





4:52 PM · Feb 21, 2023 · 106.6K Views

1,062 Retweets   121 Quote Tweets   4,438 Likes



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# Investigating User Behavior Towards Fake News on Social Media Using Gaze and Mouse Movements



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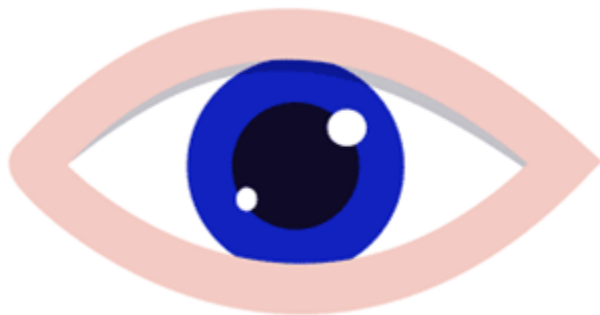


RI *Research Institute  
Cyber Defence*  
Bundeswehr University Munich

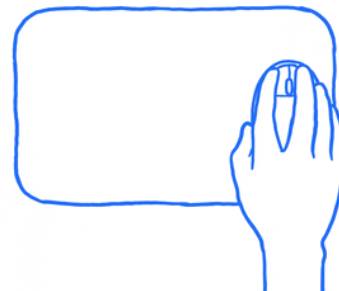




We propose a novel approach to identify users' exposure to fake news from their **gaze** and **mouse movement** behavior



[https://cliply.co/wpcontent/uploads/2019/03/371903161\\_BLINKING\\_EYE\\_400px.gif](https://cliply.co/wpcontent/uploads/2019/03/371903161_BLINKING_EYE_400px.gif)



<https://giphy.com/explore/computer-mouse>

# What could be detected from gaze and mouse movements

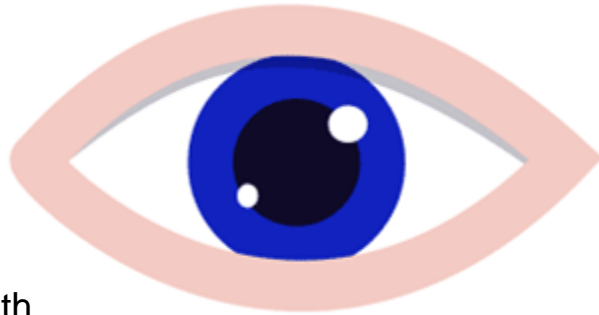
Mental workload

Gender

Age

Mental health

Etc.

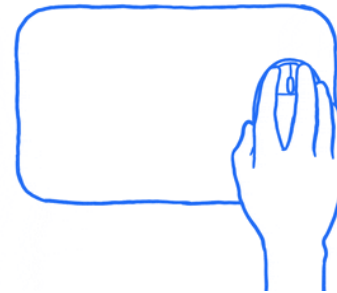


Mental workload

Phishing email exposure

Task proficiency

Etc.





# Data Collection





# Study Design

## Remote Study

Mimicked  
Facebook  
Interface



# Interface Design



The screenshot displays a Facebook news feed. At the top, there is a search bar and navigation icons for home, marketplace, groups, and pages. The left sidebar contains a menu with options: Elena Karypidou, COVID-19 Information Center, Friends, Groups, Marketplace, Events, Memories, Saved, Pages, and See More. The right sidebar shows the user's profile (Elena), sponsored content, and contacts, with a button that says "Stop & Continue with Next Step".

The main news feed contains two posts:

- Post 1:** By Kelly Alexander Jr. (10 hours). Text: "With a vaccine a year in the future the General Assembly should use more teleconferences and fewer in person meetings to cut down on potential exposure...after all most of the GA's members are in the high risk age group...besides we need to modernize...just saying". Engagement: 210 Comments, 241 Shares. Interaction buttons: Haha, Comment, Share.
- Post 2:** By Beate Singer (April 23). Text: "Selbst ein positiv getesteter Selbstmörder, dessen Todesursache offensichtlich nicht Corona ist, kommt in die Statistik der Coronatoten.. Super Statistik würde ich mal sagen". Engagement: 119 Comments, 212 Shares. Interaction buttons: Like, Comment, Share.

# Interface Design



The screenshot displays the Facebook user interface. At the top, there is a search bar with the Facebook logo and the text "Search Facebook". Below this is a navigation bar with icons for home, marketplace, groups, and a profile icon. The profile icon is highlighted with a red box and labeled "Elena".

The left sidebar contains a list of navigation options: "Elena Karypidou" (highlighted with a red box), "COVID-19 Information Center", "Friends", "Groups", "Marketplace", "Events", "Memories", "Saved", "Pages", and "See More".

The central feed shows a post by "Kelly Alexander Jr" from 10 hours ago. The post text reads: "With a vaccine a year in the future the General Assembly should use more teleconferences and fewer in person meetings to cut down on potential exposure...after all most of the GA's members are in the high risk age group...besides we need to modernize...just saying". Below the text are reaction icons (thumbs up, heart, wow, sad face) and the text "You and 50 others", along with "210 Comments" and "241 Shares". Interaction buttons for "Haha", "Comment", and "Share" are visible. A "Write a comment..." input field is highlighted with a red box.

The right sidebar shows "Sponsored" and "Contacts" sections. A "See All (0)" button is present, and a blue button at the bottom says "Stop & Continue with Next Step".

# Interface Design



The screenshot displays a Facebook news feed. At the top, there is a search bar and navigation icons. The left sidebar contains a list of user profiles and categories like 'Friends', 'Groups', and 'Marketplace'. The main feed shows two posts. The first post is by Kelly Alexander Jr., dated 10 hours ago, with a text-based message. Below the text are reaction icons (thumbs up, heart, wow, sad face) and a 'Haha' reaction. A red arrow points to the 'Haha' reaction. Below the reactions are 'Comment' and 'Share' buttons. The second post is by Beate Singer, dated April 23, with a text-based message in German. It also has 'Like', 'Comment', and 'Share' buttons. The right sidebar shows a 'Sponsored' section, a 'Contacts' section with a 'See All (0)' button, and a blue button labeled 'Stop & Continue with Next Step'.



# Study Design

## Remote Study

Mimicked  
Facebook  
Interface



## 3 Post Types

Text



Image





Article









# Dataset Creation: Image-based

 **Emily Gunther**  
September 26




👍👎🗨️ 50 others 167 Comments 189 Shares


 Like  Comment  Share








# Dataset Creation: Article-based

 **Emily Gunther**  
September 26



50 others      167 Comments   189 Shares

 Like      Comment       Share

 Write a comment...

 **Herbert Heining**  
August 26



EXTREMENEWS.COM  
**Anzeige gegen Spahn: Türkei lässt Chlordioxid als Arzneimittel zu**

 25 others      107 Comments   233 Shares

 Like      Comment       Share

 Write a comment...



# Dataset Creation: Text-based

**Emily Gunther**  
September 26

**Herbert Heining**  
August 26

**Hanna Pratter**  
August 28

Young people aren't as good at spotting environmental changes, like disappearing biodiversity, compared to older generations. It could mean that irreversible environmental change could go unnoticed if older generations aren't consulted about what should be considered 'normal'. We have to educate our children!

👍👎👏👤 55 others 138 Comments 253 Shares

Like Comment Share

Write a comment...

**Trump's TikTok Ban Judge Hours Before**

50 others Like Com

Write a comment...

**rdioxid als Arzneimittel zu**

107 Comments 233 Shares

ment Share

Write a comment...





# Study Design

## Remote Study

Mimicked  
Facebook  
Interface



## 3 Post Types

Text



Image



Article



## 5 News Categories

Environment

Health

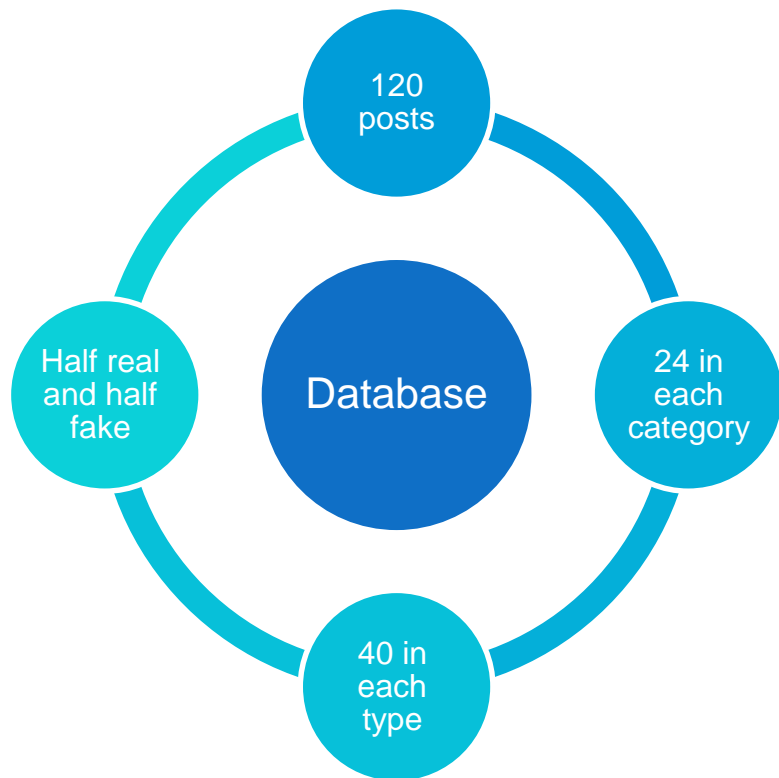
Entertainment

American Politics

European Politics



# Dataset Creation



- ❑ [healthfeedback.org/](https://healthfeedback.org/)
- ❑ [climatefeedback.org/](https://climatefeedback.org/)
- ❑ [sciencefeedback.co/](https://sciencefeedback.co/)
- ❑ [snopes.com/](https://snopes.com/)
- ❑ [politifact.com/](https://politifact.com/)
- ❑ [correctiv.org/faktencheck/](https://correctiv.org/faktencheck/)

# Interface Design



Facebook interface showing a news feed with two posts. The first post is by Kelly Alexander Jr, dated 10 hours ago, with a text snippet: "With a vaccine a year in the future the General Assembly should use more teleconferences and fewer in person meetings to cut down on potential exposure...after all most of the GA's members are in the high risk age group...besides we need to modernize...just saying". The post has 210 Comments and 241 Shares. The second post is by Beate Singer, dated April 23, with a text snippet: "Selbst ein positiv getesteter Selbstmörder, dessen Todesursache offensichtlich nicht Corona ist, kommt in die Statistik der Coronatoten.. Super Statistik würde ich mal sagen". The post has 45 likes and 212 Shares. The interface includes a search bar, navigation icons, and a right sidebar with 'Sponsored' and 'Contacts' sections.



# Study Design

## Remote Study

Mimicked Facebook Interface



## 3 Post Types

Text



Image



Article



## 5 News Categories

Environment

Health

Entertainment

American Politics

European Politics

## Dependent Variables

Mouse features

Gaze features

Task duration



# Study Design

## Remote Study

Mimicked Facebook Interface



## 3 Post Types

Text



Image



Article



## 5 News Categories

Environment

Health

Entertainment

American Politics

European Politics

## Dependent Variables

Mouse features

Gaze features

Task duration

## 7 Minutes

Average 2.5 seconds per post





# Participants and Apparatus

Recruiting: university mailing lists, and social media groups

54 participants

28 female, 26 male

average age 25.8 (SD=7.7)

Diverse backgrounds, majority students



# Participants and Apparatus

Recruiting: university mailing lists, and social media groups

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28 female, 26 male

average age 25.8 (SD=7.7)

Diverse backgrounds, majority students



GazeRecorder



Native HTML



Both synced using timestamp



# Procedure

Consent &  
Demographics



Calibration



Scrolling  
Task



Accuracy  
Test



Post  
Labelling



Questionnaire







# Results



# Data Overview: Labeling Task Veracity

Text-based news is the hardest to judge, then images and the articles

American politics are mostly judged wrongly

Environmental posts were mostly labeled correctly



# Data Overview: Labeling Task Duration

Entertainment posts took the shortest duration for labeling

Participants longer durations labeling fake news

Text-based posts took the longest duration for labeling



# Classification Approach

## Classifiers

- User Dependent
- User Independent

## Models

- SVM
- Random Forest
- Logistic Regression

## Features

- Gaze Features only
- Mouse Features Only
- Both Features



# Feature Extraction

# Areas of Interest |(AOIs)



Search Facebook

Elena Karypidou

COVID-19 Information Center

Friends

Groups

Marketplace

Events

Memories

Saved

Pages

See More

Write a comment...

**Kelly Alexander Jr**  
10 hours

Header

With a vaccine a year in the future the General Assembly should use more teleconferences and fewer in person meetings to cut down on potential exposure...after all most of the GA's members are in the high risk age group...besides we need to modernize...just saying

You and 50 others 210 Comments 241 Shares

Haha Comment Share

Write a comment...

**Beate Singer**  
April 23

Selbst ein positiv getesteter Selbstmörder, dessen Todesursache offensichtlich nicht Corona ist, kommt in die Statistik der Coronatoten.. Super Statistik würde ich mal sagen

45 others 119 Comments 212 Shares

Like Comment Share

Write a comment...

Sponsored

Contacts

See All (0)

Stop & Continue with Next Step

# Areas of Interest |(AOIs)



The screenshot shows a Facebook post by Kelly Alexander Jr. The post text reads: "With a vaccine a year in the future the General Assembly should use more teleconferences and fewer in person meetings to cut down on potential exposure...after all most of the GA's members are in the high risk age group...besides we need to modernize...just saying". The post has 210 comments and 241 shares. The interaction buttons shown are "Haha", "Comment", and "Share".

**Header** (Red box): Kelly Alexander Jr, 10 hours

**Footer** (Red box): Haha, Comment, Share

# Areas of Interest |(AOIs)



The screenshot shows a Facebook interface with a post from Kelly Alexander Jr. Three red boxes highlight the following areas:

- Header:** The post header containing the user's profile picture, name "Kelly Alexander Jr", and the time "10 hours".
- Content:** The main text of the post: "With a vaccine a year in the future the General Assembly should use more teleconferences and fewer in person meetings to cut down on potential exposure...after all most of the GA's members are in the high risk age group...besides we need to modernize...just saying".
- Footer:** The interaction bar showing "You and 50 others", "210 Comments 241 Shares", and buttons for "Haha", "Comment", and "Share".





# Classification Performance: User Dependent

Classifier	Gaze Features	Mouse Features	Both Features
Random Forest	62.6% + 17%	61.3% + 19.8%	61.3% + 22%
Logistic Regression	63.2% + 19.6%	61.9% + 20%	64.3% + 19.7%
SVM	<b>64.2% + 18.3%</b>	<b>63.9% + 18.3%</b>	<b>64.2% + 18.3%</b>



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SVM	<b>64.2% + 18.3%</b>	<b>63.9% + 18.3%</b>	<b>64.2% + 18.3%</b>



# Classification Performance: User Independent

Classifier	Gaze Features	Mouse Features	Both Features
Random Forest	57.9% + 3.5%	53.3% + 6.5%	49.2% + 6.5%
Logistic Regression	66.7% + 2.7%	63.3% + 6.4%	62.5% + 8.7%
SVM	<b>67% + 3</b>	<b>65.9% + 2.2%</b>	<b>68.4% + 2.9%</b>



# Classification Performance: User Independent

Classifier	Gaze Features	Mouse Features	Both Features
Random Forest	57.9% + 3.5%	53.3% + 6.5%	49.2% + 6.5%
Logistic Regression	66.7% + 2.7%	63.3% + 6.4%	62.5% + 8.7%
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User Independent	Gaze Features	Mouse Features	Both Features
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Logistic Regression	66.7% + 2.7%	63.3% + 6.4%	62.5% + 8.7%
<b>SVM</b>	<b>67% + 3</b>	<b>65.9% + 2.2%</b>	<b>68.4% + 2.9%</b>



# Take away Messages

We present a novel approach of using gaze and mouse movements to detect user exposure to fake news ➤

Reading Fake news induces cognitive load reflected in users' fixation count, slow mouse movements and labeling duration ➤

User-dependent classifiers reflect unique users' behavior ➤

Gaze movements are better predictors than mouse movements ➤

Future work could investigate different interventions to nudge users before sharing fake news ➤





# Thank you



*Research Institute  
Cyber Defence*  
Bundeswehr University Munich

## Full Paper



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## Investigating User Behavior Towards Fake News on Social Media Using Gaze and Mouse Movements