



DIGITAL DEMOGRAPHY: ANALYZING WEB AND SOCIAL MEDIA DATA

BASICS OF DIGITAL DEMOGRAPHY

EDSD JUNE 2024

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DIGITAL DEMOGRAPHY.

What is 'digital' demography?



DIGITAL DEMOGRAPHY (NOT SERIOUS!)

- Demography is old
- It is your job to come up with novel methods to capture/analyze/draw-conclusions-from demographic data
- →Computers!



DIGITAL DEMOGRAPHY.

Digital Data <--> Digital methods



DIGITAL DEMOGRAPHY

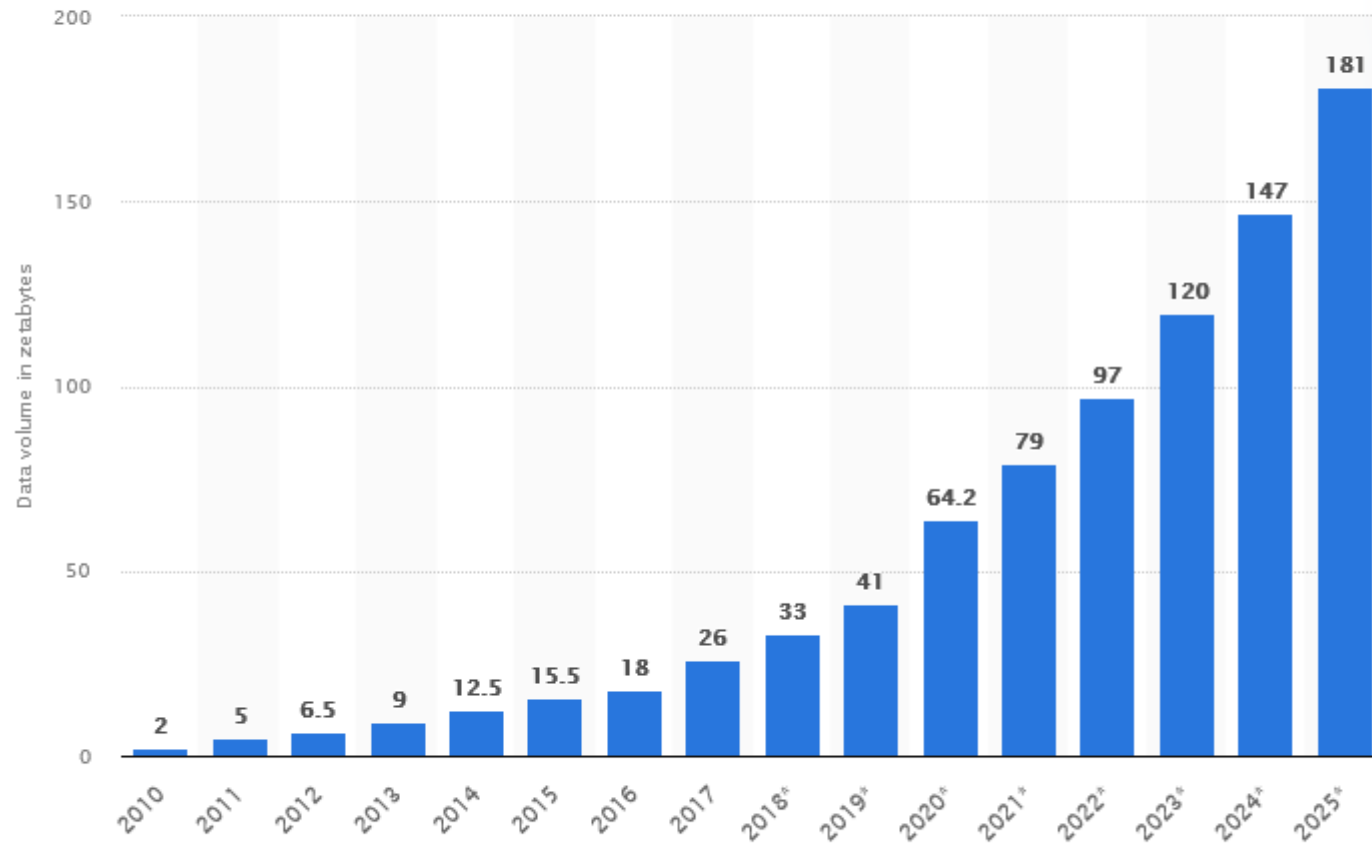
- 2nd next birthday: Did you learn something that was completely new to you?
- 3rd next birthday: What kind of data will you use in your research and In what time did your planned data source first appear?
- 4th next birthday: What makes digital trace data a type of 'new' big data for population research that is different from 'old' big population data sources?

What did you not understand?

Criticism of the paper?

Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2020, with forecasts from 2021 to 2025

(in zettabytes)



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Release date

June 2021

Region

Worldwide

Survey time period

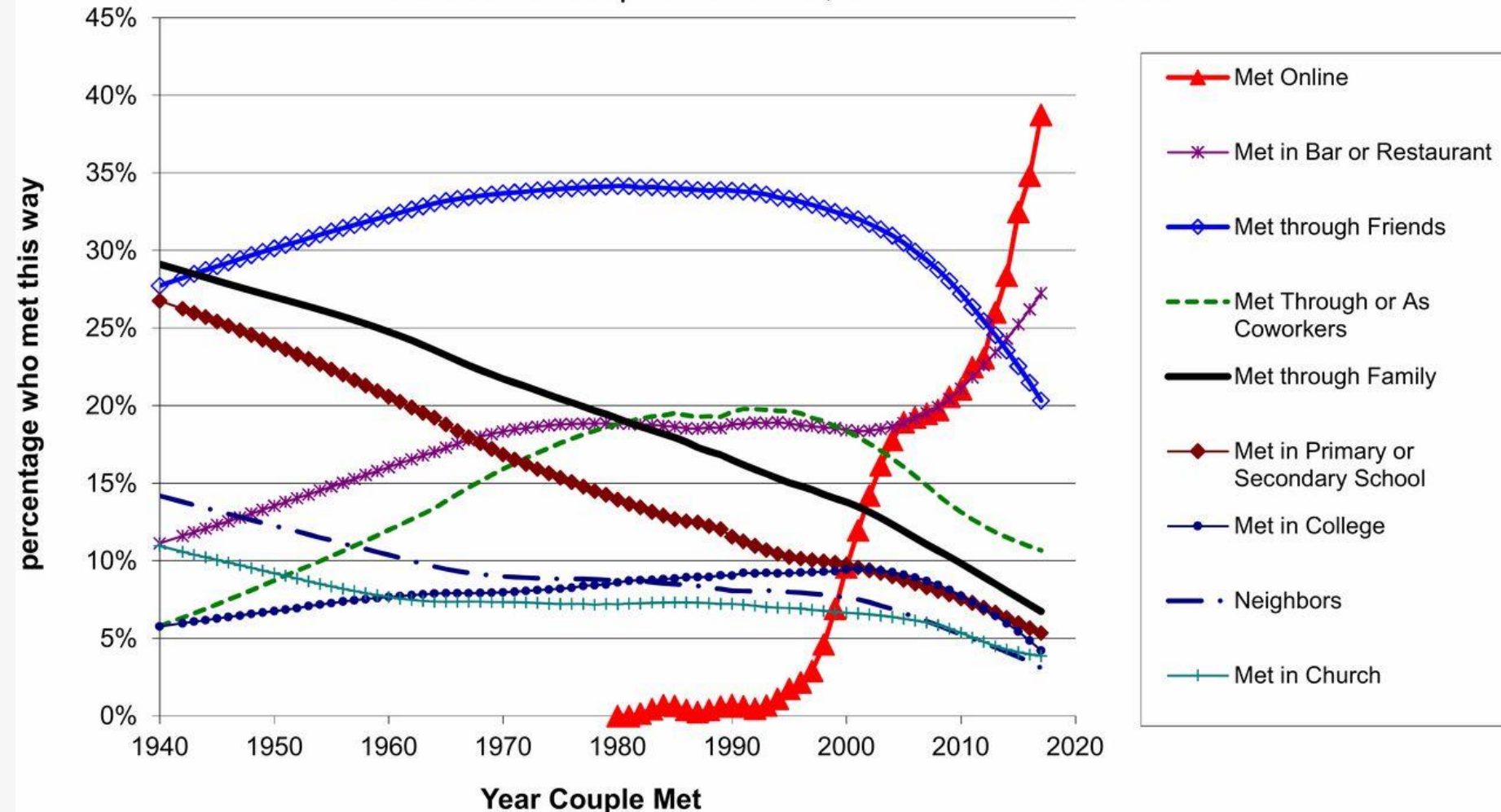
2010 to 2020

Supplementary notes

* The data was taken from various publications released over several years: Forecast for the years 2018 and 2019 as of 2018; Forecast for 2020 as of May 2021; Forecast for 2021 to 2025 as of March 2021.

DIGITAL TRANSFORMATIONS HAVE CHANGED OUR LIVES

How heterosexual couples have met, data from 2009 and 2017



Source: <https://www.pnas.org/doi/10.1073/pnas.1908630116> - Rosenfeld 2019

DIGITAL DATA SOURCES FOR DEMOGRAPHIC RESEARCH

1. Digital Trace Data (online and offline)

1. Social media
2. Mobile phones
3. Wearable devices, etc...

2. Crowd-sourced online data

1. Wikipedia and Wikidata
2. DNA and online genealogies
3. Petitions, etc...

3. Online Surveys

4. Simulations (made-up data)



DIGITAL DEMOGRAPHY

What:

1. Apply formal demography to digital trace data (1)
 1. "Digital censuses" in Facebook and LinkedIn
 2. Life tables to estimate survival within platforms (users are born and die)
2. Advance theory (2)
 1. Demographic (holy trinity: mortality, fertility, migration)
 2. Sociological theory (explain social action)

1 Cesare, N., Lee, H., McCormick, T., Spiro, E., and Zagheni, E. (2018). Promises and pitfalls of using digital traces for demographic Research. *Demography* 55(5):1979–1999.

2 Edelman, A., Wolff, T., Montagne, D., and Bail, C.A. (2020). Computational Social Science and Sociology. *Annual Review of Sociology* 46(1):61–81

DIGITAL DEMOGRAPHY

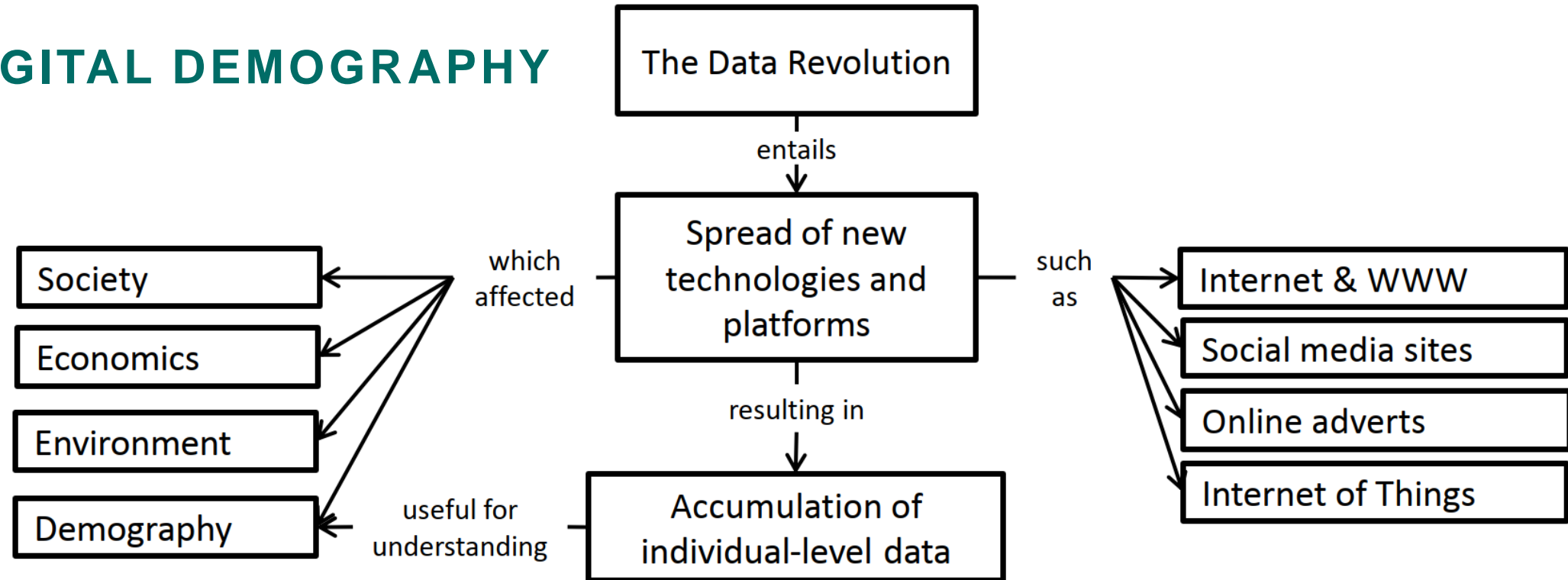


Fig. 1 The Data Revolution and new sources of data for demographic analysis.

- Digital vs analogue
- Online vs offline
- 'Big' vs 'small' data

IS 'BIG DATA' NEW DATA?

DEMOGRAPHER COLLECTING BIG DATA FOR THE 1925 US CENSUS



https://upload.wikimedia.org/wikipedia/commons/6/6f/Volkstelling_1925_Census.jpg





LIMITATIONS OF TRADITIONAL DATA SOURCES

- Costly
- Outdated
- Time consuming
- Inconsistent
- Unavailable
- Lack of data on emigration
- Incomplete answers/misunderstanding of questions etc.
- Immigrants are often underrepresented in traditional data sources.
- limited in hard-to-reach contexts and societies.

WHAT IS BIG DATA?

is “information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation” 6 [1]. It can be described in 3 Vs which are:

- ▶ *Volume: As the name suggests, the size of the data is Big, hence the volume of the data.*
- ▶ *Velocity: Big data such as Twitter allow us to stream data at real-time. The rate at which we obtain data is faster than the traditional data sources.*
- ▶ *Variety: Traditional data are mostly structured data. Big data, on the other hand, come in various forms. It can be videos, photos, texts, and audios. It requires a thorough data processing before extracting information/knowledge from it.*

WHAT IS DIGITAL TRACE DATA?

What makes digital trace data a type of ‘new’ big data for population research that is different from ‘old’ big population data sources?

- *by-product of digital activity*
- *always collected, not once in a while*
- *Unlike rectangular dataframes with rows and columns, many digital traces data are unstructured, messy, and come in formats unfamiliar to many demographers*
- *The variety of formats, units of analyses, and also sizes of these data sets, which may contain*
- *millions of records, often require computational approaches for data management, retrieval, and analysis that are not yet a part of mainstream demo-graphic training.*
- *not comparable over longer time periods - platforms, users and algorithms change fast*
- *these data often come from and are owned by private companies*

Ridhi Kashyap: Has demography witnessed a data revolution? Promises and pitfalls of a changing data ecosystem? 2021



DIGITAL TRACES ARE BY-PRODUCTS OF OUR ONLINE PRESENCE

Digital breadcrumbs are unavoidable

- ▶ Pre-GDPR: largely unchecked
- ▶ Marketing-led
- ▶ Not collected for social-scientific research

Diego Alburez-Gutierrez, EDSD 2022; 2



BIG DATA FOR SOCIAL RESEARCH: THE GOOD

Twitter, Facebook, Yahoo, ...

- Big
- Free (sometimes) or cheap (often)
- Granular data
- Large scale data
- Continuously generated, always-on
- Non-reactive
- Information/opinion shared by users from an uncontrolled environment
- Various forms of data: video, image, text, audio etc.

BIG DATA FOR SOCIAL RESEARCH: THE BAD

- incomplete
- inaccessible
- nonrepresentative (within- and out-of sample)
- drifting (population, behavioural, system)
- algorithmically confounded (observing a casino)
- inaccessible
- dirty
- sensitive

Salganik, M. (n.d.). Bit by Bit: Social Research in the Digital Age. Princeton, NJ: Princeton University Press.

CURRENT TOPICS IN DIGITAL DEMOGRAPHY

1. Methodological developments
 1. Inference from non-representative samples
 2. Understand and address online bias
 3. Nowcasting demographic processes
2. Understanding internet users and online use
 1. Infer demographics (age, sex, location, SE status, etc) from image and text
 2. Track inequalities in online access
 3. Consequences of platform use for users
3. Migration (internal and external)
 1. Estimate flows and stocks
 2. Mobility by subgroups (e.g. undocumented, highly-skilled)
 3. Cultural assimilation of immigrants
4. Mortality and morbidity
5. Online and offline fertility dynamics
6. Time use and well-being



ISSUES WITH TRADITIONAL SURVEYS

Efficacy: traditional sampling methods are outdated and less feasible

Coverage: decreased response rates, difficult to sample from hard-to-reach populations

Resources: expensive and time consuming

Recency: quickly become outdated, long period between new data collections

Comparability: lack of common definitions across countries

ISSUES WITH TRADITIONAL SURVEYS



Cost-effectiveness: less expensive than traditional surveys

Coverage: targeted sub-populations, hard-to-reach populations

Timeliness: easy and timely implementation, data collection & analysis in near real-time

Flexibility: less burdensome, user-friendly interfaces, easy to manage

Recency: continuous data collection, easy to make edits

Comparability: cross-national surveys, comparative data collections, common definitions

ONLINE SURVEYS ON SOCIAL MEDIA

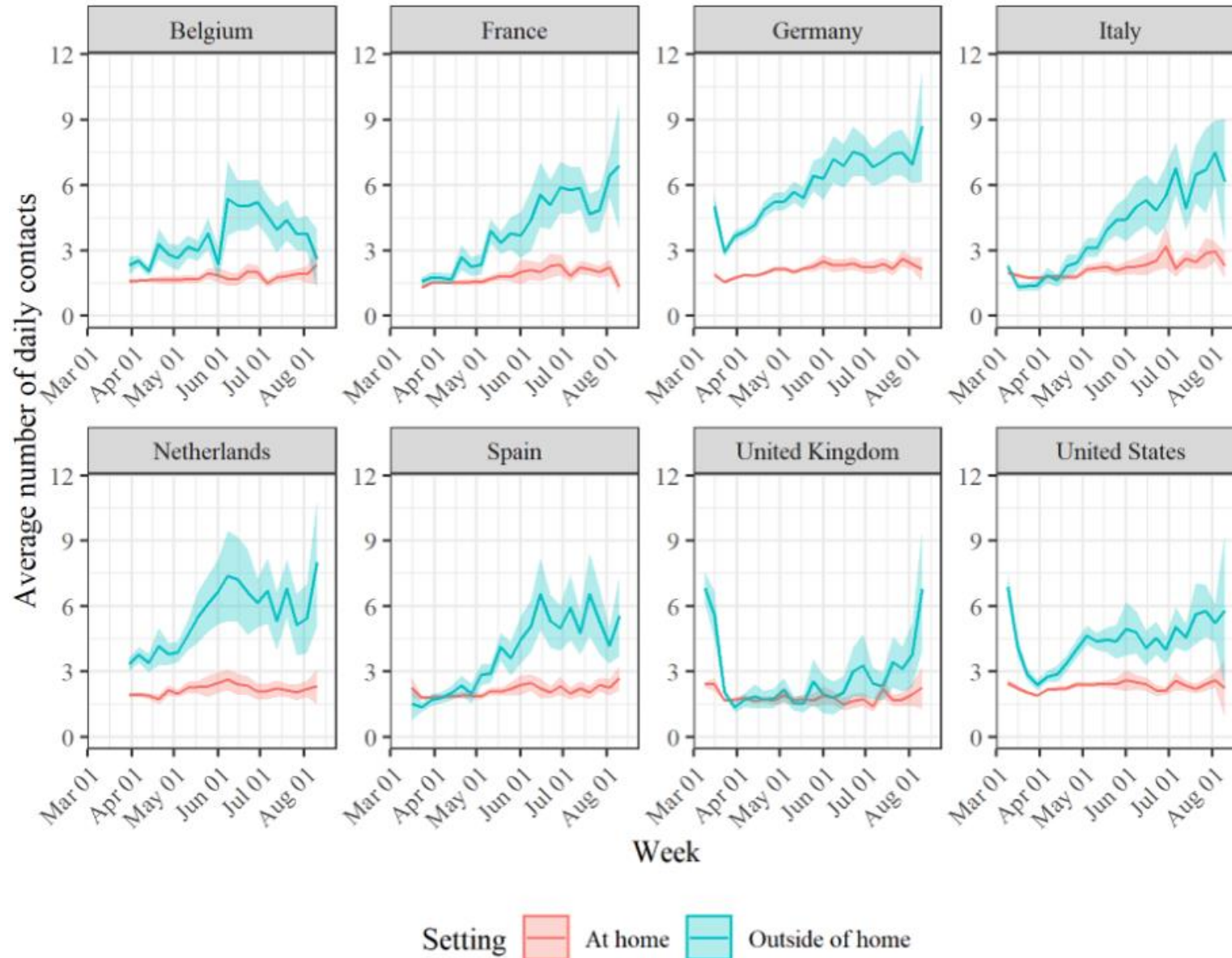
Relative advantage: scale

Important for:

- Targeting specific subgroups or regions
- Conducting research outside of Western countries



ONLINE SURVEYS ON SOCIAL MEDIA



Grow, A., Perrotta, D., Del Fava, E., Cimentada, J., Rampazzo, F., Gil-Clavel, S., & Zagheni, E. (2020). Addressing public health emergencies via Facebook surveys: advantages, challenges, and practical considerations. *Journal of medical Internet research*, 22(12), e20653.

ONLINE SURVEYS ON SOCIAL MEDIA

Table 4. Comparison of Sample Sizes at Different Stages of the Sampling and Survey Process.

	Number of Users Belonging to the Target Population (According to Facebook) ^a	Unique Users Reached with Ads ^a		Paid Link Clicks ^a		Completed Questionnaires ^b	
		Percentage of Targeted FB Users in this Country		Percentage of Targeted FB Users in this Country		Percentage of Targeted FB Users in this Country	
		<i>n</i>		<i>n</i>		<i>n</i>	
Austria	15,000	7,918	52.79	408	2.72	117	0.78
Ireland	54,000	28,107	52.05	1,314	2.43	425	0.79
Switzerland	9,000	3,432	38.13	215	2.39	62	0.69
United Kingdom	410,000	50,979	12.43	1,257	0.31	424	0.10

Note. ^aSource of absolute figures: Facebook (FB) advertisement statistics. Relative values: own calculation. ^bBased on paradata. Only respondents who reached the questionnaire via the FB advertisements.

Budget of €500, and 96% of the 1,028 respondents belonged to target population.

- Pötzschke, S., & Braun, M. (2017). Migrant sampling using Facebook advertisements: A case study of Polish migrants in four European countries. *Social Science Computer Review*, 35(5), 633-653.

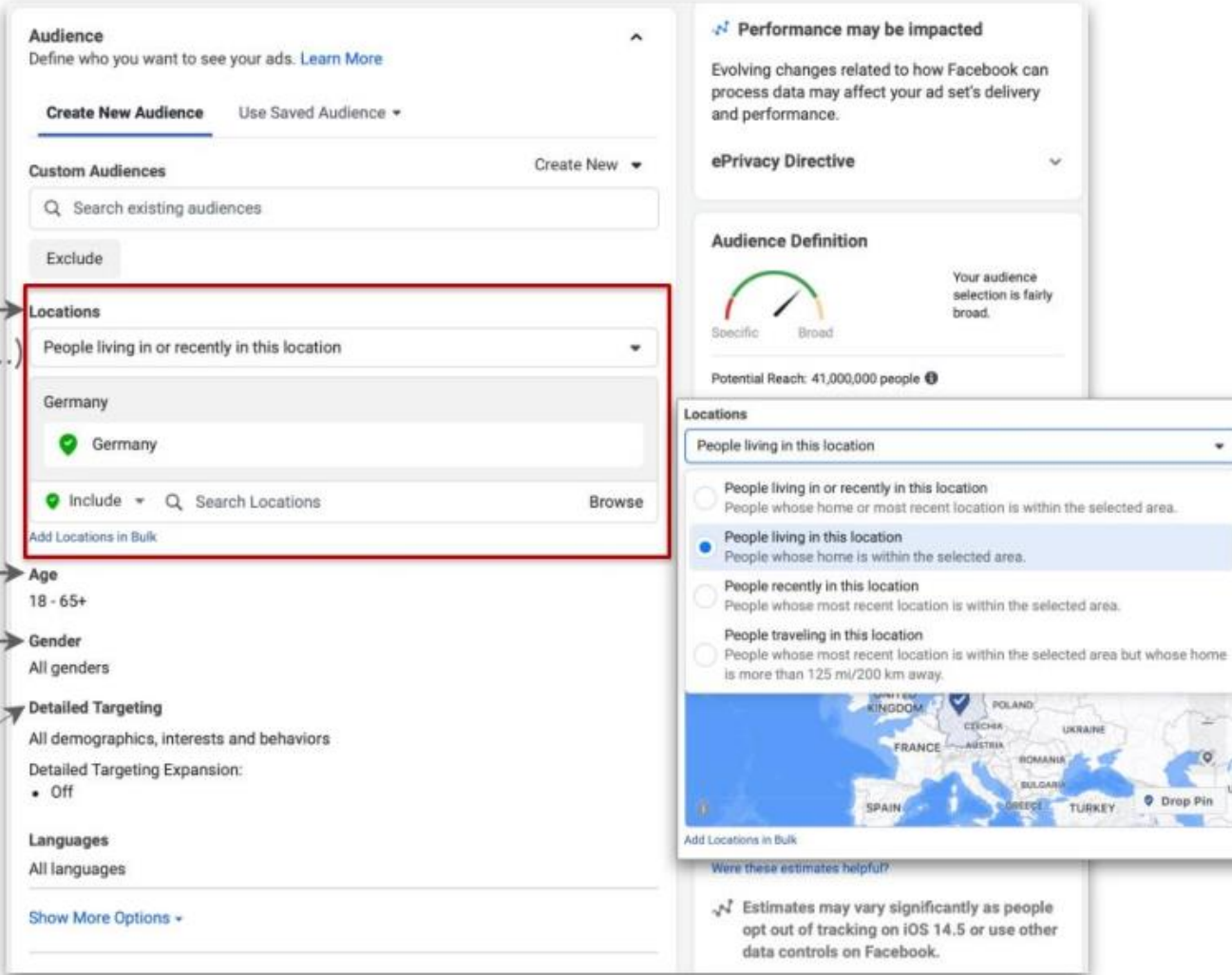
ONLINE SURVEYS ON SOCIAL MEDIA

Location
(country, region, city, ...)

Age (ranges)

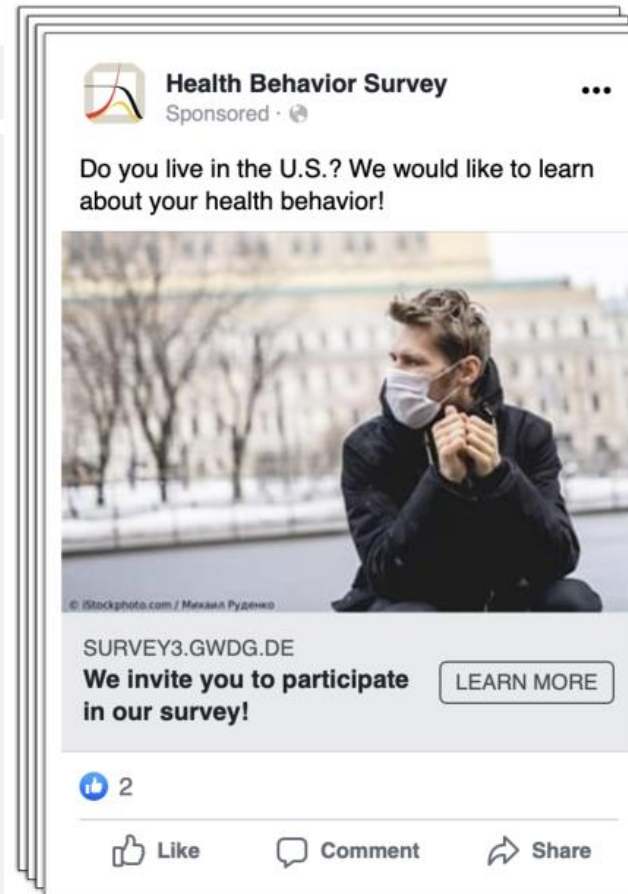
Gender
(men, women, both)

Other matching criteria
(interests, industry, behaviours, ...)



The screenshot shows the Facebook Audience Definition interface. A red box highlights the 'Locations' section, which includes a dropdown menu for 'People living in or recently in this location' and a list of countries with 'Germany' selected. To the right, a 'Locations' modal is open, showing options for 'People living in this location' (selected), 'People recently in this location', and 'People traveling in this location'. Below these options is a map of Europe with a pin dropped in Germany. Annotations on the left point to the 'Locations' section, 'Age' (18-65+), 'Gender' (All genders), and 'Detailed Targeting' (All demographics, interests and behaviors; Detailed Targeting Expansion: Off).

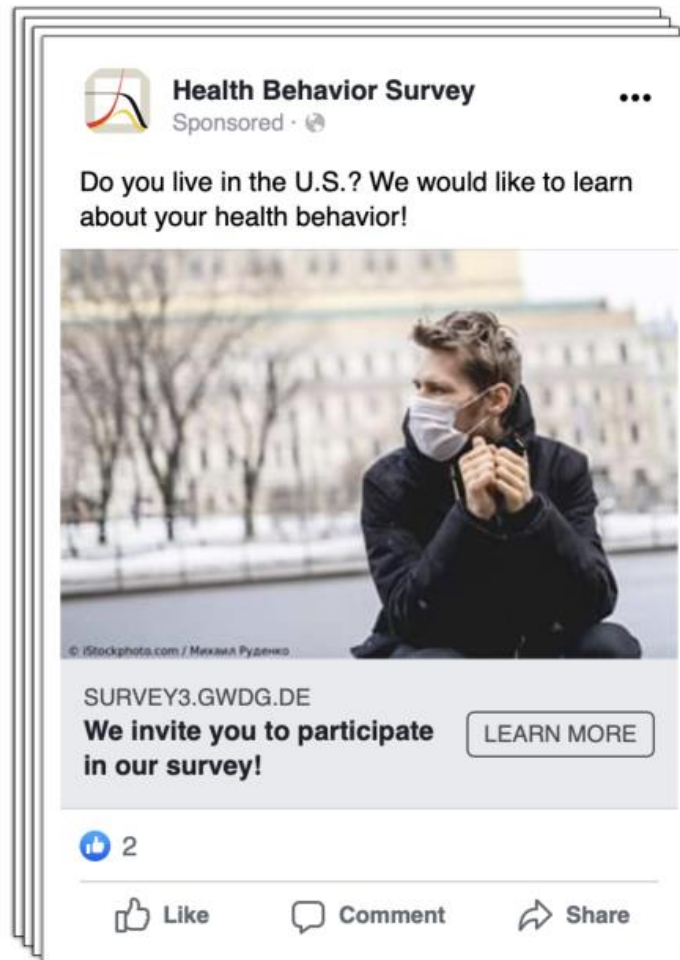
ONLINE SURVEYS



Example of FB ad in the US.



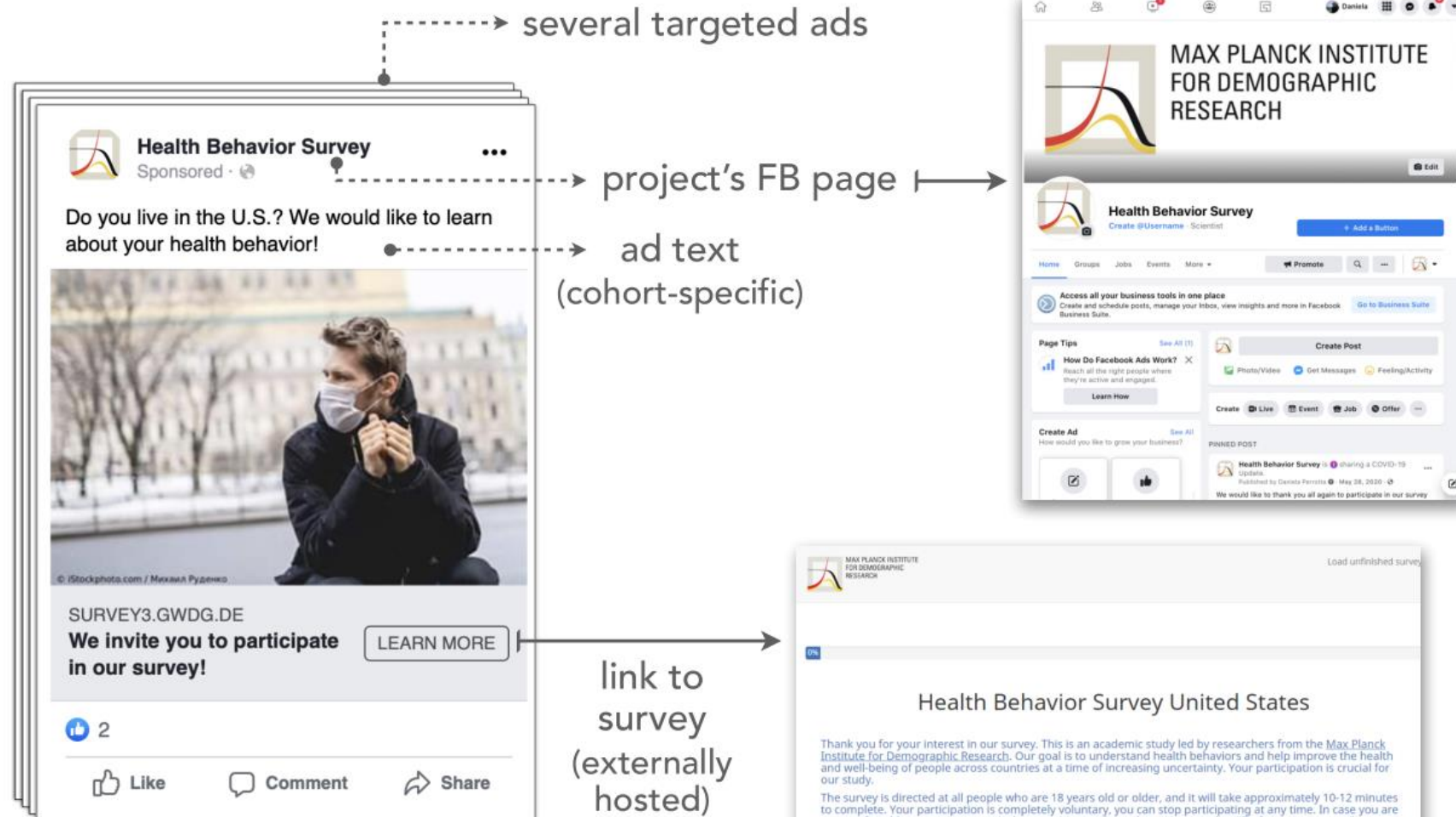
RESPONDENTS RECRUITMENT VIA FACEBOOK



Example of FB ad in the US.

Grow A, Perrotta D, Del Fava E, Cimentada J, Rampazzo F, Gil-Clavel S, Zagheni E. Addressing Public Health Emergencies via Facebook Surveys: Advantages, Challenges, and Practical Considerations. JMIR, 2020

RESPONDENTS RECRUITMENT VIA FACEBOOK



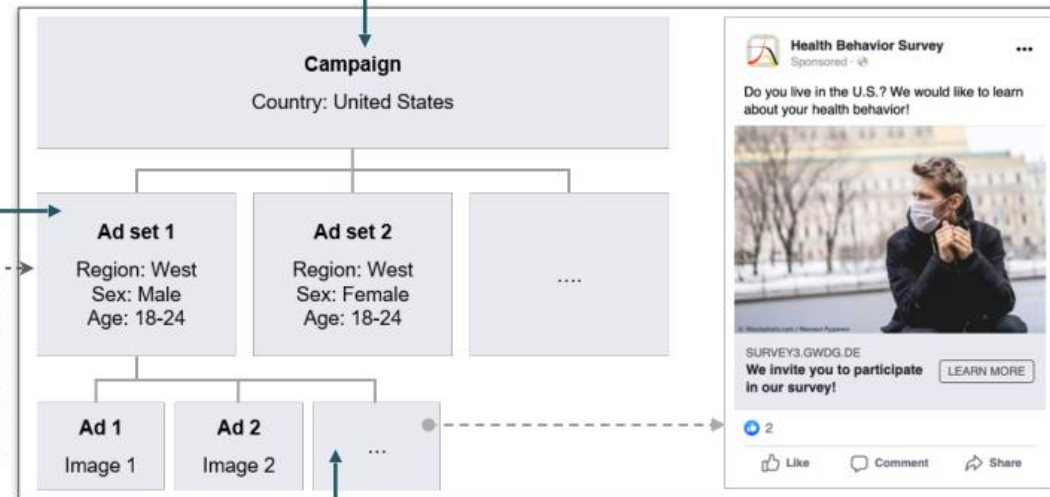
RESPONDENTS RECRUITMENT VIA FACEBOOK

ONE AD SET PER DEMOGRAPHIC GROUP

- ▶ sex (M, F)
- ▶ age (18-24, 25-44, 44-64, 65+)
- ▶ region of residence (NUTS1/US Census regions)



ONE AD CAMPAIGN PER COUNTRY



SIX AD IMAGES WITHIN EACH AD SET



1 – Male athlete
©Adobe Stock/grki



2 – Group of athletes
©Adobe Stock/nd3000



3 – Woman blowing nose
©iStockphoto/Goodboy Picture Company



4 – Couple blowing noses
©iStockphoto/Goodboy Picture Company



5 – Woman wearing mask
©Adobe Stock/shintartanya



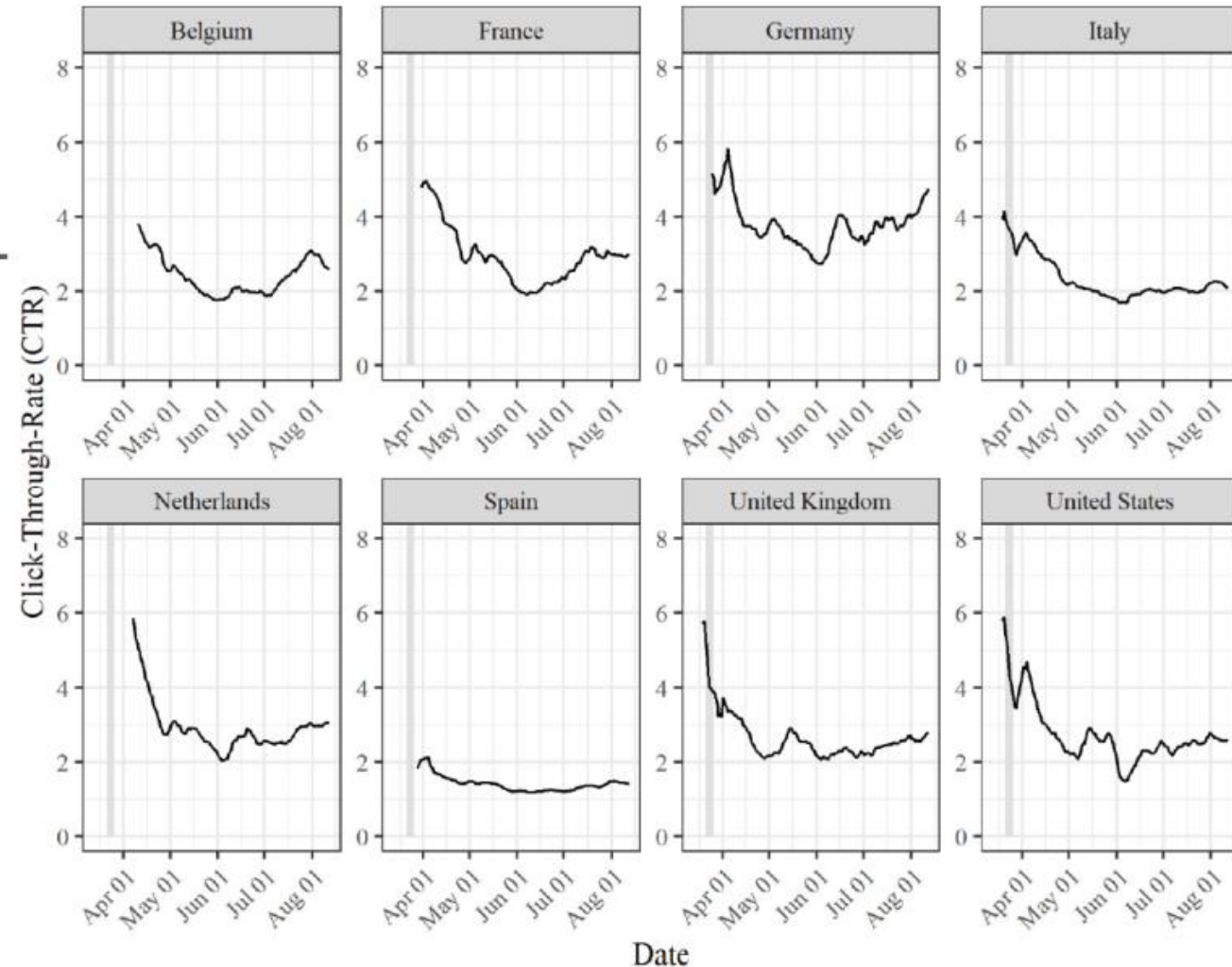
6 – Man wearing mask
©iStockphoto/Михаил Руденко

Grow A, Perrotta D, Del Fava E, Cimentada J, Rampazzo F, Gil-Clavel S, Zagheni E. Addressing Public Health Emergencies via Facebook Surveys: Advantages, Challenges, and Practical Considerations. JMIR, 2020

RESPONDENTS RECRUITMENT VIA FACEBOOK

Click-through rate (CTR) =
click-throughs / impressions

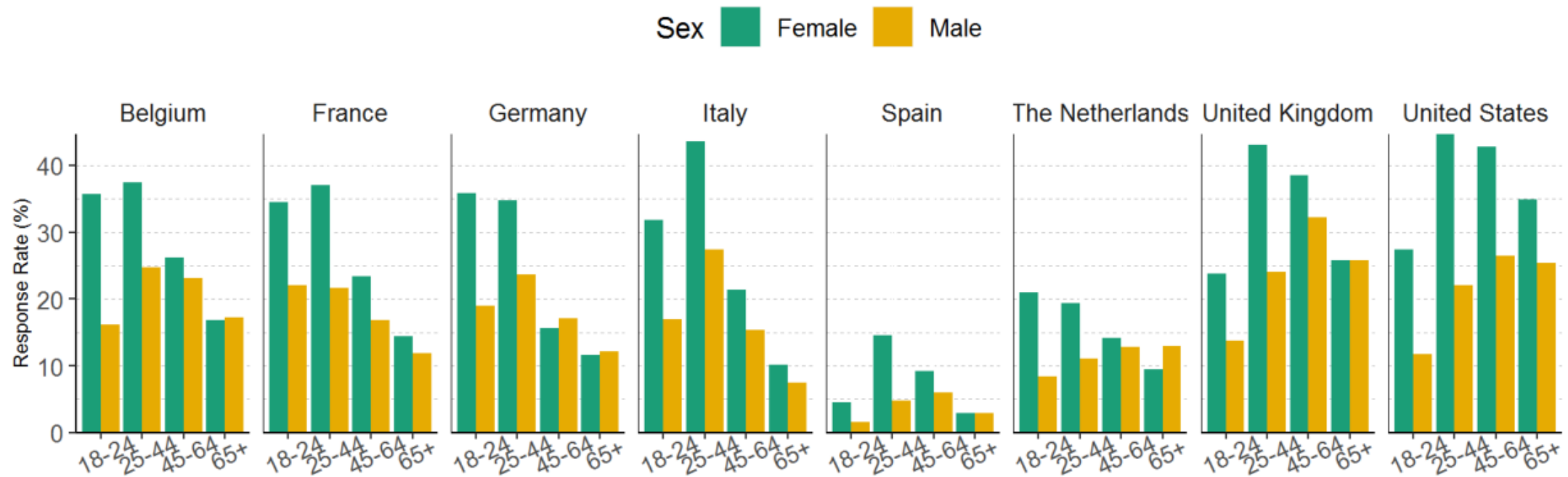
Facebook users were
more likely to click on
our ads in the early
phases of the survey



RESPONDENTS RECRUITMENT VIA FACEBOOK

Response rate (%) = completed questionnaires / click-throughs

- ▶ response rate (overall): from 6% in Spain to 31% in UK and US
- ▶ response rate higher for women



CROWDSOURCED PLATFORMS

Relative advantage: convenience

- They facilitate participant payment, re-recruitment, and messaging without requesting personally identifying information. These features allow for complex research designs.



Prescreen participants ⓘ

YOUR CRITERIA

Age

Minimum Age: 25, Maximum Age: 60

[Edit](#) [Remove](#)

COVID-19 Vaccination

Yes (at least one dose)

[Edit](#) [Remove](#)

[+ Add screener](#)

We've found **28,650** matching participants who have been active in the past 90 days

STUDY COST

How long will your study take to complete?

ⓘ Max. time: 30 mins

Participants are paid according to your estimated study completion time. If the median completion time exceeds your estimate we will ask you to make additional payments. [Read more about study completion time](#) [↗](#)

🕒 5 minutes

How much do you want to pay them?

£ 1.00

12.00/hr

Hourly rate

£6.00

£12.00 Great!

Cost

Participant payments	£500.00
Service fee	£166.66
VAT (0% on service fee)	£0.00
Total	£666.66



Aguinis, H., Villamor, I., &
Ramani, R. S. (2021). MTurk
research: Review and
recommendations. Journal of
Management, 47(4), 823-837.

CROWDSOURCED PLATFORMS

Relative disadvantages

- Population size is relatively small. While researchers were able to recruit ~1,000 Polish migrants in four countries with Facebook, and Facebook reported ~500,000 such users on their platform, Prolific reports only ~400 such respondents available for recruitment in these countries.
- Participants tend to be concentrated in the West, especially the U.S.
- You cannot use these platforms to recruit voluntary samples



SOCIAL MEDIA AND CROWDSOURCED PLATFORMS

What do you think are potential problems?

ONLINE SURVEYS ON SOCIAL MEDIA

Challenges of recruitment via Facebook:

- Facebook is a “black box”: Facebook will “optimize” your advertisement in ways that skew participant demographics.
 - Also: Self-selection based on interest in the survey topic
 - Partial solution: run lots of advertisements targeting specific demographic groups. (Grow et al. 2020)
- Facebook will sometimes cause delays, either by reviewing your advertisements or claiming problems with your payment method.
 - Delays are unpredictable, but they are more common if your ad is related to social or political topics or if you offer to pay participants.
- Facebook has no built-in methods for paying participants or advertising specifically to people who previously completed your survey.
- Lack of attention of respondents

Rinderknecht, Gordon, PHDS 2022



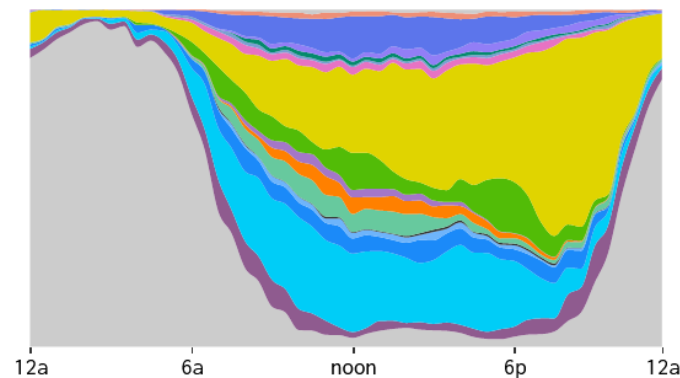
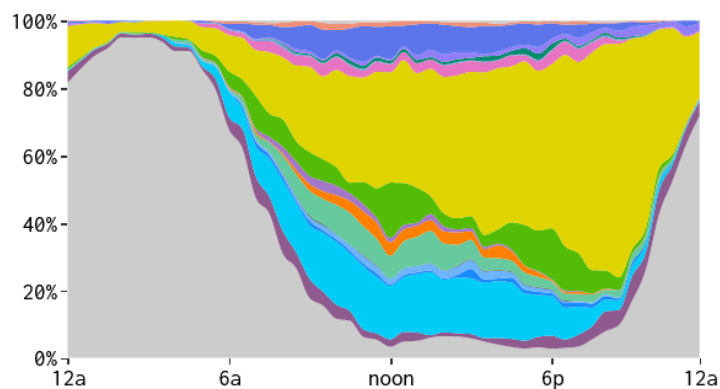
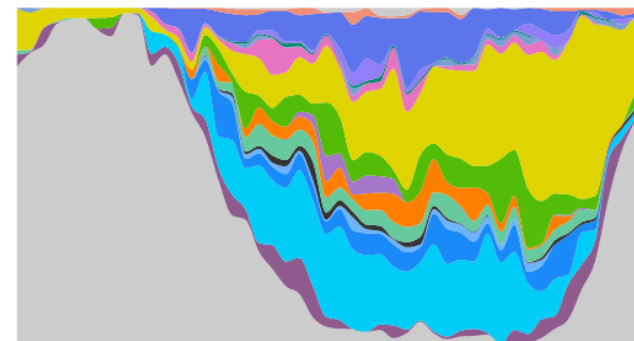
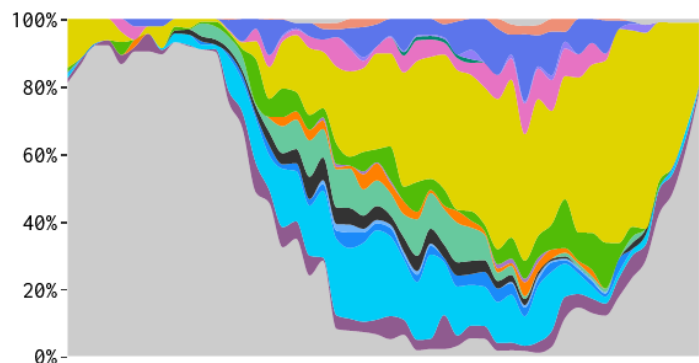
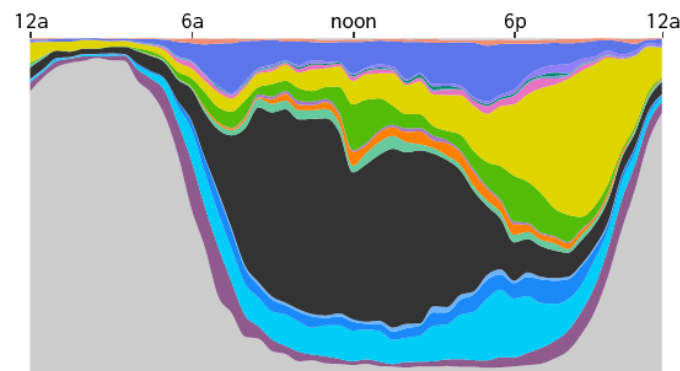
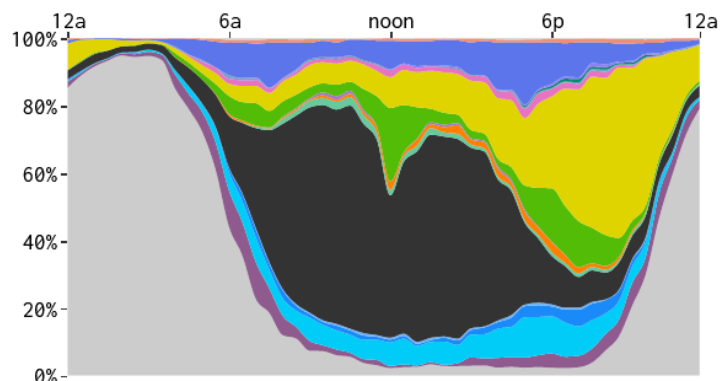
EMPLOYED

UNEMPLOYED

NOT IN LABOR FORCE

MEN

WOMEN



- Sleeping
- Personal Care
- Household Activities
- Caring for and Helping Household Members
- Caring for and Helping Non-Household Members
- Working
- Education
- Consumer Purchases
- Professional and Personal Care Services
- Eating and Drinking
- Socializing, Relaxing, and Leisure
- Sports, Exercise, and Recreation
- Religious and Spiritual Activities
- Volunteer Activities
- Telephone Calls
- Traveling
- Other
- Gap/can't remember

Who participated in this activity with you?

<input type="checkbox"/>	Spouse/partner(s)
<input checked="" type="checkbox"/>	Own child/children
<input type="checkbox"/>	Other family member(s)
<input type="checkbox"/>	Co-worker/colleague(s)
<input checked="" type="checkbox"/>	Friend(s)
<input type="checkbox"/>	Other People
<input type="checkbox"/>	Pet(s)
<input type="checkbox"/>	No one

Select anyone you primarily engaged with via the internet or phone:

<input type="checkbox"/>	Own child/children
<input checked="" type="checkbox"/>	Friend(s)

- Rinderknecht, R. G., Doan, L., & Sayer, L. C. 2022. “MyTimeUse: An Online Implementation of the Day-Reconstruction Method” *Journal of Time Use Research*.



THANK YOU FOR
YOUR ATTENTION!

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