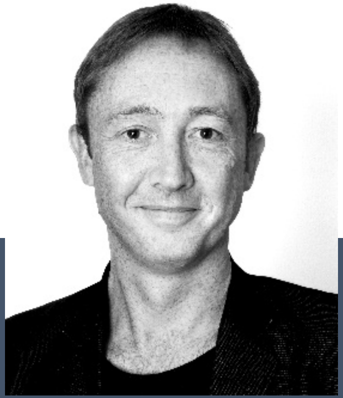



# Fredrik Folke

MD, Phd, Clinical Professor
Copenhagen Emergency Medical Services
Herlev Gentofte Hospital
University of Copenhagen, Denmark

E-mail: Fredrik.Folke@ regionh.dk

@FolkeFredrik

FredrikFolke

DET MEDICINSKE SELSKAB
I KØBENHAVN

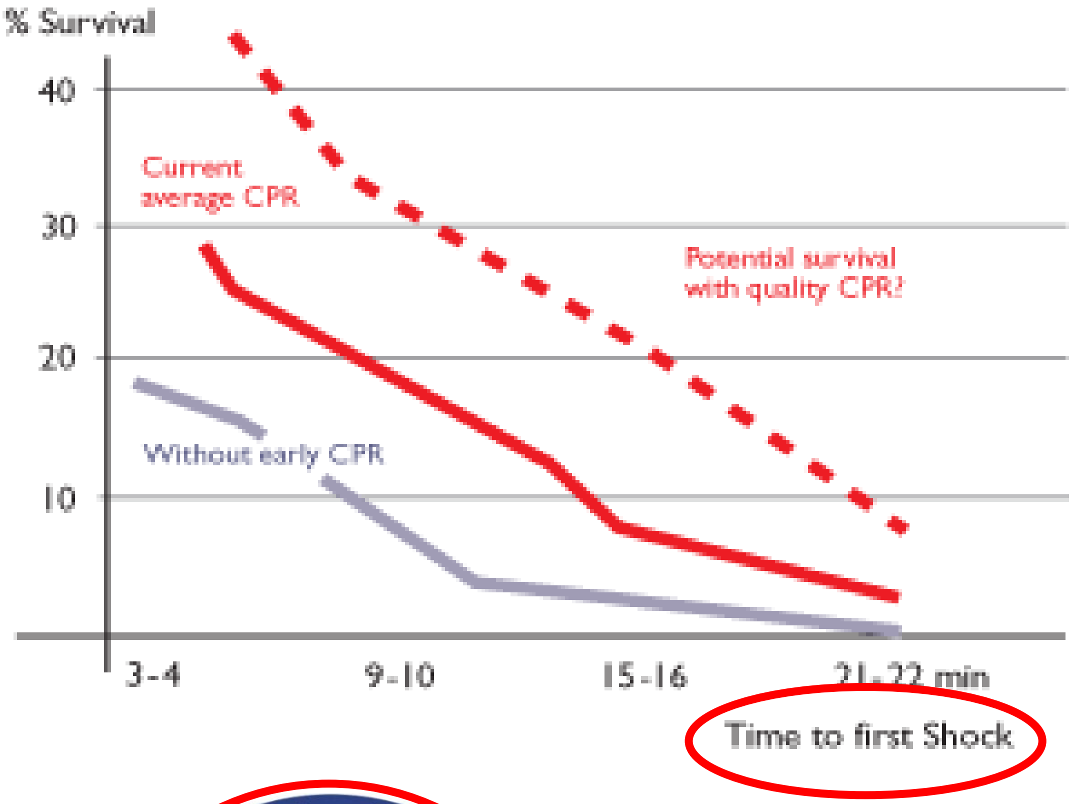
# Can AI detect cardiac arrest before the dispatcher?

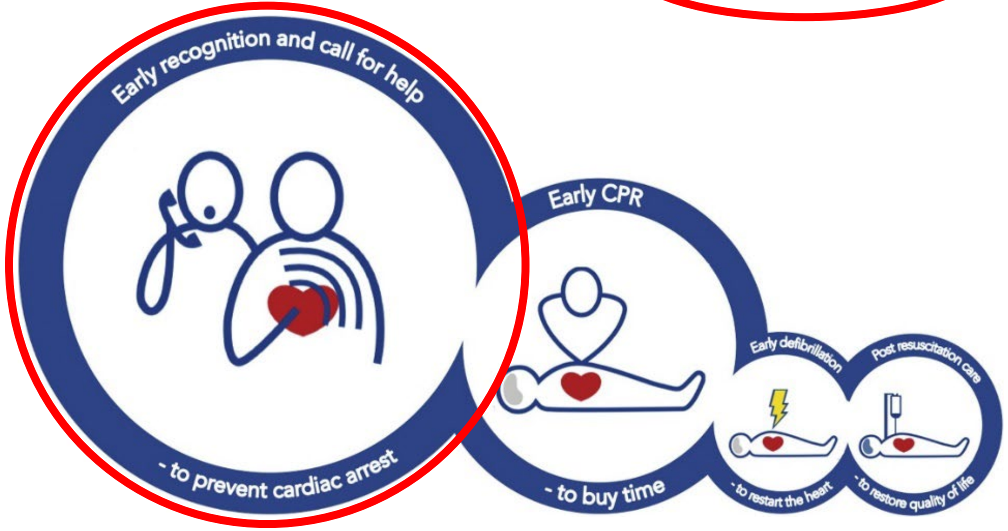
# Declaration of interest

- **Received research grants from:**
- The Danish TrygFonden
- The Danish Heart Foundation
- Novo Nordisk Foundation

- Copenhagen EMS has received unrestricted research grant from the Laerdal Foundation

# *Time* is critical in cardiac arrest survival!



# The challenge for cardiac arrest recognition

- 1 % of all emergency calls are cardiac arrests
- 25 % of cardiac arrest identified by caller
- Another 50 % identified by call taker during the call
- 25 % initially missed until arrival of ambulance
- Early recognition is **VERY** important to outcome!

# Solutions

Public awareness and education to identify cardiac arrest

Dispatcher training in identifying cardiac arrest

Can artificial intelligence / machine learning do better?


THOMAS VINTERBERGs
FESTEN
ALLE FAMILIER HAR EN HEMMELIGHED


Green Talks

# Human vs. Machine


Use pattern recognition

Remember every case

Years of experience in one model

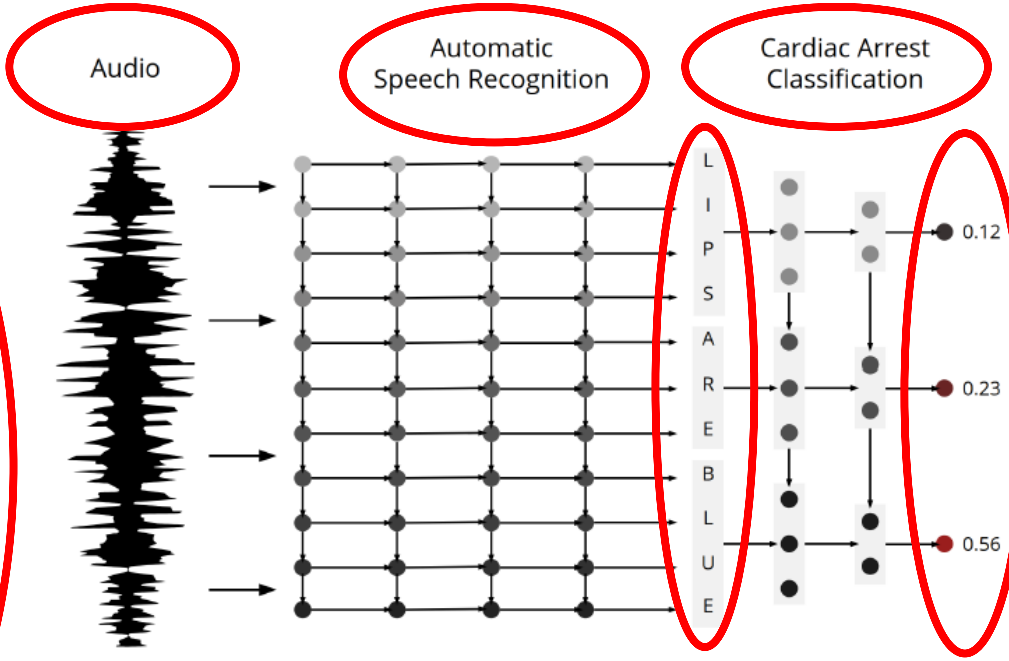
Processed in no time

No human bias

AI better in cardiac arrest recognition?

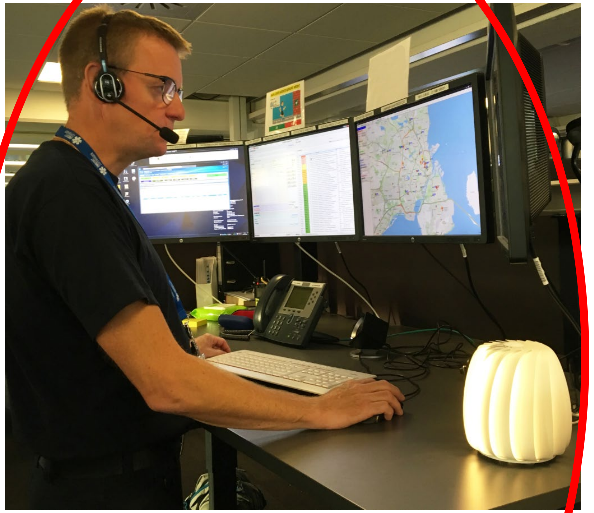
# Machine Learning in Cardiac Arrest Recognition
# - Artificial Intelligence -

1-1-2 call regarding potential OHCA




**Neural network (AI)**

corti



**Alerting dispatcher**

Available online at www.sciencedirect.com
Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation
ELSEVIER
EUROPEAN RESUSCITATION COUNCIL

Clinical paper

# Machine learning as a supportive tool to recognize cardiac arrest in emergency calls

*Stig Nikolaj Blomberg*[a,b,*], *Fredrik Folke*[a,b,c], *Annette Kjær Ersbøll*[d], *Helle Collatz Christensen*[a], *Christian Torp-Pedersen*[e,f], *Michael R. Sayre*[g], *Catherine R. Counts*[g], *Freddy K. Lippert*[a,b]

[a] Emergency Medical Services Copenhagen, Denmark
[b] Department of Clinical Medicine, University of Copenhagen, Denmark
[c] Department of Cardiology, Gentofte University Hospital, Denmark
[d] National Institute of Public Health, University of Southern Denmark, Denmark
[e] Department of Clinical Epidemiology, Aalborg University Hospital, Denmark
[f] Department of Health Science and Technology, Aalborg University, Denmark
[g] Department of Emergency Medicine, University of Washington, United States

RESUSCITATION 162 (2021) 218–226
Available online at www.sciencedirect.com
Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation
ELSEVIER
EUROPEAN RESUSCITATION COUNCIL

Clinical paper

# Machine learning can support dispatchers to better and faster recognize out-of-hospital cardiac arrest during emergency calls: A retrospective study

Check for updates

*Fredrik Byrsell*[a,b,*], *Andreas Claesson*[a], *Mattias Ringh*[a], *Leif Svensson*[a], *Martin Jonsson*[a], *Per Nordberg*[a], *Sune Forsberg*[a], *Jacob Hollenberg*[a], *Anette Nord*[a]

[a] Department of Medicine, Centre for Resuscitation Science, Karolinska Institutet, Solna, Sweden
[b] SOS Alarm AB, Stockholm, Sweden

# What did the observational studies show?


Available online at www.sciencedirect.com
Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation
ELSEVIER
EUROPEAN RESUSCITATION COUNCIL

Clinical paper

**Machine learning as a supportive tool to recognize cardiac arrest in emergency calls**

*Stig Nikolaj Blomberg[a,b,*], Fredrik Folke[a,b,c], Annette Kjær Ersbøll[d], Helle Collatz Christensen[a], Christian Torp-Pedersen[e,f], Michael R. Sayre[g], Catherine R. Counts[g], Freddy K. Lippert[a,b]*

[a] Emergency Medical Services Copenhagen, Denmark
[b] Department of Clinical Medicine, University of Copenhagen, Denmark
[c] Department of Cardiology, Gentofte Ur
[d] National Institute of Public Health, Univ
[e] Department of Clinical Epidemiology, A
[f] Department of Health Science and Tec
[g] Department of Emergency Medicine, U


RESUSCITATION 162 (2021) 218 –226
Available online at www.sciencedirect.com
Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation
ELSEVIER
EUROPEAN RESUSCITATION COUNCIL

Clinical paper

**Machine learning can support dispatchers to better and faster recognize out-of-hospital cardiac arrest during emergency calls: A retrospective study**

*Fredrik Byrsell[a,b,*], Andreas Claesson[a], Mattias Ringh[a], Leif Svensson[a], Martin Jonsson[a], Per Nordberg[a], Sune Forsberg[a], Jacob Hollenberg[a], Anette Nord[a]*

[a] Department of Medicine, Centre for Resuscitation Science, Karolinska Institutet, Solna, Sweden
[b] SOS Alarm AB, Stockholm, Sweden

Sample: 108,607 emergency calls, 918 (0.8%) were cardiac arrests

Sample: 43,832 emergency calls, 3944 (9.0%) were cardiac arrests

Machine learning model had a significantly higher sensitivity (72.5% vs. 84.1%, $p < 0.001$) than dispatchers in OHCA recognition

Machine learning model recognized 36% within 1 min compared with 25% by dispatchers, and recognition rate at any time during the call was 86% for ML and 84% for dispatchers

AI surpassed humans in detecting cardiac arrest during live emergency calls (faster and higher sensitivity) – but with lower specificity


THOMAS VINTERBERGs
FESTEN
LLE FAMILIER HAR EN HEMMELIGHE


TALK

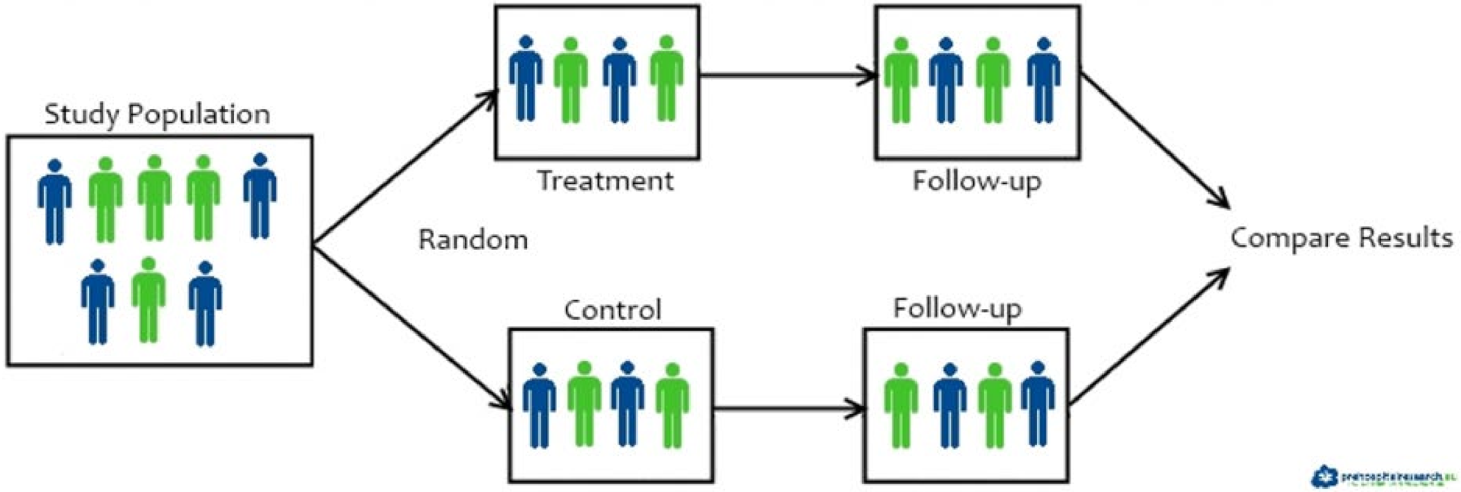
JAMA Network | Open

Original Investigation | Emergency Medicine

# Effect of Machine Learning on Dispatcher Recognition of Out-of-Hospital Cardiac Arrest During Calls to Emergency Medical Services

## A Randomized Clinical Trial

Stig Nikolaj Blomberg, MsC; Helle Collatz Christensen, MD, PhD; Freddy Lippert, MD; Annette Kjær Ersbøll, MsC, PhD; Christian Torp-Petersen, MD, PhD; Michael R. Sayre, MD; Peter J. Kudenchuk, MD; Fredrik Folke, MD, PhD



# What did the randomised study show?

The machine learning model assessed all 112-calls. Identified OHCA calls were randomized 1:1 to be shown or not

169 049 emergency calls were examined, 654 confirmed OHCAs (336 control vs. 318 intervention)

AI surpassed humans in detection cardiac arrest during live-calls: **85.0% vs. 77.5%,** but ***NO*** improvement for dispatcher reconition in the AI assisted group

***No*** improvements in CPR instructions started in the AI assisted group vs. in control: **64.8% vs. 61.9%** (*P* = .47)

The alert from AI did ***not*** result in an increased number of correct recognitions of OHCA by dispatchers or improved bystander CPR instructions

JAMA Network | Open

Original Investigation | Emergency Medicine

Effect of Machine Learning on Dispatcher Recognition of Out-of-Hospital Cardiac Arrest During Calls to Emergency Medical Services
A Randomized Clinical Trial

Stig Nikolaj Blomberg, MsC; Helle Collatz Christensen, MD, PhD; Freddy Lippert, MD; Annette Kjær Ersbøll, MsC, PhD; Christian Torp-Petersen, MD, PhD; Michael R. Sayre, MD; Peter J. Kudenchuk, MD; Fredrik Folke, MD, PhD

RESUSCITATION 183 (2023) 109689

Available online at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Clinical paper

# When the machine is wrong. Characteristics of true and false predictions of Out-of-Hospital Cardiac arrests in emergency calls using a machine-learning model

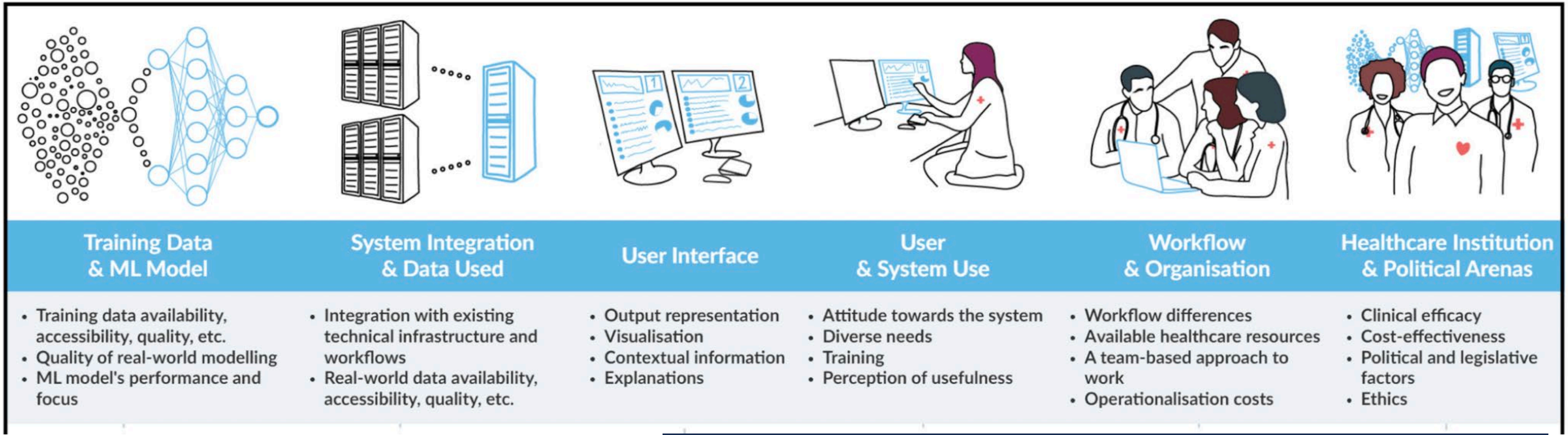
*Stig Nikolaj Blomberg*[a,b,*], *Theo W. Jensen*[a,b], *Mikkel Porsborg Andersen*[f], *Fredrik Folke*[a,b,d], *Annette Kjær Ersbøll*[a,e], *Christian Torp-Petersen*[f,g], *Freddy Lippert*[a,b,h], *Helle Collatz Christensen*[a,b,c]

Clinical paper

# When the machine is wrong. Characteristics of true and false predictions of Out-of-Hospital Cardiac arrests in emergency calls using a machine-learning model

169,068 calls

# Conclusion




Hubert D. Zając, Dana Li, Xiang Dai, Jonathan F. Carlsen, Finn Kensing, and Tariq O. Andersen. 2023. Clinician-Facing AI in the Wild: Taking Stock of the Sociotechnical Challenges and Opportunities for HCI. *ACM Trans. Comput.-Hum. Interact.* 30, 2, Article 33 (March 2023), 39 pages.