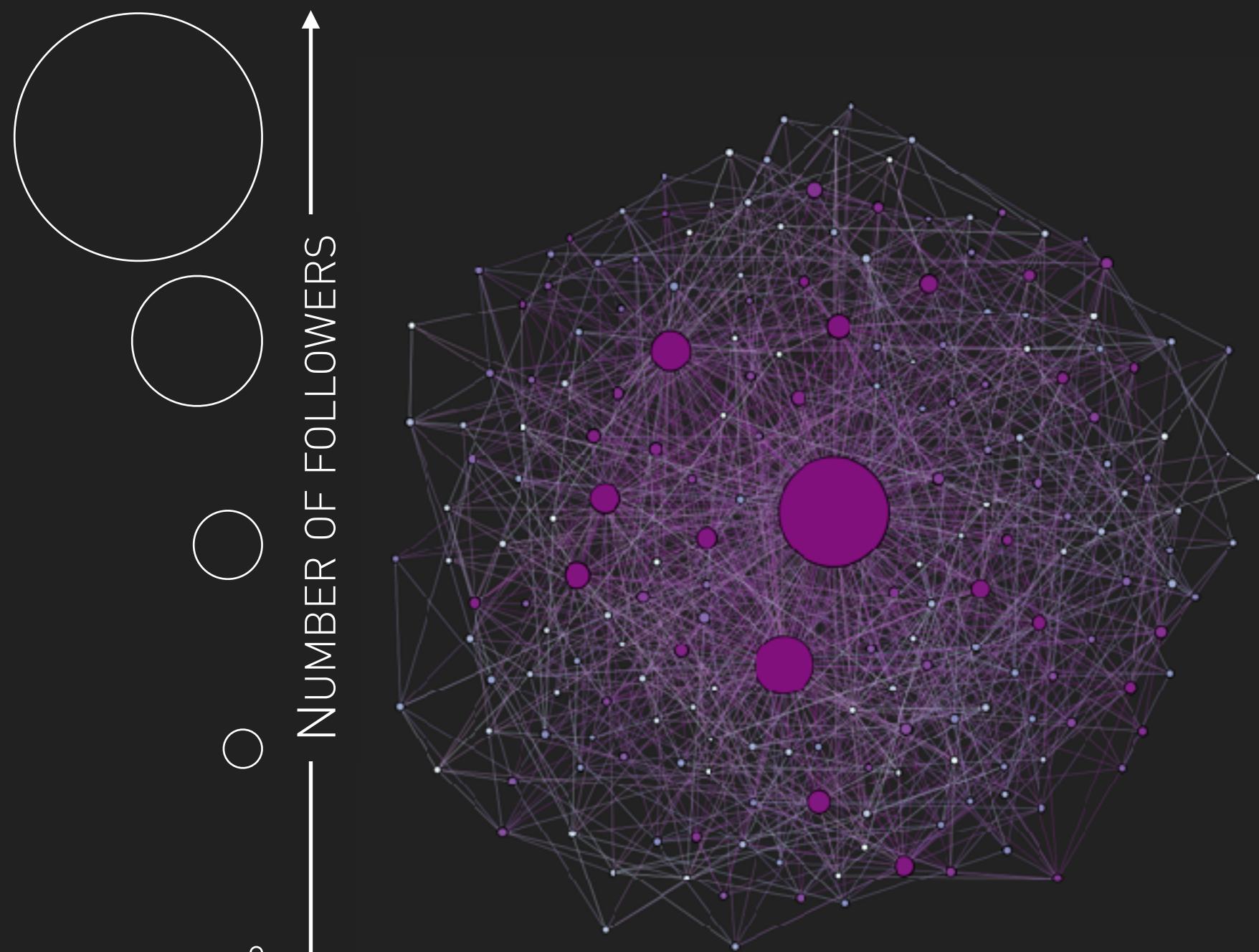
EXTREME PREFERENTIAL ATTACHMENT



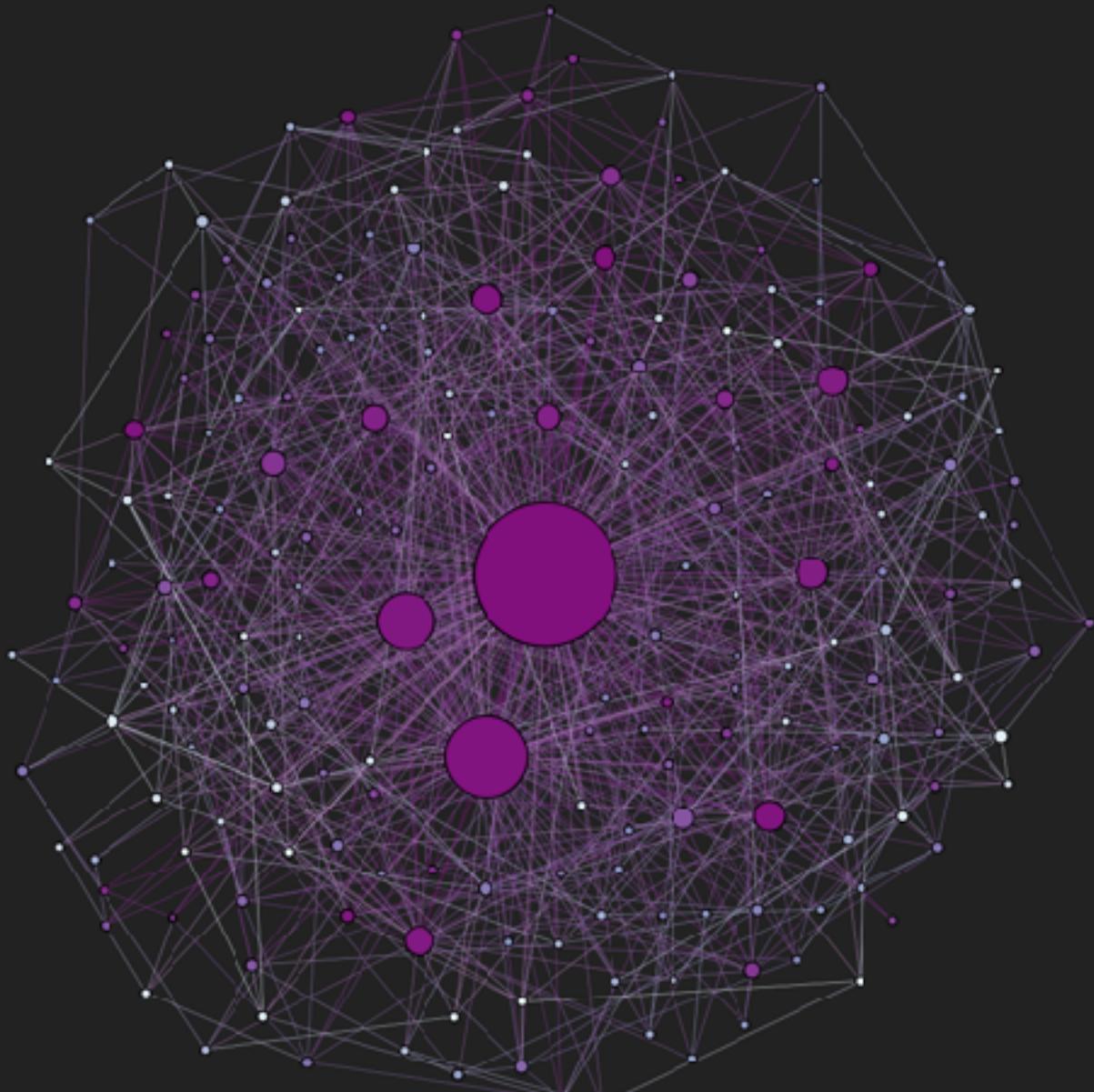
NUMBER OF FOLLOWERS
CORRELATES WITH
UGC-QUALITY

Max ← Recommendation System's EXPLORATION → Min

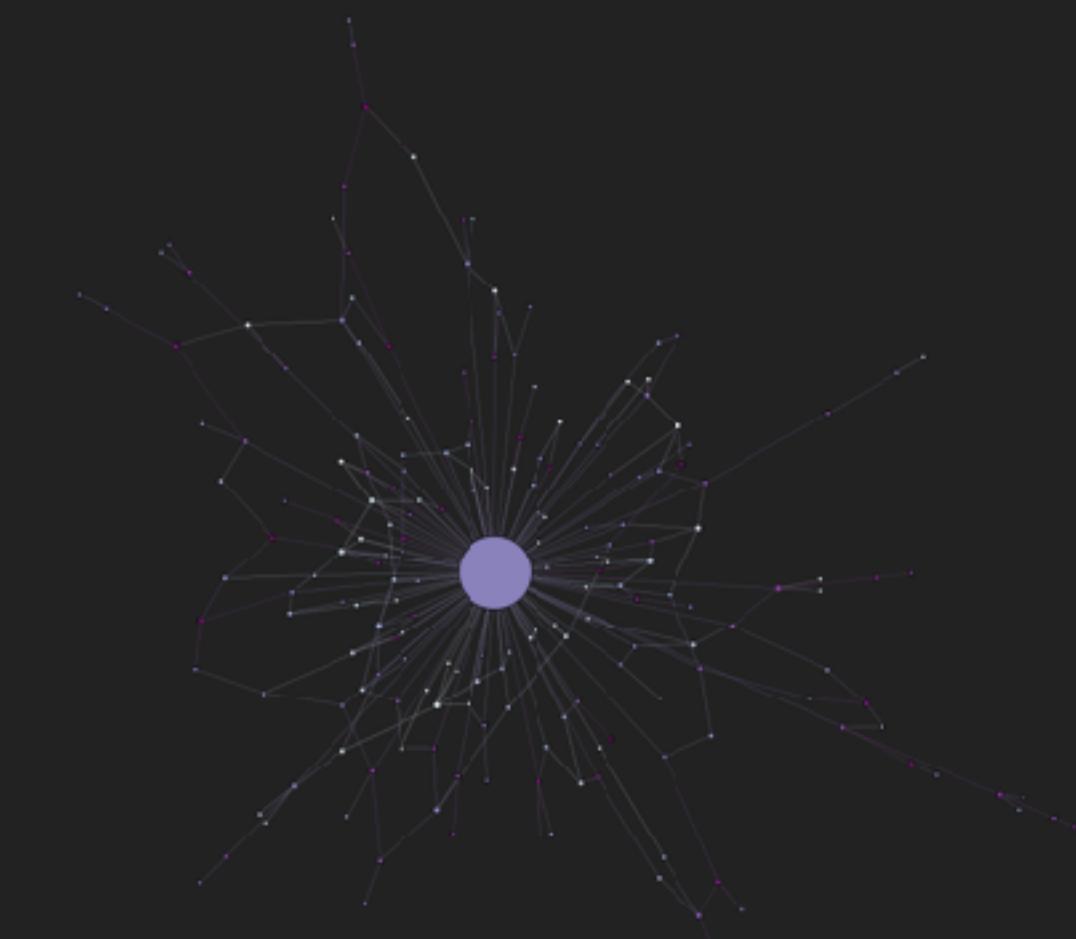
UNIFORM RANDOM



PREFERENTIAL ATTACHMENT

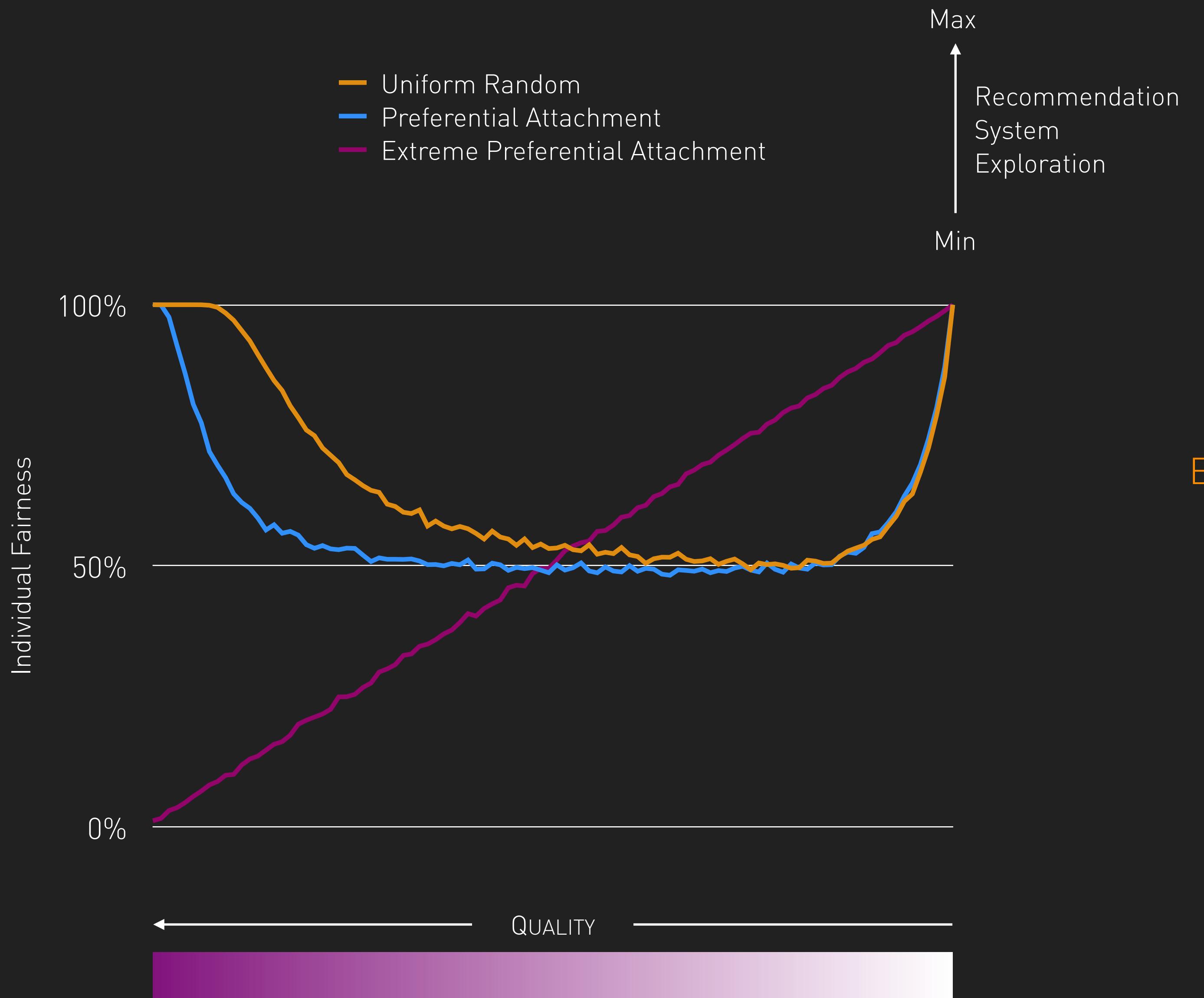


EXTREME PREFERENTIAL ATTACHMENT



← QUALITY →





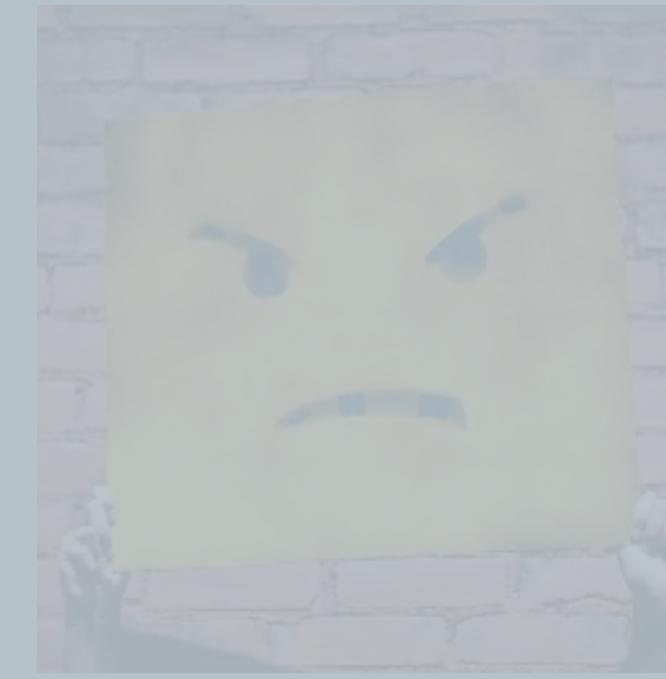
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2. FEED-BACK LOOPS IN ML-BASED AUTOMATED DECISION-MAKING SYSTEMS

MOTIVATION:

- ▶ Machine-Learning (ML)-based Decision-Making systems are widely employed in various domains, including recommendation systems, credit lending, hiring, and predictive policing.
- ▶ These systems appear to be vulnerable to **RUNAWAY FEEDBACK LOOPS** e.g., when police are repeatedly sent back to the same neighborhoods regardless of the actual rate of criminal activity, which exacerbate existing **BIASES**.

2. FEED-BACK LOOPS IN ML-BASED AUTOMATED DECISION-MAKING SYSTEMS

MOTIVATION:

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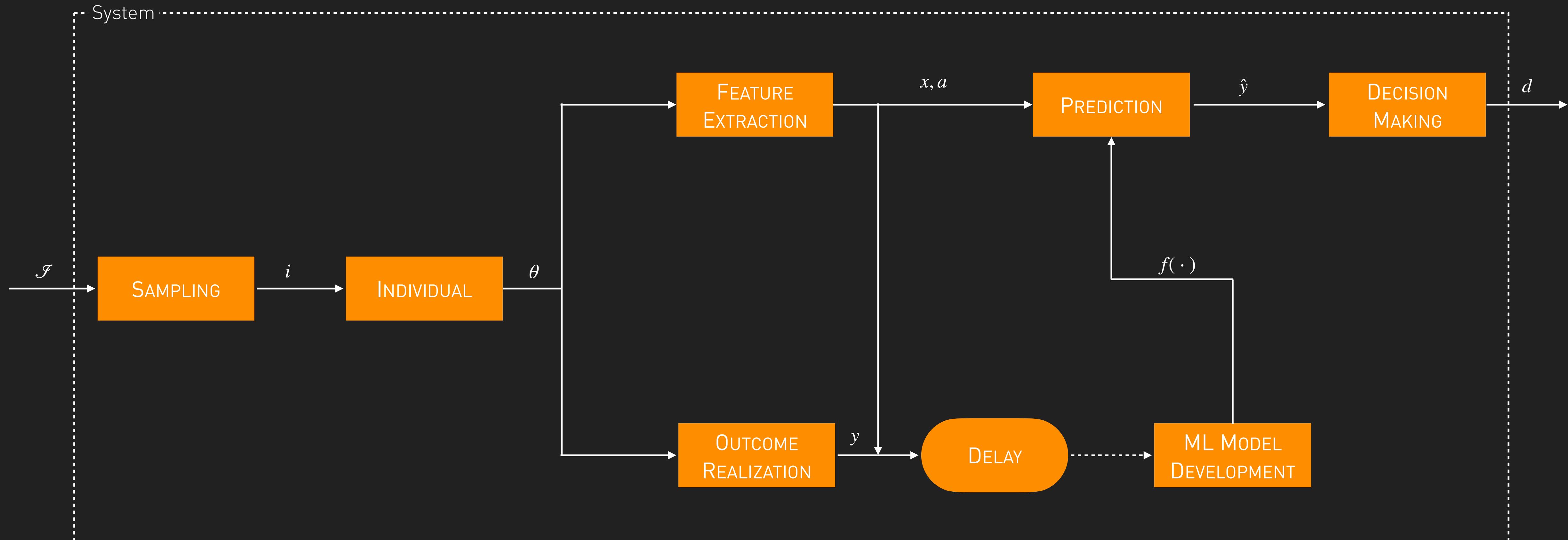
RESEARCH QUESTIONS:

- ▶ What is the role of these feedback loops, and how do they impact the ML decision-making pipeline?
- ▶ How are they linked to the different types of biases?

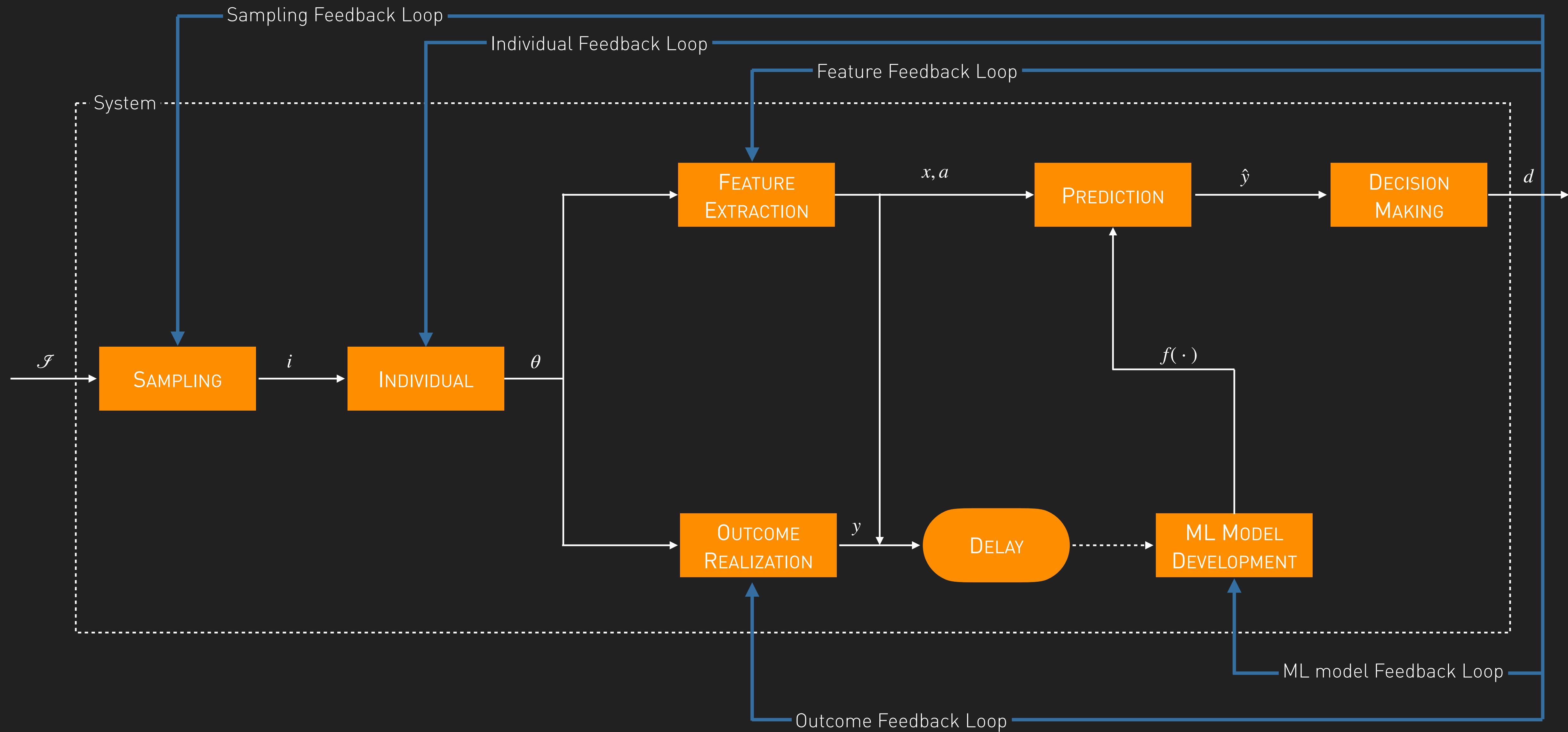
METHODS:

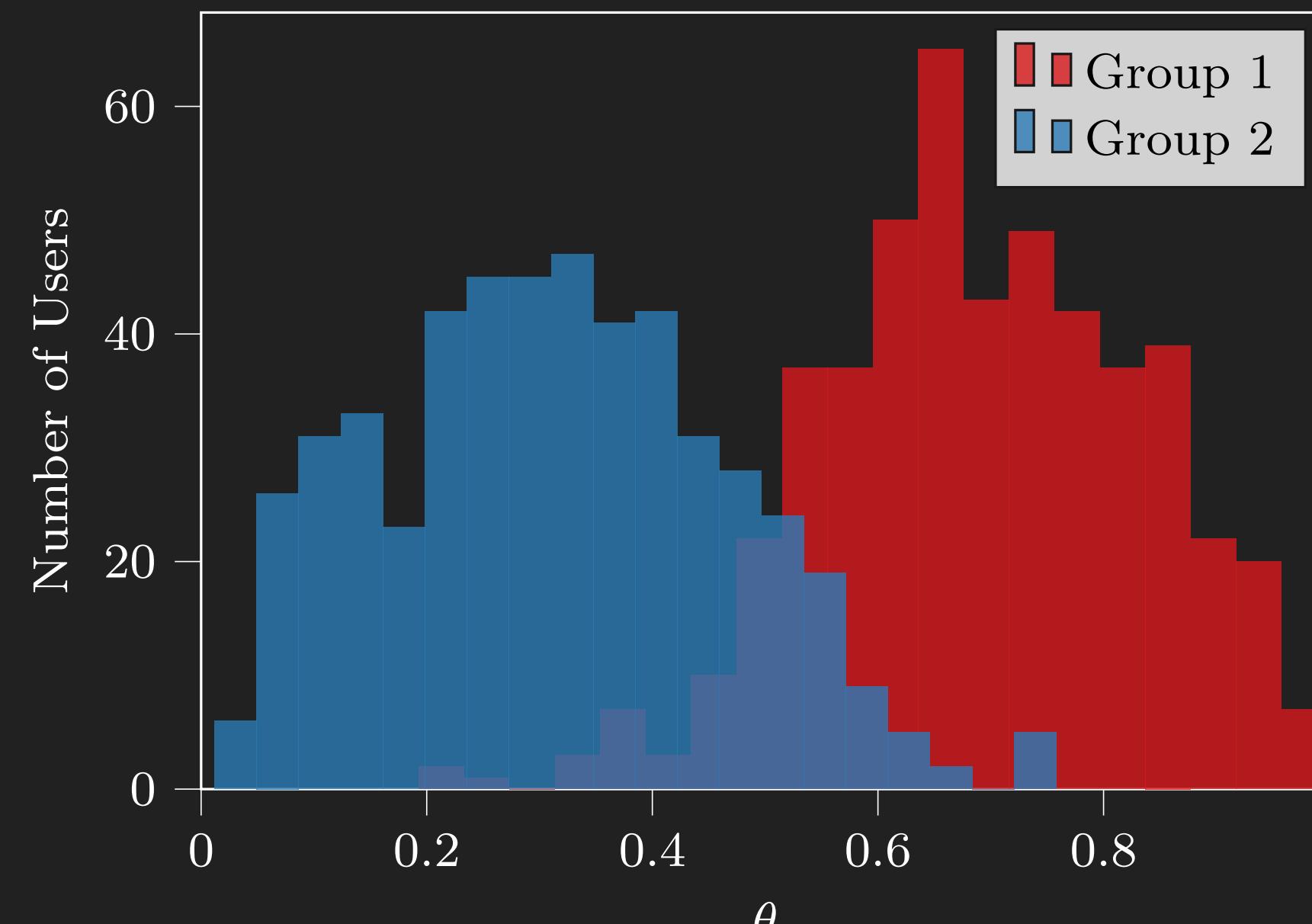
- ▶ Dynamical Systems Theory, Algorithmic Fairness

THE ML-BASED DECISION-MAKING PIPELINE

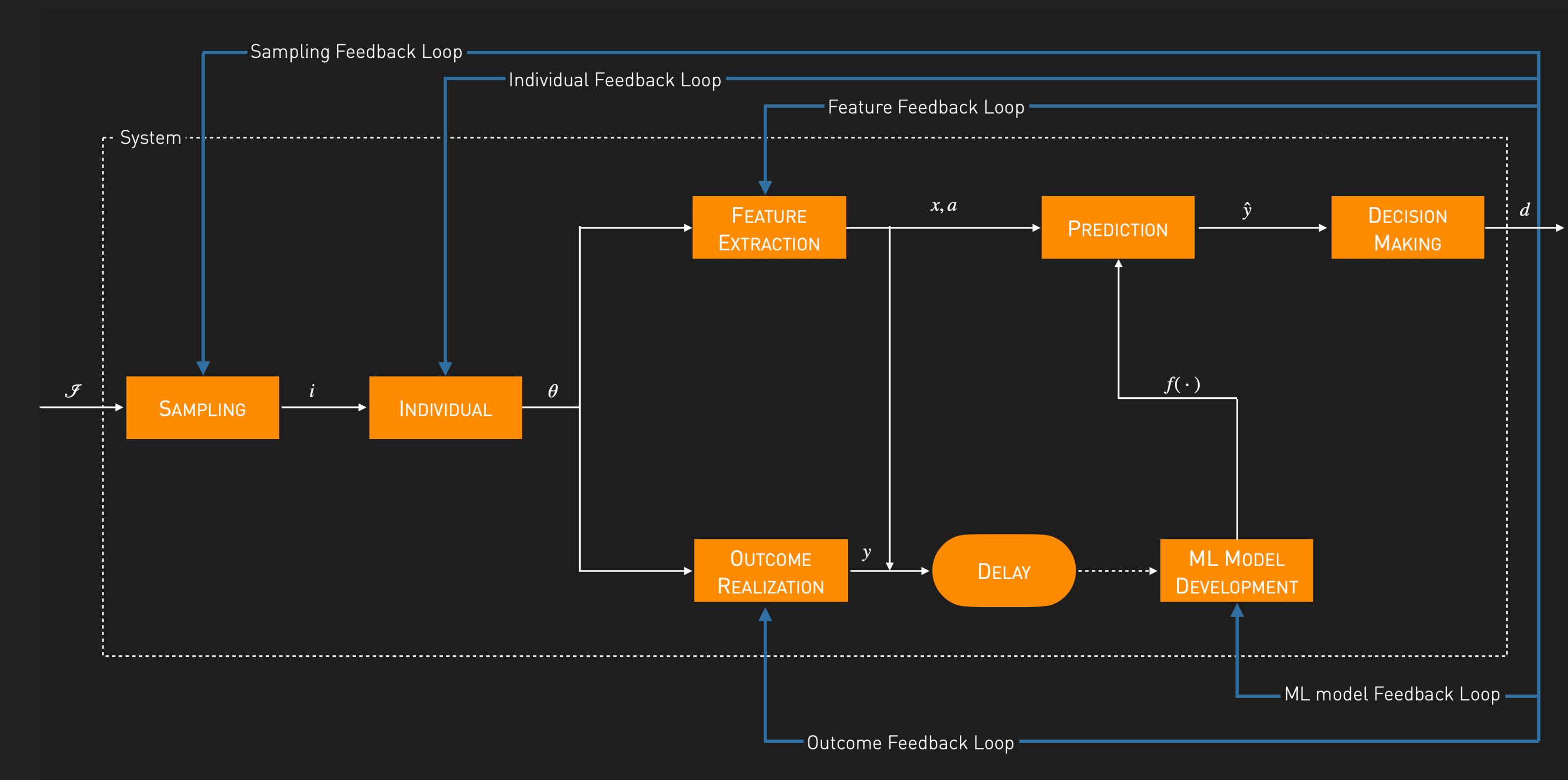


A CLASSIFICATION FRAMEWORK



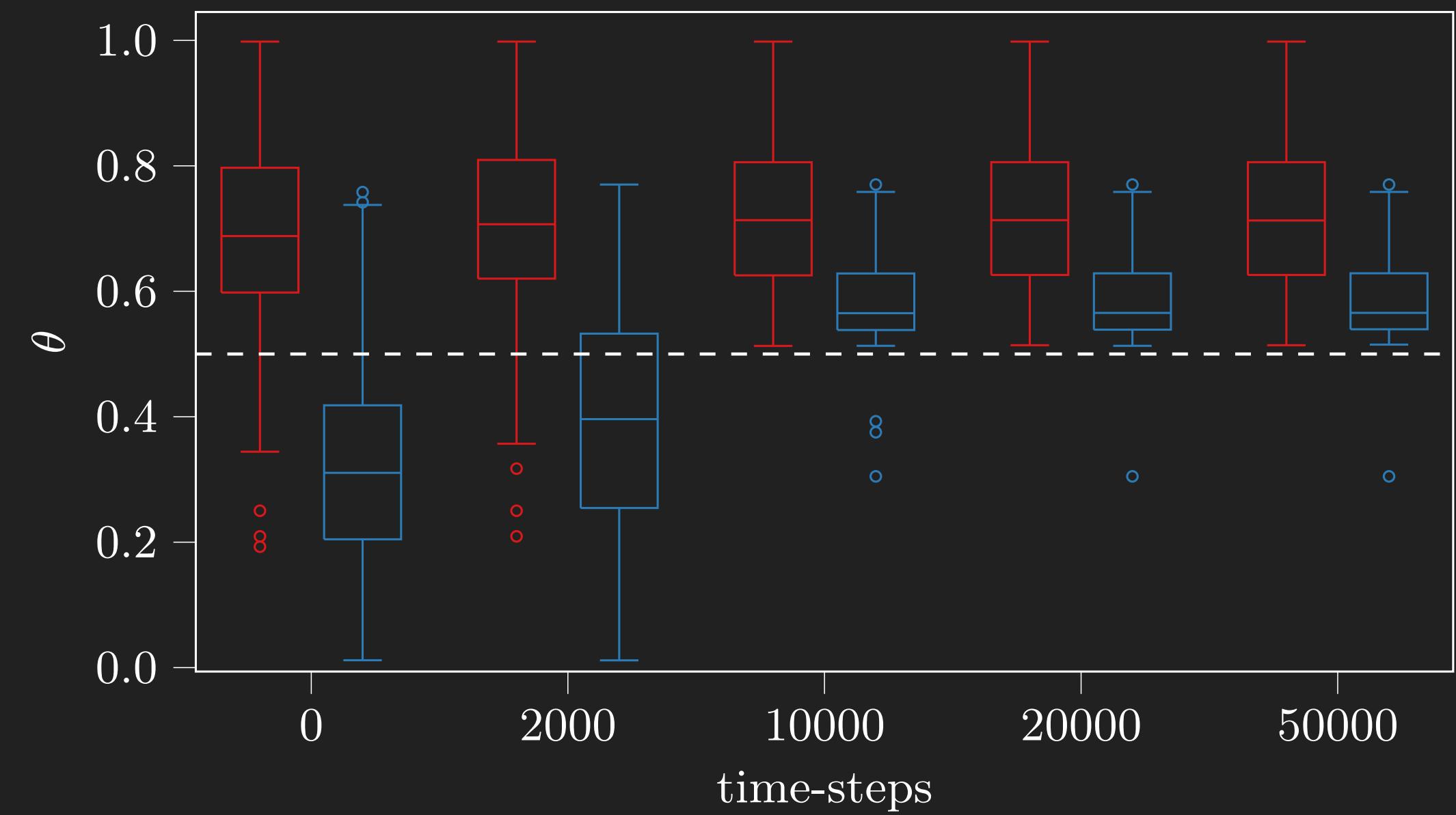
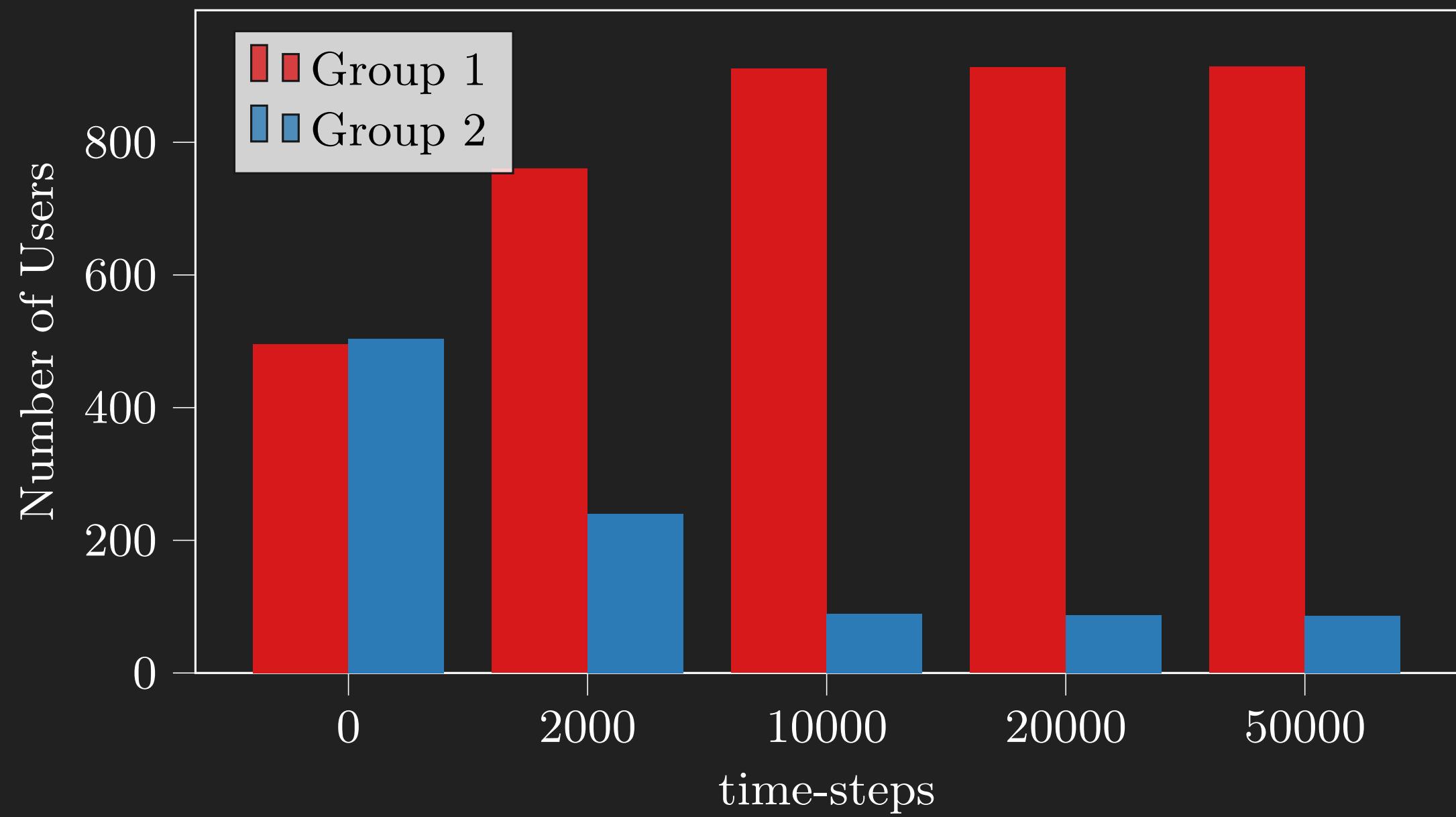


Initial Distribution



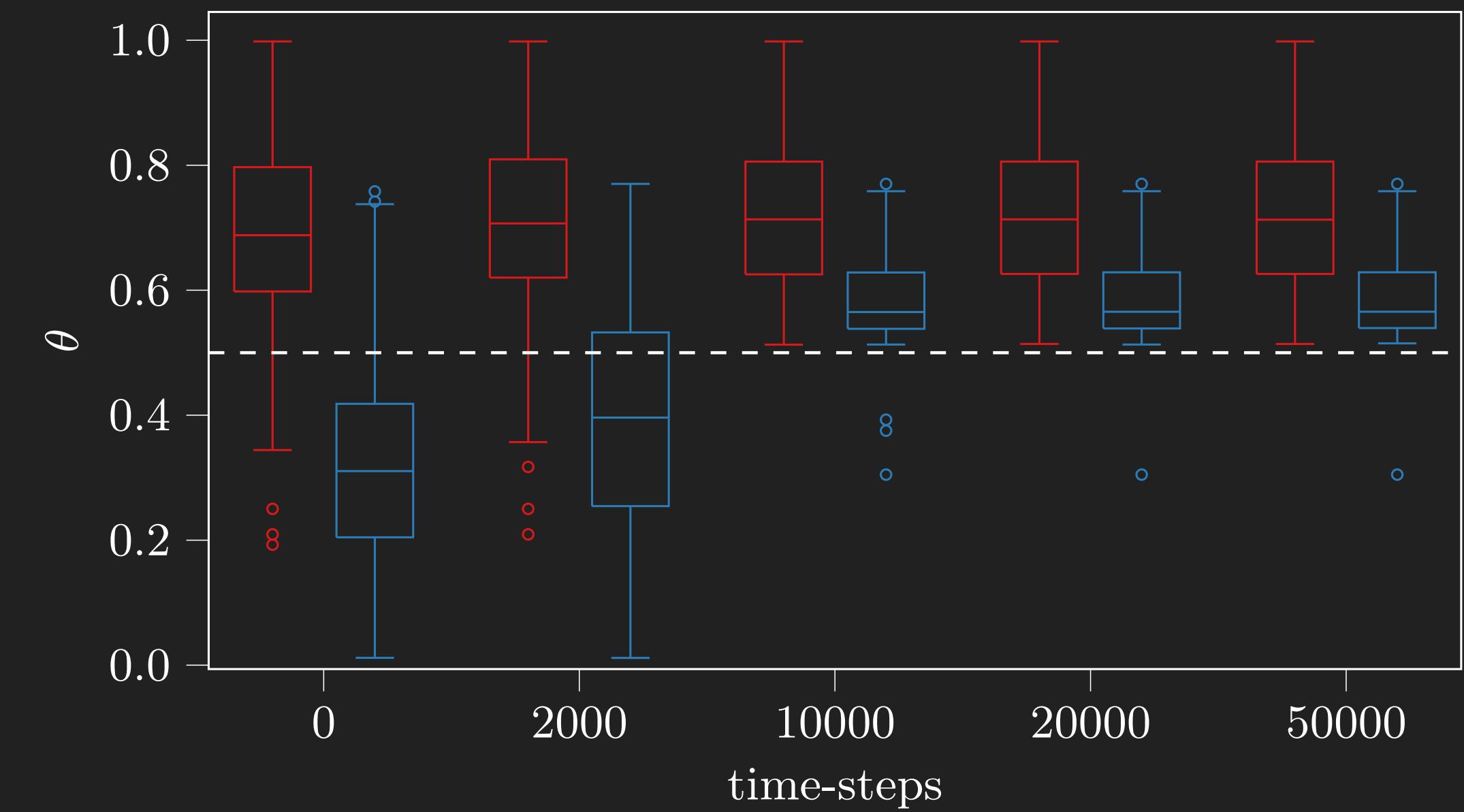
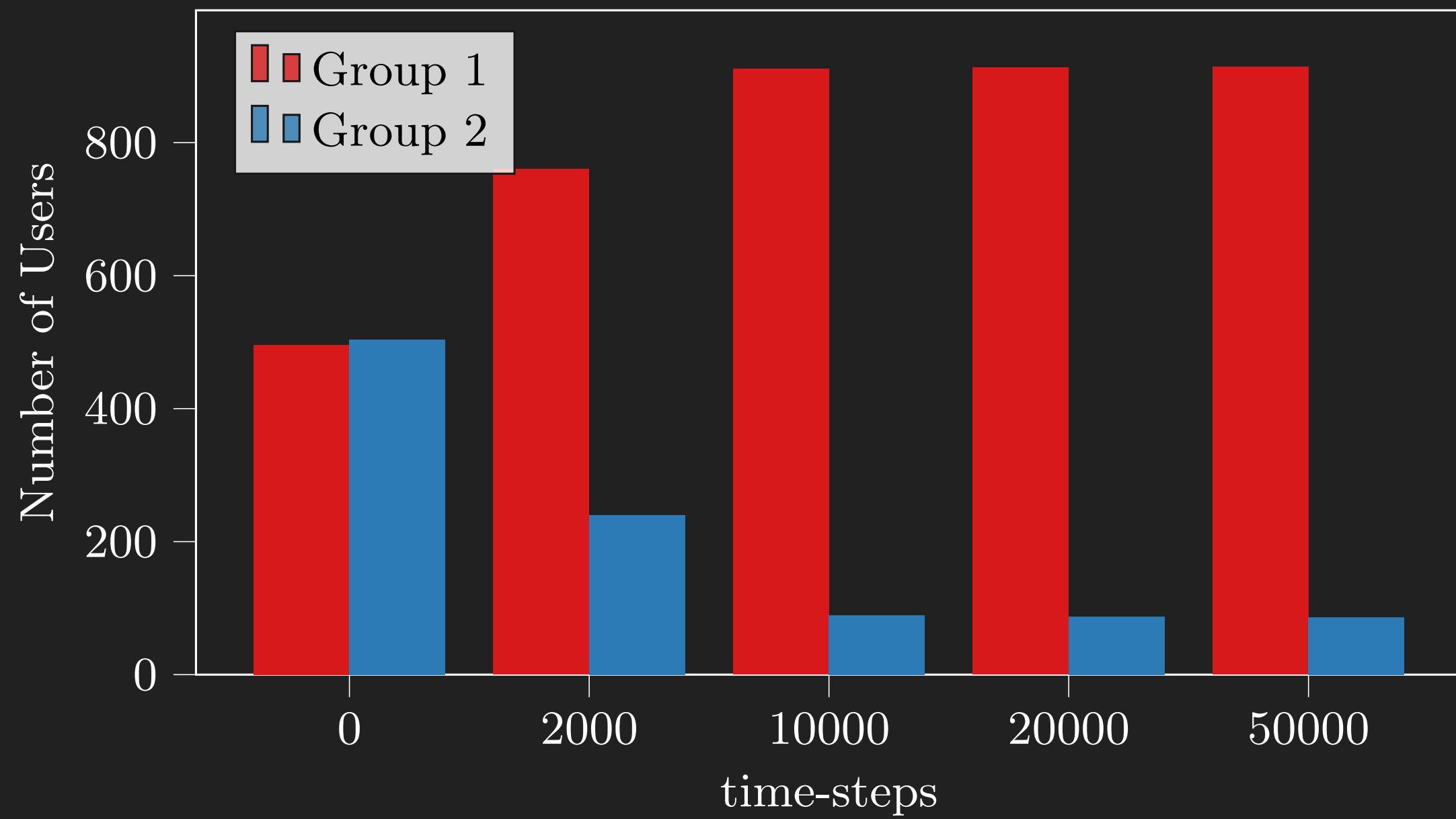
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The platform is right-skewed and users that do not see content aligned with their view leave the platform)

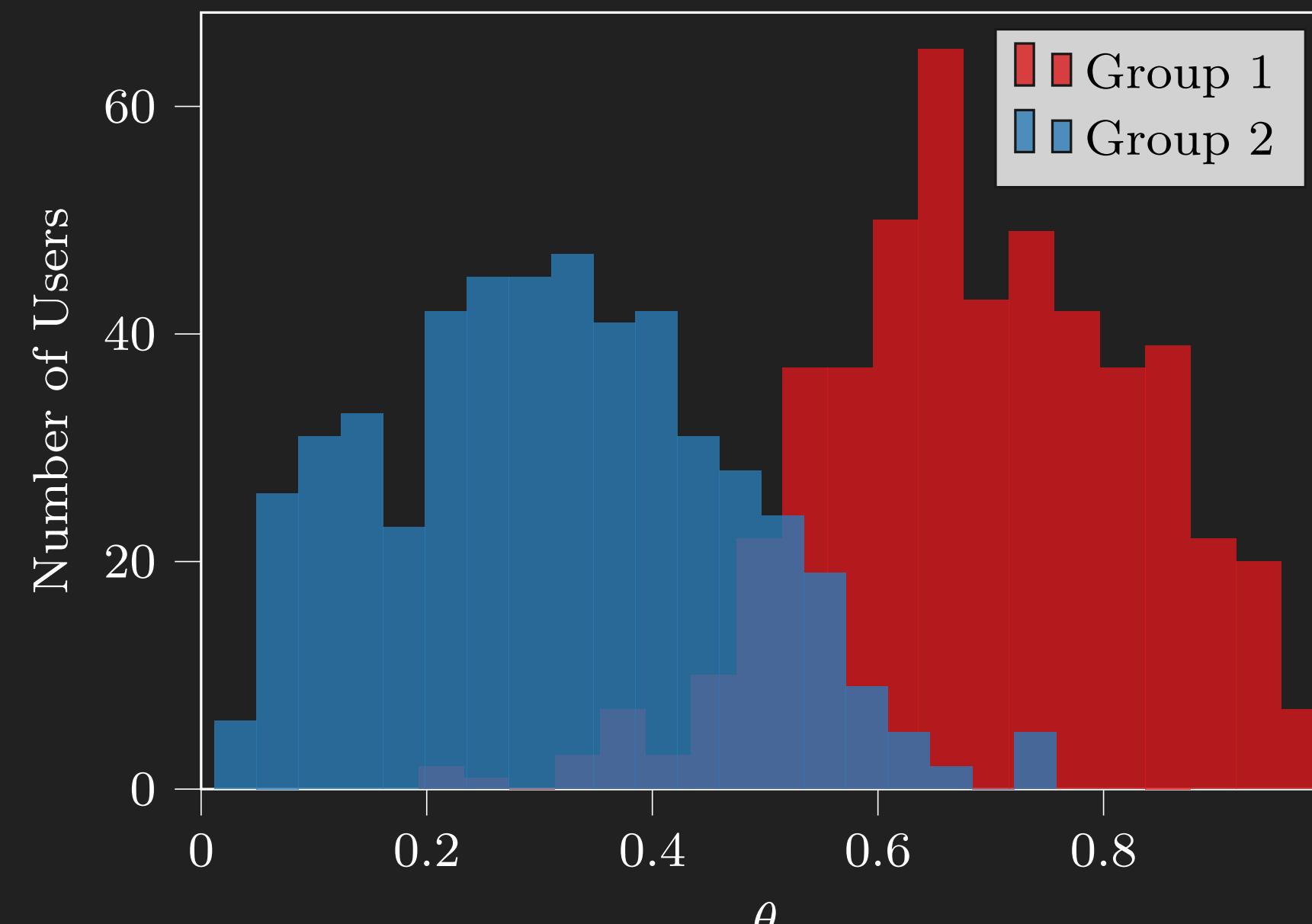


1. SAMPLING FEEDBACK LOOP:

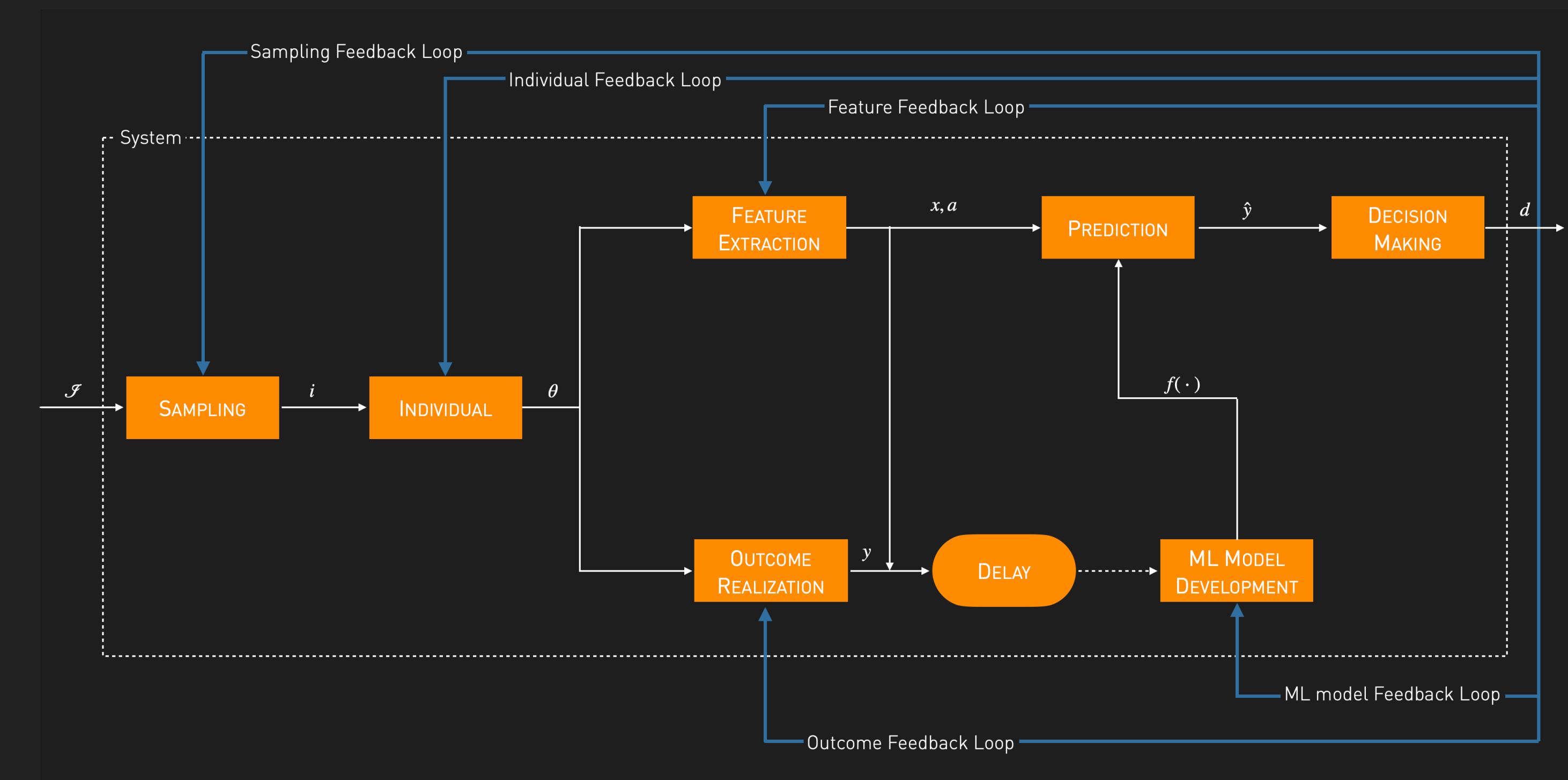
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INCREASES THE
REPRESENTATION BIAS

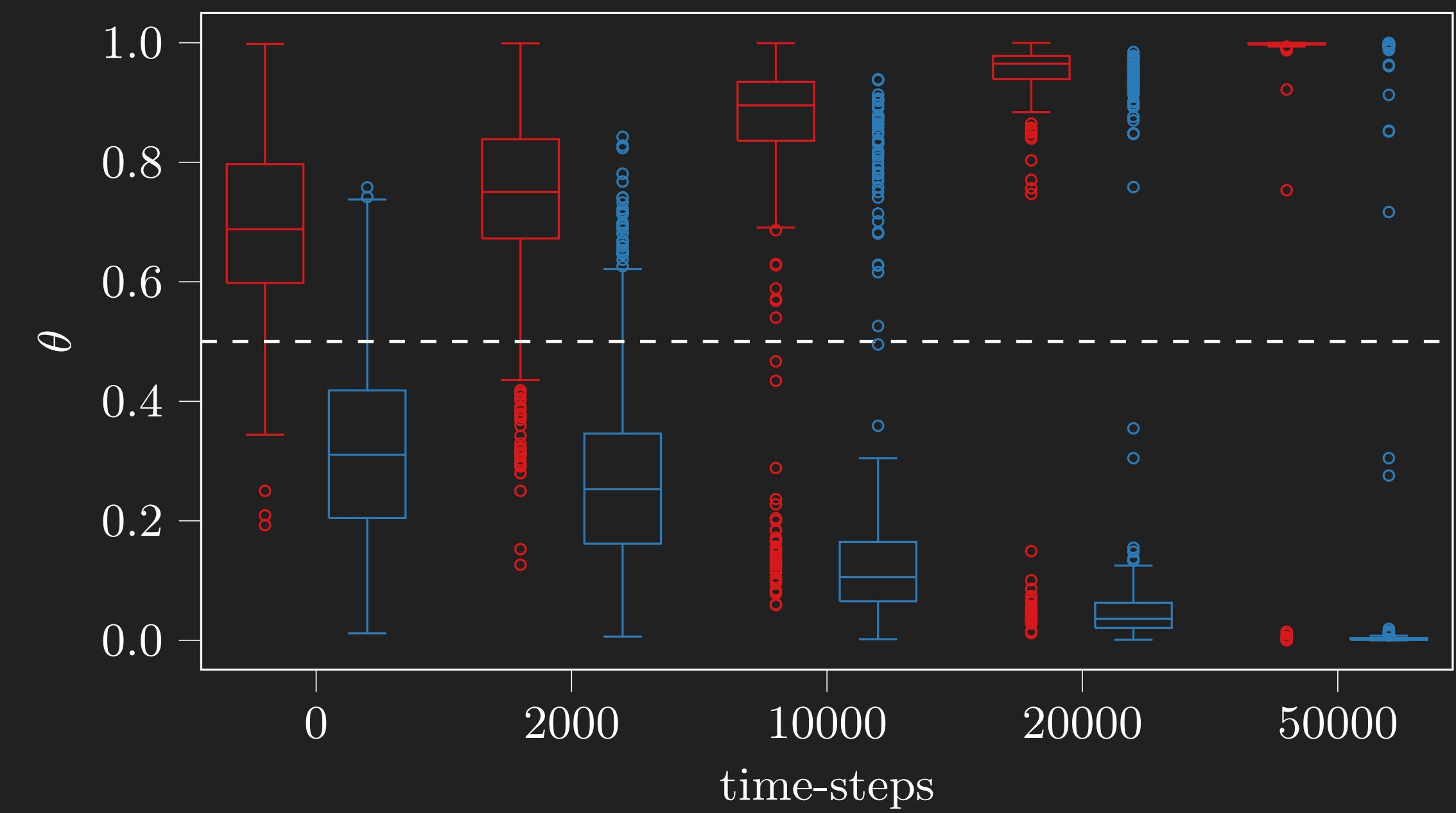
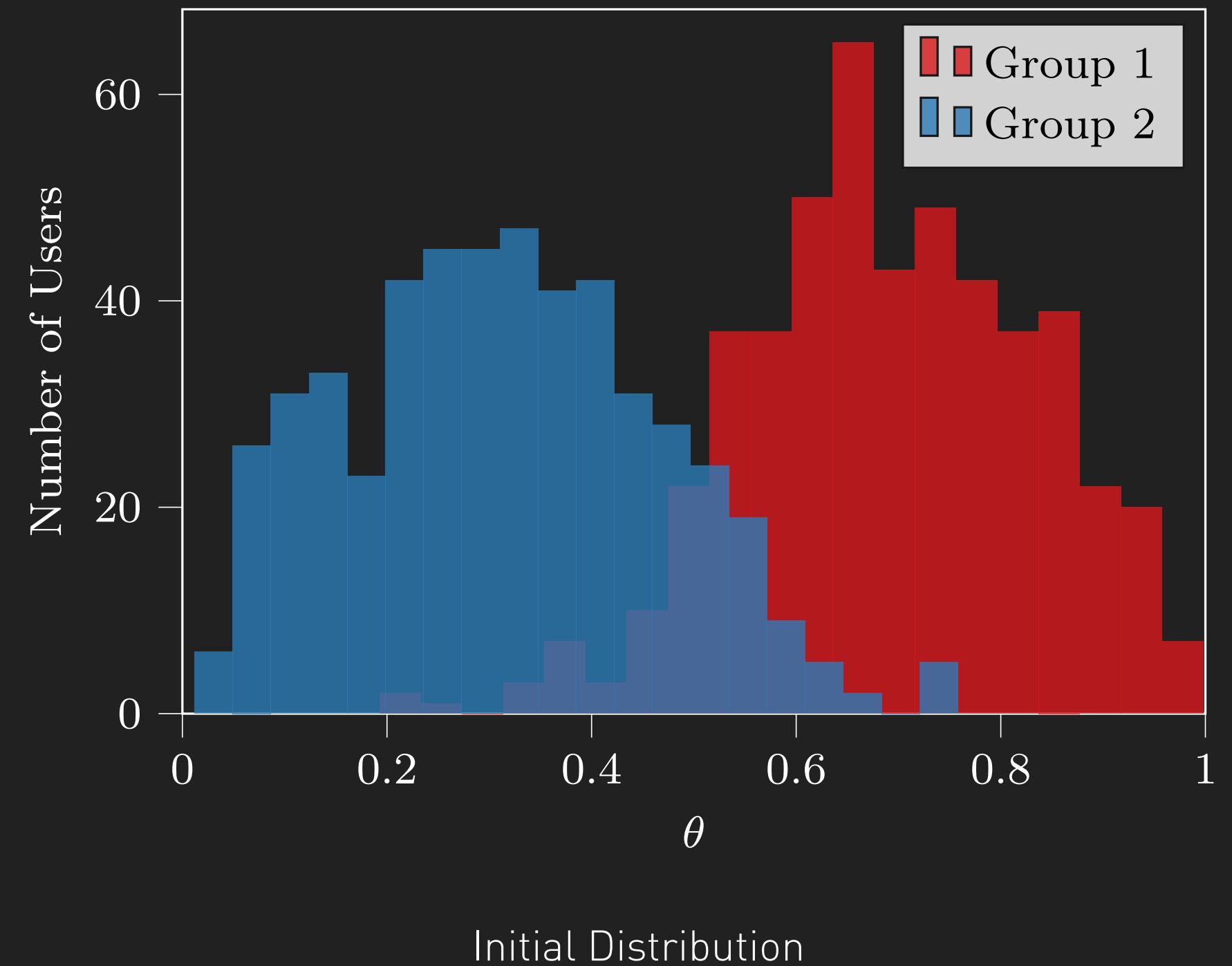


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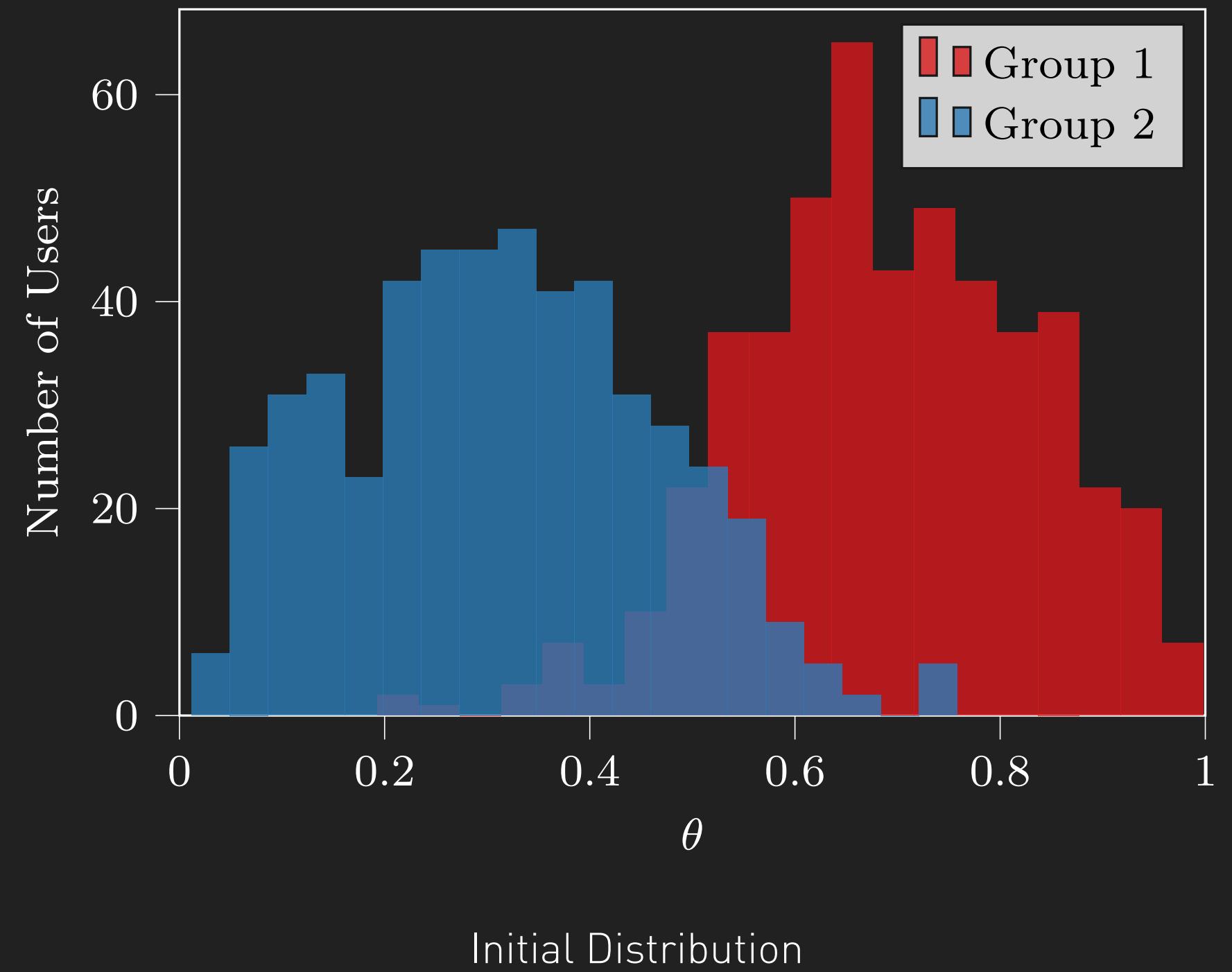
2. INDIVIDUAL FEEDBACK LOOP:

The platform recommended content
reinforces user's opinion

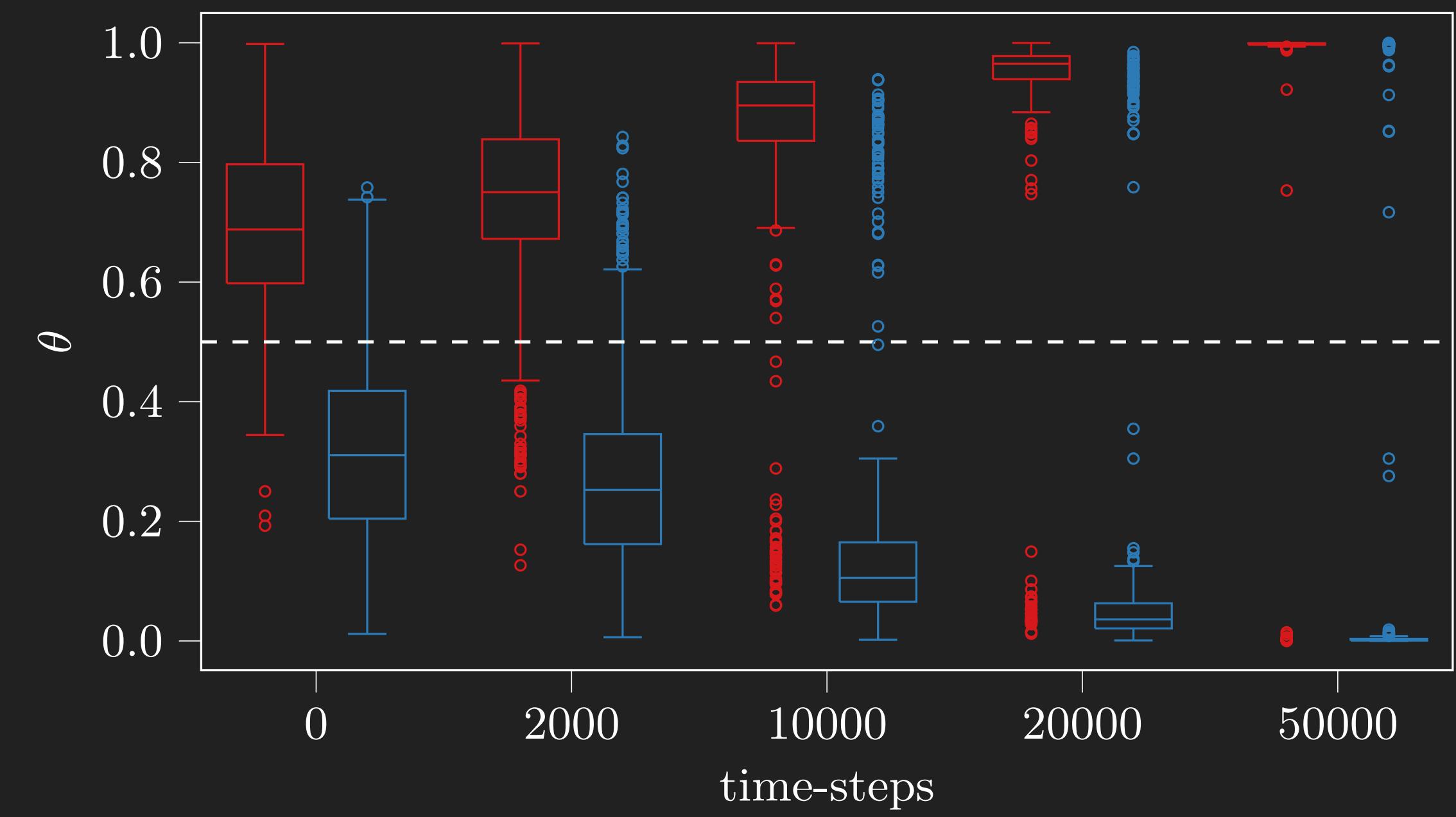


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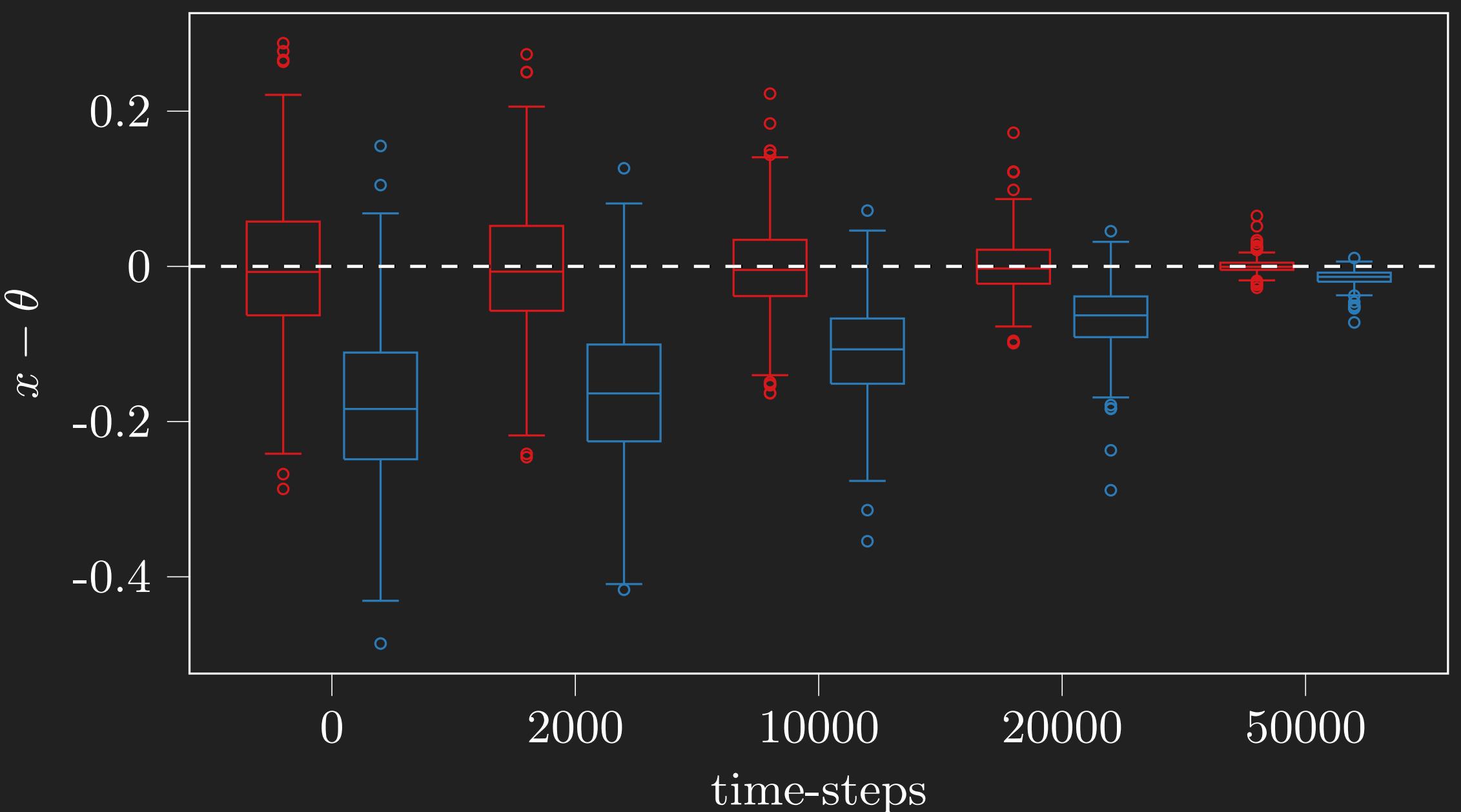
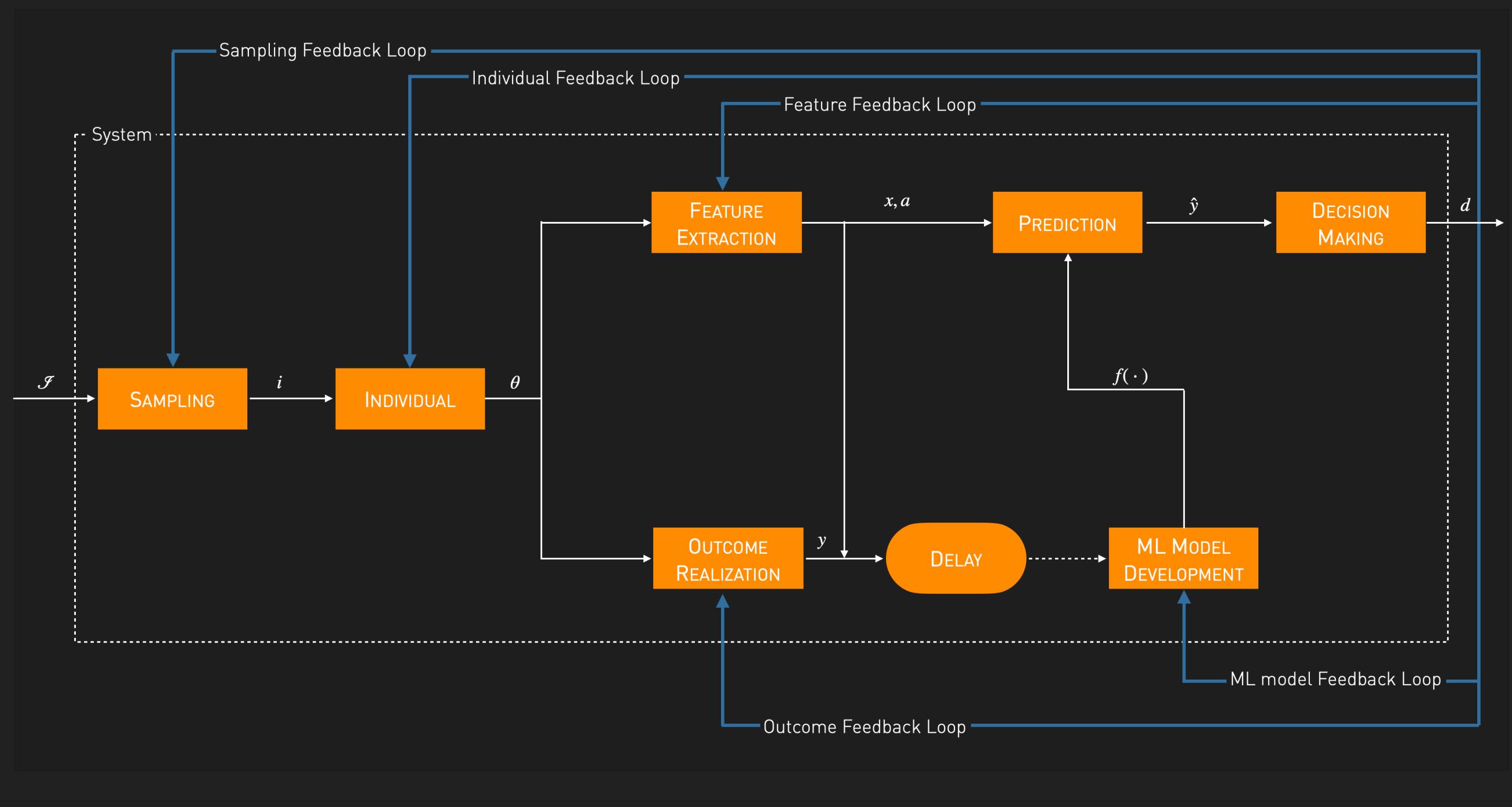
Initial Distribution



INCREASES THE
LIFE BIAS

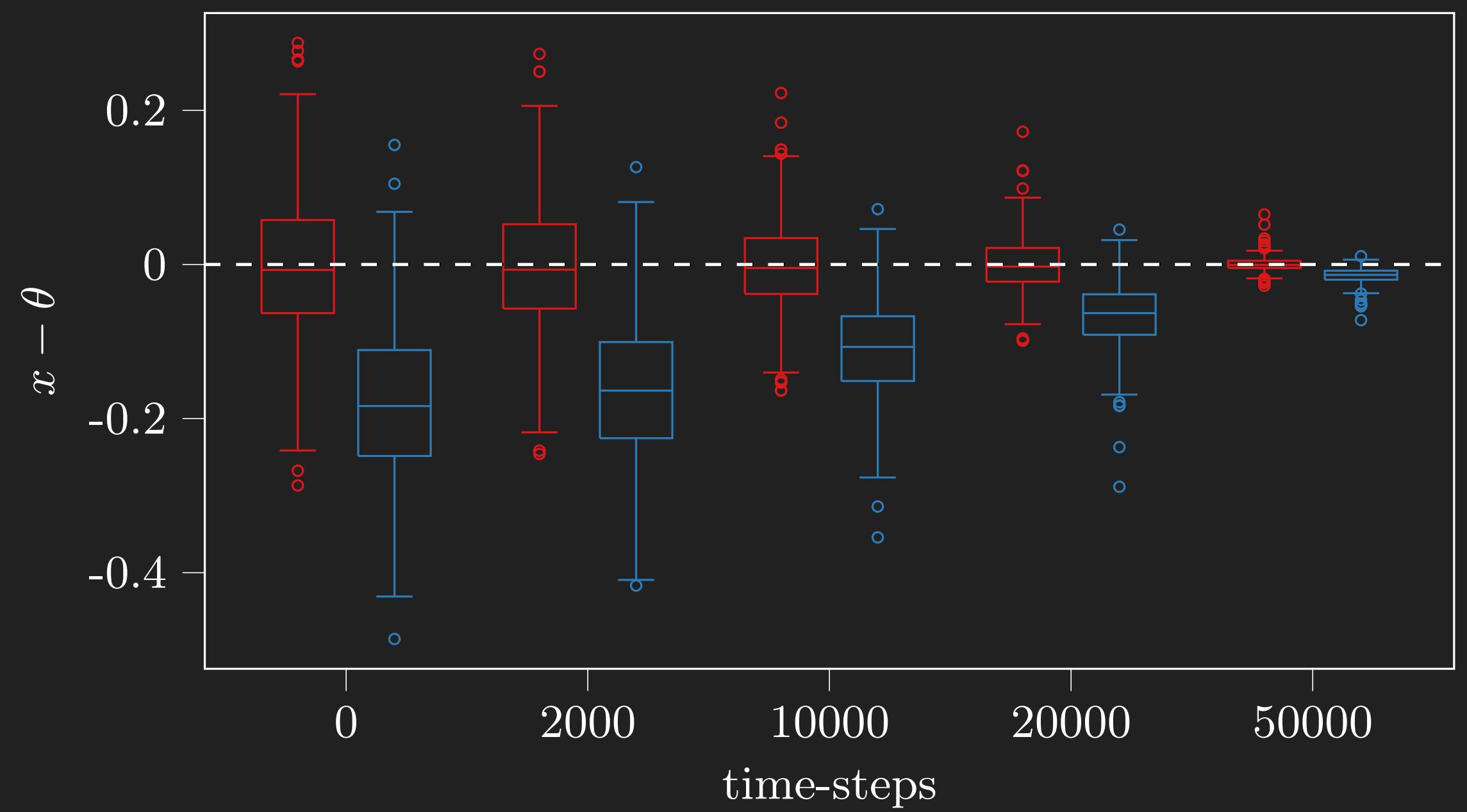
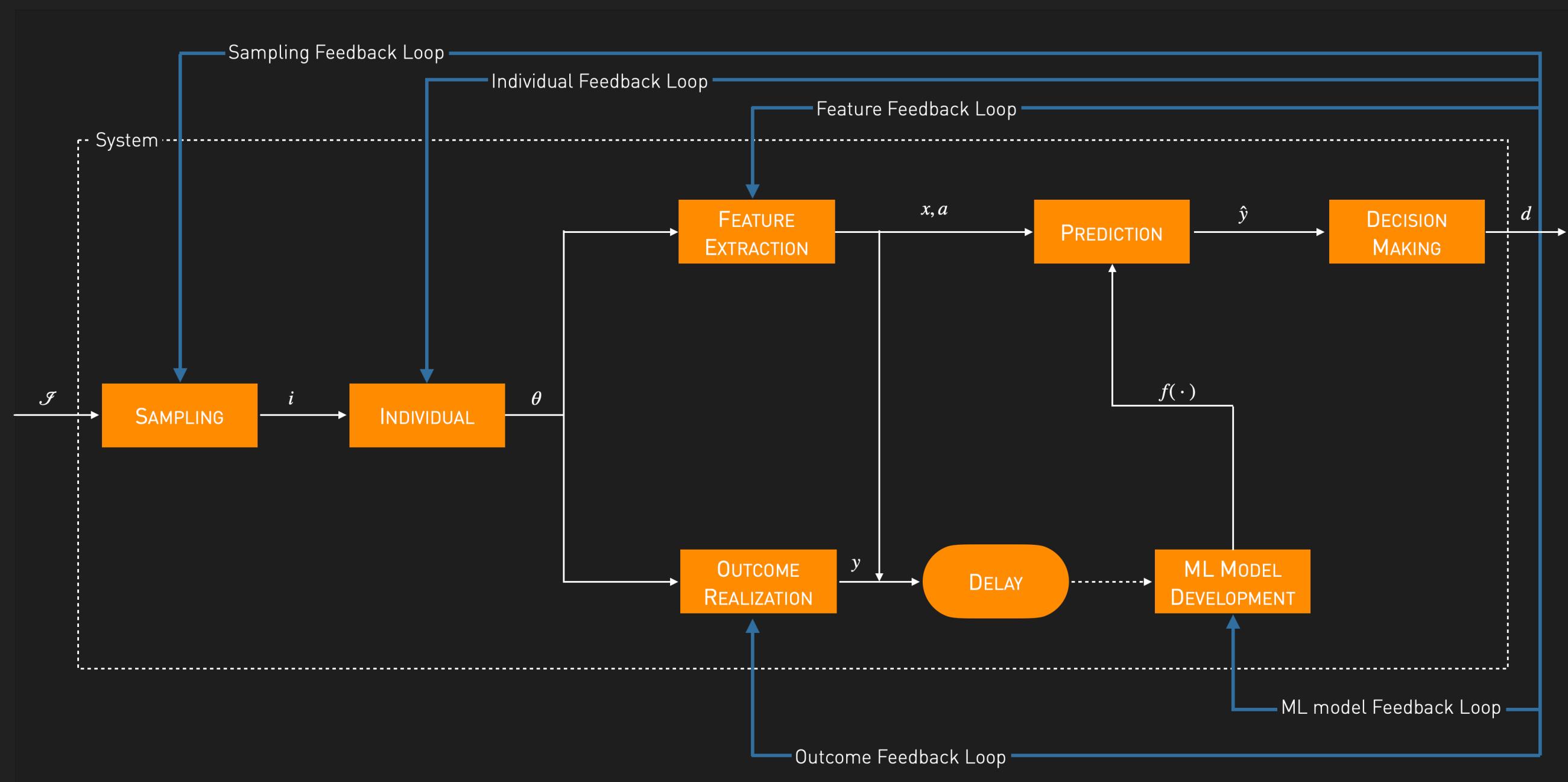
3. FEATURE FEEDBACK LOOP:

The platform recommended content informs on the correct features



3. FEATURE FEEDBACK LOOP:

The platform recommended content informs on the correct features



REDUCES THE
MEASUREMENT BIAS

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3. POLARISATION
AND HATE SPEECH



2. FEEDBACK LOOPS IN
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4. BIAS IN
SEARCH ENGINES

3. POLARISATION AND HATE SPEECH

MOTIVATION:

- ▶ Social media platforms play a crucial role in shaping public discourse around societal relevant topics, e.g., ABORTION RIGHTS or VACCINATION.
- ▶ Together with HATE SPEECH and TOXIC BEHAVIOR, polarised groups threaten social harmony and can lead to violence.
- ▶ Exposure to hate speech and toxic behavior on social media can negatively impact MENTAL HEALTH.

RESEARCH QUESTIONS:

- ▶ What drives the change of user behavior (e.g., hate speech) and how is it connected to the polarisation of the individuals?

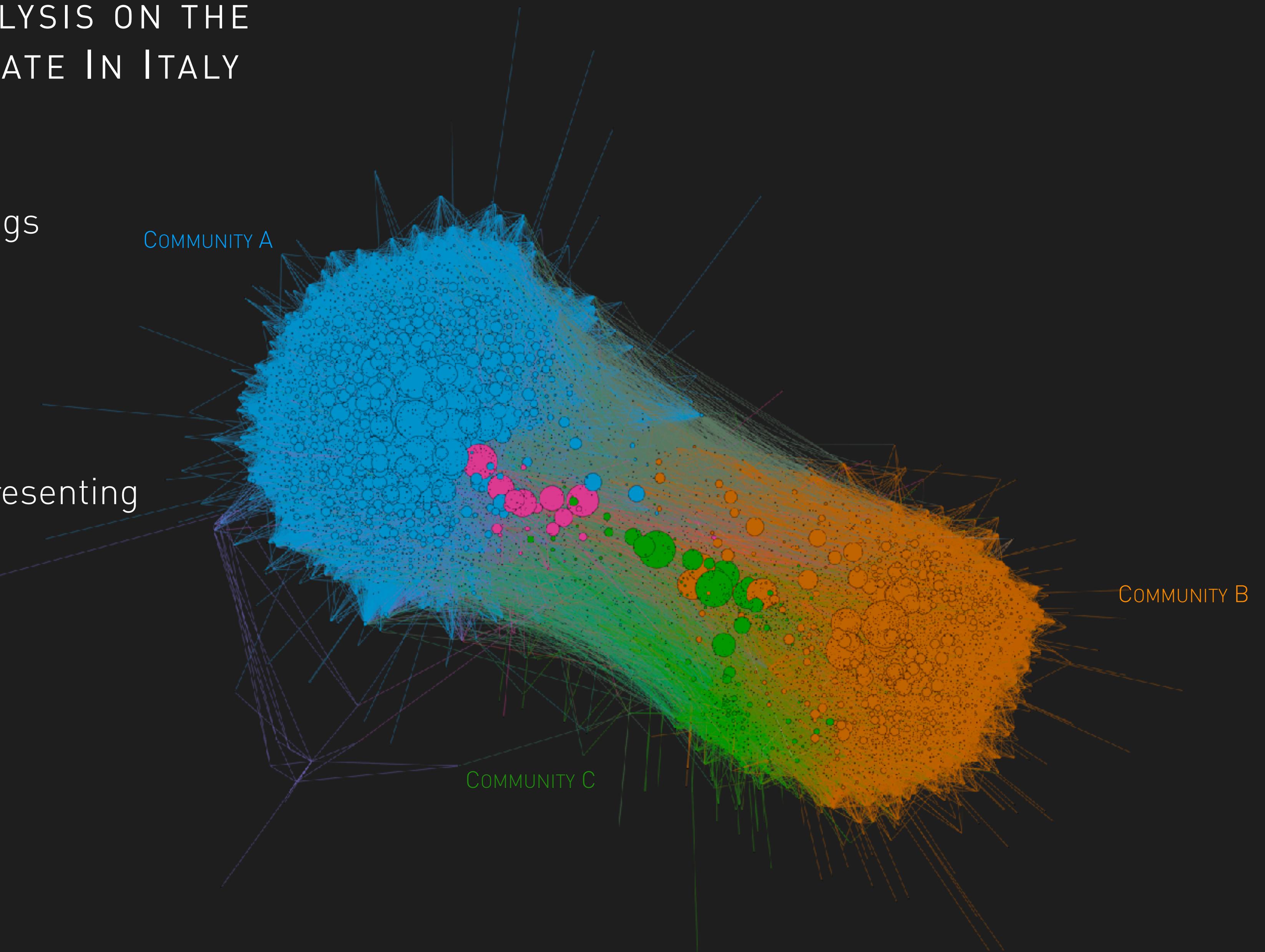
METHODS:

- ▶ Network Science, NLP

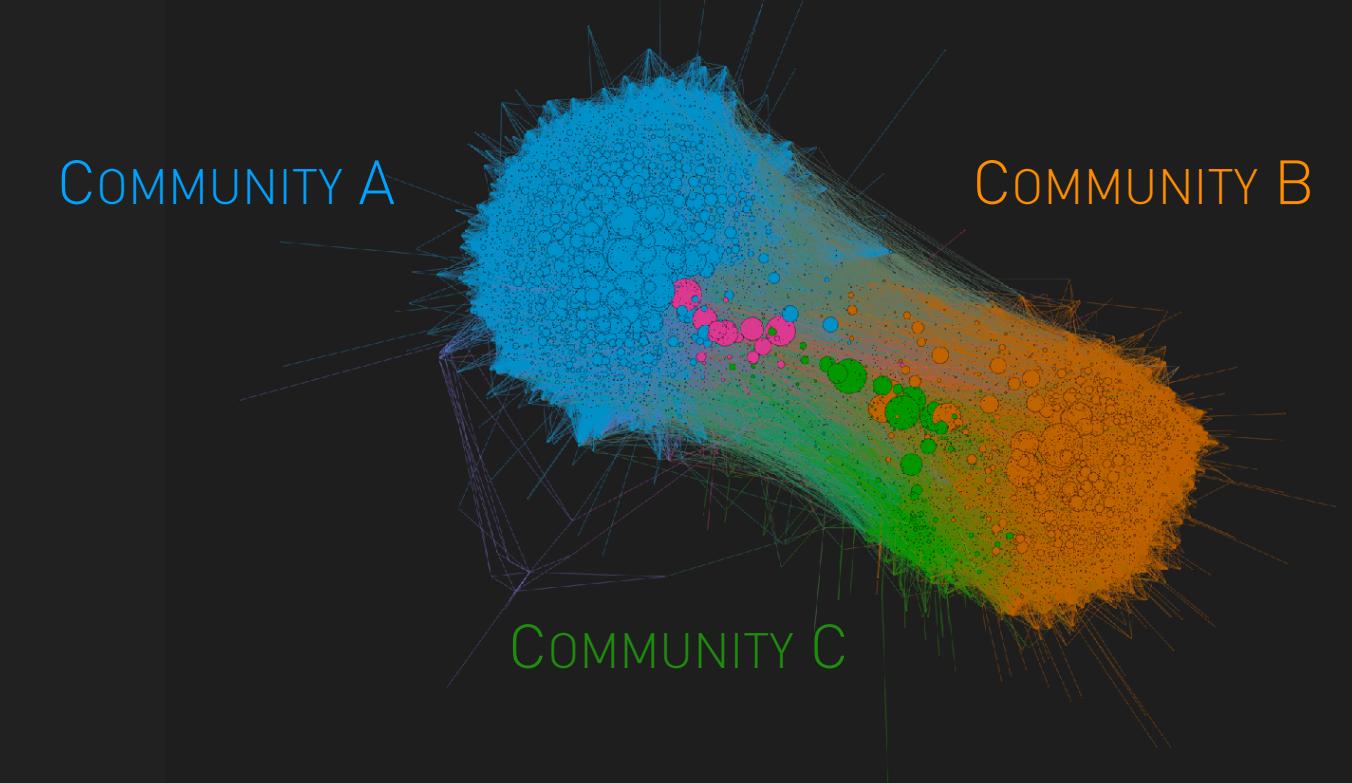
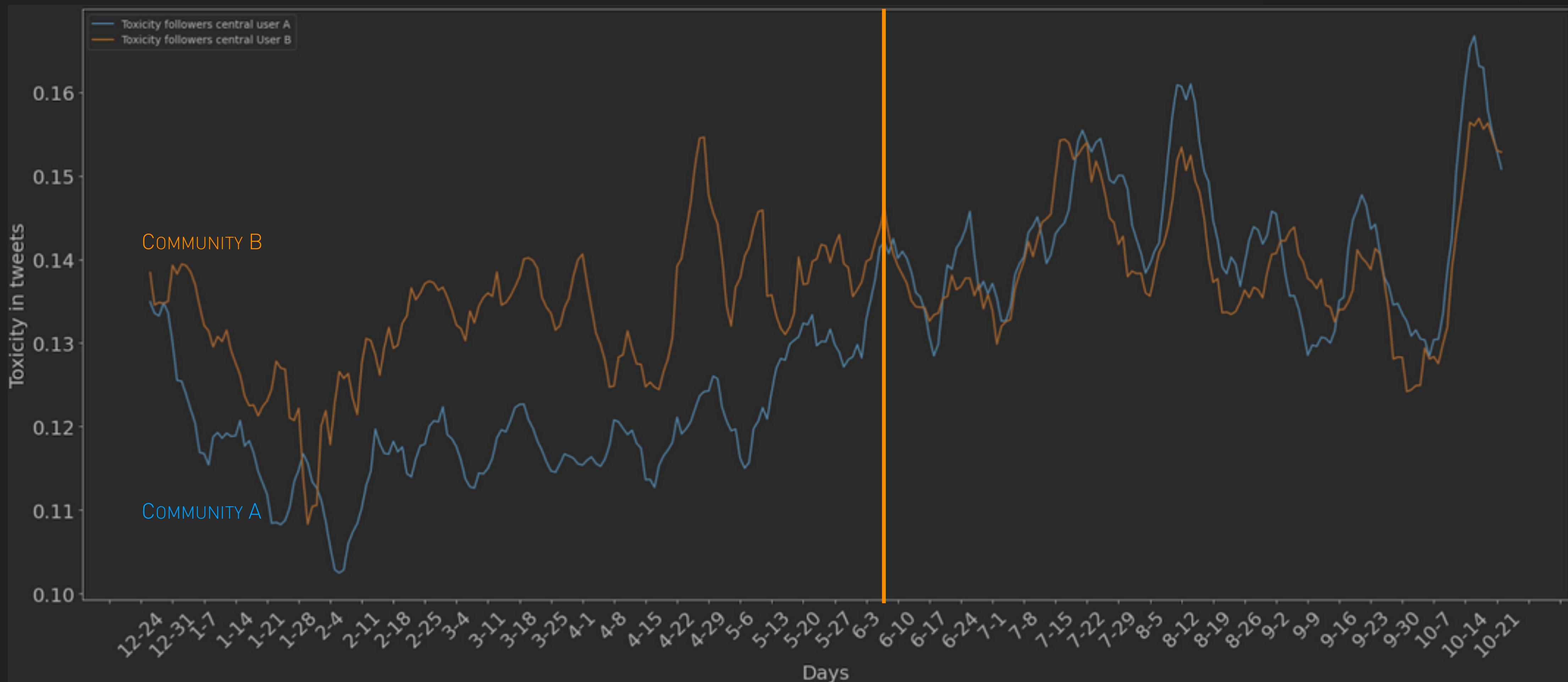
COMMUNITY DETECTION ANALYSIS ON THE COVID-19 VACCINATION DEBATE IN ITALY

DATA:

- ▶ Twitter API, using Italian hashtags
- ▶ December 2020 - October 2021
- ▶ Re-tweet network with:
 - 8'980 Core users
 - 644'784 weighted edges representing
 - 2'215'605 retweets



ANALYSIS OF TOXIC BEHAVIOUR AMONG FOLLOWERS OF CENTRAL USERS



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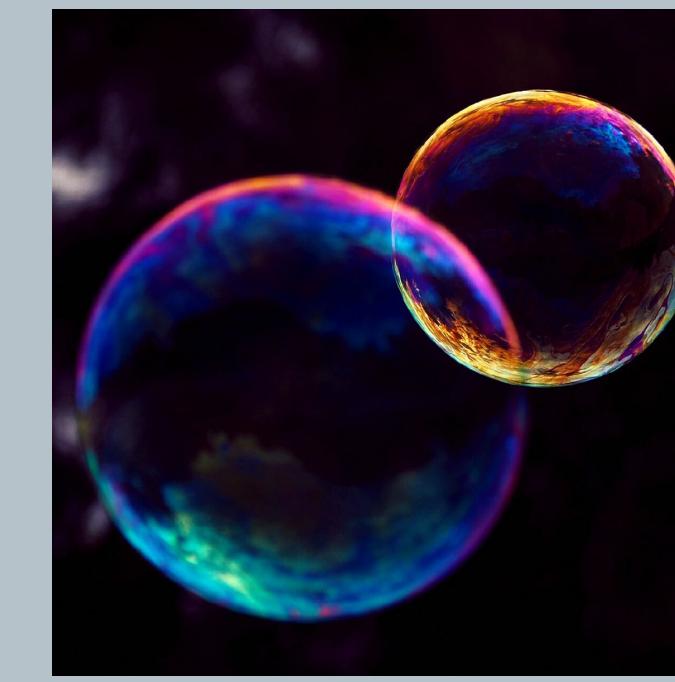
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4. BIAS IN
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4. BIAS IN SEARCH ENGINES

MOTIVATION:

- ▶ SEARCH ENGINES are used by most internet users on a daily basis and are highly trusted
- ▶ The information found in search results is NOT ALWAYS UNBIASED OR ACCURATE
- ▶ Search outputs can have an effect on users' opinions and (perceived) knowledge on contentious topics
- ▶ Search interfaces have significantly evolved and often contain so-called KNOWLEDGE GRAPH ELEMENTS such as FEATURED SNIPPETS

RESEARCH QUESTION:

- ▶ How does information in specific Knowledge Graph elements such as featured snippets affect user knowledge?

METHODS:

- ▶ Online experiments

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You can drive in Switzerland using your foreign driving license for up to 12 months. However, if your driver's license is not in English, German, French, or Italian, you also need an International Driving License. This isn't actually a license but a translation of your foreign one.

<https://www.expatica.com> > ... > Transport

Tips for driving and parking in Switzerland | Expatica

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Driving in Switzerland on a foreign licence

27.11.2017 — A foreign, national or international licence entitles the holder to drive all categories of vehicles for which that licence is valid on Swiss ...

<https://www.ch.ch> > international-d...

International driving licence from Switzerland - ch.ch

Validity and price. The international driving licence is valid for three years, but not beyond the expiry date of your Swiss driving licence. You cannot renew ...

<https://www.autoeurope.com> > Travel Tips > IDP FAQ

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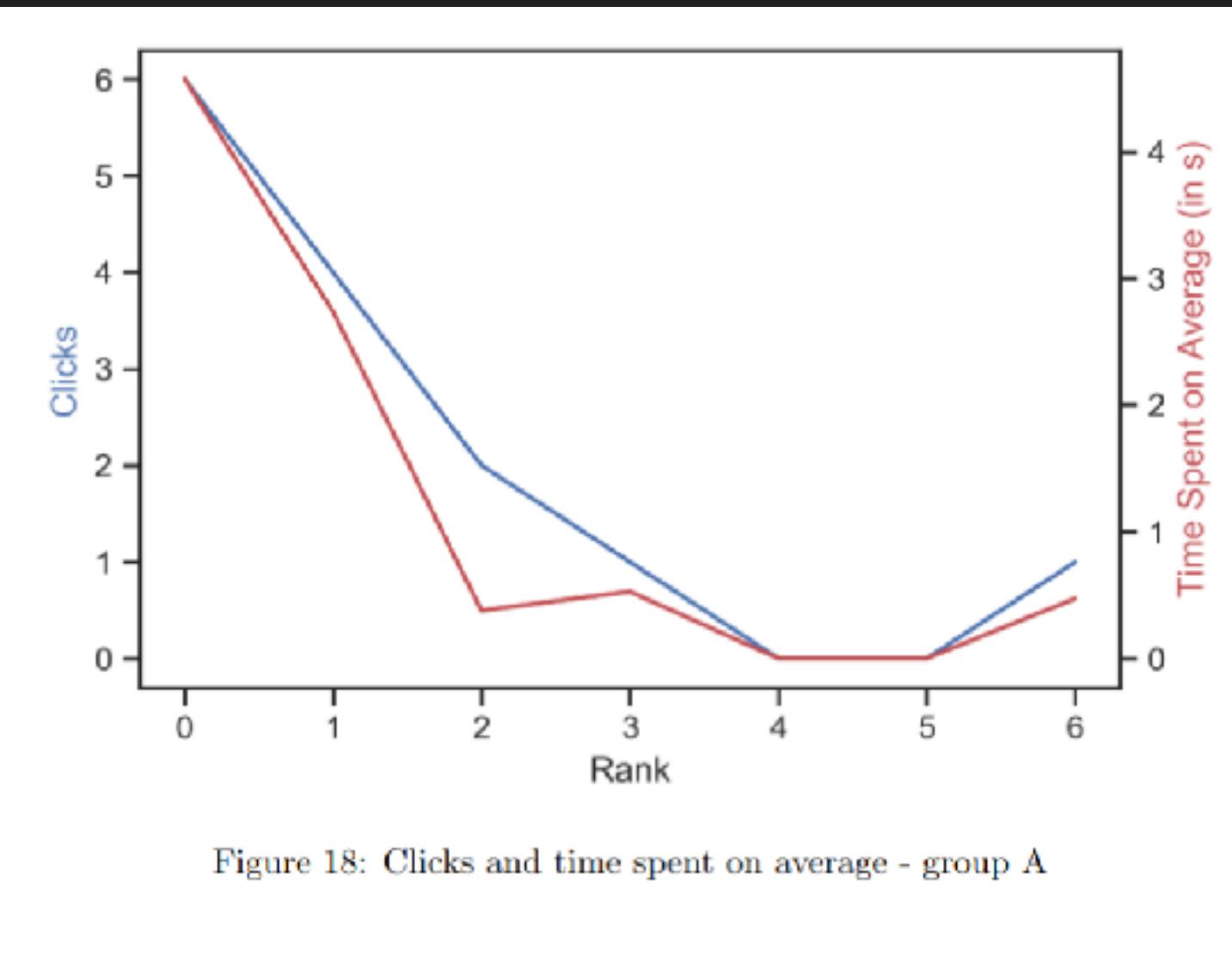
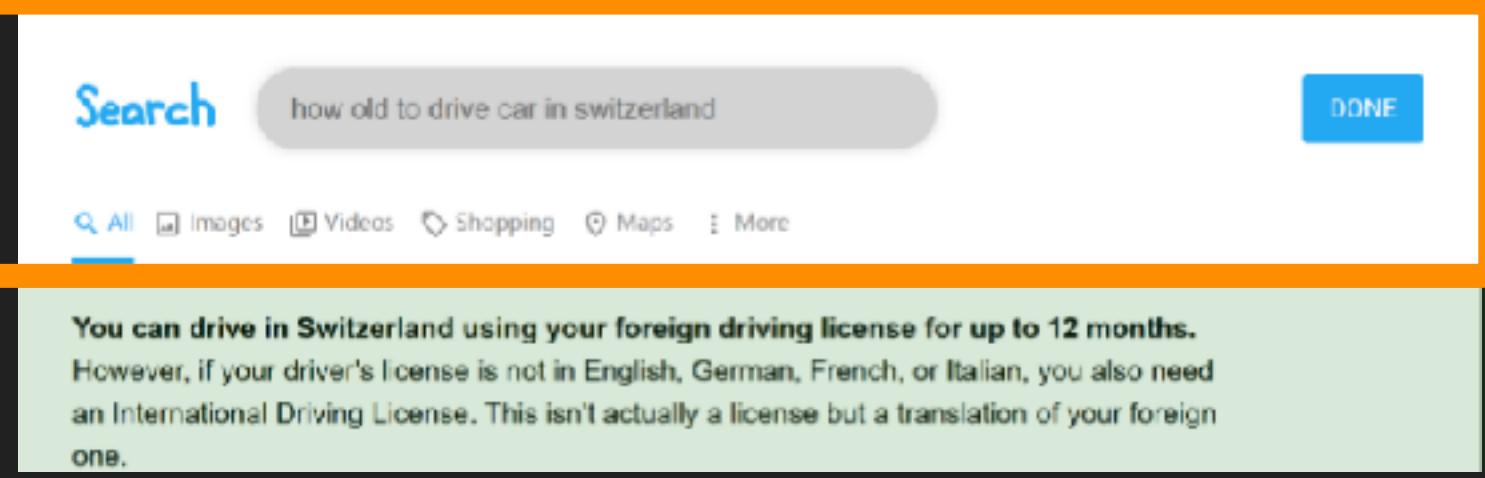
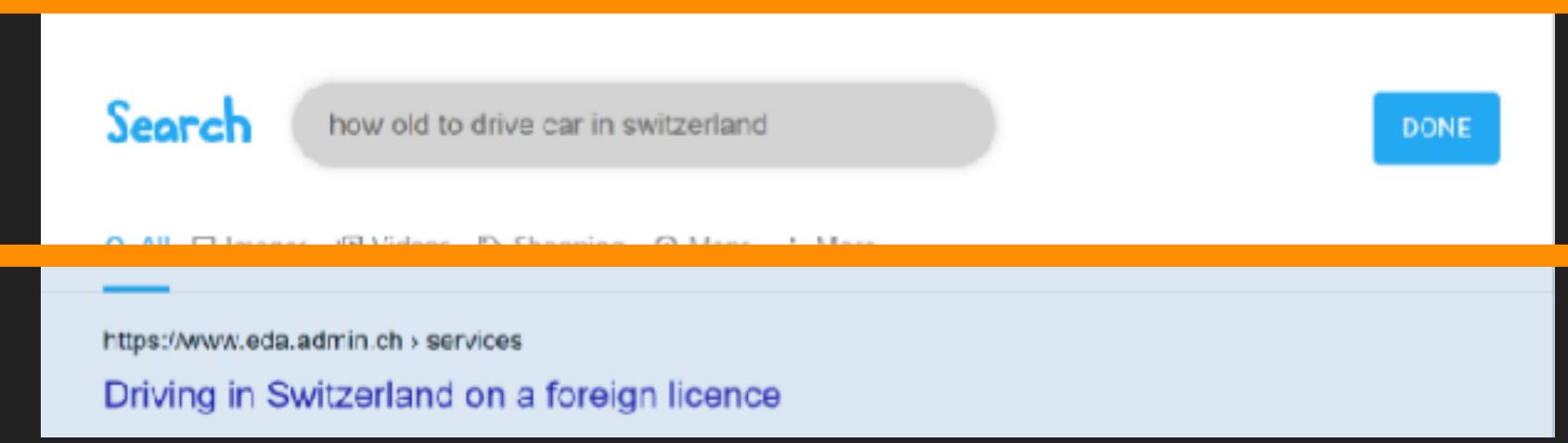
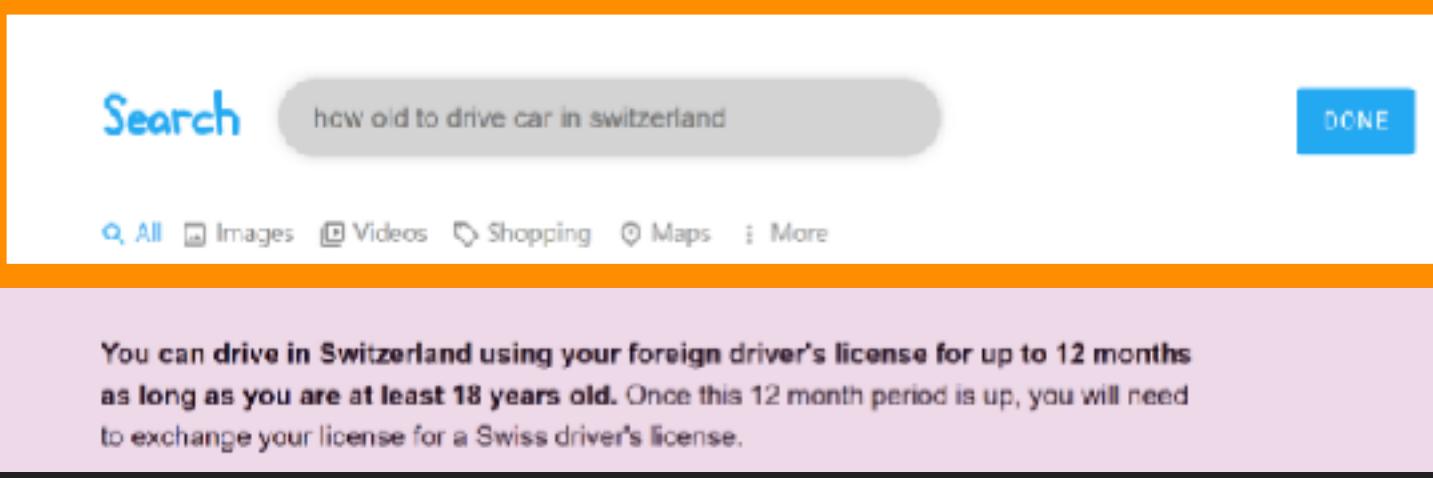


Figure 18: Clicks and time spent on average - group A

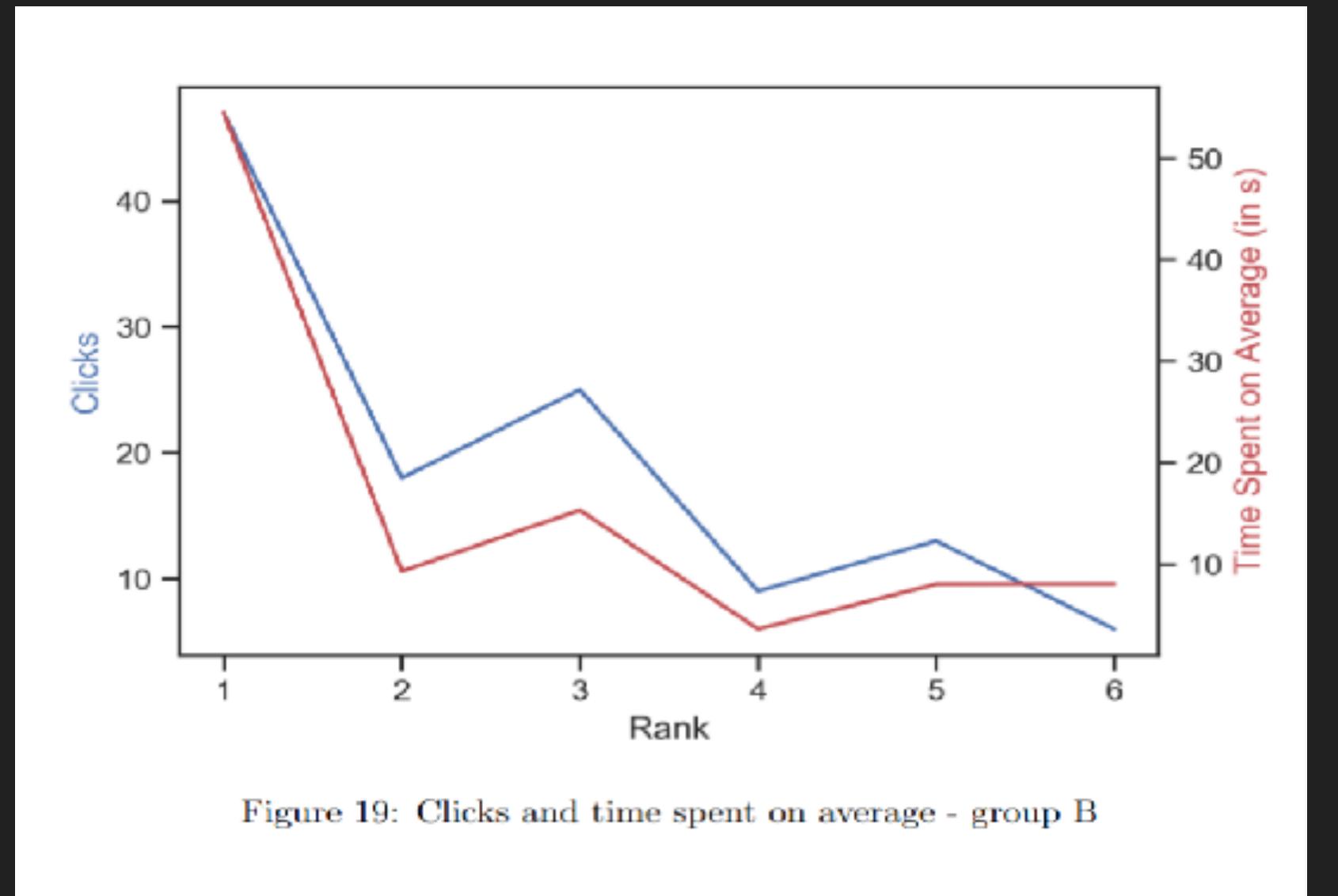


Figure 19: Clicks and time spent on average - group B

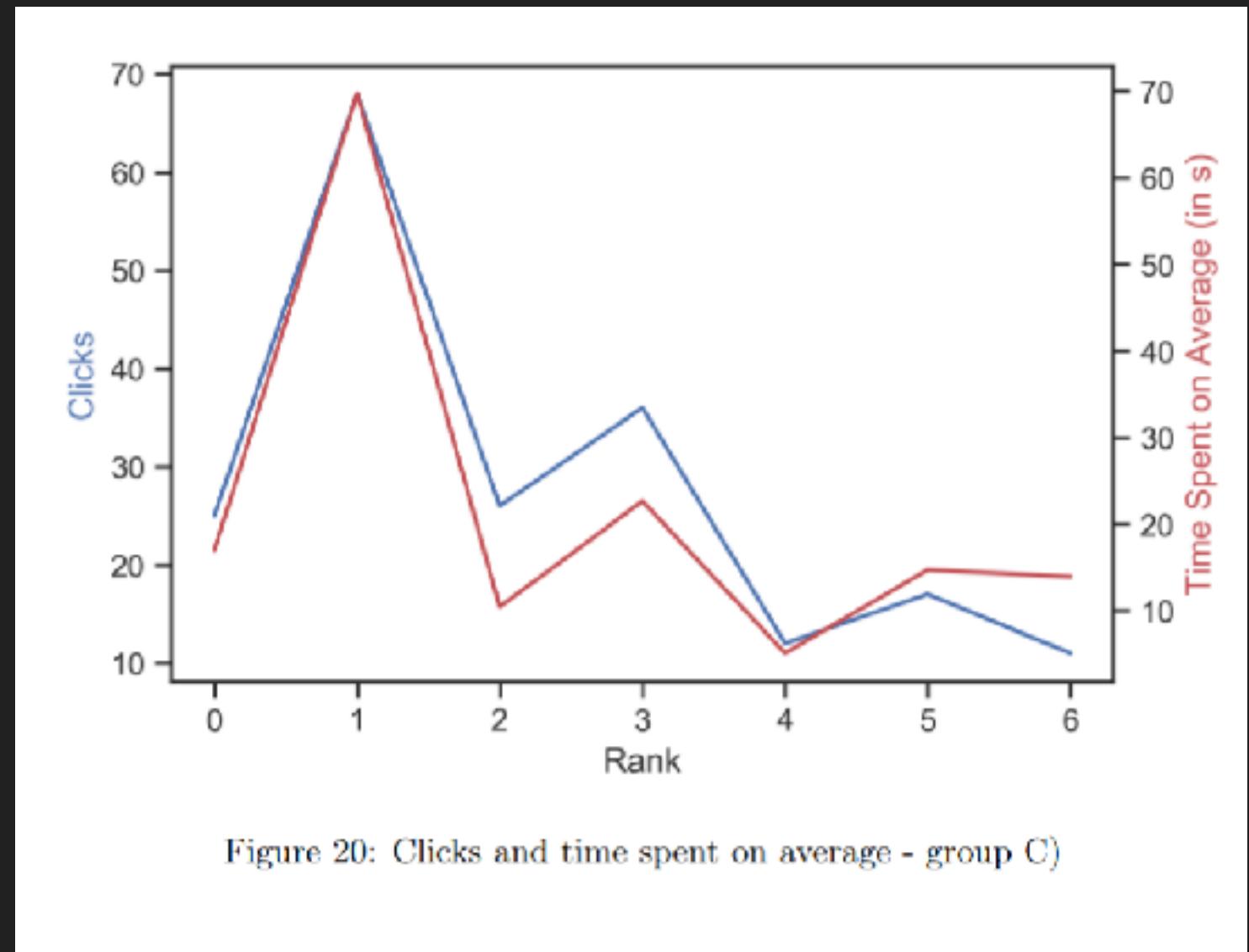
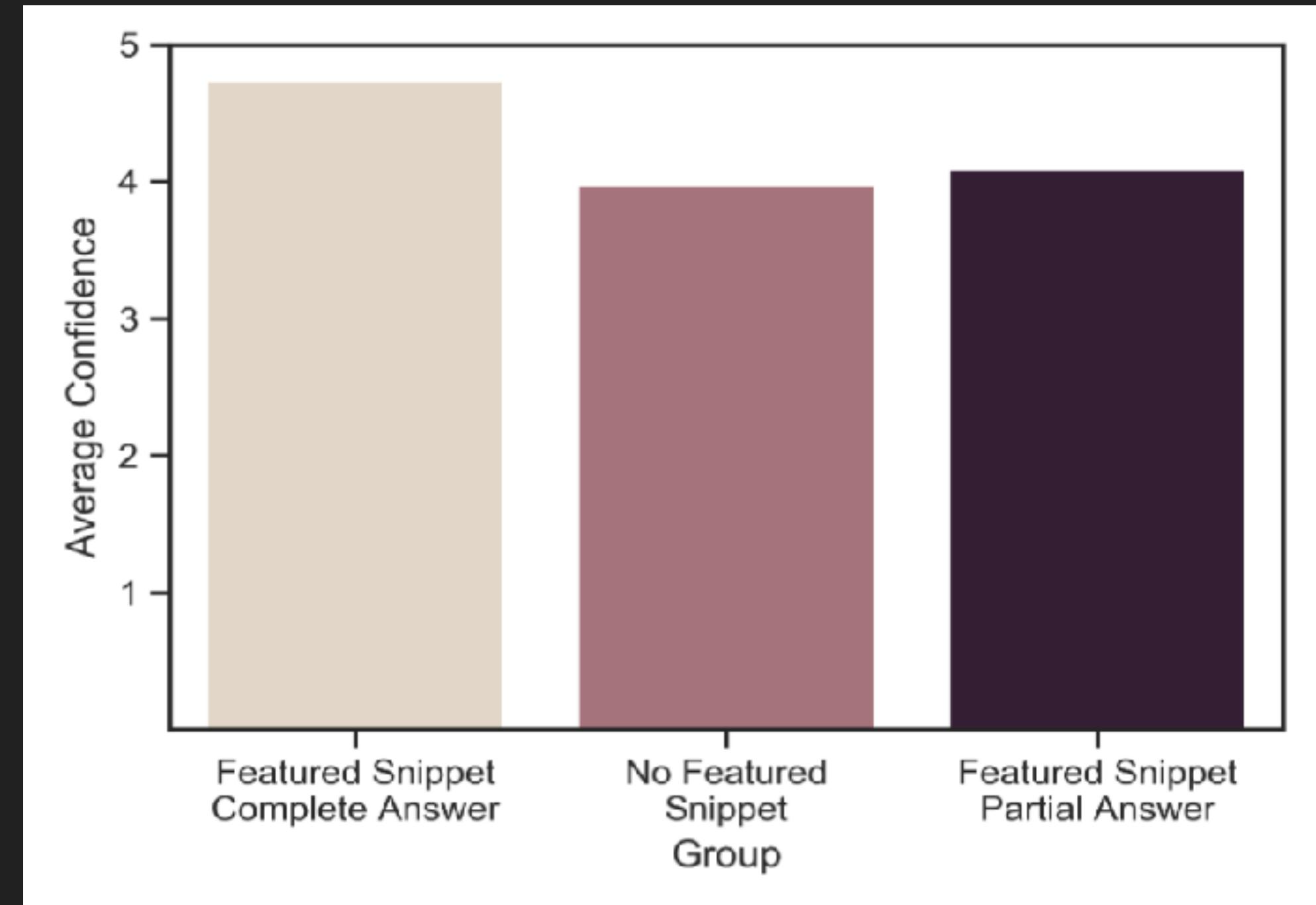
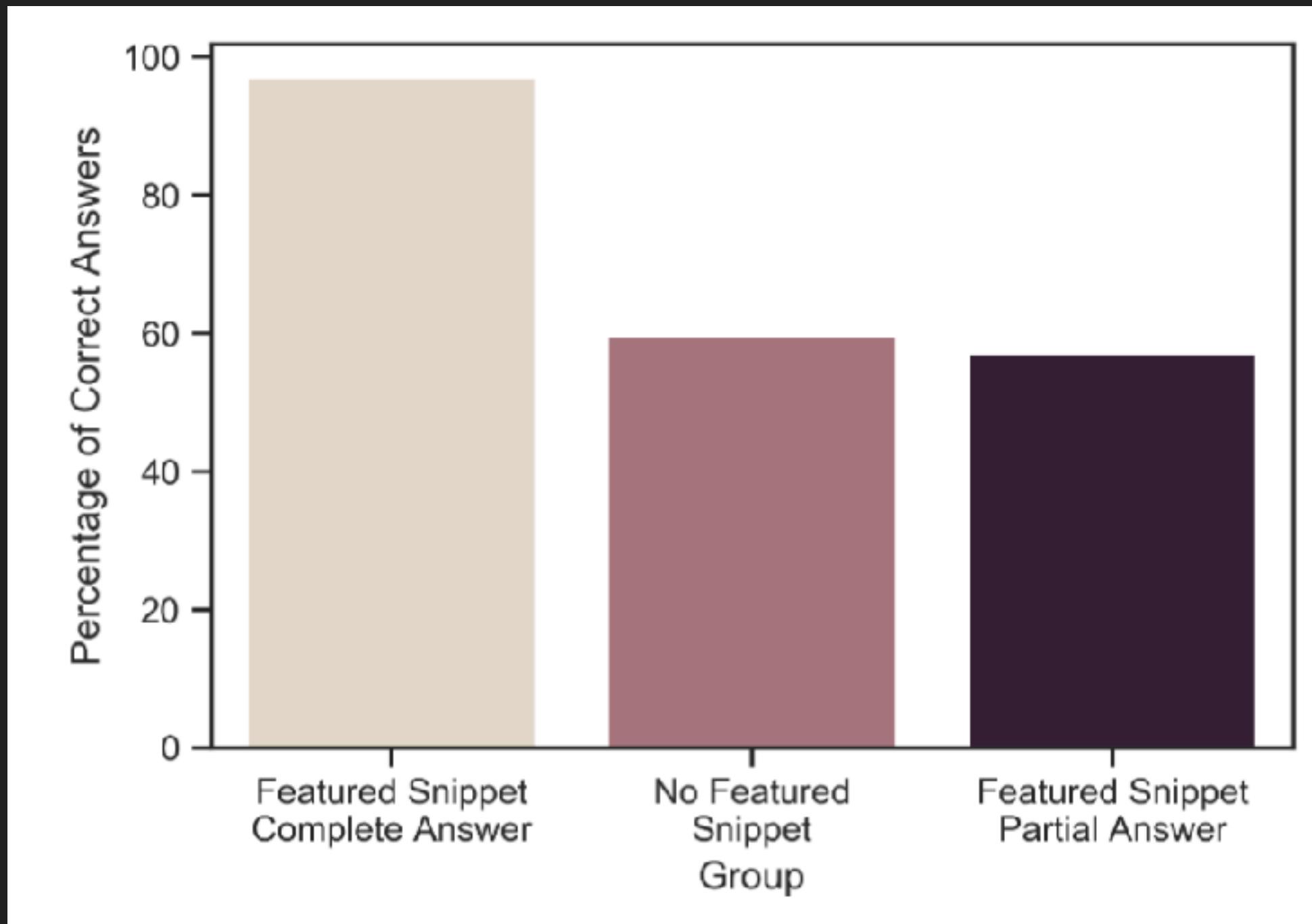


Figure 20: Clicks and time spent on average - group C

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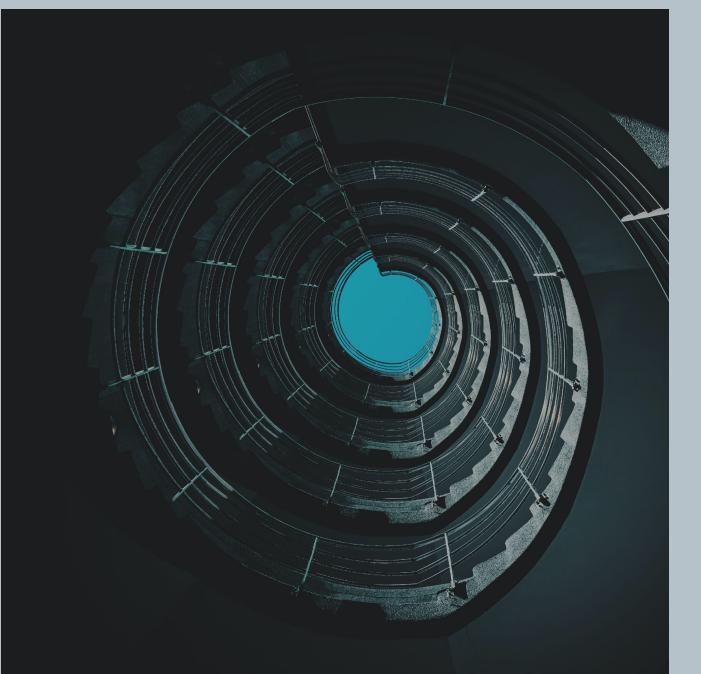
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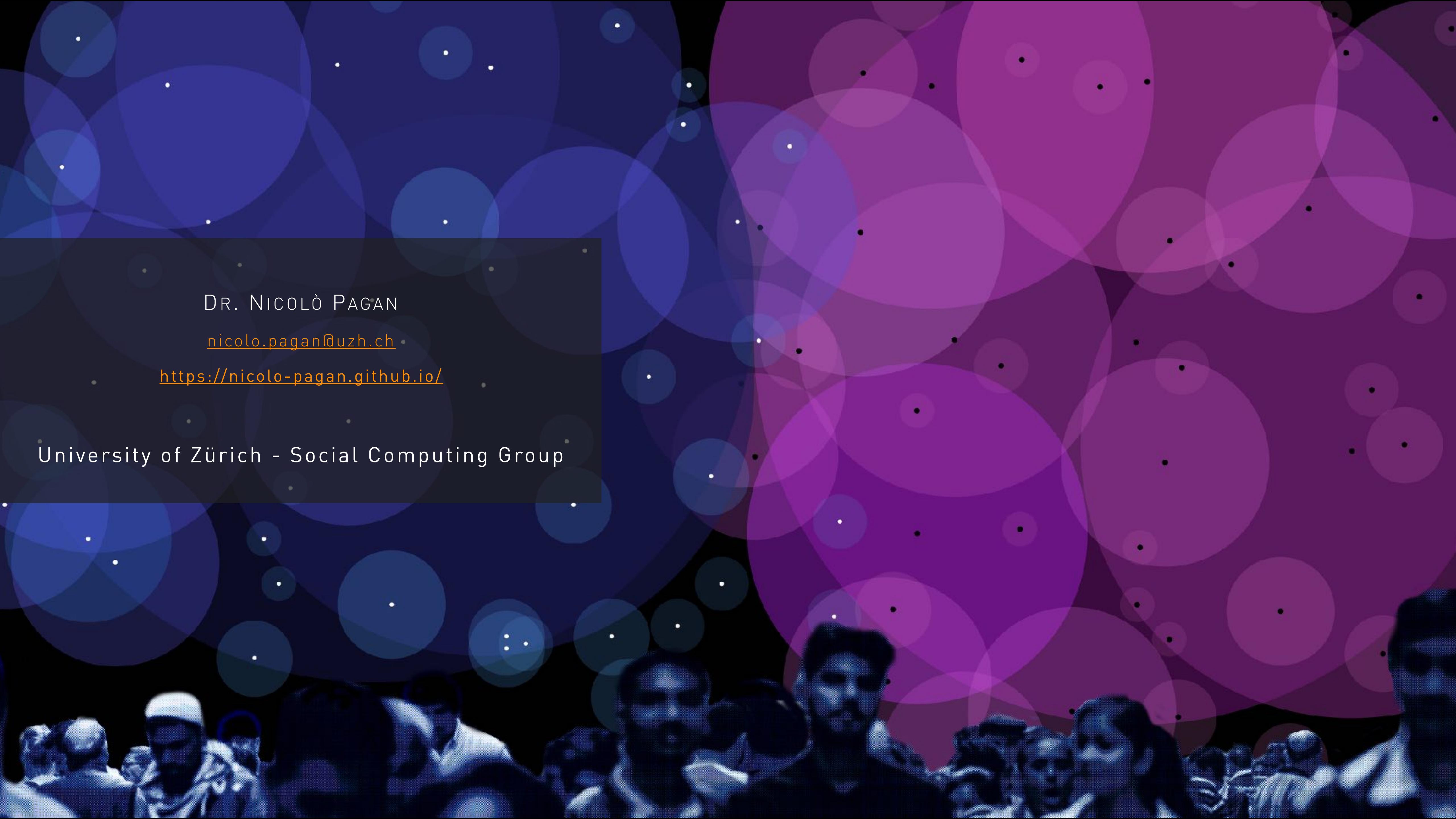
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