



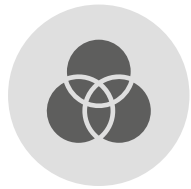
# NO FILTER BUBBLES?

Evidence from an Online Experiment on News  
Diversity of Personalizing News Aggregators

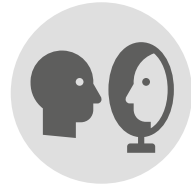


# Motivation

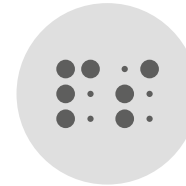
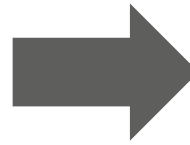
News aggregators are intermediaries that can...



Collect News from  
Variety of Sources



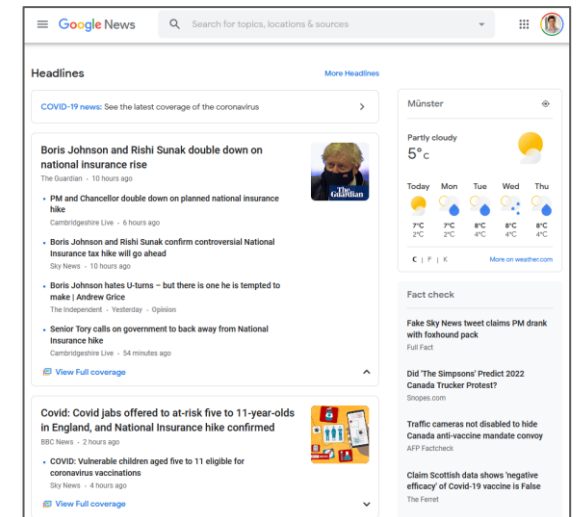
Personalize the  
Displayed News Set



Address Diverse,  
Individual  
Information Needs



Personalization can improve fit between information needs  
and available information on the internet.

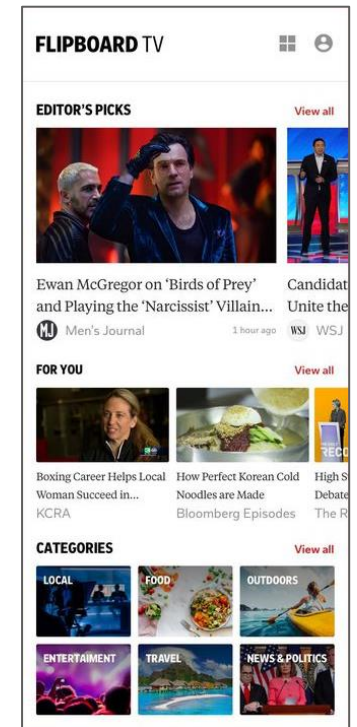


Sources: Hölzig & Hasebrink, 2020; Athey & Mobius, 2012; Voakes et al., 1996.

# Motivation

Personalization is a Double-Edged Sword.

- Interest from literature:
  - Understanding information consumption on platforms is important to society (Kitchens et al. 2020)
- Too extensive personalization can:
  - stifle diversity
  - convey a distorted picture of news reality and add to dividing society
- The degree of personalization may determine whether a news aggregator...
  - Shows a diverse news offering
  - Limits diversity of news offering



Sources: Kitchens et al., 2020; Pariser, 2011; Stroud, 2010.

# Research Question



How does the personalization by online news aggregators affect the diversity of their displayed news collection?

# Hypotheses

Topics are central to news diversity



Maximize users' length of stay & personalize as much as possible.

1

## Hypothesis 1

Personalization decreases news diversity on news aggregator websites compared to a non-personalized baseline.

Manually curated news websites do not personalize their news content for their users.

2

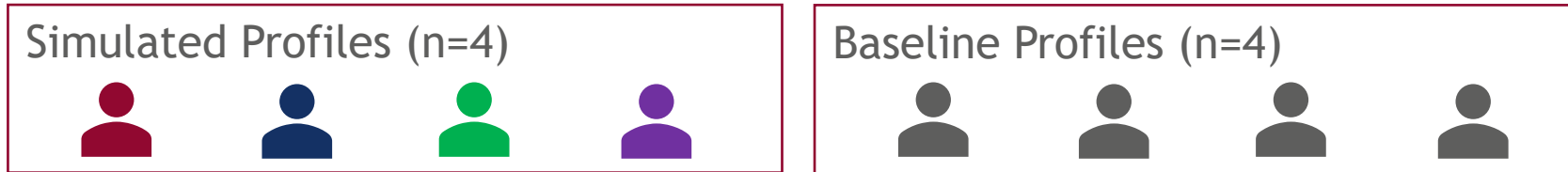
## Hypothesis 2

Personalization decreases news diversity on news aggregator websites compared to edited newspaper websites.

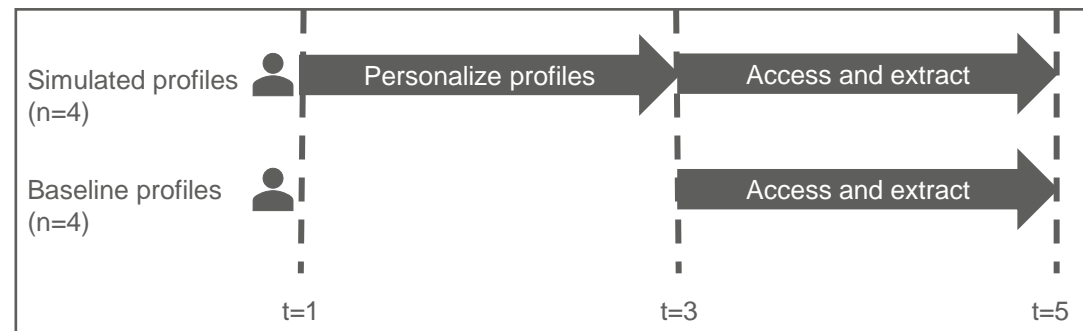
Sources: Kitchens et al., 2020; Stroud, 2011; Voakes et al., 1996; Bodó et al. 2019.

# Methods

Collecting data from Google News and Flipboard.



- Build profiles based on German sociodemographics
- Personalized profiles explicitly and implicitly
- Scraped news articles from the home pages



# Methods

## Technical Setup



Firefox

Mimic user  
interaction



Seperate profiles



Scalability

# Findings

## Summary Statistics.



Variable	Levels	n	%			Variable	Levels	n	%	
Sources	Flipboard	826	25.60			Topics	Other	373	11.60	
	Google News	1898	58.80				Covid	1017	31.50	
	National News	265	8.20				Economics	263	8.10	
	Local News	240	7.40				Health	45	1.40	
		<u>3229</u>	<u>100.00</u>				Leisure	429	13.30	
Profiles	Simulated 1	562	17.40				Culture	120	3.70	
	Simulated 2	536	16.60				Social	114	3.50	
	Simulated 3	541	16.80				Sports	158	4.90	
	Simulated 4	508	15.70				Crime & Accidents	77	2.40	
	Baseline (Flipboard)	178	5.50				Tech	134	4.20	
	Baseline (Google News)	399	12.40				Politics	469	14.50	
	Baseline (National News)	265	8.20				Science	30	0.90	
	Baseline (Local News)	240	7.40					<u>3229</u>	<u>100.00</u>	
		<u>3229</u>	<u>100.00</u>							



# Findings

Estimates for Hypotheses 1.



1

## Hypothesis 1

Personalization decreases news diversity on news aggregator websites compared to a non-personalized baseline.

	Google News	Google News	Flipboard	Flipboard
	Shannon-Diversity	Shannon-Diversity	Shannon-Diversity	Shannon-Diversity
Baseline	0.4961 (0.0266)**	0.4734 (0.0225)**	0.7193 (0.0662)	0.6938 (0.0703)
Simulated	0.5849 (0.0119)***	0.5622 (0.0186)***	0.5944 (0.0307)***	0.5762 (0.0693)***
Day Fixed Effects	No	yes	no	yes
R <sup>2</sup>	0.38	0.63	0.12	0.21
F Statistic	11.18 (df=1;18)**	6.40 (df=4;15)**	3.56 (df=1;26)	0.92 (df=6;21)

(Values are unstandardised coefficients; standard errors are in parentheses; \*p<0.05; \*\*p<0.01; \*\*\*p<0.001)

## Changes in Diversity:

Google News:

8 %

Flipboard:

-12 %



# Findings

## Estimates for Hypotheses 2.



2

### Hypothesis 2

Personalization decreases news diversity on news aggregator websites compared to edited newspaper websites.

	Google News	Google News	Flipboard	Flipboard
	Shannon-Diversity	Shannon-Diversity	Shannon-Diversity	Shannon-Diversity
Baseline (Local News)	0.5973 (0.0240)	0.5834 (0.0260)	0.5973 (0.0440)	0.5895 (0.0449)
Baseline (National News)	0.7730 (0.0240)***	0.7590 (0.0260)***	0.7730 (0.0440)***	0.7651 (0.0449)***
Simulated	0.5849 (0.0157)***	0.5782 (0.0251)***	0.5944 (0.0261)***	0.5918 (0.0477)***
Day Fixed Effects	no	yes	no	yes
R <sup>2</sup>	0.66	0.70	0.30	0.37
F Statistic	35.61 (df=2;37)***	10.54 (df=7;32)***	9.28 (df=2;43)***	3.12 (df=7;38)*

(Values are unstandardised coefficients; standard errors are in parentheses; \*p<0.05; \*\*p<0.01; \*\*\*p<0.001)

### Changes in Diversity:

Local News:  
< 2 %

National News:  
18 %

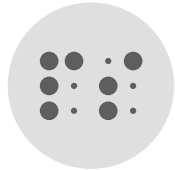


# Discussion

Implications for Theory and Practice.



Personalization can be additive or subtractive (hypothesis 1)



News aggregators may be more diverse in niche topics than Local News (hypothesis 2)



News aggregators are a viable medium for fulfilling diverse information needs, especially since they also cater to niche topics.



**Further Work:** increase sample size, look at diversity and slant (ideological dimension)



## Leonard Sensmeier

University of Münster

Email: [sensmeier@uni-muenster.de](mailto:sensmeier@uni-muenster.de)

## Joschka Hüllmann

University of Twente

Email: [j.huellmann@utwente.nl](mailto:j.huellmann@utwente.nl)



@johuellm



# Backup

- Selected interests on Google News
    - Teacher Society: social justice, the Greens, sustainability, Münster
    - Business economist: politics, finance, Münster
    - Schoolgirl: Fitness, fashion, nutrition, Münster
    - Nurse: Baking, nutrition, Münster
  - Chosen interests on Flipboard
    - Teacher: Electromobility, Food&Drink, Garden, Society, Culture, Sustainability, News, Politics, Psychology, Environment, Knowledge
    - Business economist: Auto, Corona Virus, Digital Economy, Finance, Investment, Career, Cryptocurrencies, Marketing, News, Politics, World News, Business
    - Schoolgirl: Beauty, Design, Fitness, Music, Music festivals, celebrities, travel, royals, series, social media, style
    - Nurse: Baking, Covid, Celebrities, Recipes, Animals
- (also different schedule, age, browser versions)

# Methods

## Coding and Statistical Analysis.



- Coding
  - Two authors coded all news articles (n=3,229)
  - Categories are primary **topic (n=12)**, subtopic, article type, place, paywall
- Diversity
  - Shannon Index
  - Simpson Index
- Fixed effects model:
  - Model time as confounding fixed effect
  - Selection of profiles as intervention

# Model Specification



From the remaining news articles, we calculate the Shannon diversity index *diversity* for each home page:

$$diversity = - \sum_i p_i \ln(p_i) \text{ with } p_i = \frac{n_i}{N}$$

where,  $p_i$  denotes the proportional frequency of topic  $i$  relative to the total number of topics across all websites  $N$ . The index is then normalized by dividing through  $\ln(N)$  (Oksanen et al., 2020; Shannon, 1948).

To test our four hypotheses, we compute four fixed effects regression models, estimating the effects of personalization on news diversity (Angrist & Pischke, 2009). Since the data collection occurred over multiple days, we control for time as a confounding effect and model a fixed effect for the variable days (Hanck et al., 2021). The model specification is:

$$diversity_{it} = \beta_0 + \beta_1 personalization_{it} + \beta_2 day_t + \epsilon_{it}$$

where,  $diversity_{it}$  is the Shannon diversity index,  $personalization_{it}$  is a dummy variable whether the profile is personalized or not,  $day_t$  is the unobserved effect of time, and  $\epsilon_{it}$  is the error term.



# Descriptive Statistics for Diversity



## Summary Statistics

	n	mean	St.dev.	variance	median	min	max
Flipboard	28	0.62	0.15	0.023	0.66	0.29	0.85
Google News	25	0.62	0.13	0.017	0.59	0.45	0.89
National News	12	0.77	0.06	0.004	0.77	0.70	0.88
Local News	12	0.6	0.08	0.006	0.64	0.43	0.69

## Bivariate Correlations (Pearson)

	Google News	Flipboard	National News	Local News
Google News	1.00	-0.16	-0.24	-0.11
Flipboard	-0.16	1.00	0.25	0.02
National News	-0.24	0.25	1.00	-0.01
Local News	-0.11	0.02	-0.01	1.00

# Robustness Checks



- **Day Fixed Effects:** no relevant change in estimates (higher  $R^2$ ).
- **Interaction Effects between Days and Diversity:** inconclusive.
- **Shapiro Wilk test:** no evidence for non-normale distribution of diversity. ( $W = 0.976$ ,  $p\text{-value} = 0.157$ ).
- **Durbin-Watson test:** no autocorrelation ( $d=0.045$ ,  $p=0.656$ ).
- **Breusch-Pagan test:** no evidence for heteroscedasticity ( $bp=0.07$ ,  $p=0.789$ ).
- **Modelling sub-topics:** consistent effect sizes and direction.
- **Including/Leaving out COVID:** Smaller effect sizes, consistent direction.
- **Single profiles/Pooling:** no change.
- **Further analysis on other diversity attributes:** inconclusive for form, place, paywall.