

# **Understanding Misinformation**

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Societal Computing, School of Computer Science

# Understanding Misinformation

**Ng, Lynnette Hui Xian**, and Araz Taeihagh. "How does fake news spread? Understanding pathways of disinformation spread through APIs." *Policy & Internet* 13, no. 4 (2021): 560-585. **Most Cited Paper Award, 2022.**

**Ng, Lynnette Hui Xian**, and Jia Yuan Loke. "Analyzing public opinion and misinformation in a COVID-19 telegram group chat." *IEEE Internet Computing* 25, no. 2 (2020): 84-91. **Best Paper Award, AAAI ICWSM Cyber Social Threats**

**Ng, Lynnette Hui Xian**, Wenqi Zhou, and Kathleen M. Carley. "Exploring Cognitive Bias Triggers in COVID-19 Misinformation Tweets: A Bot vs. Human Perspective." *arXiv preprint arXiv:2406.07293* (2024). **IC2S2**

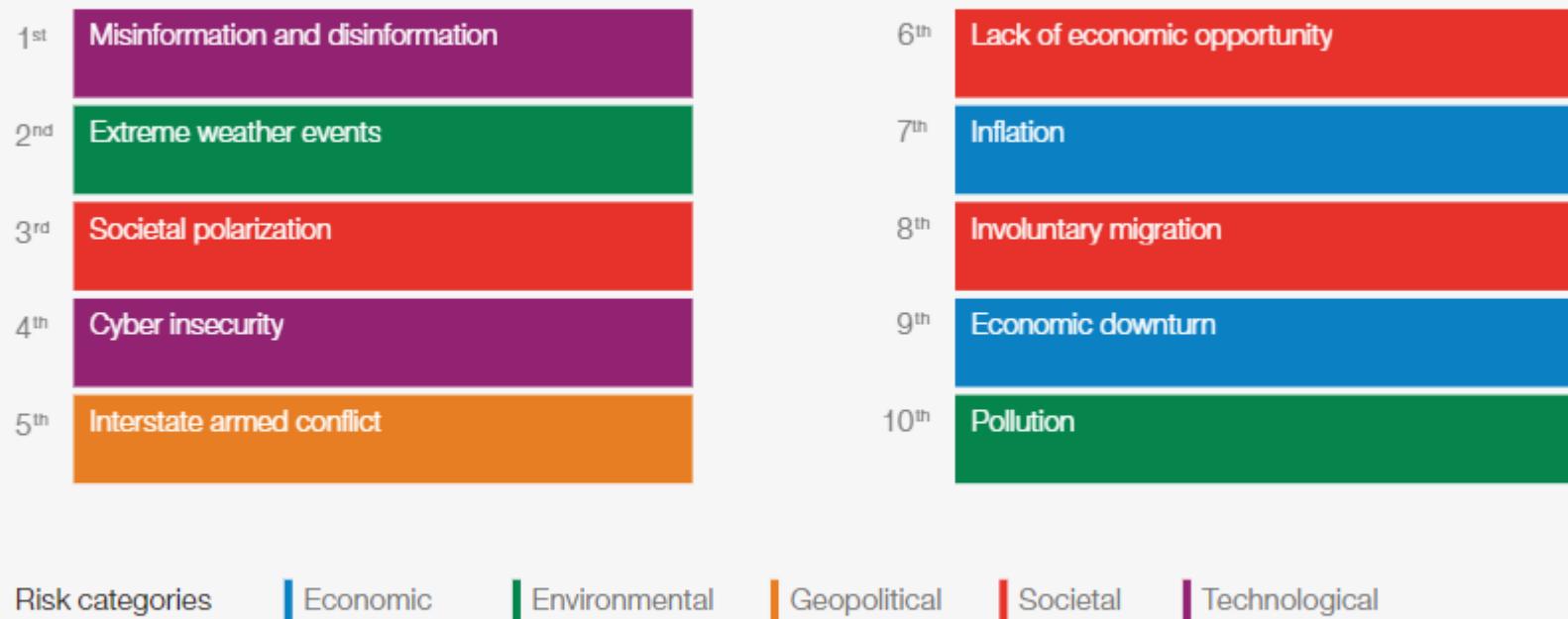
**Ng, Lynnette Hui Xian**, and Kathleen M. Carley. "Deflating the Chinese balloon: types of Twitter bots in US-China balloon incident" *EPJ Data Science* 12, no. 1 (2023): 63. **Featured on New Scientist and trended on Reddit**



FIGURE 1.3

### Global risks ranked by severity over the short term (2 years)

"Please estimate the likely impact (severity) of the following risks over a 2-year period."



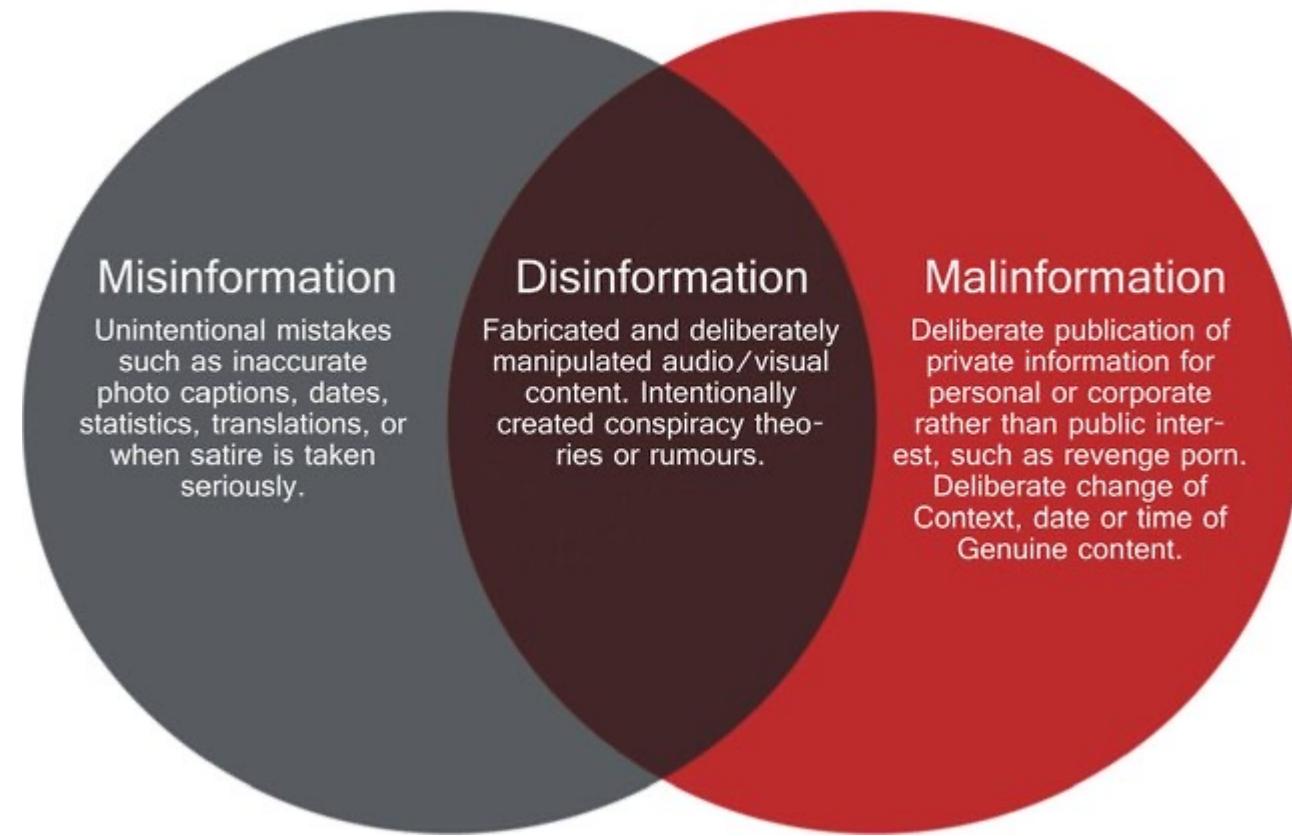
Source

World Economic Forum Global Risks  
Perception Survey 2023-2024.



## FALSENESS

## INTENT TO HARM



Rastogi, Shubhangi, and Divya Bansal. "A review on fake news detection 3T's: typology, time of detection, taxonomies." *International Journal of Information Security* 22, no. 1 (2023): 177-212.

## 7 TYPES OF MIS- & DISINFORMATION



### Satire or parody

No intention to cause harm but has potential to fool.



### Misleading content

Misleading use of information to frame an issue or individual.



### Imposter content

When genuine sources are impersonated.



### Fabricated content

New content that is 100% false, made to deceive and do harm.



### False connection

When headlines, visuals or captions don't support the content.



### False context

When genuine content is shared with false contextual information.



### Manipulated content

When genuine information or imagery is manipulated to deceive.

LOW ←

→ HIGH

Wardle C., First Draft News, 2020



- 1. How does Fake News spread?**
- 2. Why is Automated Dissemination of Concern**
- 3. Reactions to Fake News**
- 4. What we learnt**
- 5. What's next**

## Social Media /

**62.6% of the world uses social media**

**Average daily time spent is 2h 20min**

Datareportal, April 2024

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**Widespread reach  
Accessibility**

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**Social Media /**

Datareportal, April 2024

**Widespread reach  
Accessibility**

**Social Media is a great medium  
for spreading fake news**

# What are the *automated* pathways of spreading fake news on social media platforms?

## How does Fake News Spread? /

Ng, Lynnette Hui Xian, and Araz Taeihagh. "How does fake news spread? Understanding pathways of disinformation spread through APIs." *Policy & Internet* 13, no. 4 (2021): 560-585.

# Understand actions performed with automation through code repositories

## How does Fake News Spread? /

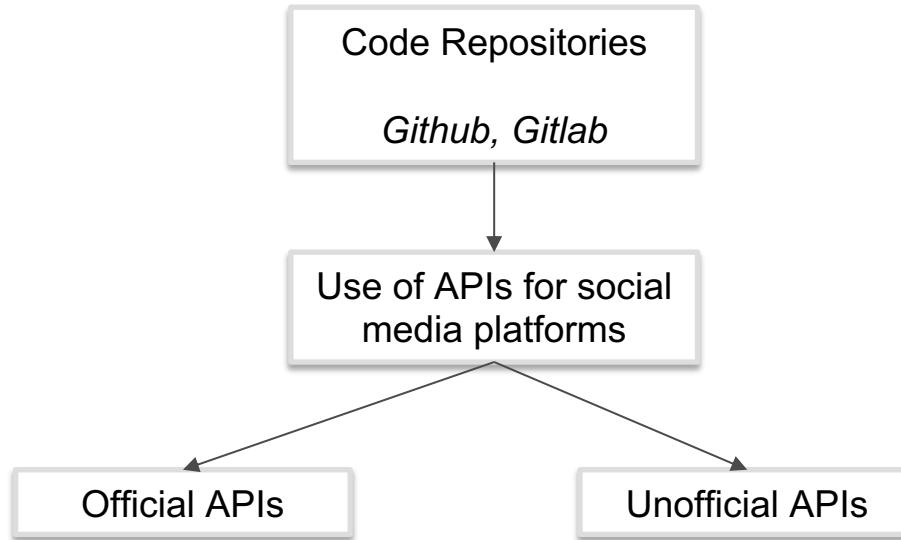
Code Repositories

*Github, Gitlab*

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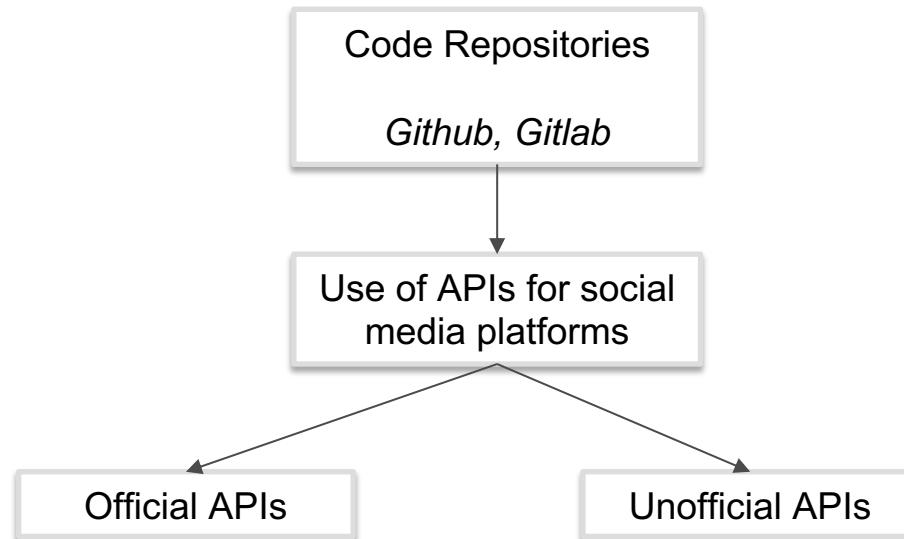


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Platform	Search terms	Type	Content identifier
Twitter	"twitter bot", "twitter scraper", "twitter crawler", "twitter posting"	Official	"consumer_secret"
Twitter	"twitter bot", "twitter scraper", "twitter crawler", "twitter posting"	Unofficial	"lxml", "selenium", "data-item-id"

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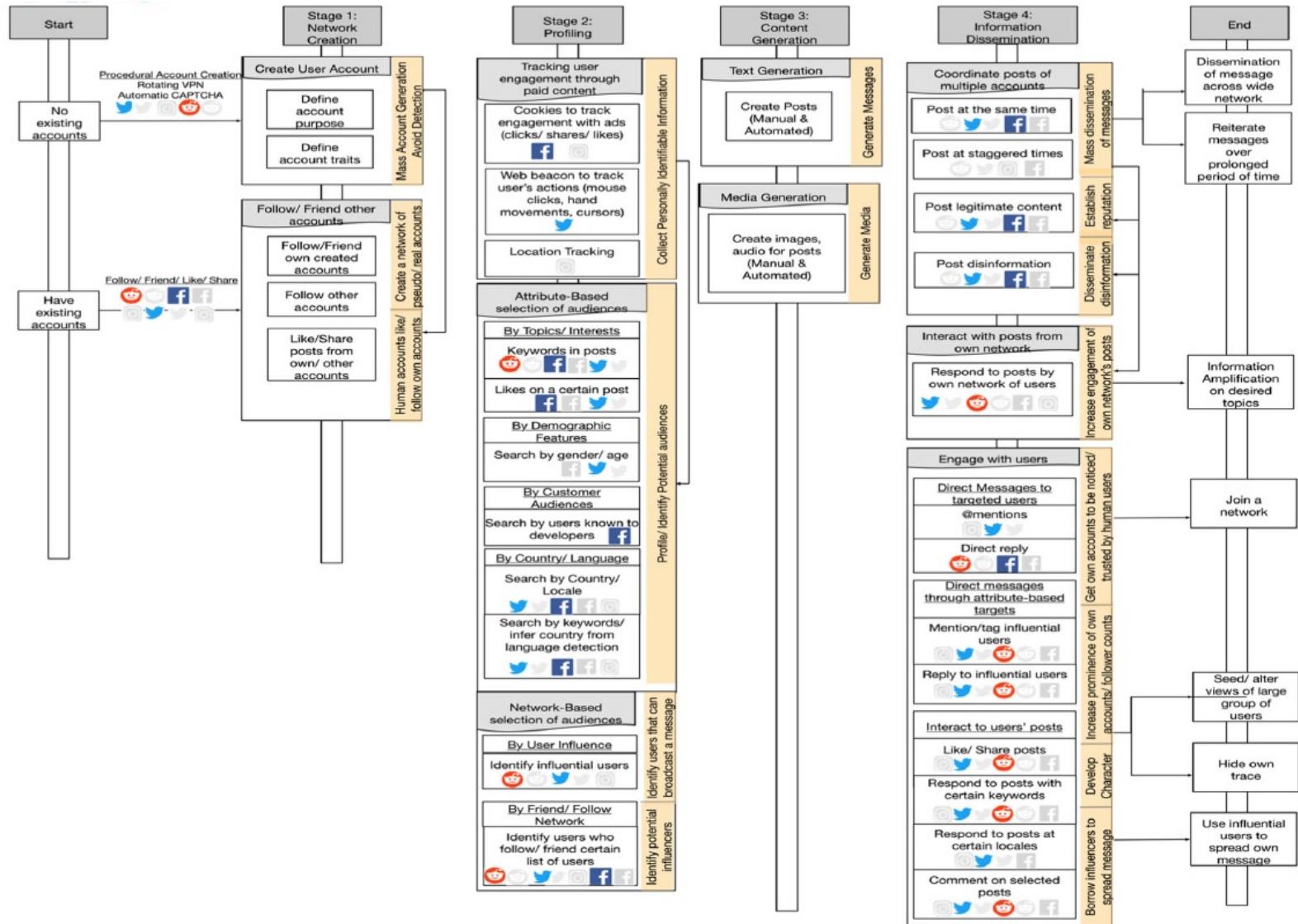


What actions were being performed on social media platforms with APIs?

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## Pathways of fake news spread /

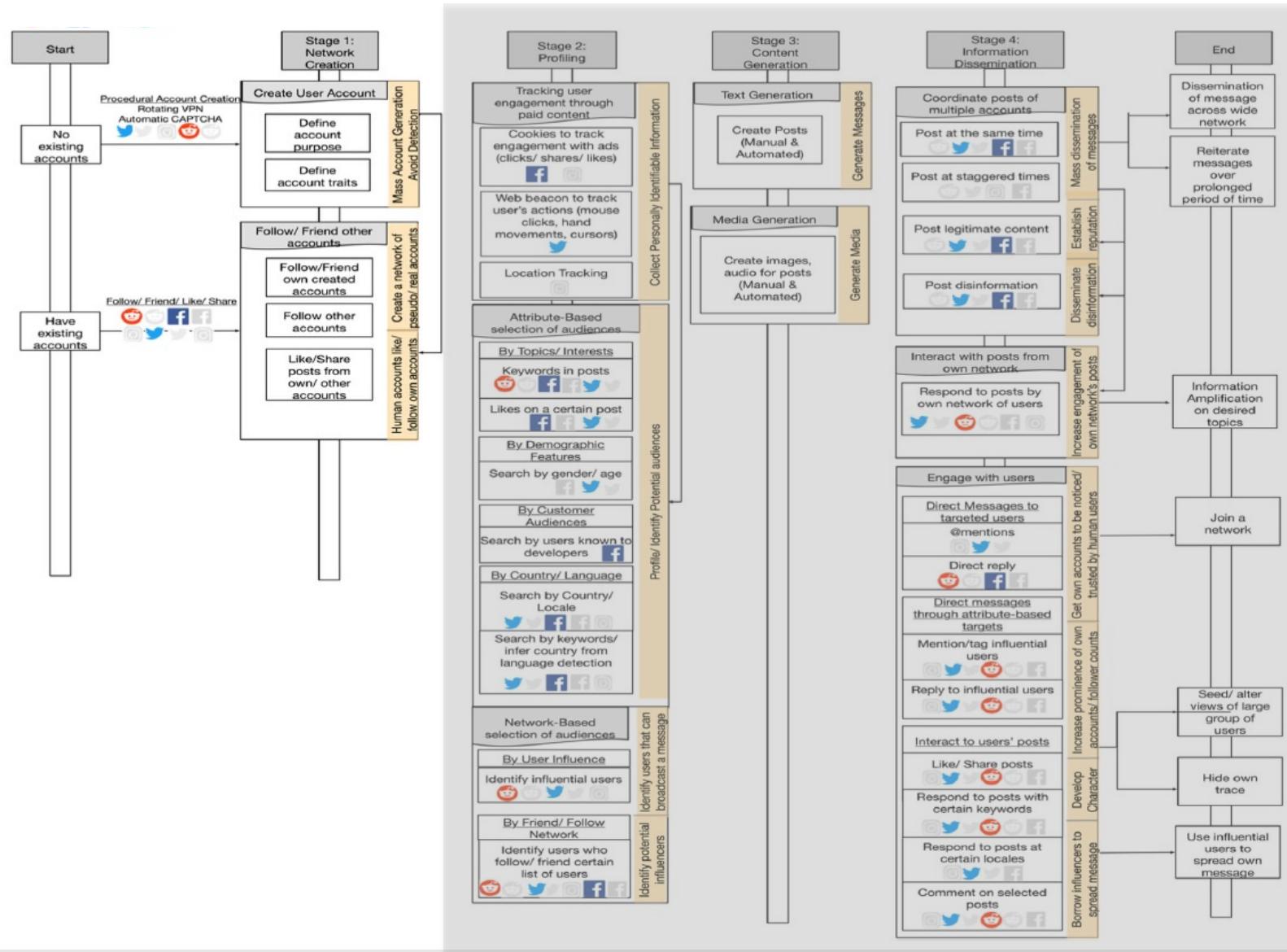


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# Stage 1: Network Creation

How does Fake News Spread? /

Pathways of fake news spread /



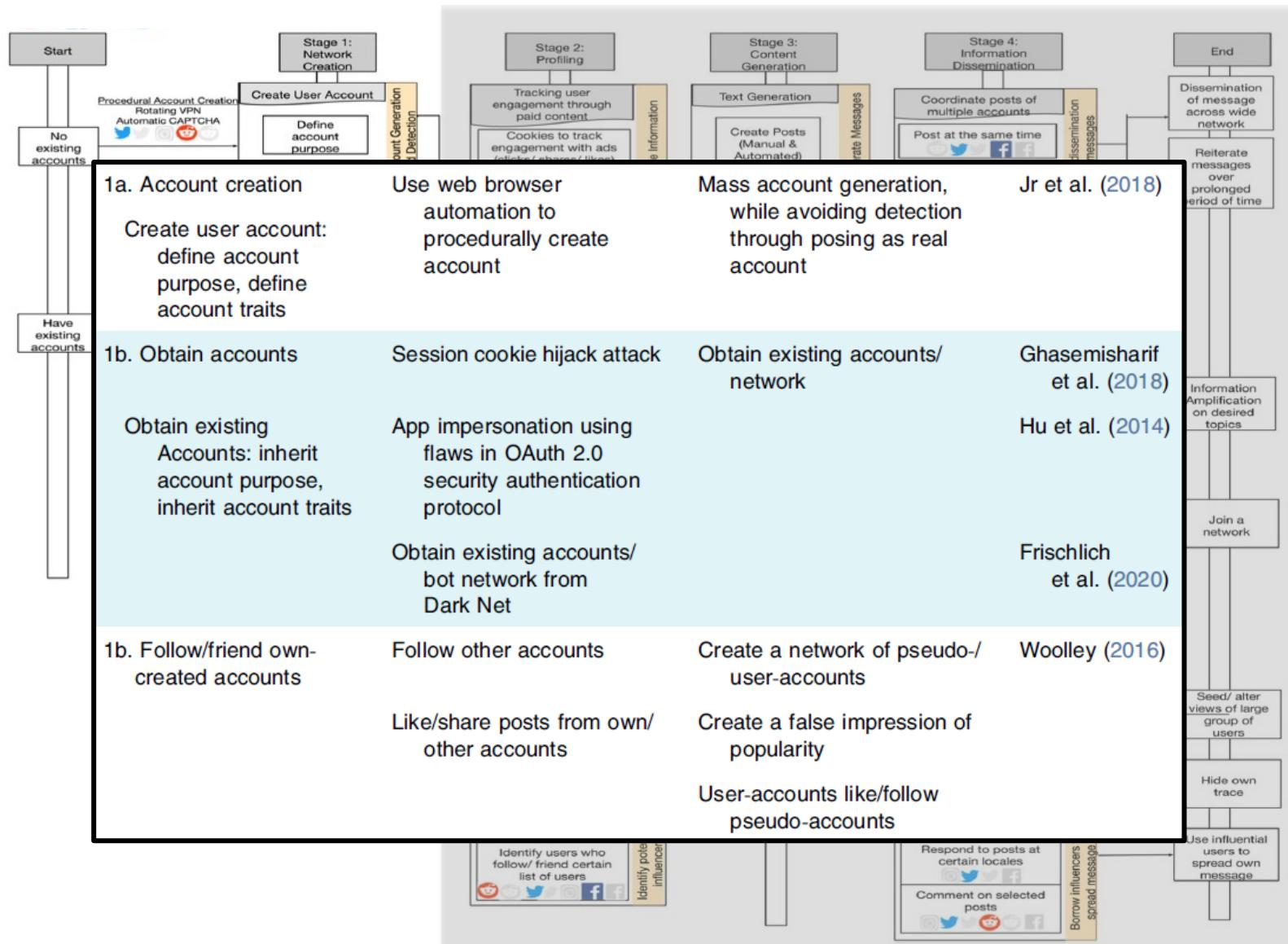
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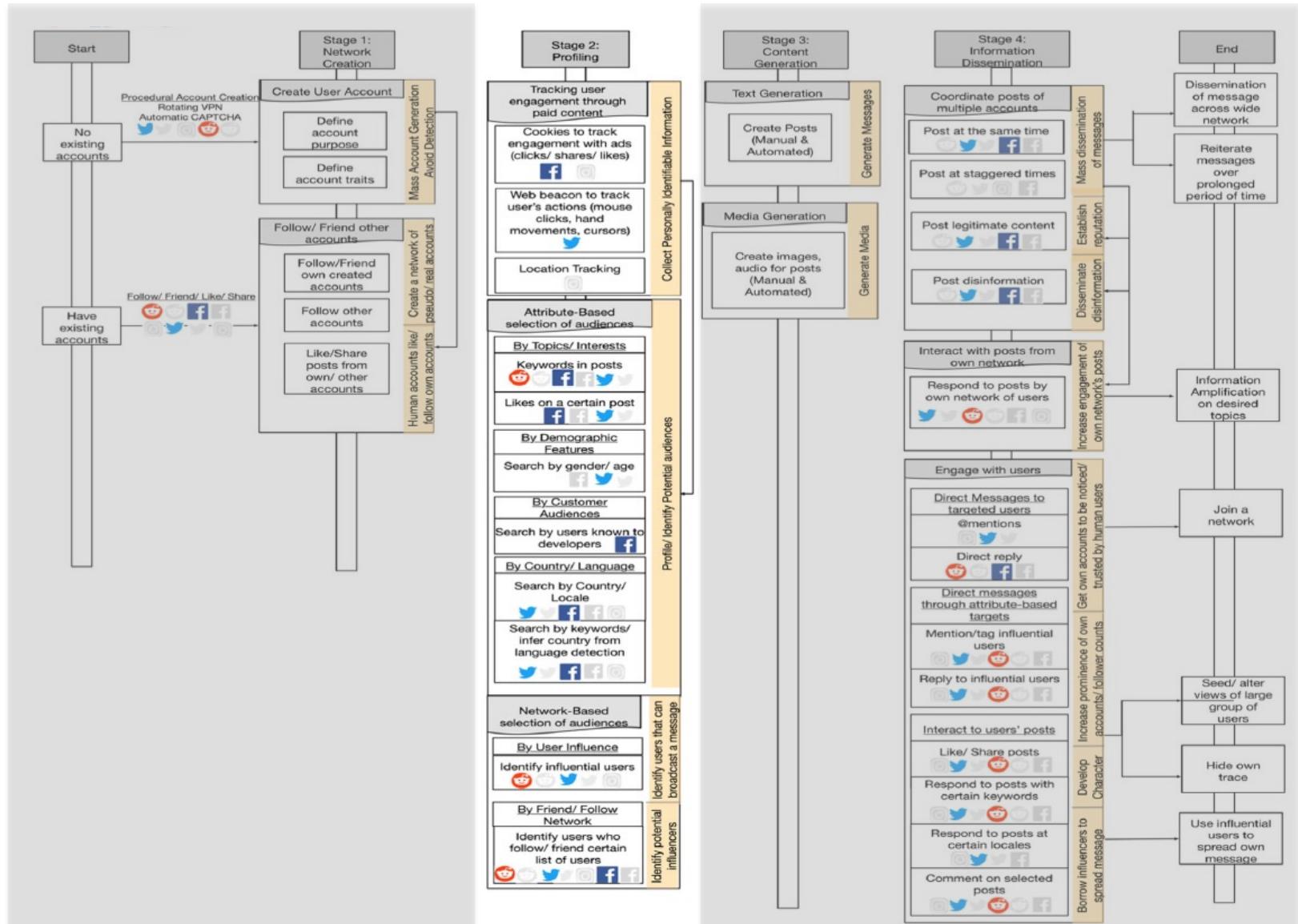


# Stage 2: Profiling

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Pathways of fake news spread /

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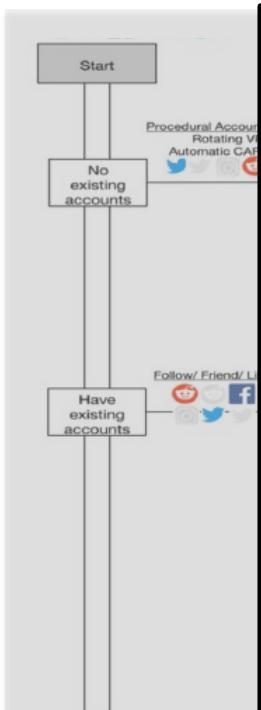


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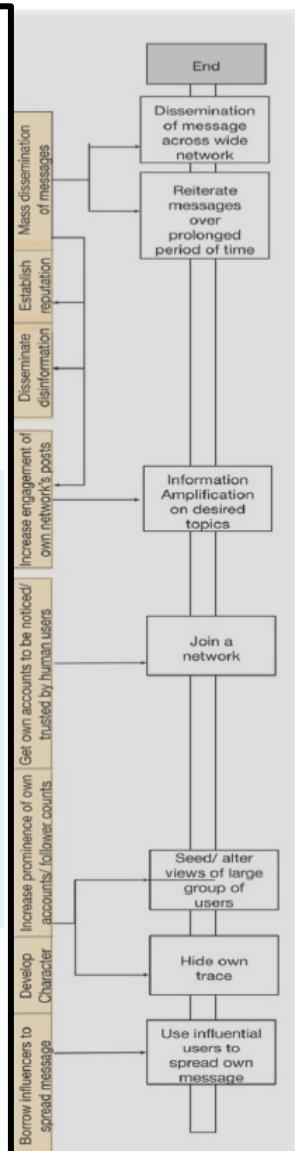
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2a. Tracking user engagement			
Cookies to track engagement with ads/ clicks/shares/likes/ retweets	Insert cookies in webpage to track user preferences	Collect personally identifiable information	Ghosh et al. (2018)
Web beacon to track users' actions	Track user preferences by demographic groups with Facebook Audience Network API		Facebook (2020a)
Location tracking	Integrate services like YouTube, Google Maps and Google Search into applications to leverage on the precise location mapping and rich consumer profiles that may be obtained through paid advertising services		Russell (2019)
2b. Attribute-based selection of audiences			
By topics/interests through...	Finding users that have certain keywords in posts or like specific posts	Profile/identify potential audiences for own narrative	Guilbeault (2018)
By demographic features through...	Identifying audiences through societal segments like gender/age		Speicher et al. (2018)
By customer audiences through...	Using Facebook Pixel on webpage to collect data of visitors to the page for users that developers may have access to		Facebook (2020b)
By country/language through...	Identifying potential targets through searching by country/locale, or keywords in target language		
2c. Network-based selection of audiences			
Identify influential users	Find users that have a large network structure	Identify users that can broadcast a message	Ghosh et al. (2018)
By friend/follow network	Identify users who friend/follow a predefined list of users of interest and select active users through network structure	Identify potential influencers	Speicher et al. (2018)

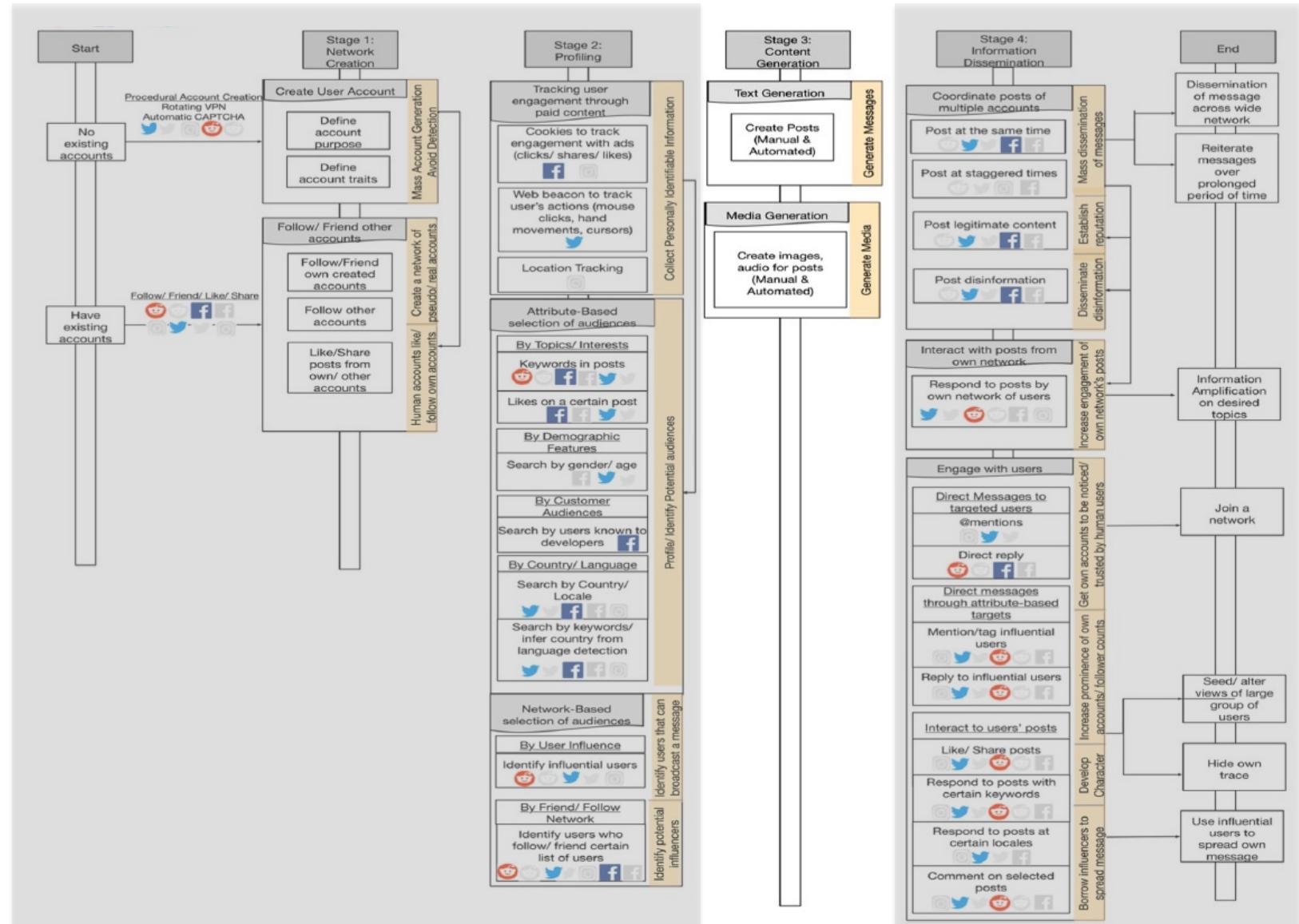


# Stage 3: Content Generation

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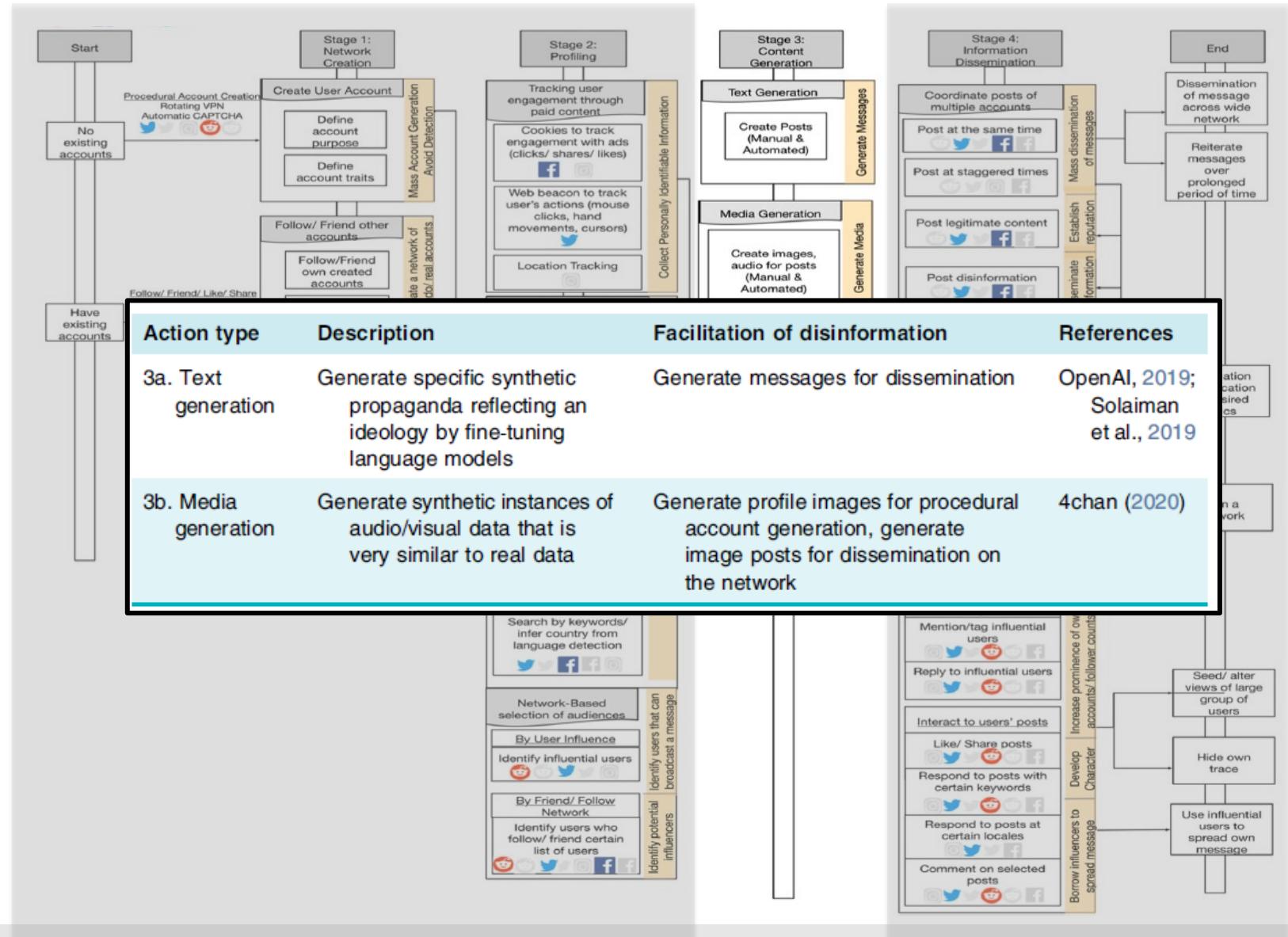


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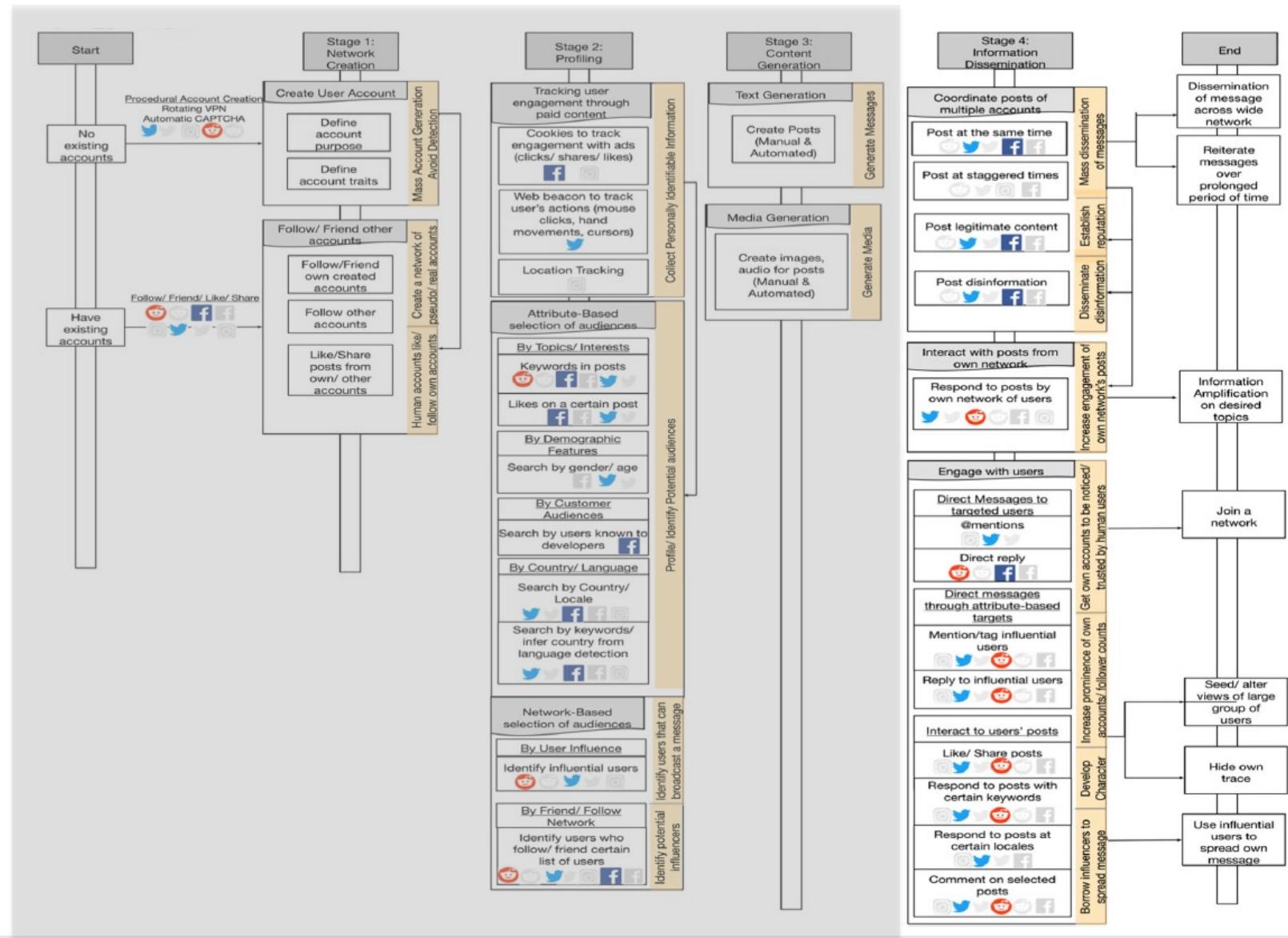


# Stage 4: Information Dissemination

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### Pathways of fake news spread /

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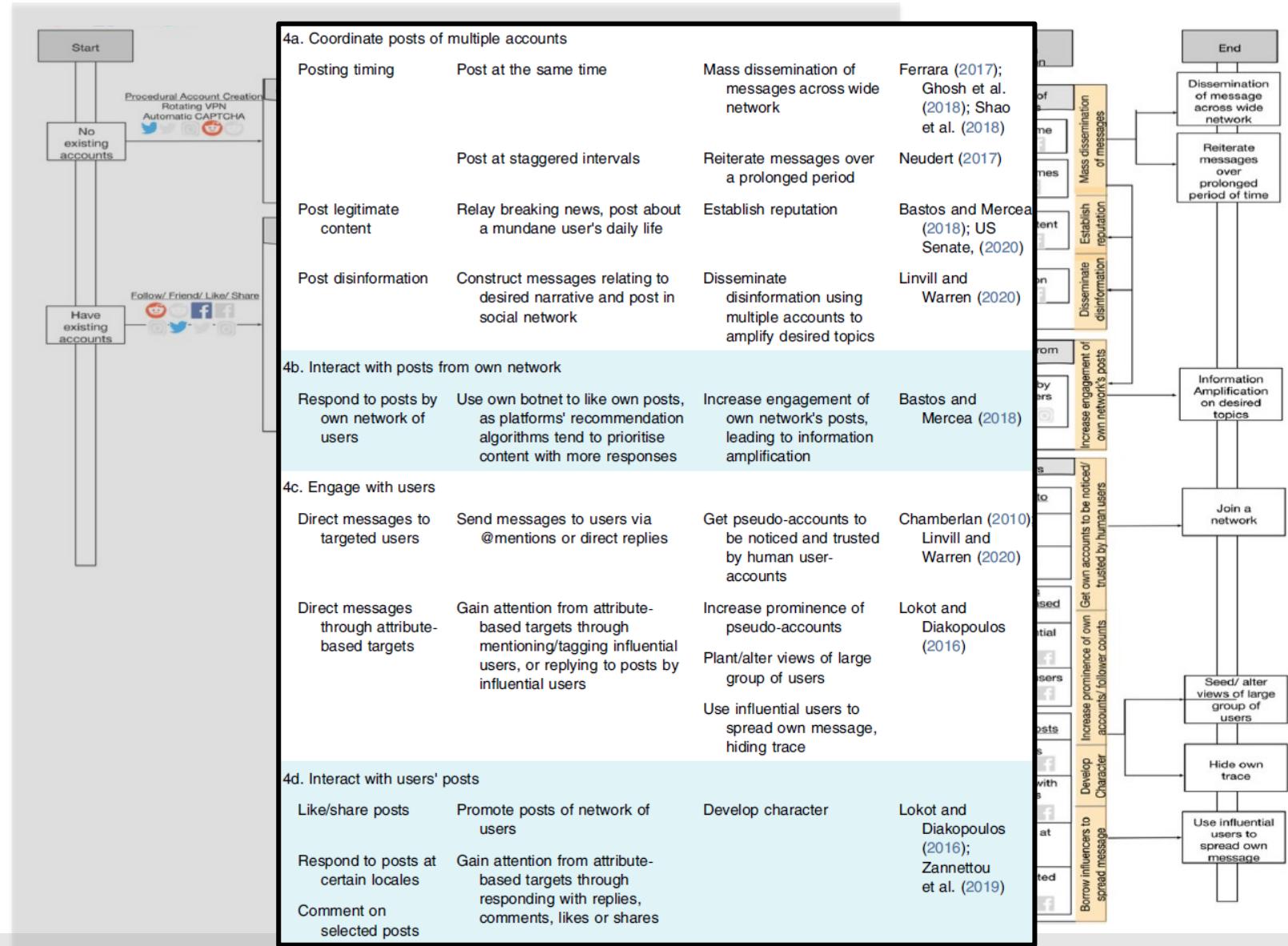


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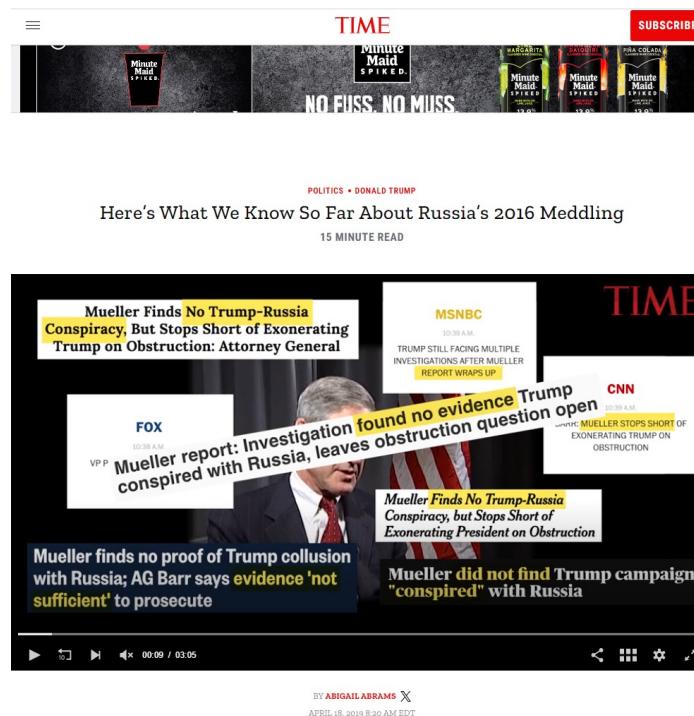


# Spread of Fake News by Russia's Internet Research Agency during the 2016 US Presidential Elections

## How does Fake News Spread? /

### Russian IRA fake news campaign during 2016 US Elections /

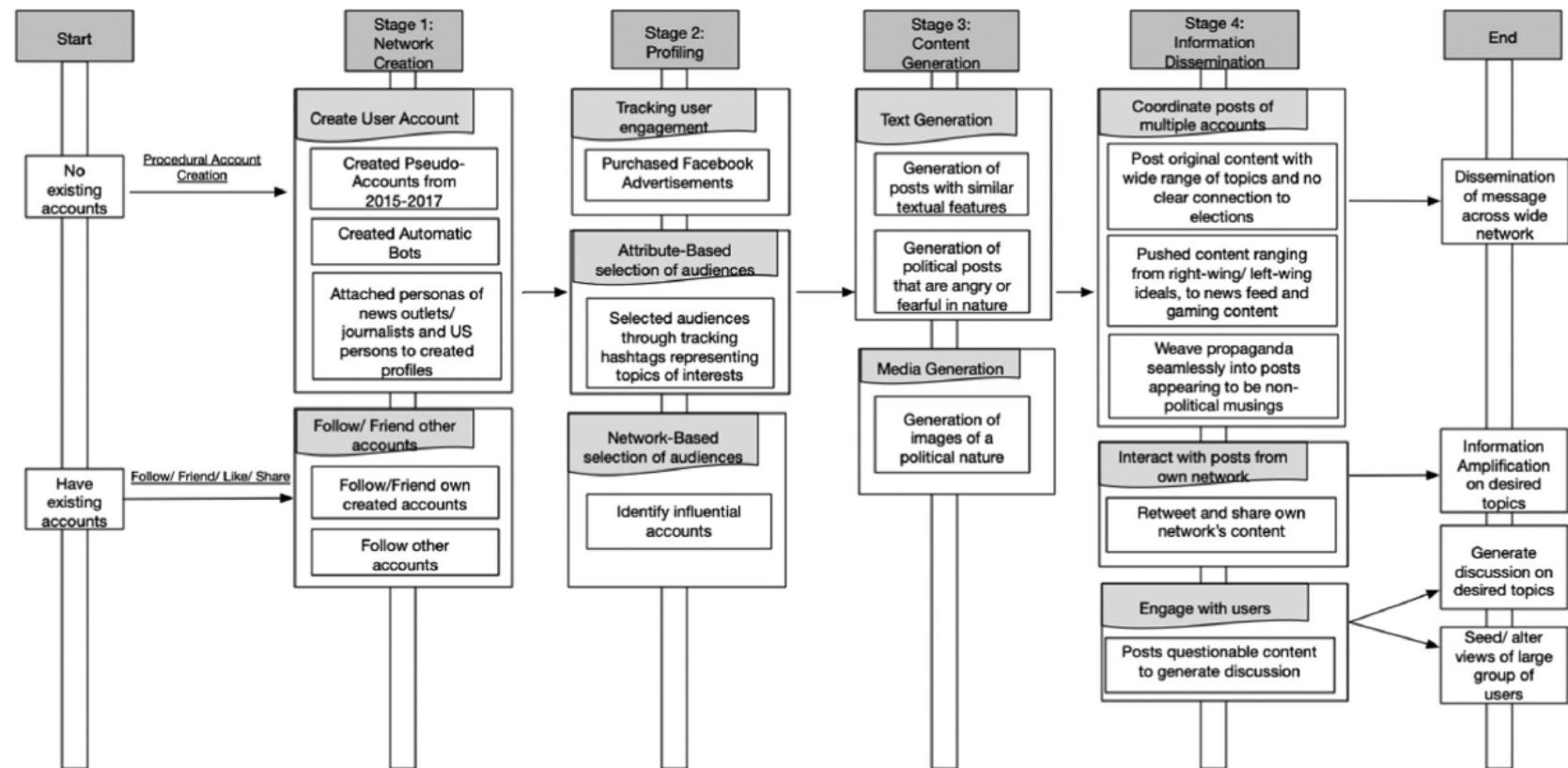
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Background to "Assessing Russian Activities and Intentions in Recent US Elections": The Analytic Process and Cyber Incident Attribution

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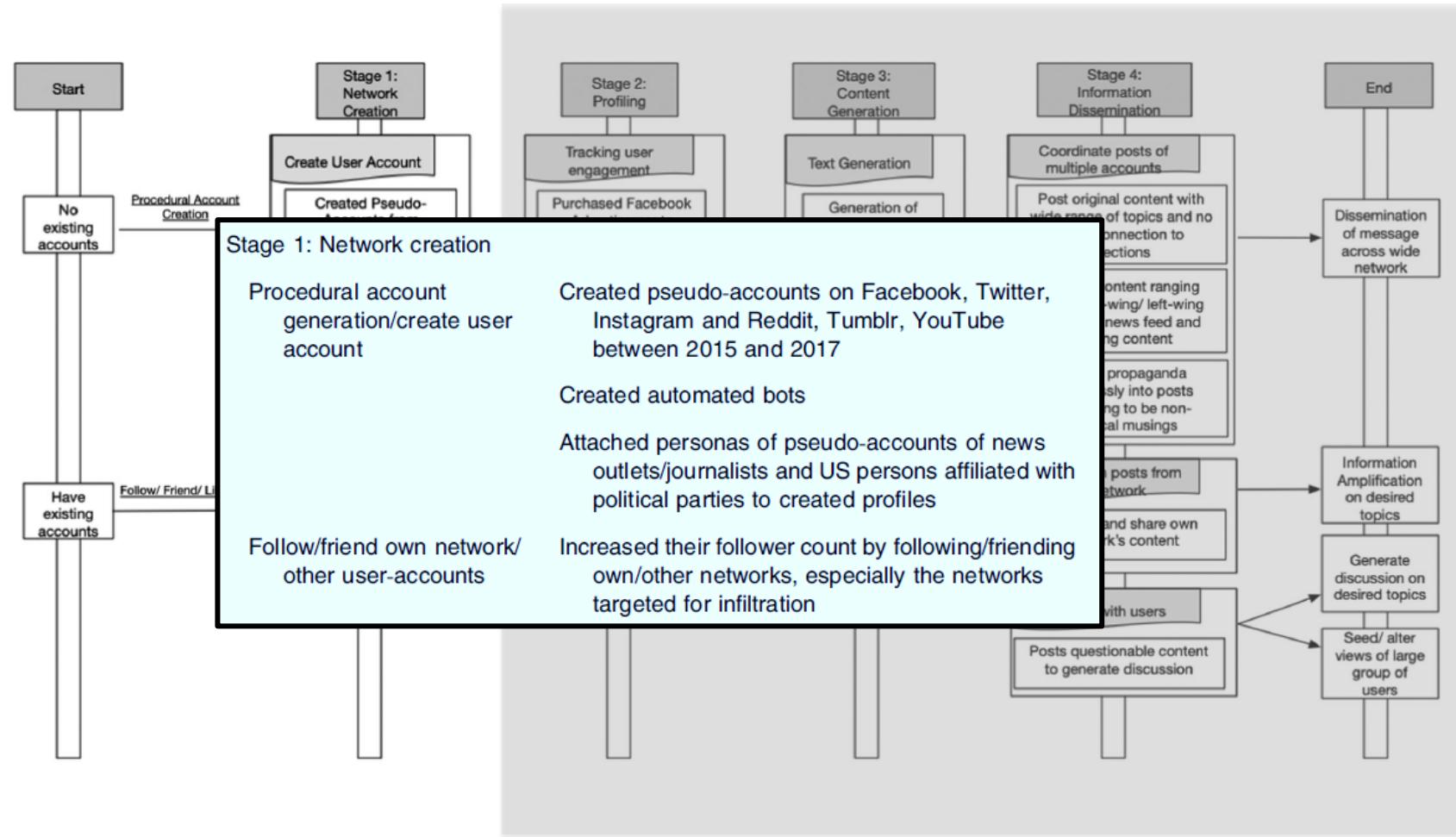


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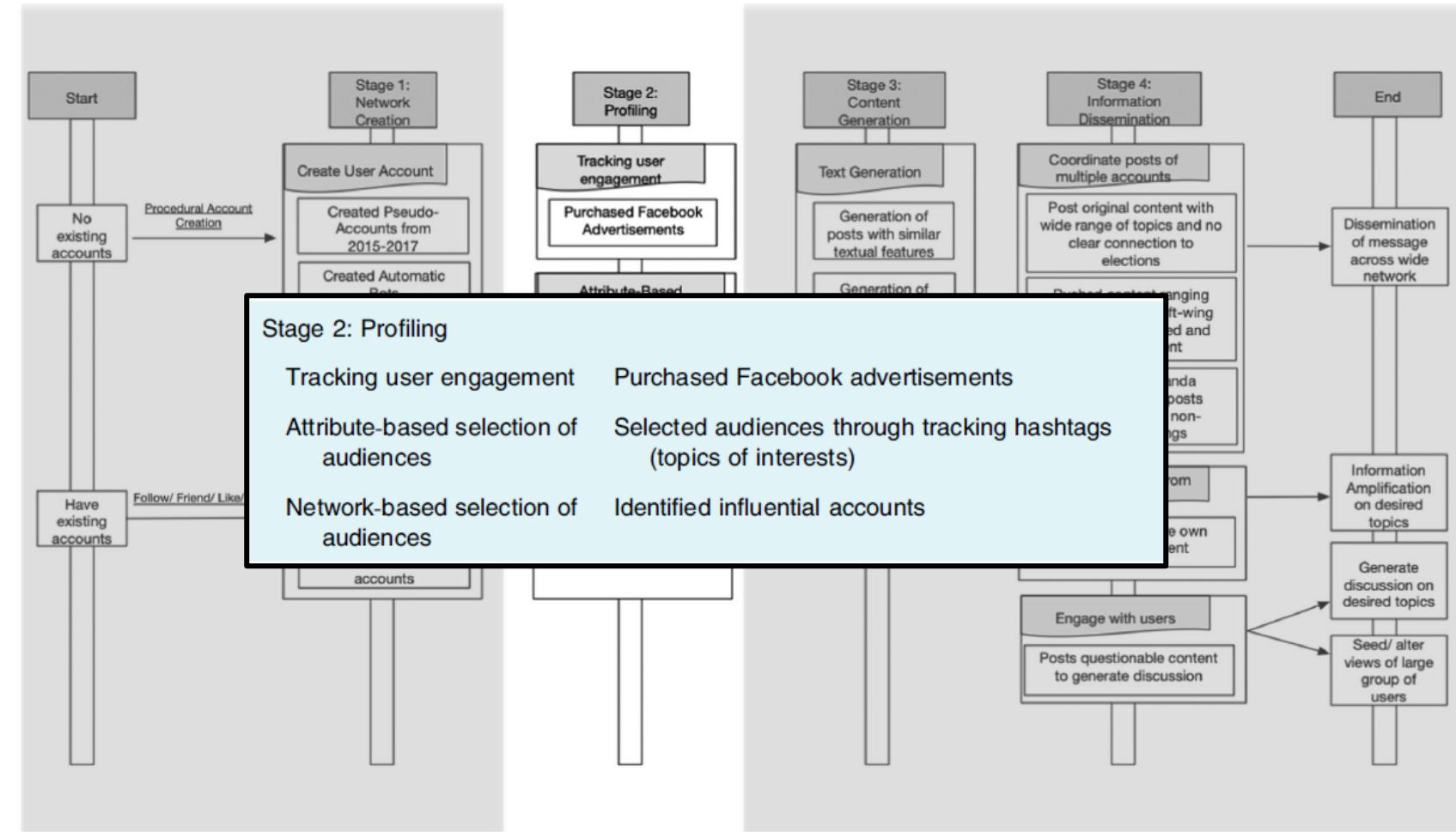


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## Stage 2: Profiling

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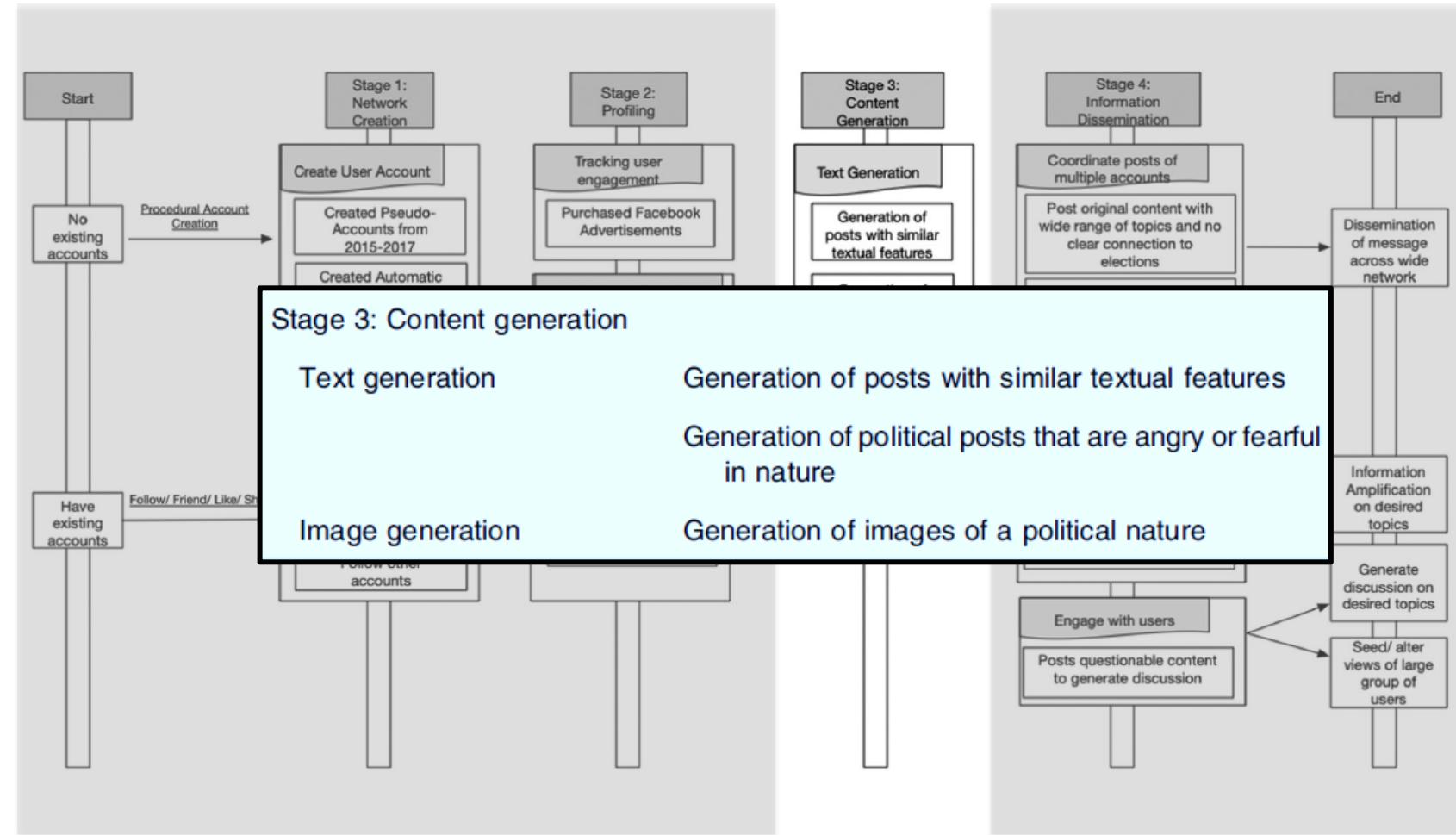


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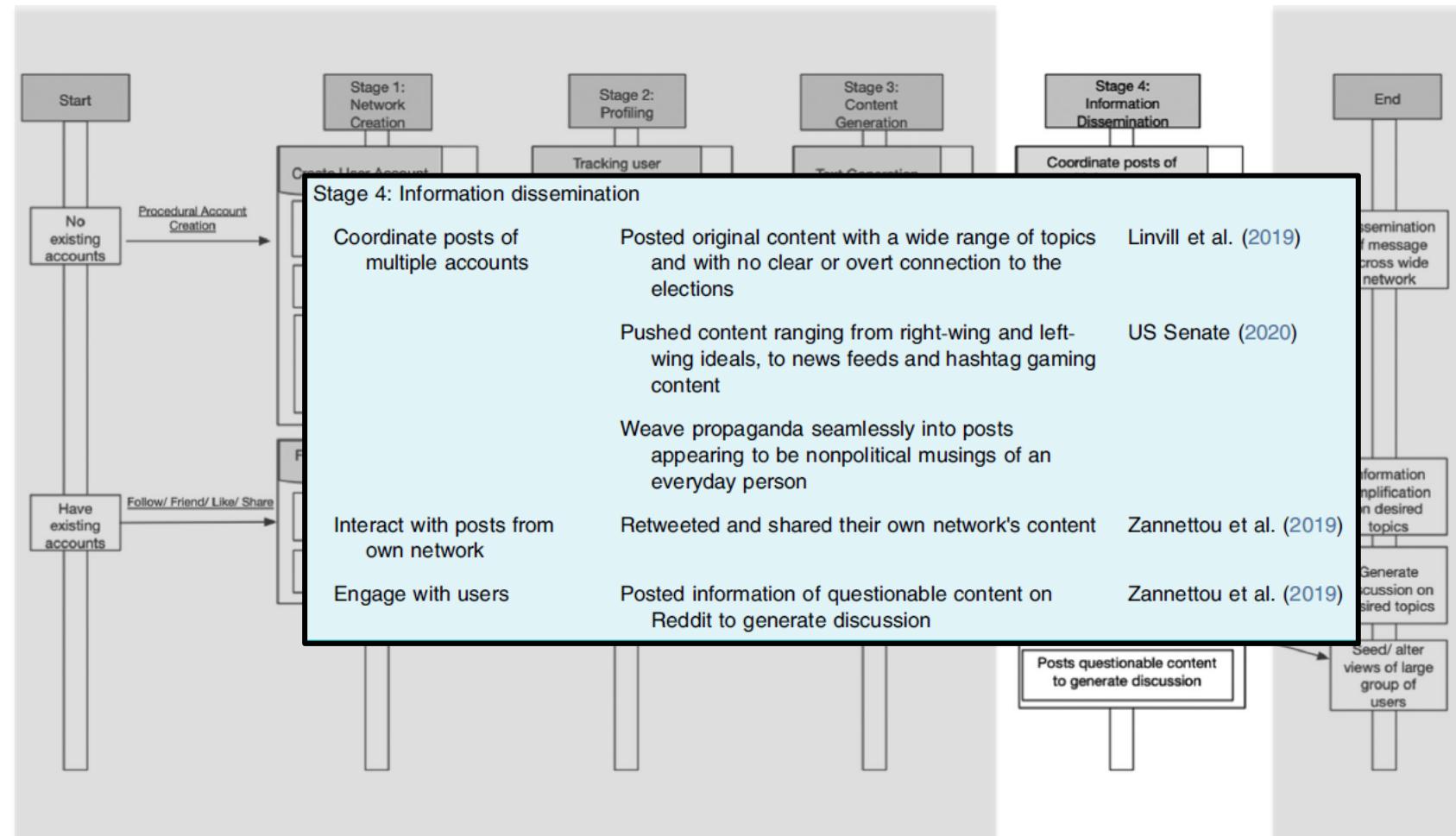


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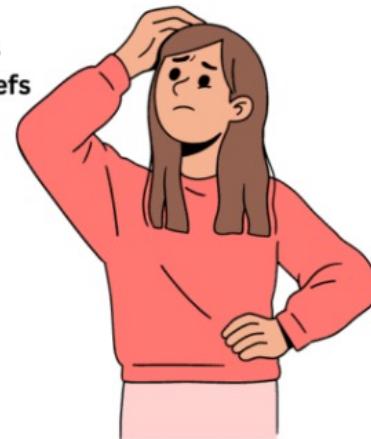
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# Because they prey on human psychology

## Why is automated misinformation dissemination of concern? /

And trigger human cognitive biases

### Signs of Cognitive Bias



Only noticing things  
that confirm your beliefs

Believing  
everyone things  
like you

Blaming others  
when things go  
wrong

Assuming  
you know  
more than  
you really do

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# Study engagement of large corpus of tweets

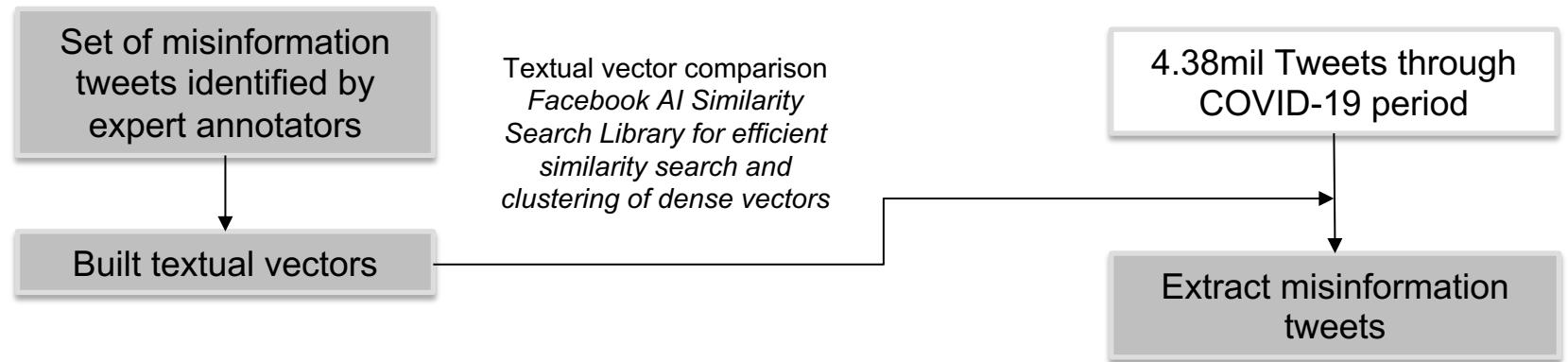
**Why is automated misinformation dissemination of concern? /**

4.38mil Tweets through COVID-19 period

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# Extracting misinformation tweets

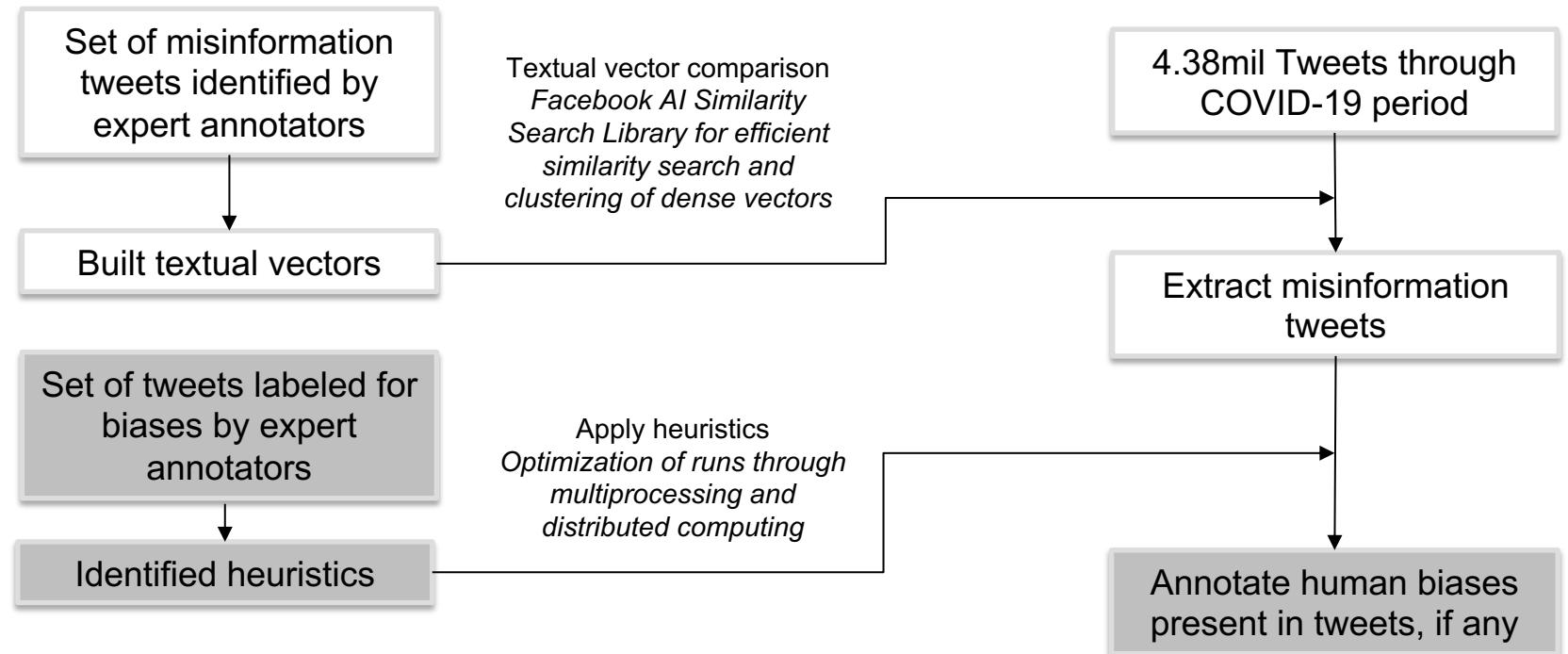
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# Annotating human biases

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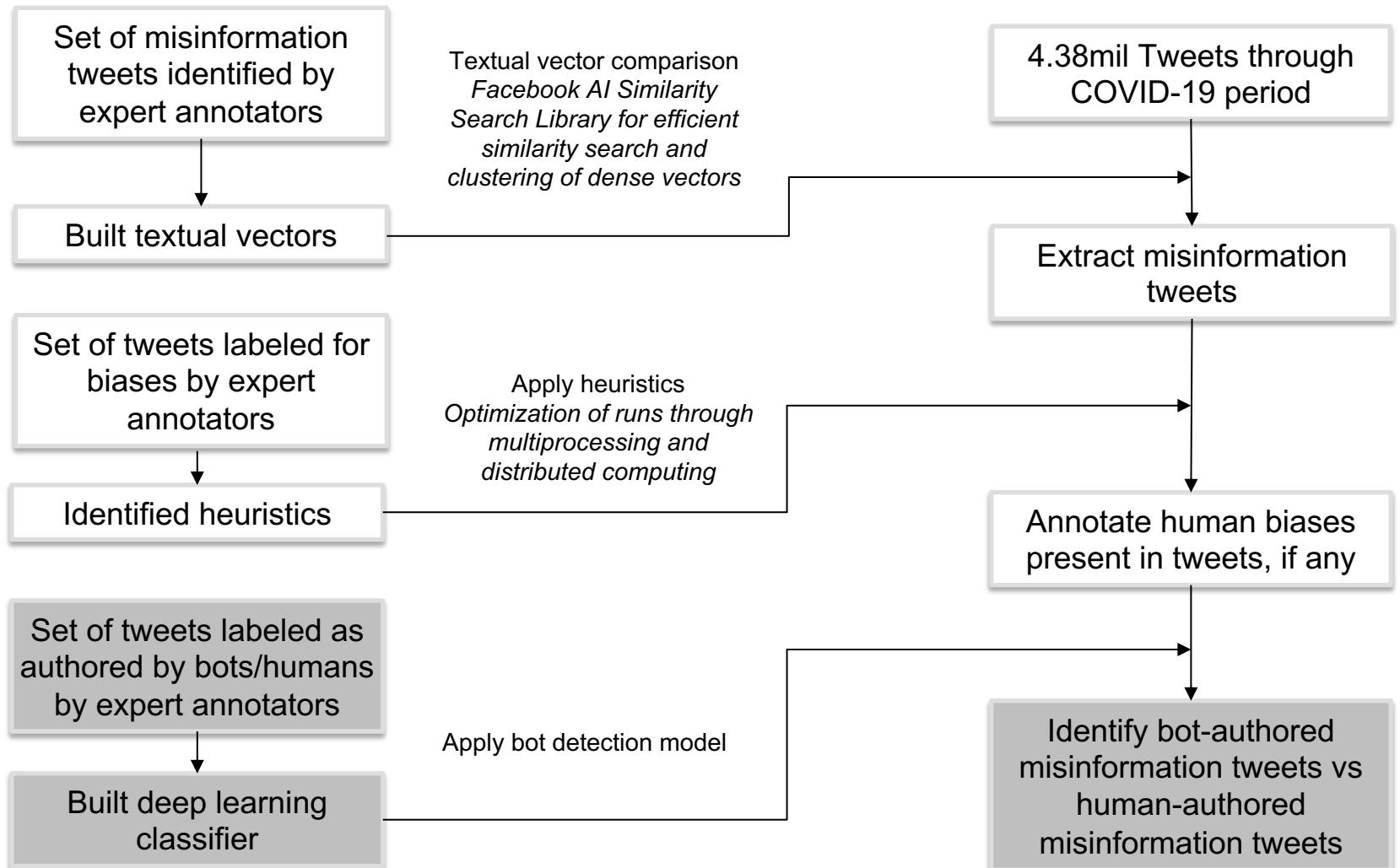


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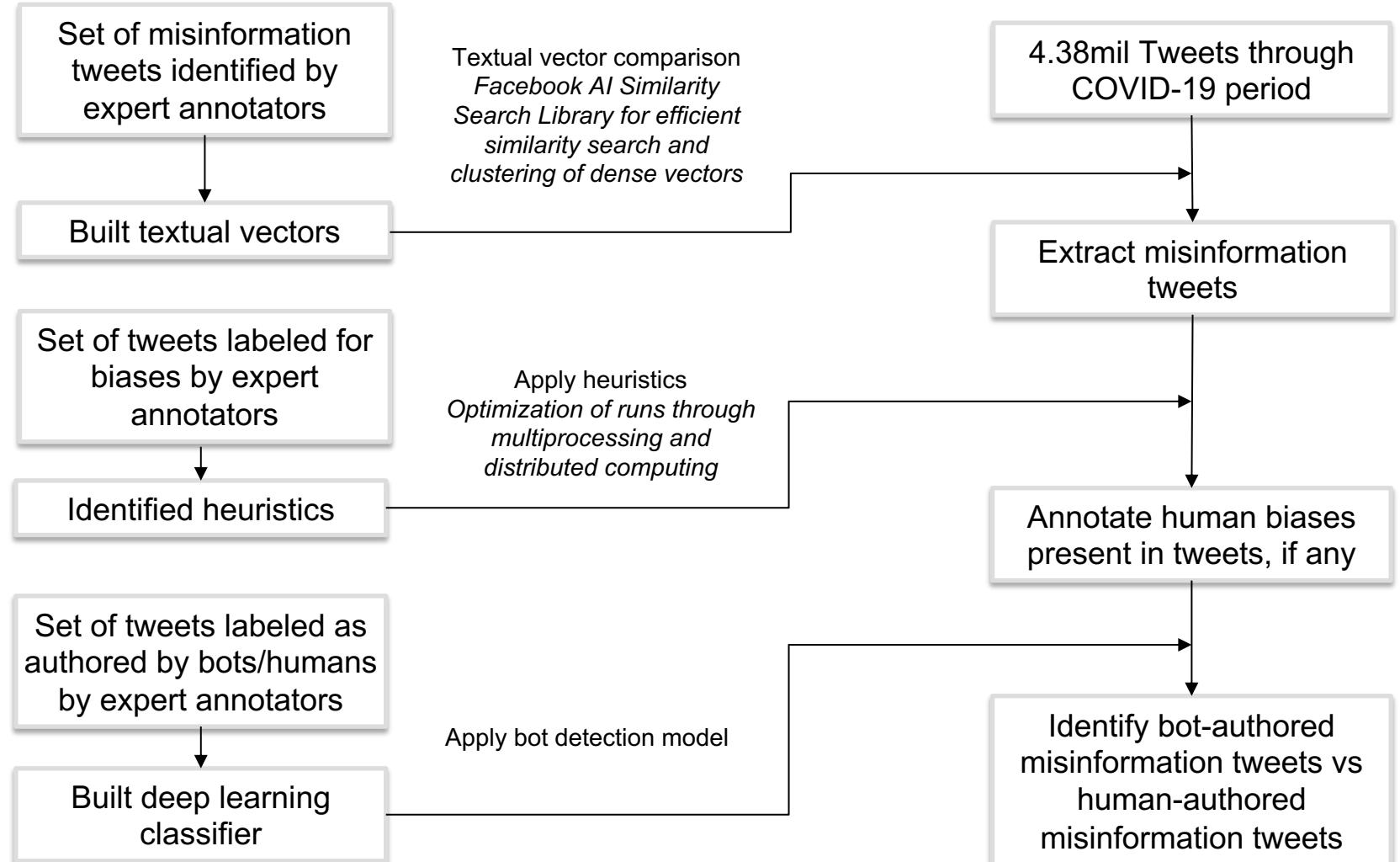
## Identifying bot- / human-misinformation



# Pipeline for identifying automated misinformation posts

## Why is automated misinformation dissemination of concern? /

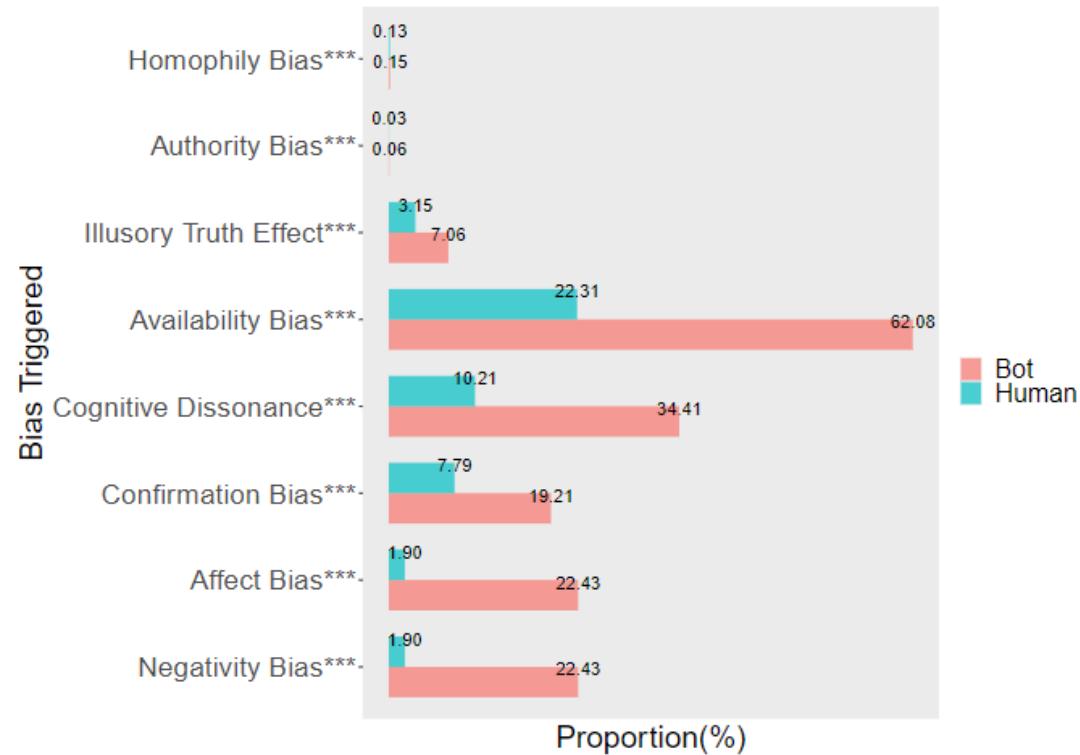
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# Bots trigger more human biases in their posts

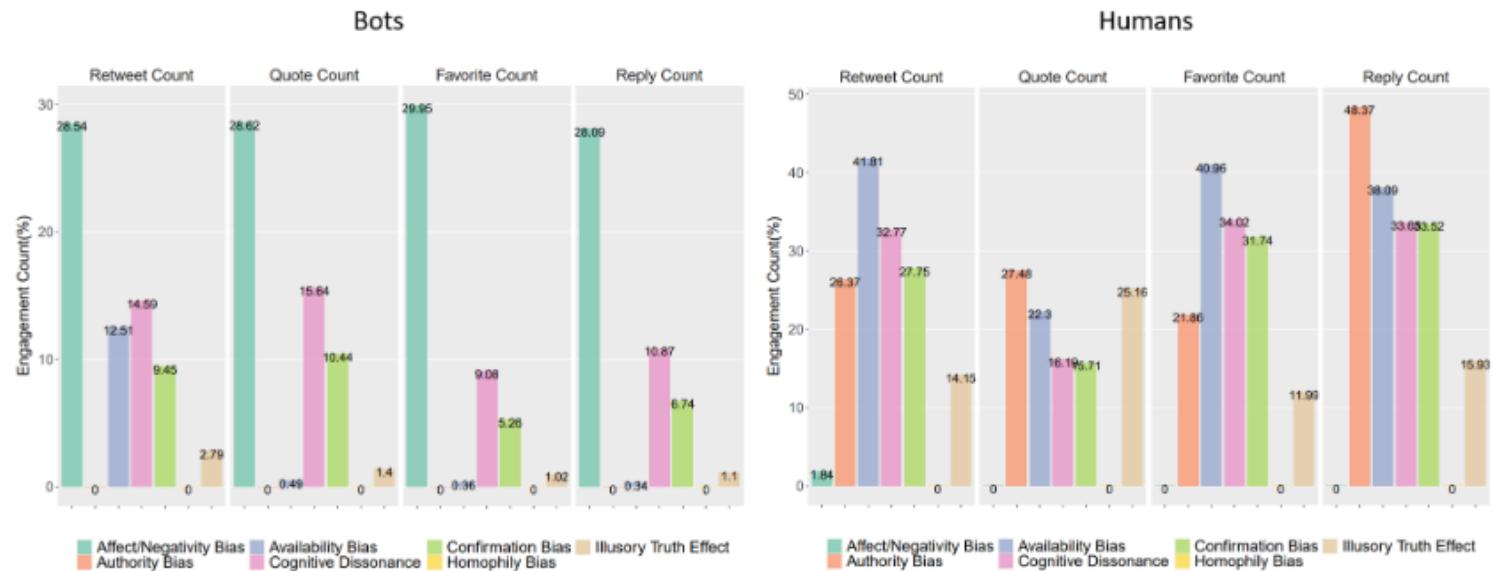
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# Bots receive consistent engagement results compared to humans

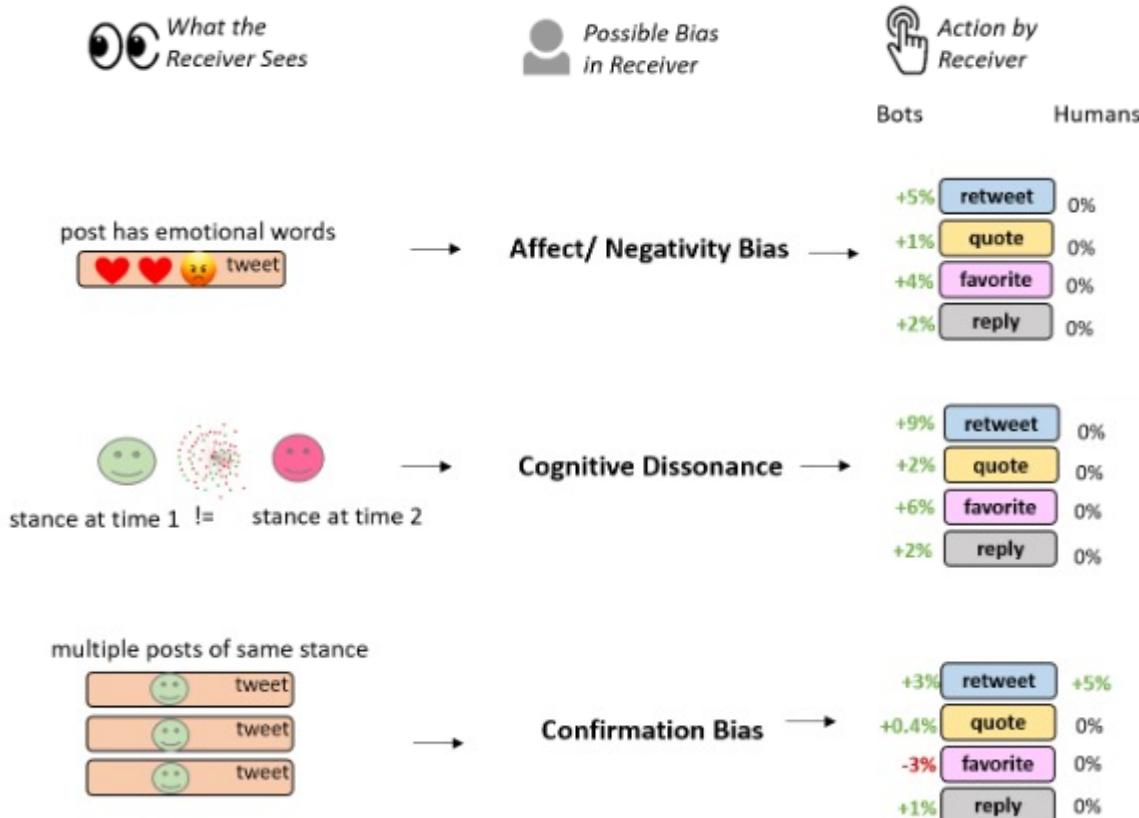
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# Triggering cognitive biases alters engagement of posts

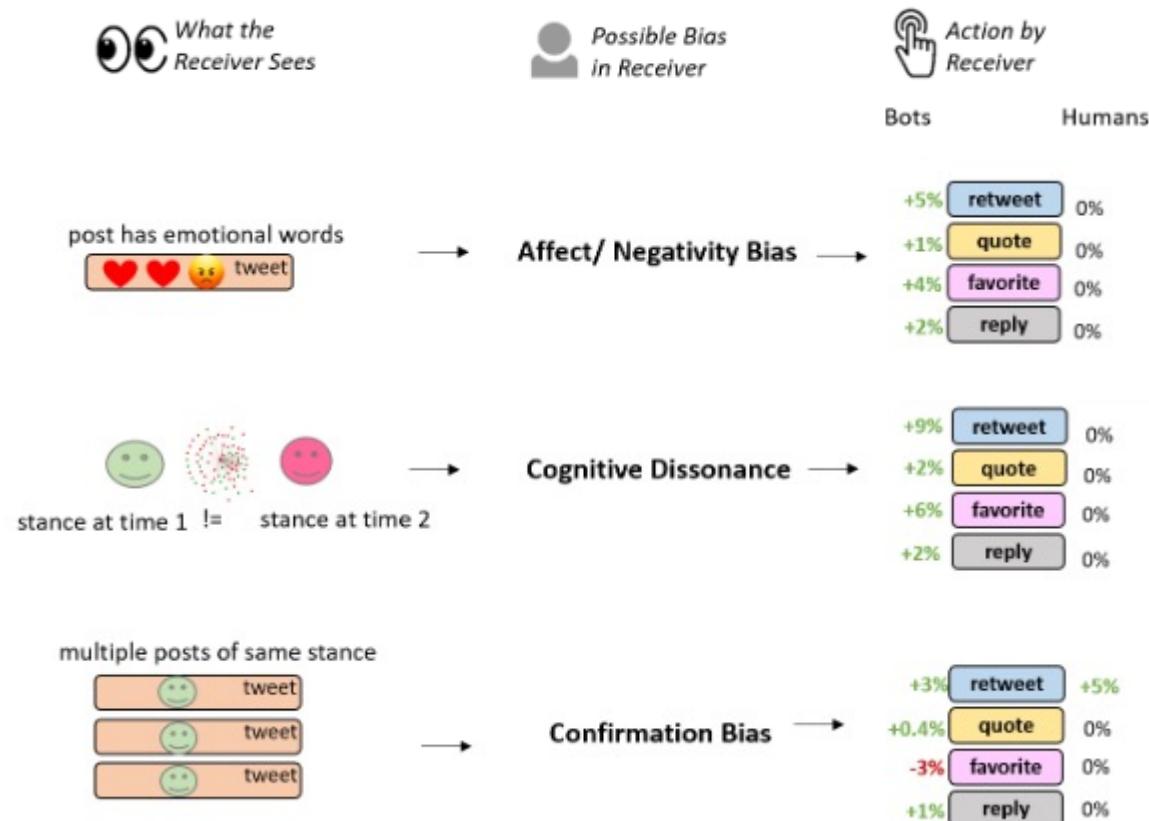
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# Misinformation spread by bots increase post engagement, while misinformation spread by humans have negligible effect

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# Reactions to Misinformation

**Affirm**

**Deny**

**Question**

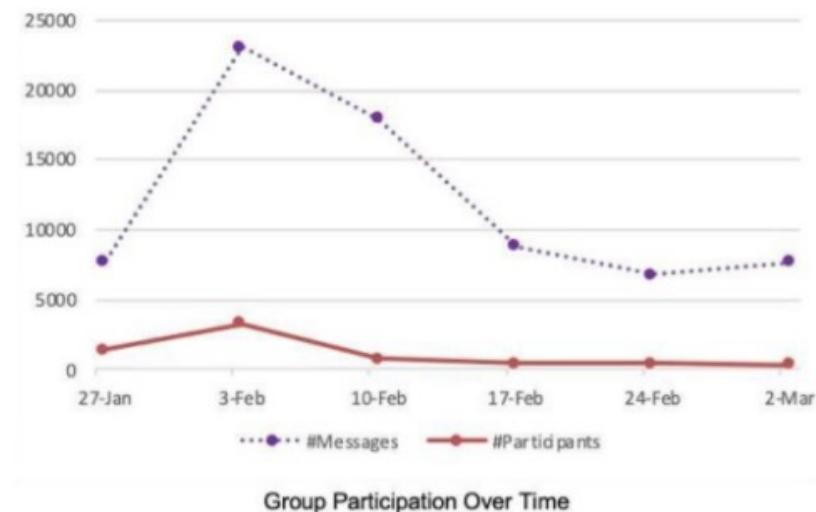
**Anxiety**

# Misinformation during crisis

Analysis of Singapore-based COVID-19 Telegram group (*SG Fight COVID-19*) with >10,000 participants

## Reactions to Misinformation /

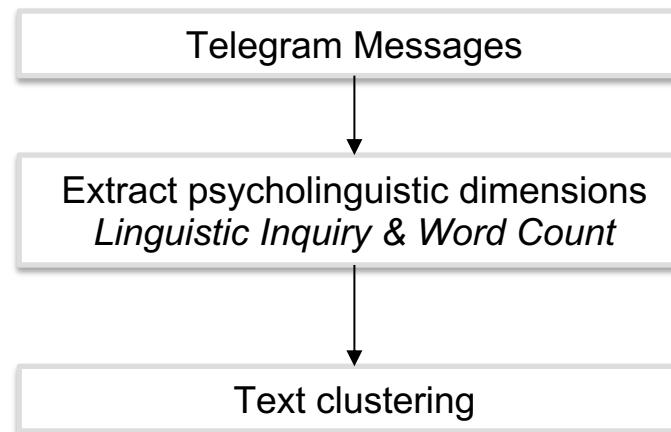
48,050 messages from 10,765 users



Ng, Lynnette Hui Xian, and Jia Yuan Loke.  
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# Topic Clusters of Telegram Messages

## Reactions to Misinformation /

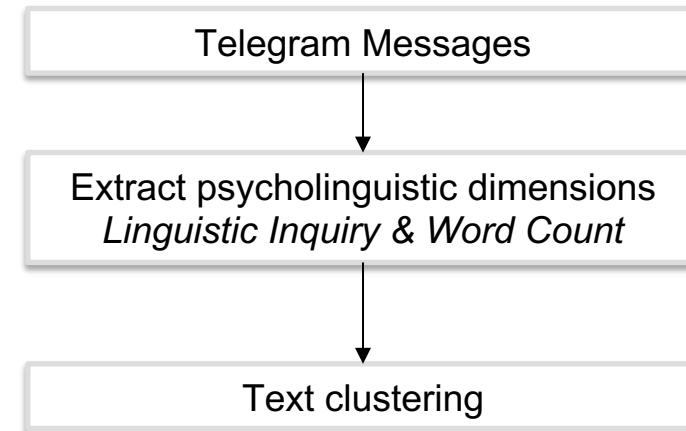


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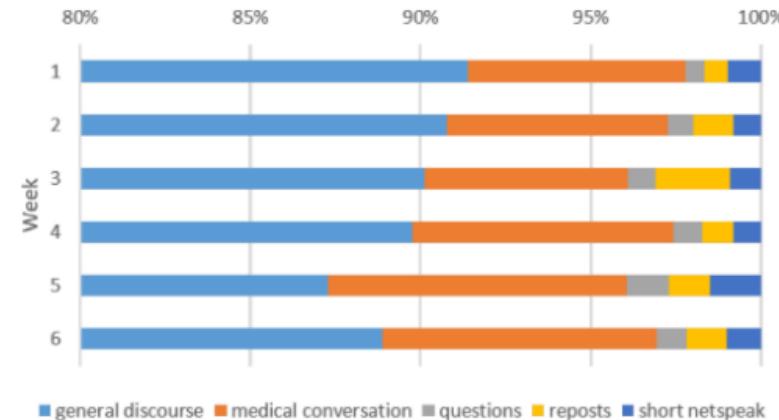


- 1) News reposts: "#asiaone #Singapore 3 new coronavirus cases [...]"
- 2) Short nextspeak: "ah, ok. Agree!"
- 3) General discourse: "so much agree. Is incompatible to profit with ncov"
- 4) Questions: "can the new virus spread through aerosol transmission?"
- 5) Medical: "if you really sick go see doc"

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# Reactions to Misinformation /

Affirm  
Deny  
Question  
Anxiety

## Reactions to Authority-Defined Misinformation

Identify fact-checked misinformation  
*Government Correction, BlackDot Research...*

Search for fact-checked misinformation in Telegram messages  
*Text comparison, text vector comparison*

Characterize user reactions towards misinformation message  
*Affirm, Deny, Question*

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# Reactions to Misinformation /

## Reactions to Authority-Defined Misinformation

Affirm

Deny

Question

Anxiety

Description	Source			Reaction			
	Government Correction	BlackDot Research	Telegram Group	Affirm	Deny	Question	Unrelated
Foreign domestic worker's death							
Visit MOH office							
States Times Review Facebook Page			1				
CNA Asia graphics				1	1	1	1
Case at Lucky Plaza				1	5	2	2
CNA Tweet on school closure						1	
Death in Singapore on 7 Feb					2	1	2
List of places to avoid on 1 Feb			3	10	2	9	

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List of places to avoid on 1 Feb				3	10	2	9

Authority defined misinformation makes up 0.2% of messages

Common reactions are Deny or Question

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Visit MOH office							
States Times Review Facebook Page			1				
CNA Asia graphics				1	1	1	1
Case at Lucky Plaza				1	5	2	2
CNA Tweet on school closure						1	
Death in Singapore on 7 Feb					2	1	2
List of places to avoid on 1 Feb			3	10	2	9	

Authority defined misinformation makes up 0.2% of messages

Common reactions are Deny or Question

Authority defined misinformation is rare

People know the information is false

Ng, Lynnette Hui Xian, and Jia Yuan Loke. "Analyzing public opinion and misinformation in a COVID-19 telegram group chat." *IEEE Internet Computing* 25, no. 2 (2020): 84-91.

# How to find *non-authority defined* misinformation?

## Reactions to Misinformation /

Ng, Lynnette Hui Xian, and Jia Yuan Loke.  
"Analyzing public opinion and  
misinformation in a COVID-19 telegram  
group chat." *IEEE Internet Computing* 25,  
no. 2 (2020): 84-91.

# Users can respond to misinformation with skepticism

(Mendoza et al, 2010...)

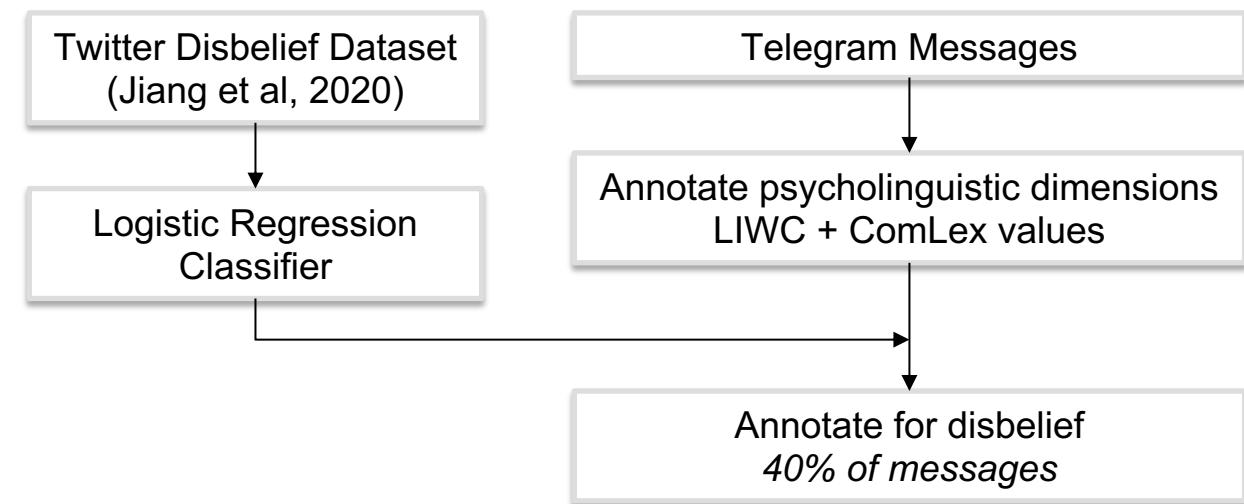
## Reactions to Misinformation /

Anxiety

Affirm

Deny

Question



Ng, Lynnette Hui Xian, and Jia Yuan Loke.  
"Analyzing public opinion and  
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# Reactions to Misinformation /

Affirm  
Deny  
Question  
Anxiety

# Misinformation found by searching for user skepticism

**TABLE 1.** Misinformation found by searching for user skepticism.

Category	Misinformation
Natural cures	Natural medical care from eucalyptus oil Traditional Chinese Medicine cures COVID-19
Case counts	Seven new cases at Lorong Chuan "New case at Changi" "4000 people locked in Grace Assembly of God church to contain the spread" A close contact of a confirmed case was not quarantined
Government crisis responses	"Government lacks masks and canned food" "[...]government is restricting sales of masks for richer people to buy first" Singaporeans who transit in Hong Kong have to be quarantined Singapore supplies masks to China
Conspiracy theories	"Dr. Boyle from Harvard law school took on an offensive biological warfare agent" "Virus was leaked by Chinese communists [...]"
Facts about the virus	"smokers have higher chance of getting virus" "[...]seizure and die immediately"

We can discover unknown misinformation by searching for skepticism

Ng, Lynnette Hui Xian, and Jia Yuan Loke. "Analyzing public opinion and misinformation in a COVID-19 telegram group chat." *IEEE Internet Computing* 25, no. 2 (2020): 84-91.

# Reactions to Misinformation /

Affirm  
Deny  
Question  
Anxiety

# Misinformation found by searching for user skepticism

**TABLE 1.** Misinformation found by searching for user skepticism.

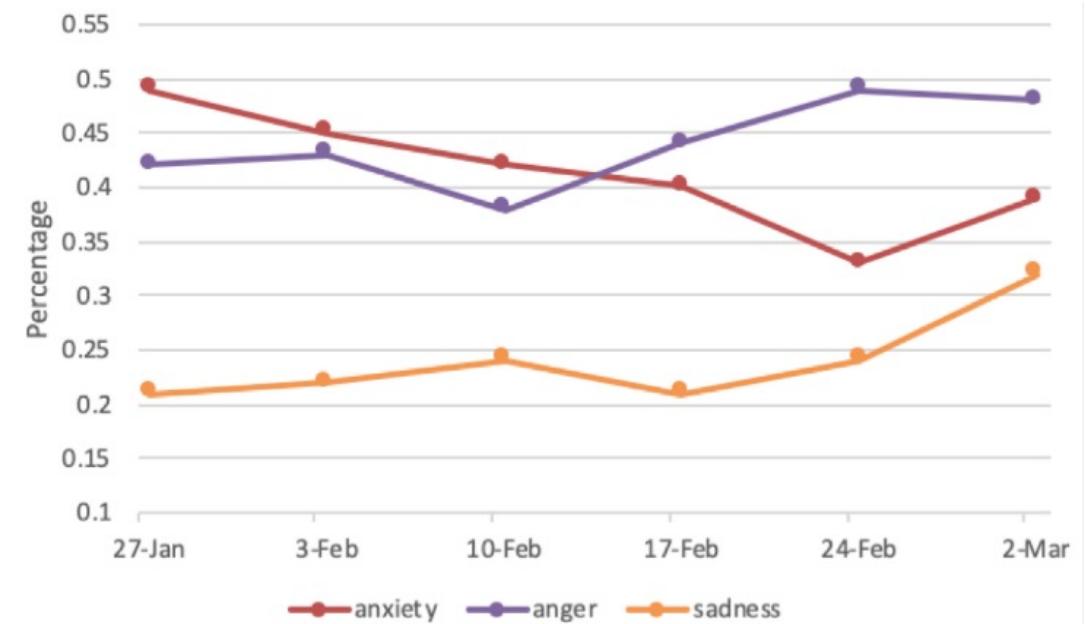
Category	Misinformation
Natural cures	Natural medical care from eucalyptus oil Traditional Chinese Medicine cures COVID-1
Case counts	Seven new cases at Lorong Chuan "New case at Changi" "4000 people locked in Grace Assembly of God church to contain the spread" A close contact of a confirmed case was not quarantined
Government crisis responses	"Government lacks masks and canned food" "[...]government is restricting sales of masks for richer people to buy first" Singaporeans who transit in Hong Kong have to be quarantined Singapore supplies masks to China
Conspiracy theories	"Dr. Boyle from Harvard law school took on an offensive biological warfare agent" "Virus was leaked by Chinese communists [...]"
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# Reactions to Misinformation /

Affirm  
Deny  
Question  
Anxiety

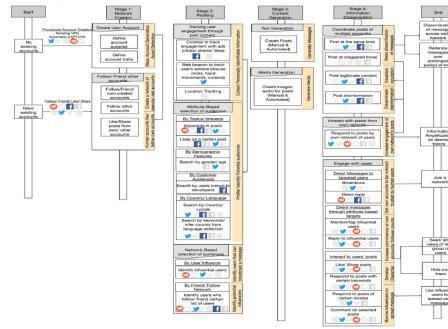
## Misinformation arises out of incomplete information



Ng, Lynnette Hui Xian, and Jia Yuan Loke.  
"Analyzing public opinion and  
misinformation in a COVID-19 telegram  
group chat." *IEEE Internet Computing* 25,  
no. 2 (2020): 84-91.

# We have discovered that...

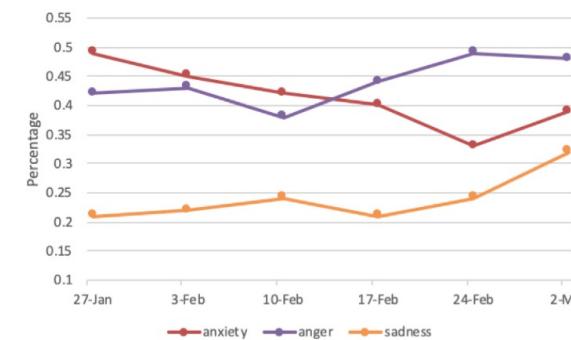
Paths of misinformation are related to the actions afforded by social media platforms



Automated dissemination of misinformation is successful because they trigger human biases.

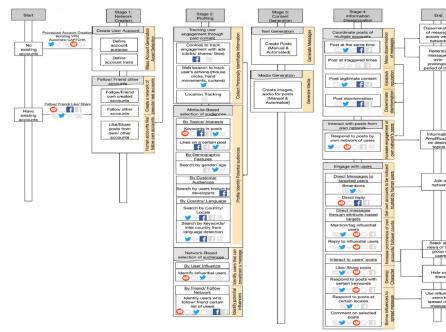


Reactions to misinformation include: affirm, deny, question, anxiety.

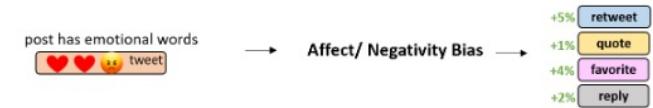


# We have discovered that...

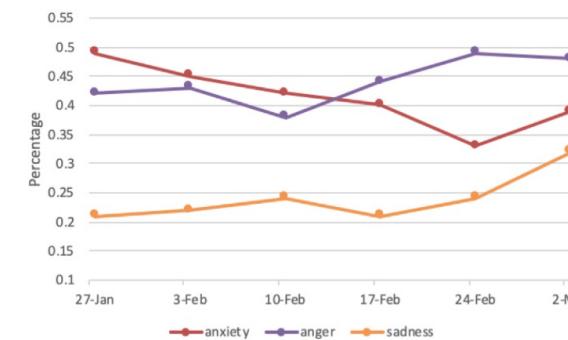
Paths of misinformation are related to the actions afforded by social media platforms



Automated dissemination of misinformation is successful because they trigger human biases.



Reactions to misinformation include: affirm, deny, question, anxiety.



# Therefore, we can

Predict paths of misinformation spread given current conditions

Identify potentially successful misinformation and estimate their impact

Discover unknown misinformation through searching for skepticism

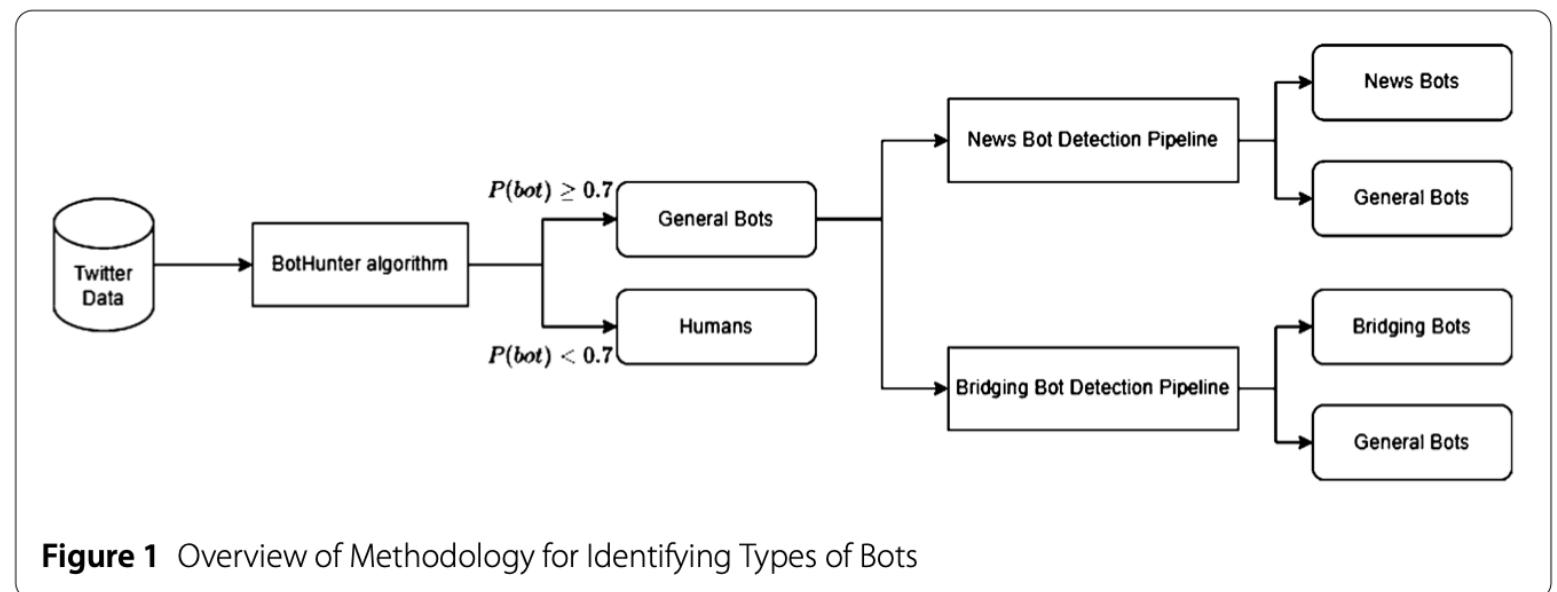
Information is  
Power /

# Digital Diplomacy during the US-China balloon crisis

Analysis of Twitter (X) data surrounding the crisis

1,192,445 tweets from 121,048 unique users

Algorithmically identified types of bots & humans;  
different types of bots serve different functions



Ng, Lynnette Hui Xian, and Kathleen M. Carley. "Deflating the Chinese balloon: types of Twitter bots in US-China balloon incident" *EPJ Data Science* 12, no. 1 (2023): 63. *Featured on New Scientist and trended on Reddit*

# Information is Power /

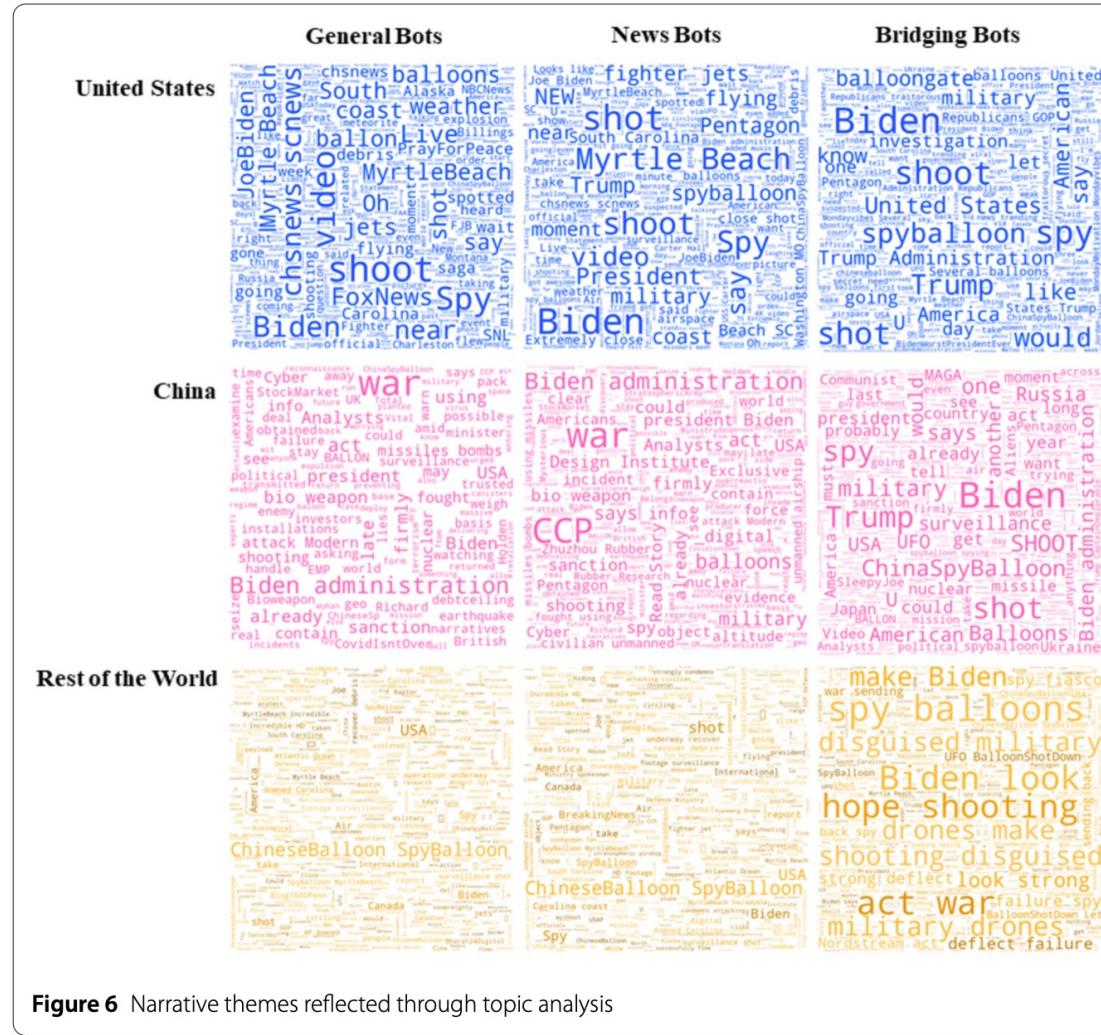
## Digital Diplomacy during the US-China balloon crisis

Bot Type	Example Tweet
Bot	[Rest of the World] I'm bored why can't we have some real life alien invasion #SpyBalloon #ChinaSpyBalloon #AlienInvasion #BBCNews #BBCNewsTen [United States] #ChineseBalloon saga causing political damage already... It's a weather balloon, so #China said [...] (URL) [United States] @(User) I'm not 100% if authentic, but it seems that is a meteorite that came down and may had produced that explosion you heard... Unless is a fake video. But it has nothing to do with the #ChineseBalloon
News Bot	[China] #USA #China #14February [...] One could speculate that the US is using the #ChineseSpyBalloon 'excuse' to escalate tensions with #Beijing.. Recall that US airspace is highly controlled and that there are more accurate satellite technologies for spying (URL) [United States] #USA #China #14February @(NewsUser) - The #Biden administration has blocked the sale of certain US technologies to various Chinese companies - This follows the #ChineseSpyBalloon events - In particular 5 companies allegedly supported programmes for these blimps [...] [Rest of the World] #USA is under attack @(User). Modern wars not fought just using missiles or bombs. #ChineseSpyBalloon #ChinaBalloon #Balloon could be act of Cyber war, #Bioweapon, EMP or surveillance of nuclear installations. The world is watching how president #Biden handle #china firmly on this
Bridging Bot	[United States] @(User): Should have been shot down over Alaska. It's always about the politics. #Biden #ChineseSpyBalloon [Rest of the World] @(User1): Enjoyed joining @(User2) to discuss the #ChineseSpyBalloon [Rest of the World] Balloons have been used in warfare going back 200+ years and you're telling me the most advanced and expensive military the world has ever seen has no way to safely take out a large gently floating bag of air? @(User1) @(User2)

Ng, Lynnette Hui Xian, and Kathleen M. Carley. "Deflating the Chinese balloon: types of Twitter bots in US-China balloon incident" *EPJ Data Science* 12, no. 1 (2023): 63. **Featured on New Scientist and trended on Reddit**

# Information is Power /

## Soft power in portrayal of narratives by bots stemming from countries

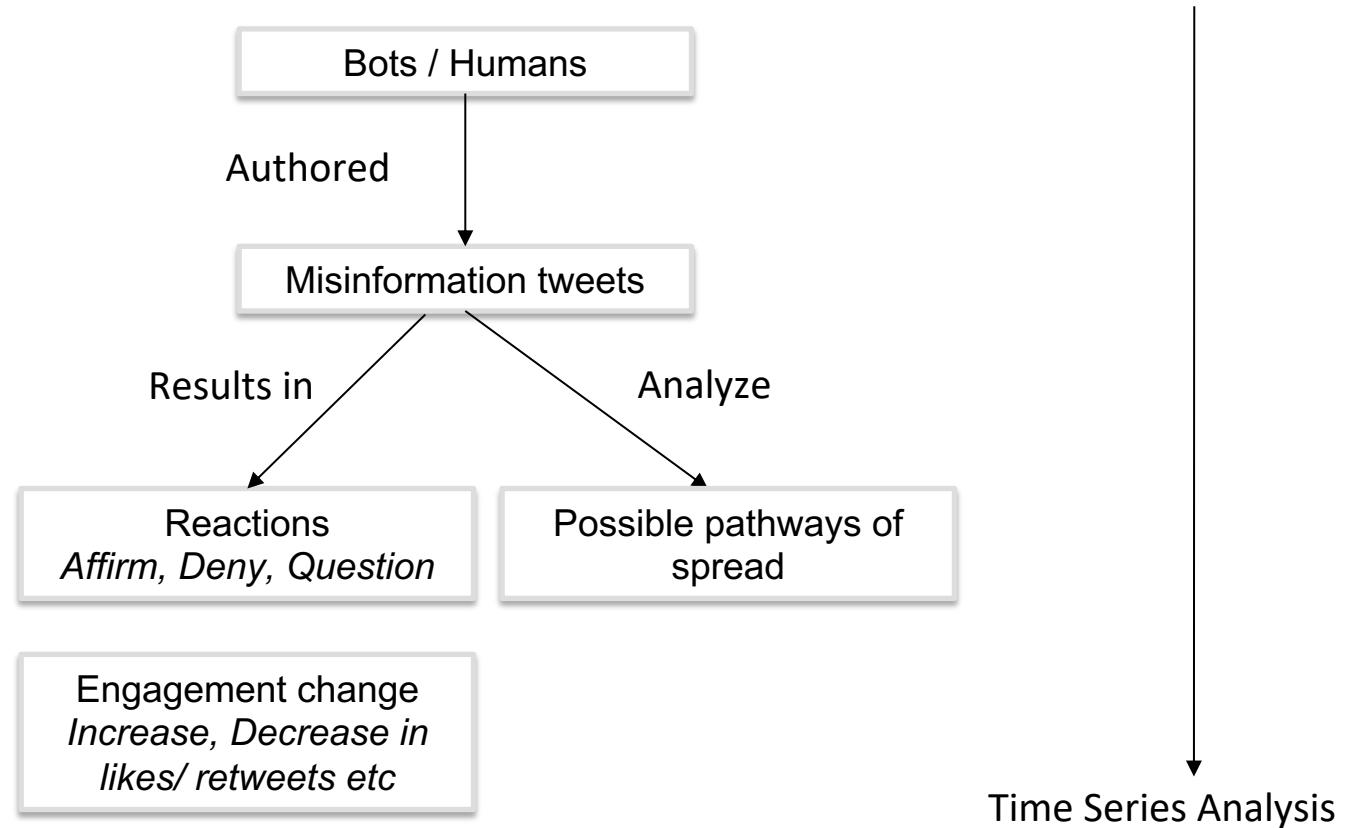


Ng, Lynnette Hui Xian, and Kathleen M. Carley. "Deflating the Chinese balloon: types of Twitter bots in US-China balloon incident" *EPJ Data Science* 12, no. 1 (2023): 63. *Featured on New Scientist and trended on Reddit*

# Future Work /

## Profiling misinformation spread

### Simulation as a predictive tool

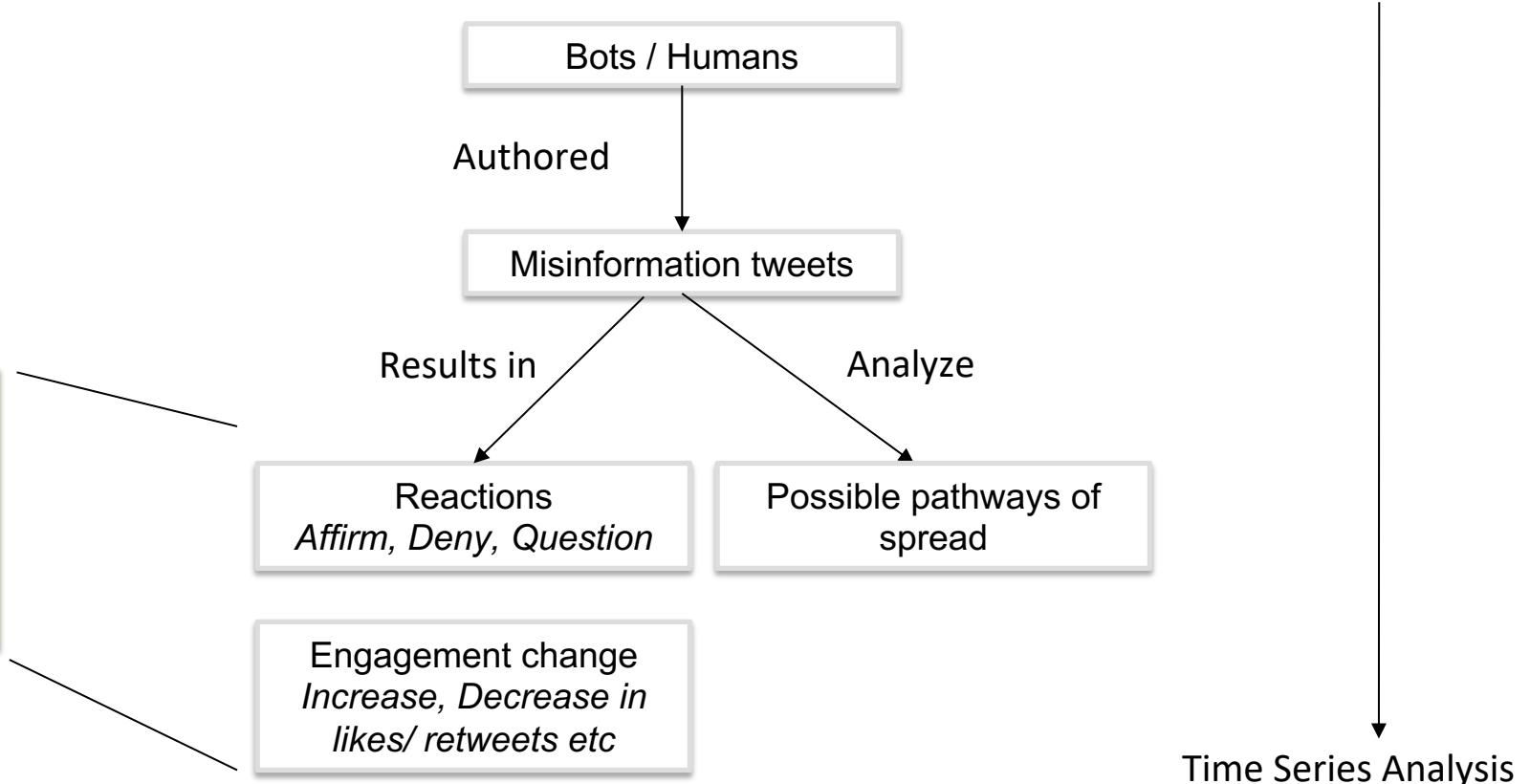


# Future Work /

## Profiling misinformation spread

### Simulation as a predictive tool

Predict reactions  
Predict potential pathways  
*Develop Counter Measures / Communication Measures*



# Understanding Misinformation

Lynnette Hui Xian Ng

Website: [quarby.github.io](https://quarby.github.io)

**Ng, Lynnette Hui Xian**, and Araz Taeihagh. "How does fake news spread? Understanding pathways of disinformation spread through APIs." *Policy & Internet* 13, no. 4 (2021): 560-585. **Most Cited Paper Award, 2022.**

**Ng, Lynnette Hui Xian**, and Jia Yuan Loke. "Analyzing public opinion and misinformation in a COVID-19 telegram group chat." *IEEE Internet Computing* 25, no. 2 (2020): 84-91. **Best Paper Award, AAAI ICWSM Cyber Social Threats**

**Ng, Lynnette Hui Xian**, Wenqi Zhou, and Kathleen M. Carley. "Exploring Cognitive Bias Triggers in COVID-19 Misinformation Tweets: A Bot vs. Human Perspective." *arXiv preprint arXiv:2406.07293* (2024). **IC2S2**

**Ng, Lynnette Hui Xian**, and Kathleen M. Carley. "Deflating the Chinese balloon: types of Twitter bots in US-China balloon incident" *EPJ Data Science* 12, no. 1 (2023): 63. **Featured on New Scientist and trended on Reddit**

