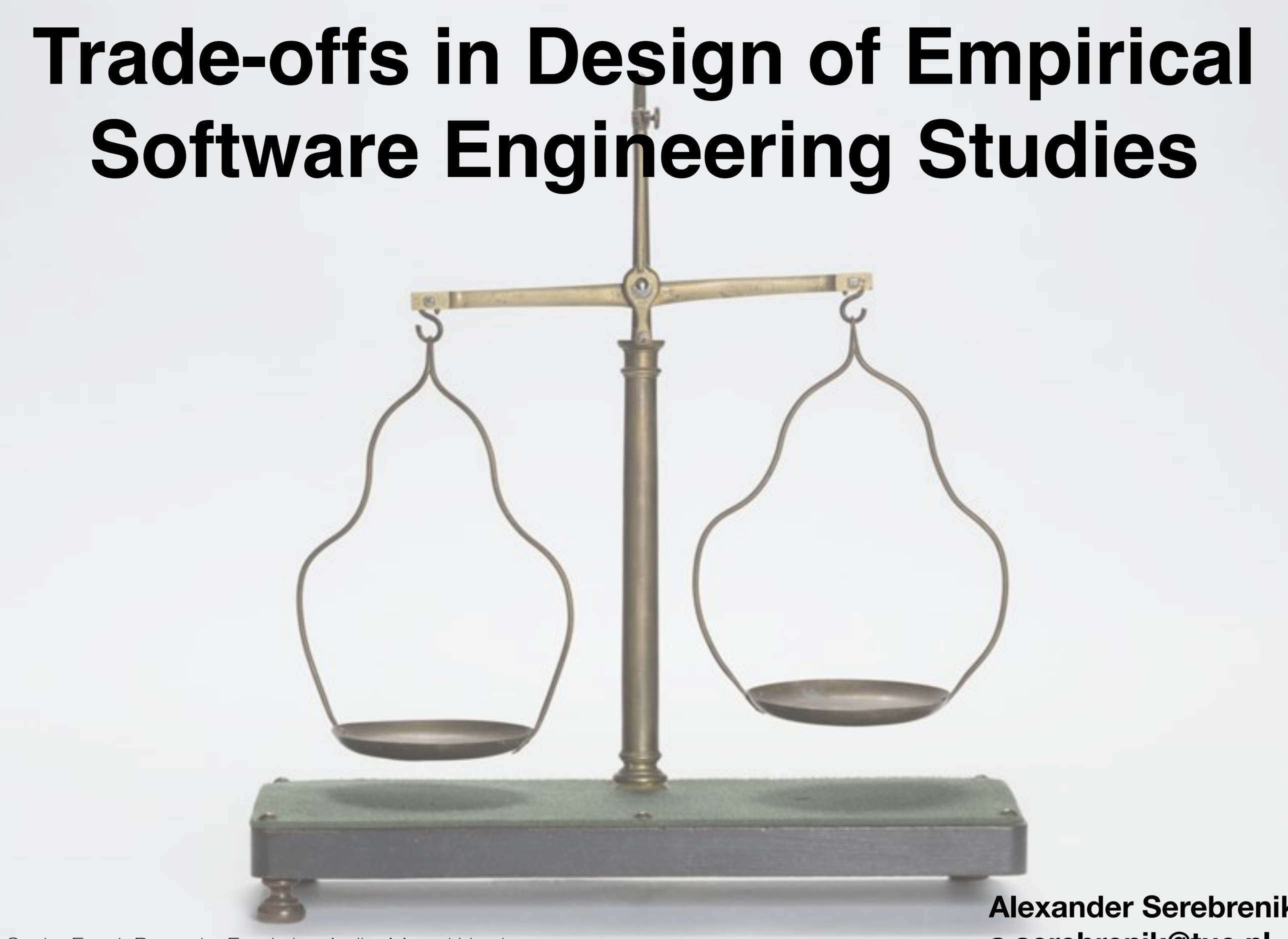
Trade-offs in Design of Empirical Software Engineering Studies



Scale. Fagel, Brussels. Fondation Atelier Marcel Hastir

Alexander Serebrenik
a.serebrenik@tue.nl

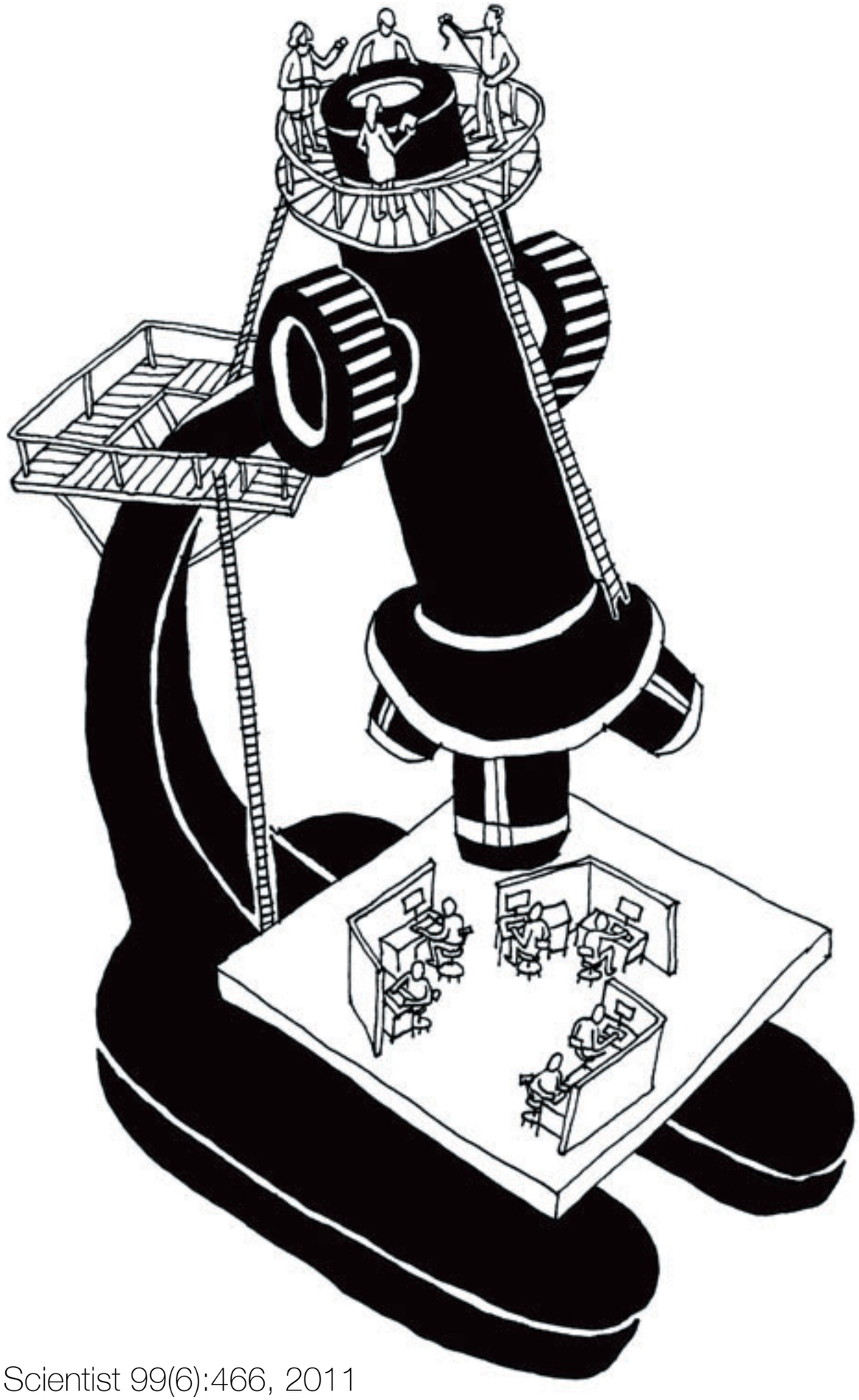


Illustration by Tom Dunne. American Scientist 99(6):466, 2011

Scale. Fagel, Brussels. Fondation Atelier Marcel Hastir

Dan Bennett. Big dog sniffs small Dachshund at the beach. Wlkicommons

GENERIC

Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)
https://www.turbosquid.com/3d-models/3d-model-generic-car/880932

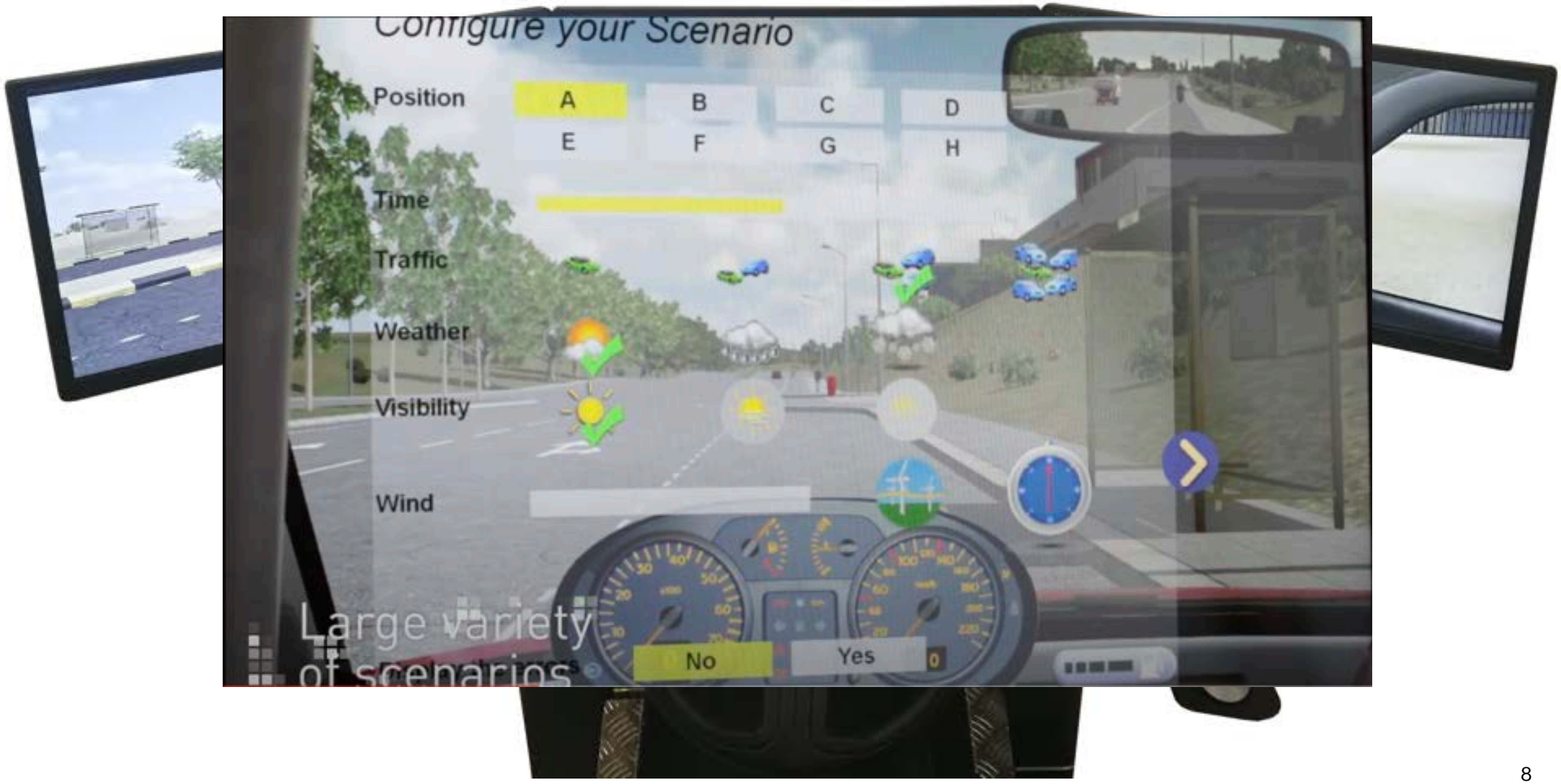
SPECIFIC

Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)
https://www.bloomberg.com/news/features/2018-06-03/ford-s-two-wheel-concept-car-gets-a-chinese-electric-makeover

Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

https://www.ecagroup.com/media-picture/5573-3162-1653-eca-group-driving-simulation-ef-car-14.jpg

CONTROLLABLE X REALISTIC?



Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

https://www.ecagroup.com/media-picture/5573-3162-1653-eca-group-driving-simulation-ef-car-14.jpg

REALISTIC BUT NOT CONTROLLABLE

Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)
https://www.peelpolice.ca/en/resourcesGeneral/Homepage-Banner/officer-road-safety-direct-trafficedit.jpg

CONTROL

REALISM

CONTRIVED

NEUTRAL

NATURAL

NON-EMPIRICAL

GENERIC

SPECIFIC

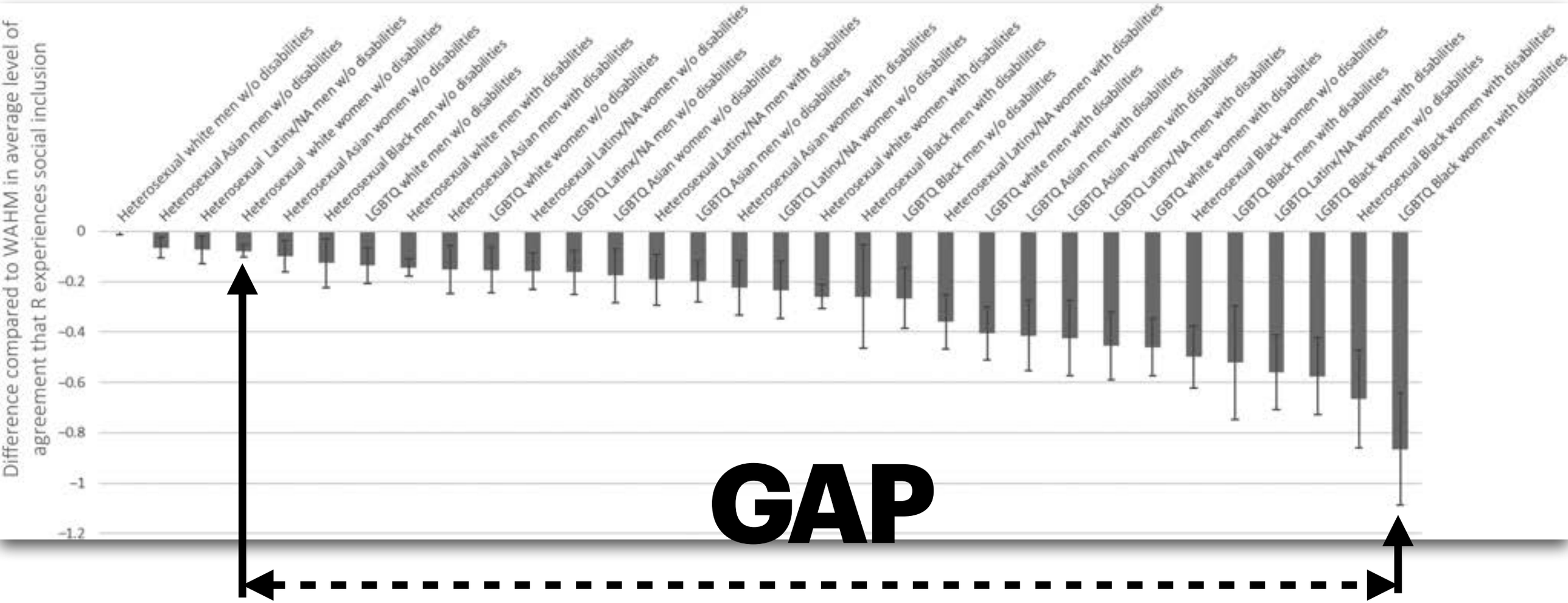
Stol, Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

GENERIC

example

https://www.trythisforexample.com/

https://freerangestock.com/photos/142291/three-female-coworkers-talking-and-smiling-while-standing-in-the-workplace.html

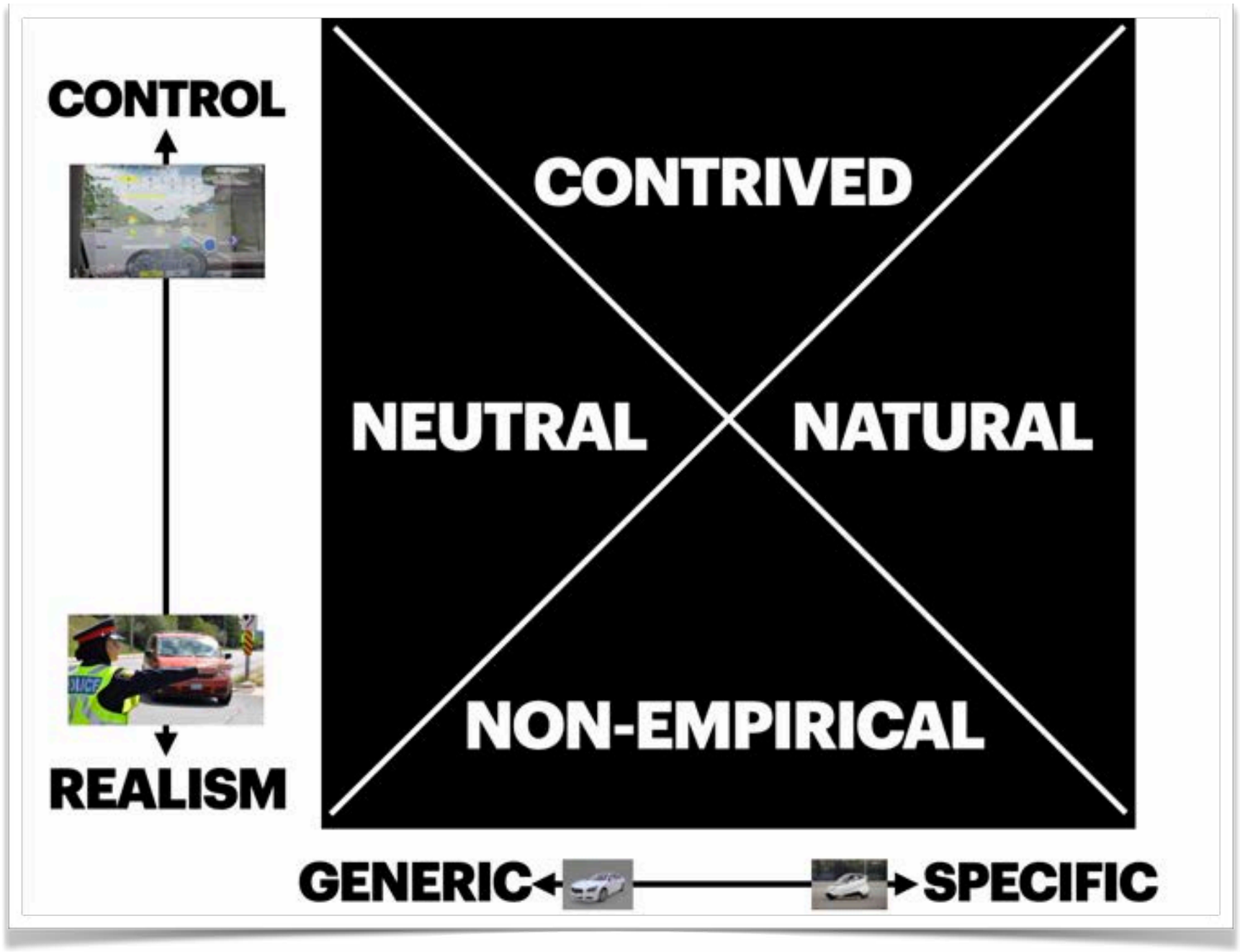


Cech. The intersectional privilege of white able-bodied heterosexual men in STEM. Science Advances 8(24), 2022

What **age- and gender-specific experiences** have veteran software developers of marginalized genders had in their careers?

Sterre van Breukelen, Ann Barcomb, Sebastian Baltes, Alexander Serebrenik: "STILL AROUND": Experiences and Survival Strategies of Veteran Women Software Developers. ICSE 2023: 1148-1160

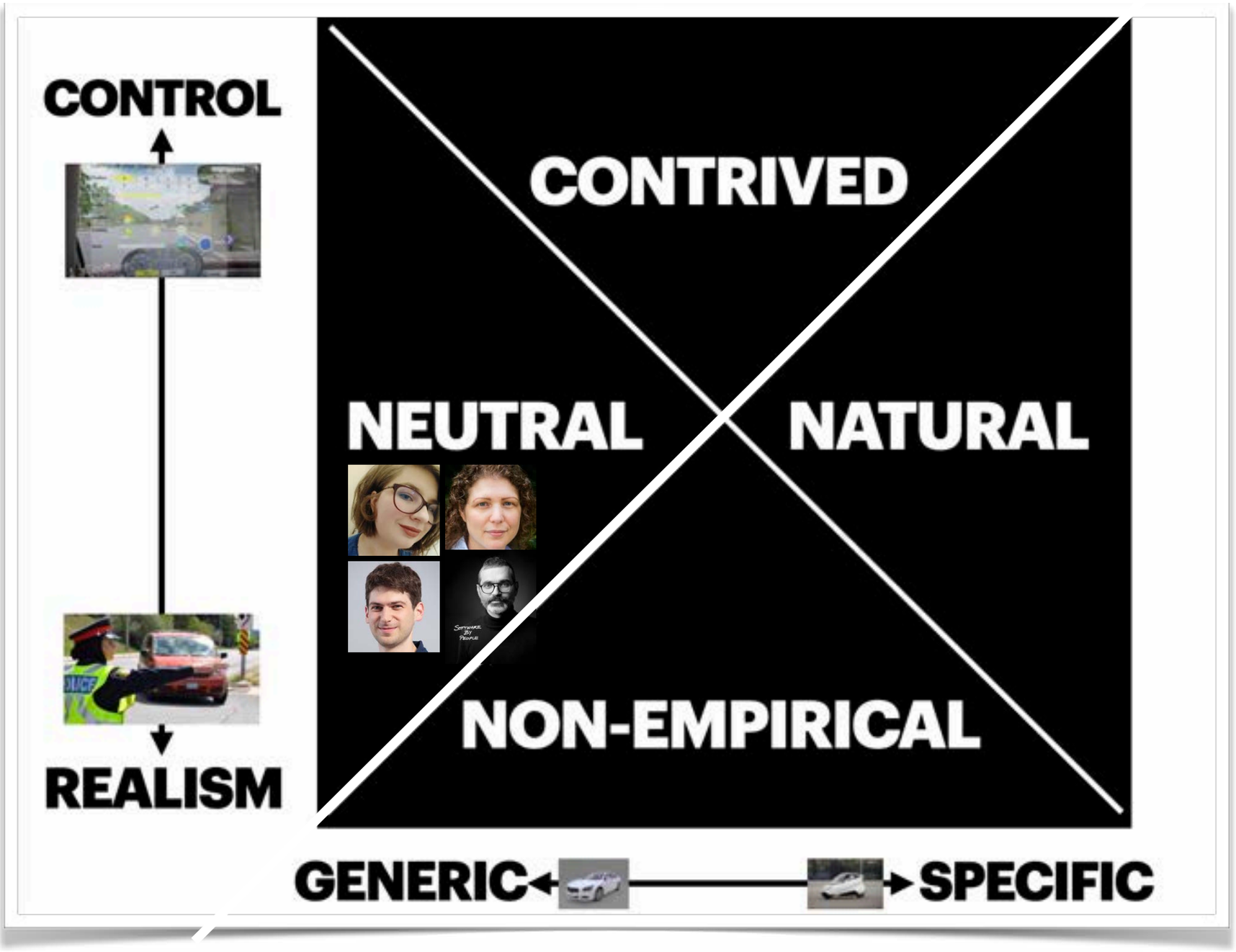
What **age- and gender-specific experiences** have veteran software developers of marginalized genders had in their careers?



Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

Sterre van Breukelen, Ann Barcomb, Sebastian Baltes, Alexander Serebrenik: "STILL AROUND": Experiences and Survival Strategies of Veteran Women Software Developers. ICSE 2023: 1148-1160

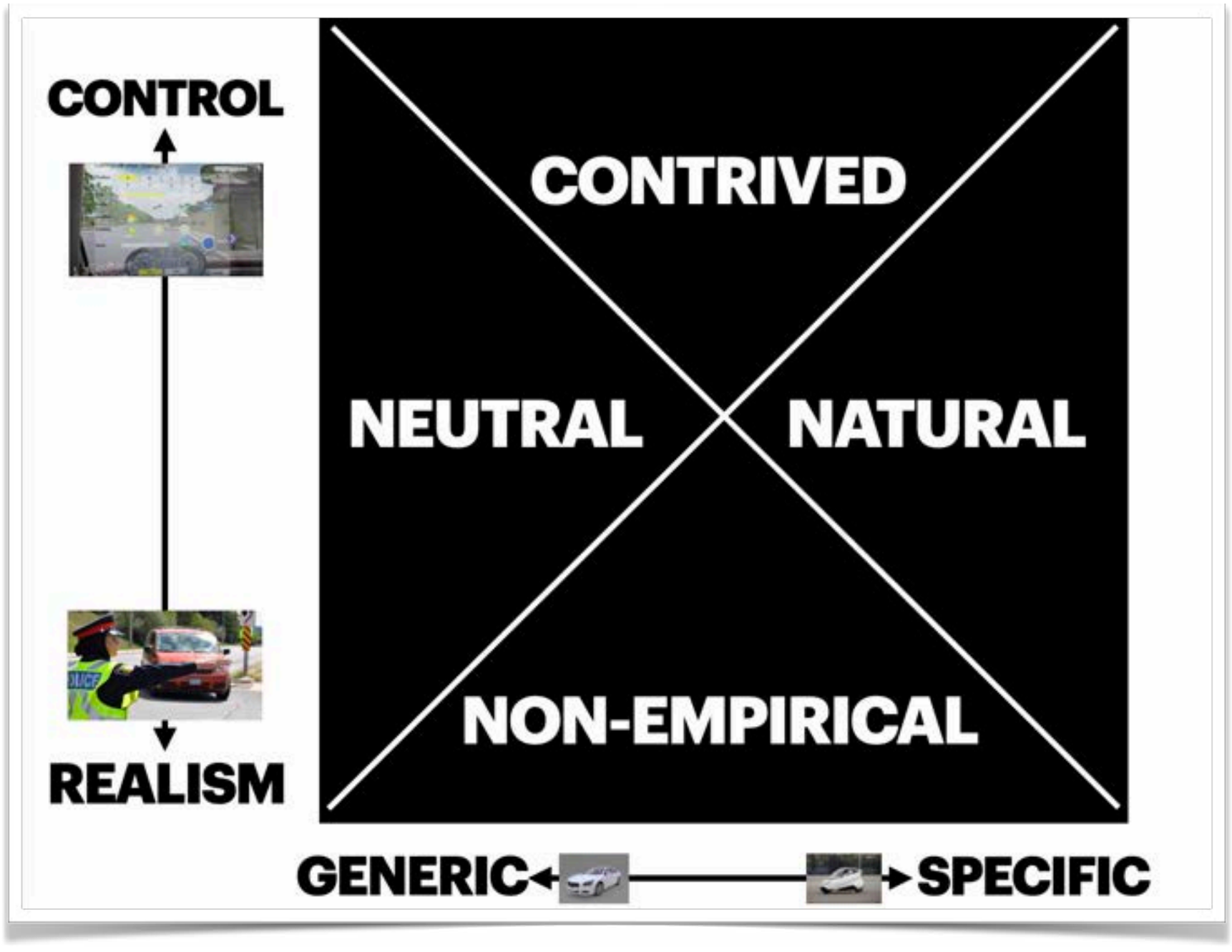
What **age- and gender-specific experiences** have veteran software developers of marginalized genders had in their careers?



Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

Sterre van Breukelen, Ann Barcomb, Sebastian Baltes, Alexander Serebrenik: "STILL AROUND": Experiences and Survival Strategies of Veteran Women Software Developers. ICSE 2023: 1148-1160

What quadrant was chosen in the paper you have brought today?



Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

CONTROL

REALISM

CONTRIVED

LAB EXP.

EXP. SIM.

JUDGEM. STUDY

FIELD EXP.

SAMPLE STUDY

FIELD STUDY

FORM. THEO

COMP SIM.

NEUTRAL

NATURAL

NON-EMPIRICAL

GENERIC

SPECIFIC

CONTROL

REALISM

CONTRIVED

NEUTRAL

NATURAL

LAB EXP.

EXP. SIM.

JUDGEM. STUDY

FIELD EXP.

SAMPLE STUDY

FIELD STUDY

FORM. THEO

COMP SIM.

NON-EMPIRICAL

GENERIC

SPECIFIC

FIELD STUDY

Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

Created by monkik
from Noun Project

Ethnography
Case study
Interview

Scale. Fagel, Brussels. Fondation Atelier Marcel Hastir

FIELD

EXPERIMENT

Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 2(45): 11:1–11:51 (2018)

https://urbangreennewcastle.org/media/1138/havannah-three-hills-woodland-path.jpg

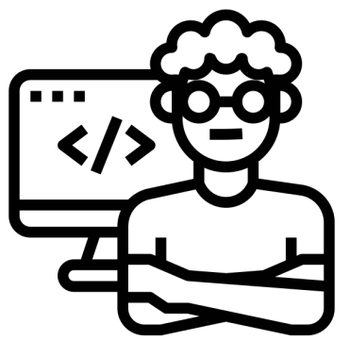
Requirements specification

Company A

Created by supalerk laipawat
from Noun Project

price, schedule, costs, reliability, usability, maintainability

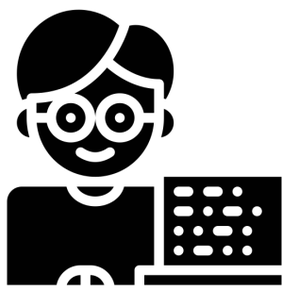
Company B



Created by monkik
from Noun Project

price, schedule, costs, reliability, usability, maintainability

Company C



Created by iconixar
from Noun Project

price, schedule, costs, reliability, usability, maintainability

Company D

Created by LUTFI GANI AL ACHMAD
from Noun Project

price, schedule, costs, reliability, usability, maintainability

Comparison: reproducible?

Bente Anda, Dag I. K. Sjøberg, Audris Mockus: Variability and Reproducibility in Software Engineering: A Study of Four Companies that Developed the Same System. IEEE Trans. Software Eng. 35(3): 407-429 (2009)

Created by monkik
from Noun Project

Case study
Quasi-Exp.
Action Research

Scale. Fagel, Brussels. Fondation Atelier Marcel Hastir

QUESTION

Caneill et al. present a case study of Debian, which investigates its evolution, rate of change, use and popularity of programming languages, and use and evolution of licenses within Debian. No attempt at generalisation is made.

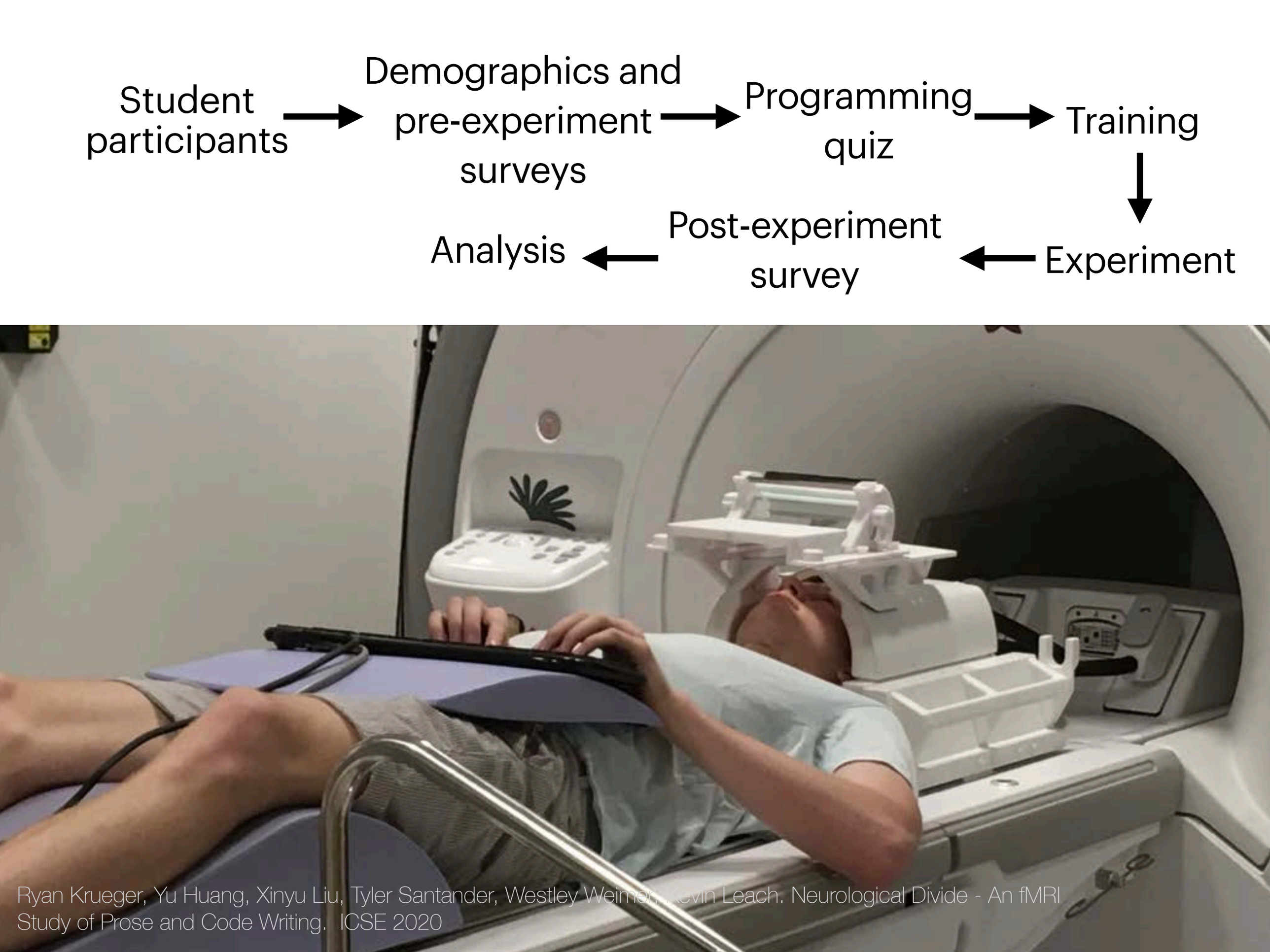
(A) FIELD STUDY

(B) FIELD EXPERIMENT

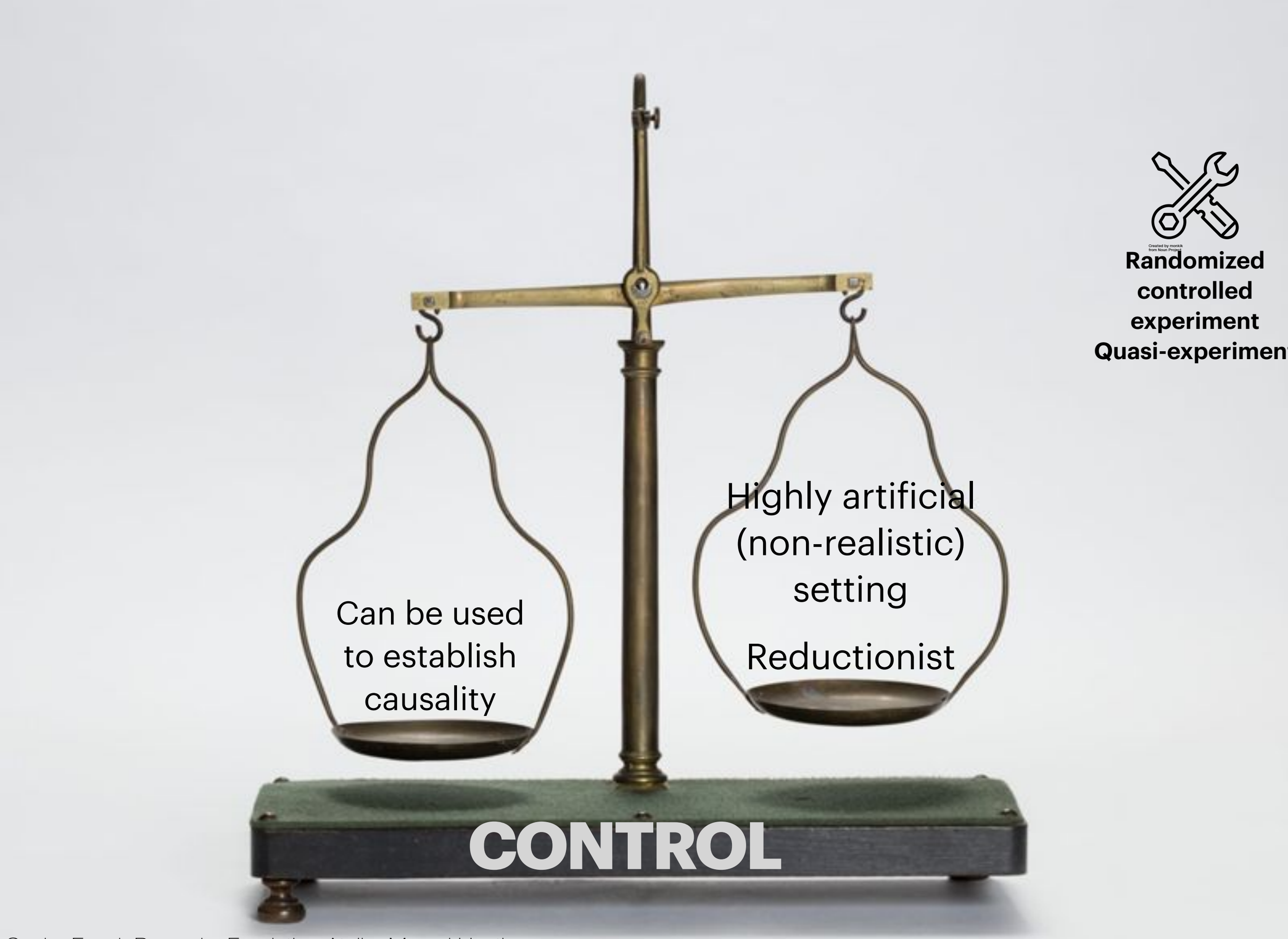
LABORATORY EXPERIMENT

Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

https://o-ring.info/o-ring.info-images-new-design/eriks_cleanroom-belgium-1535031592.jpg



Ryan Krueger, Yu Huang, Xinyu Liu, Tyler Santander, Westley Weimer, Kevin Leach. Neurological Divide - An fMRI Study of Prose and Code Writing. ICSE 2020



Scale. Fagel, Brussels. Fondation Atelier Marcel Hastir

QUESTION

Jongeling et al. investigate to what extent results from software engineering studies using sentiment analysis depend on the choice of sentiment analysis tool. Through experimental comparison, finds that tools do not compare with manual labelling, nor do different tools agree with each other.

(A) FIELD STUDY

(B) FIELD EXPERIMENT

(C) LAB EXPERIMENT

JUDGEMENT STUDY

Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

https://images.squarespace-cdn.com/content/v1/56b4be6ec2ea51ac0c6598a4/1559167353706-6O9C7PBQLT2IP2AEAI3K/ke17ZwdGBTodd8pDm48kBNRt0cg4WAanfWojlHLplx7gQa3H78H3Y0txjaiv_0fDoOvxcdMmMKkDsyUqMSsMWxHk725yiiHCCLfrh8O1z5QPOohDIaIeljMHgDF5CVlOqpeNLcJ80NK65_fV7S1US6IfA3z_hZ3gTROHXzj40oiauNtBL88ZRQhKg2xy4MQPt_AAiqPvsV6TvkS6kIncw/image-asset.jpeg?format=2500w

57 CERTIFIED PROJECT MANAGERS

Created by Adrien Coquet from Noun Project

CHECK QUALIFICATIONS

15 EXPERTS

Created by Adrien Coquet from Noun Project

6 MOST IMPORTANT RISKS IN OFFSHORING

25 RISKS

Created by popcomarts from Noun Project

IMPORTANCE RANKING

RANKED LIST

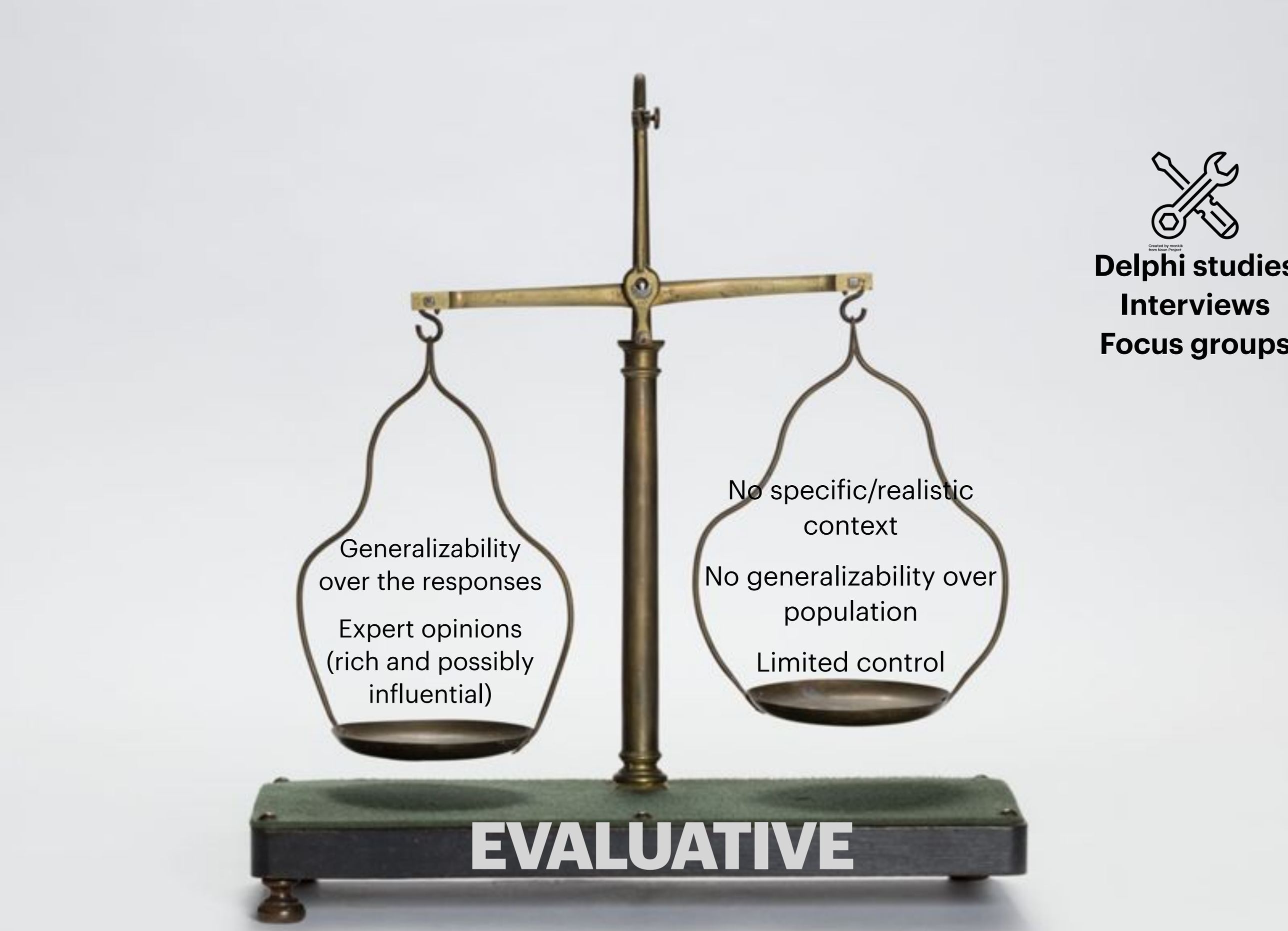
Created by alison from Noun Project

COMPARE PERSONAL RANKING AND AVERAGE RANKING OF THE PANEL

ADJUSTED RANKING

Created by alison from Noun Project

Charalambos L. Iacovou, Robbie T. Nakatsu: A risk profile of offshore-outsourced development projects. CACM 51(6): 89-94 (2008)

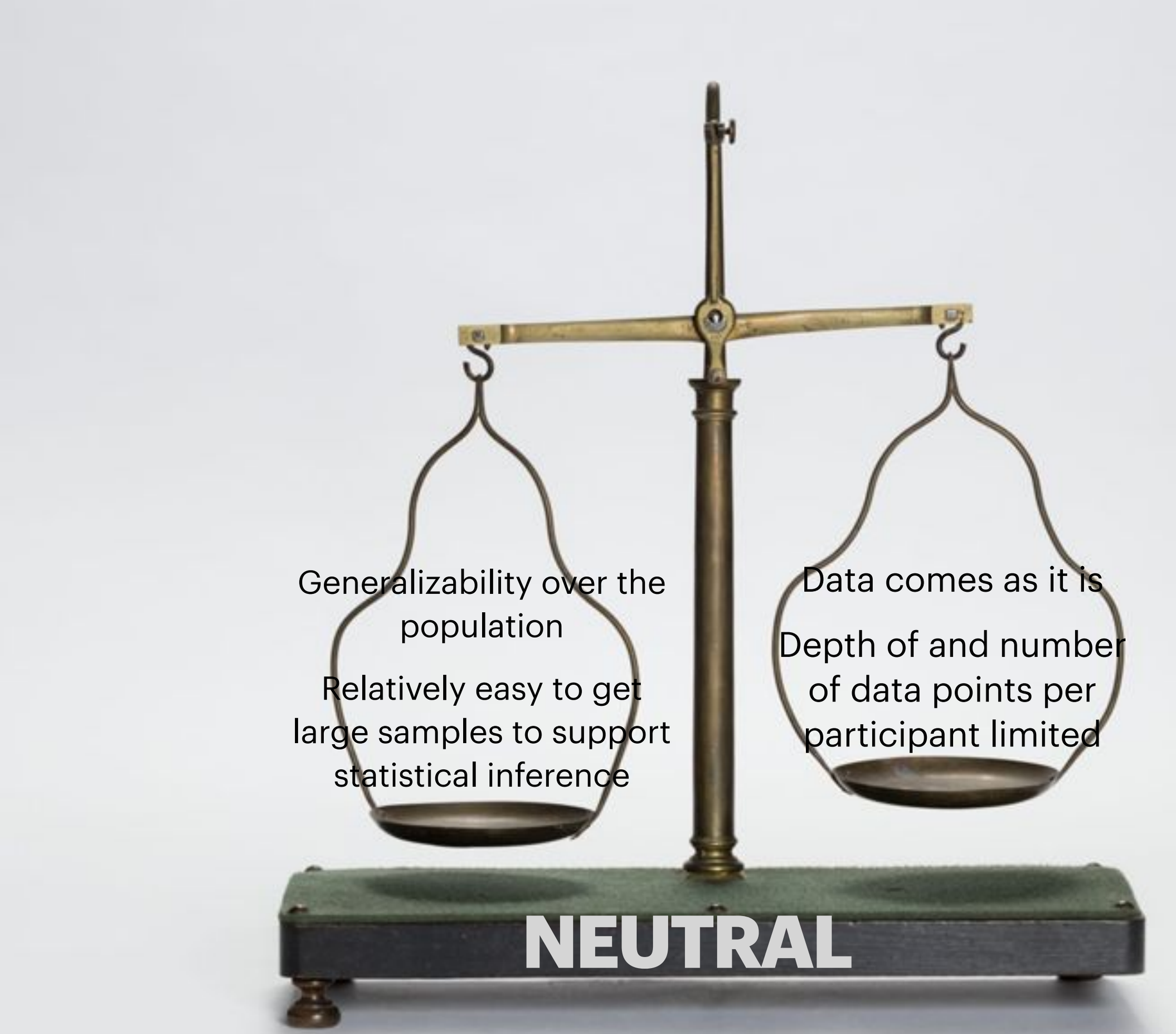


Scale. Fagel, Brussels. Fondation Atelier Marcel Hastir

SAMPLE STUDY

Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

https://media.npr.org/assets/img/2015/08/10/gettyimages-154[illegible]819_wide-951d6c9ff73d9a7f786db15c0d3879d4dc7d2c44.jpg?s=1400



Created by monkik
from Noun Project

Repository mining
Survey
Interview

Scale. Fagel, Brussels. Fondation Atelier Marcel Hastir

QUESTION

Joblin et al. investigate the evolution of developer coordination in open-source projects, through an analysis of 18 large open-source software projects, with findings that aim to generalize.

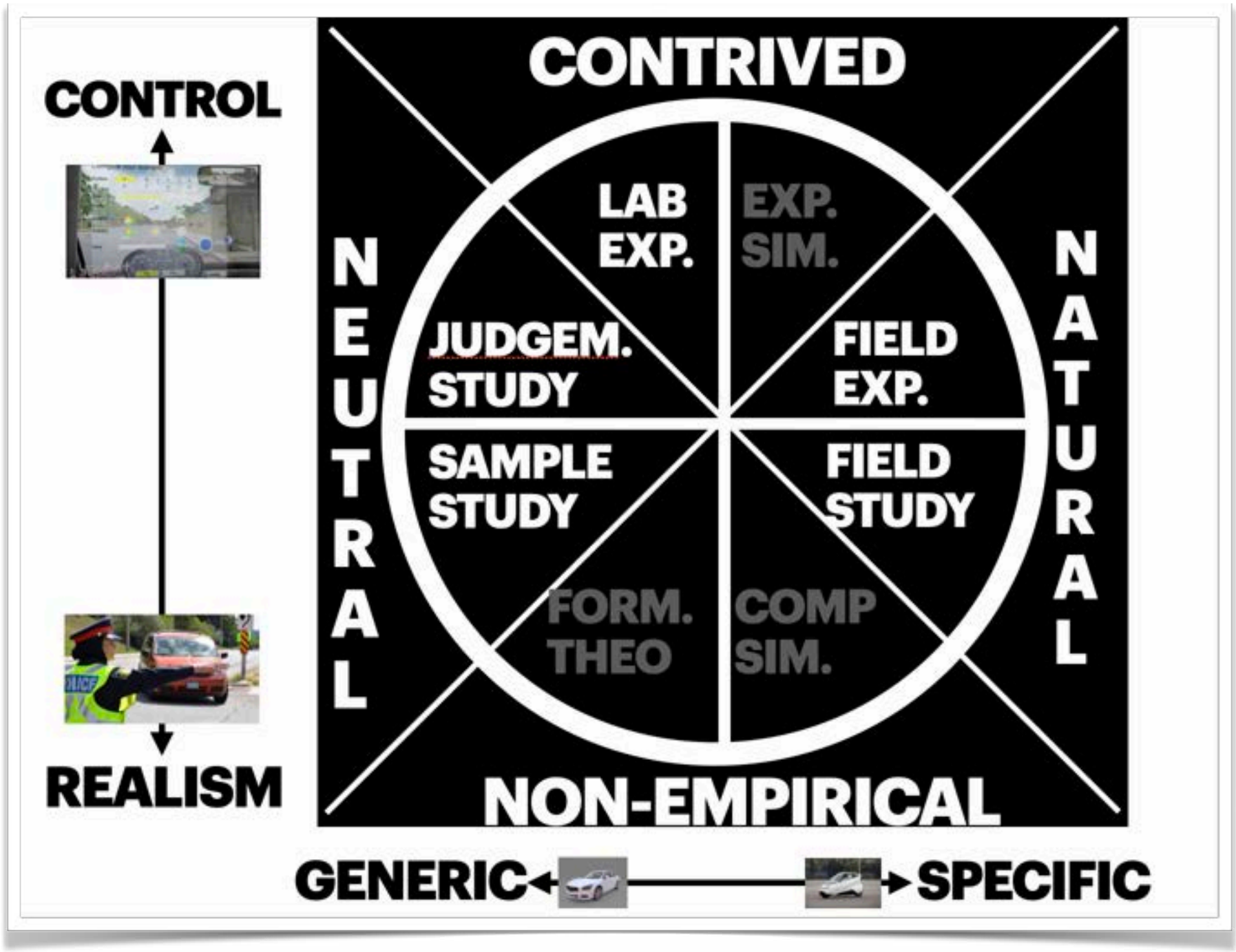
(A) FIELD STUDY

(B) SAMPLE STUDY

(C) JUDGEMENT STUDY

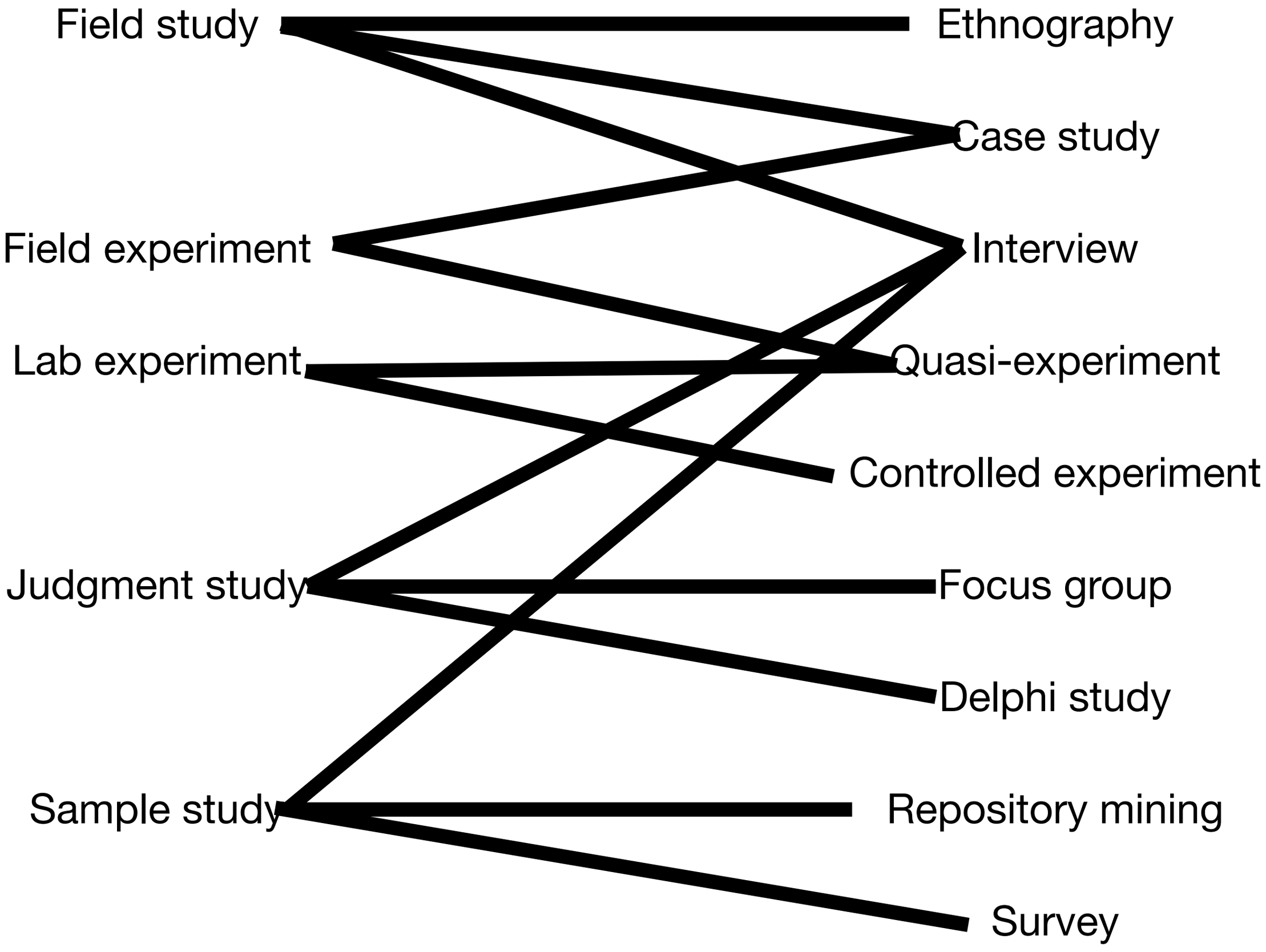
(D) LAB EXPERIMENT

What **age- and gender-specific experiences** have veteran software developers of marginalized genders had in their careers?

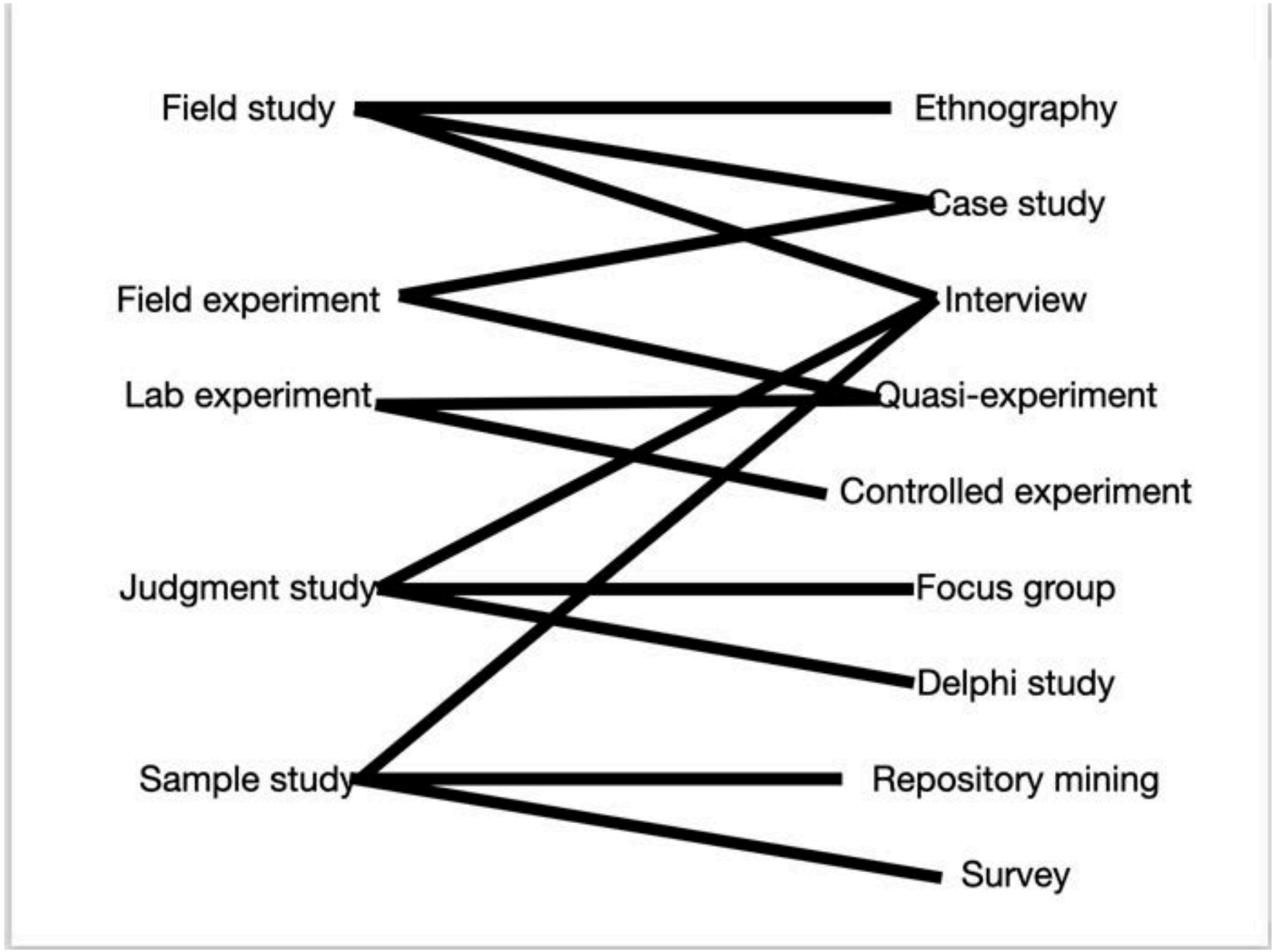


Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

Sterre van Breukelen, Ann Barcomb, Sebastian Baltes, Alexander Serebrenik: "STILL AROUND": Experiences and Survival Strategies of Veteran Women Software Developers. ICSE 2023: 1148-1160

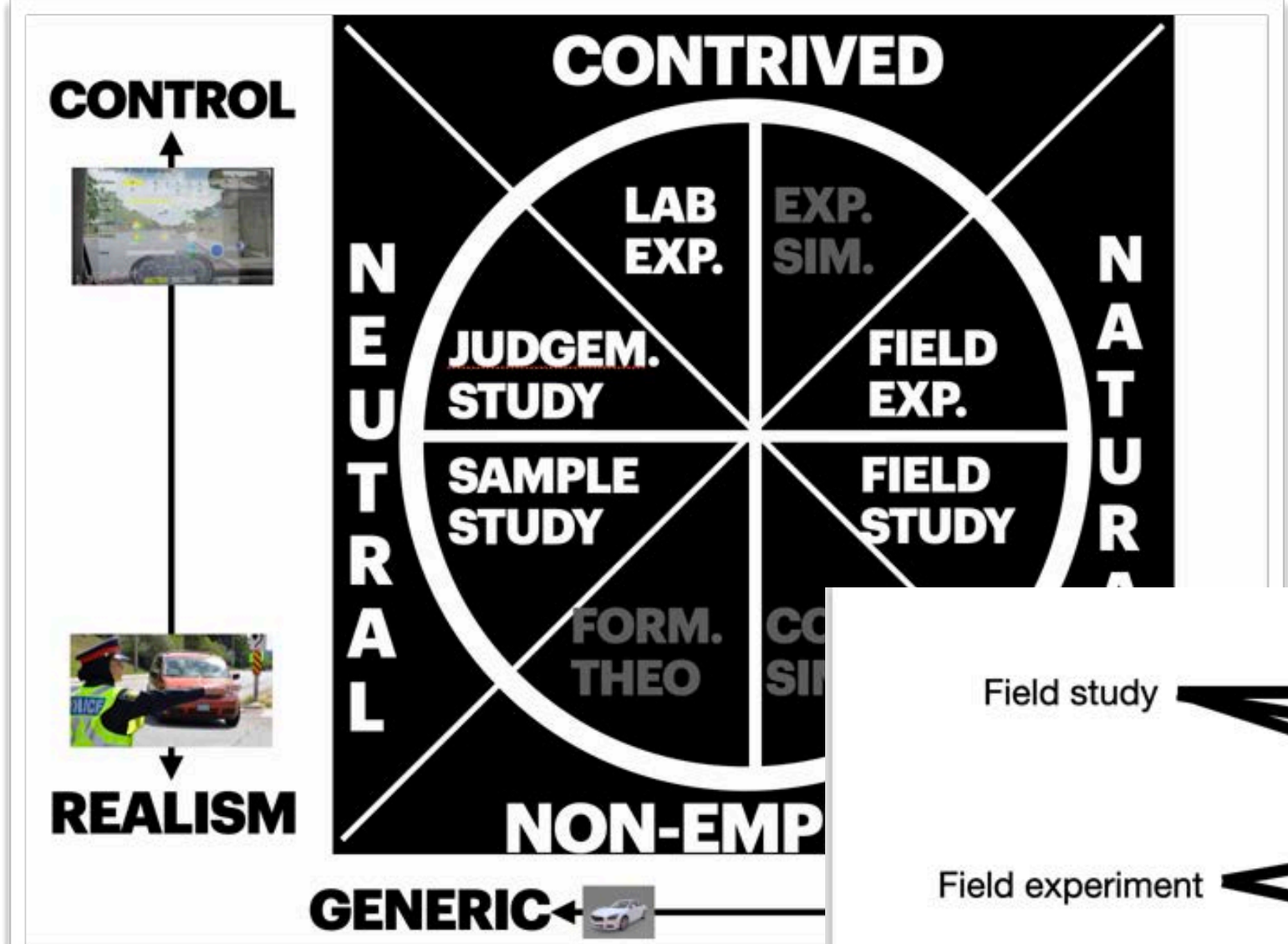

Field study
Ethnography
Case study
Field experiment
Interview
Lab experiment
Quasi-experiment
Controlled experiment
Judgment study
Focus group
Delphi study
Sample study
Repository mining
Survey

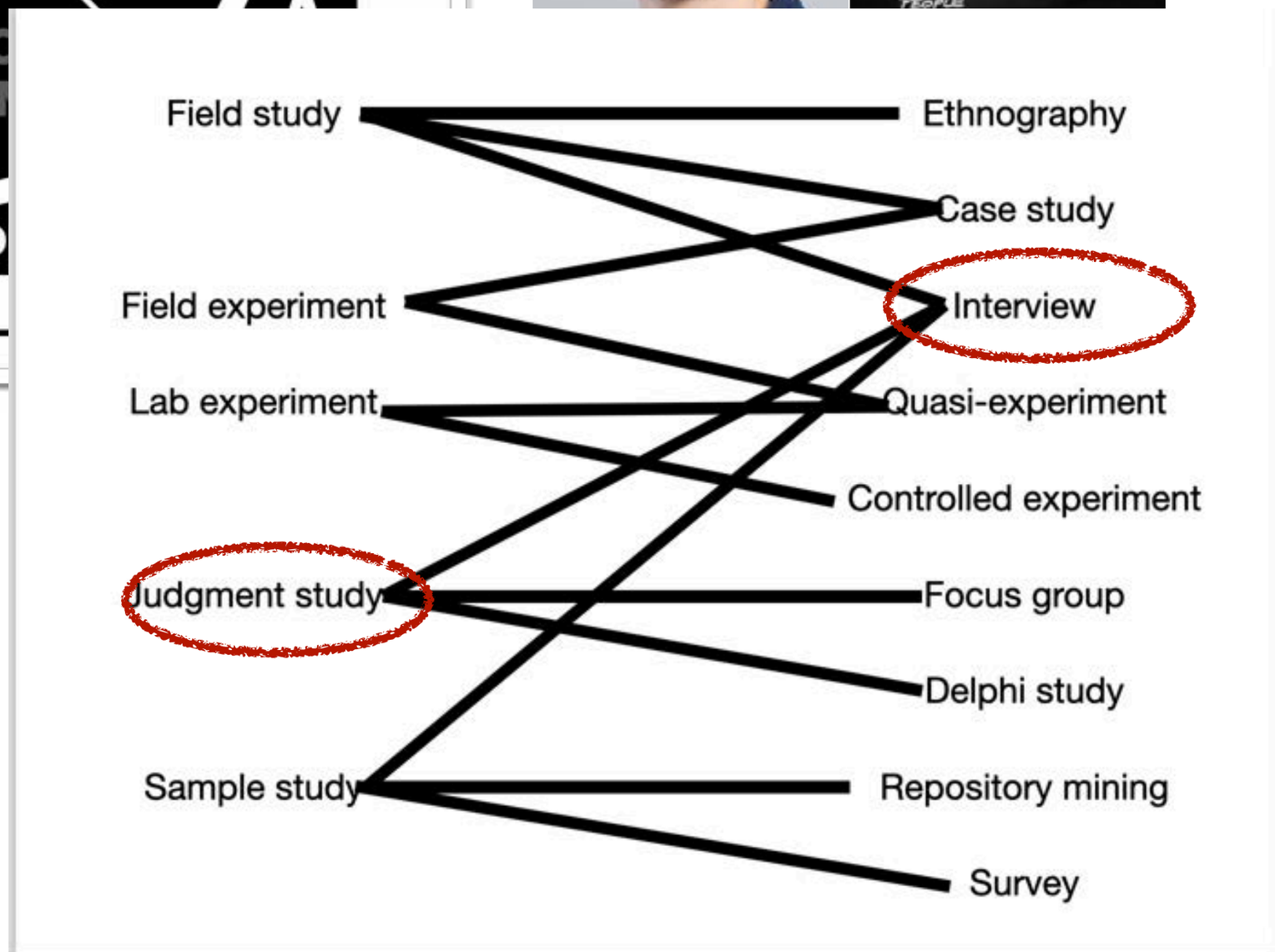
What **age- and gender-specific experiences** have veteran software developers of marginalized genders had in their careers?

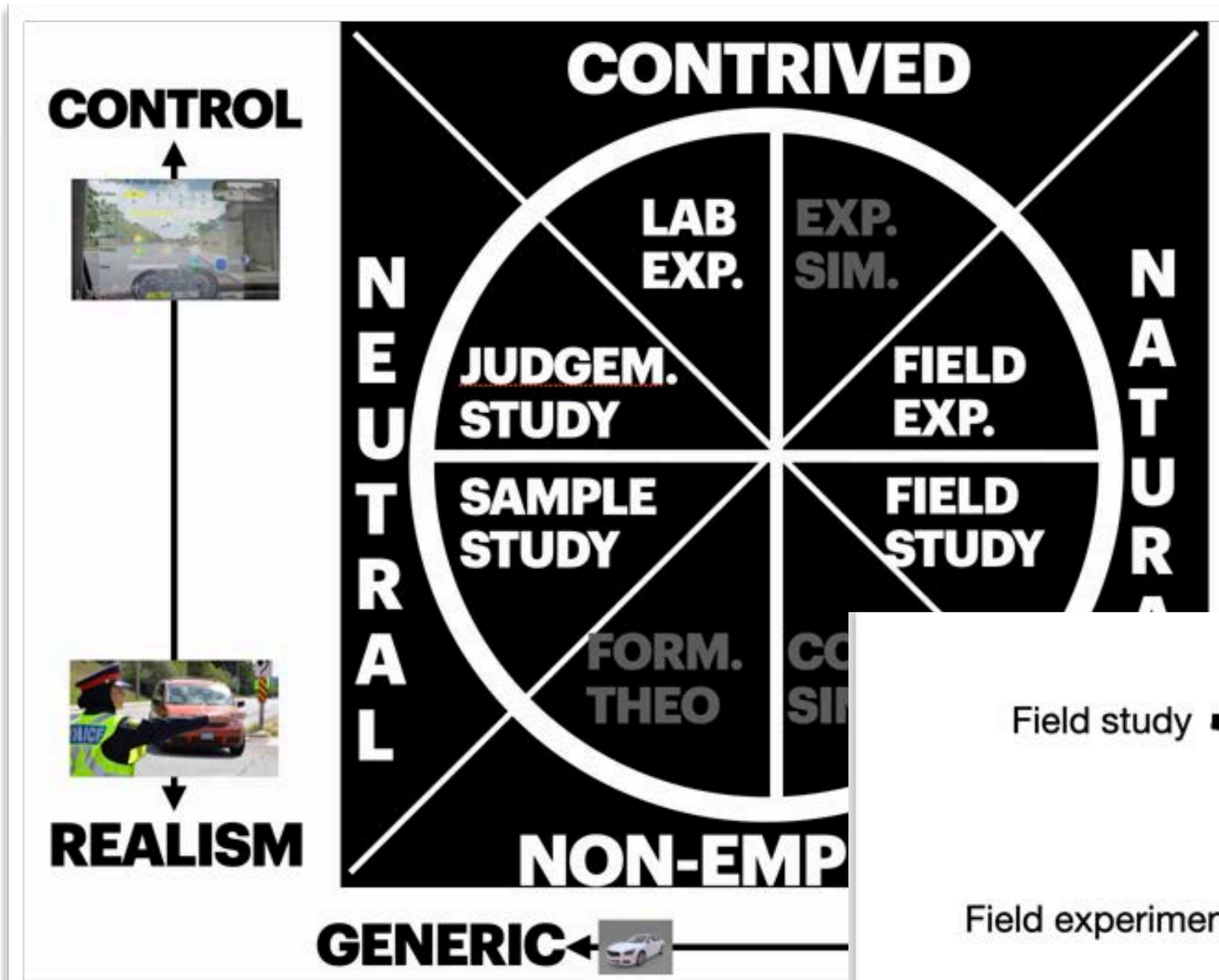


Klaas-Jan Stol, Brian Fitzgerald: The ABC of Software Engineering Research. TOSEM 27(3): 11:1-11:51 (2018)

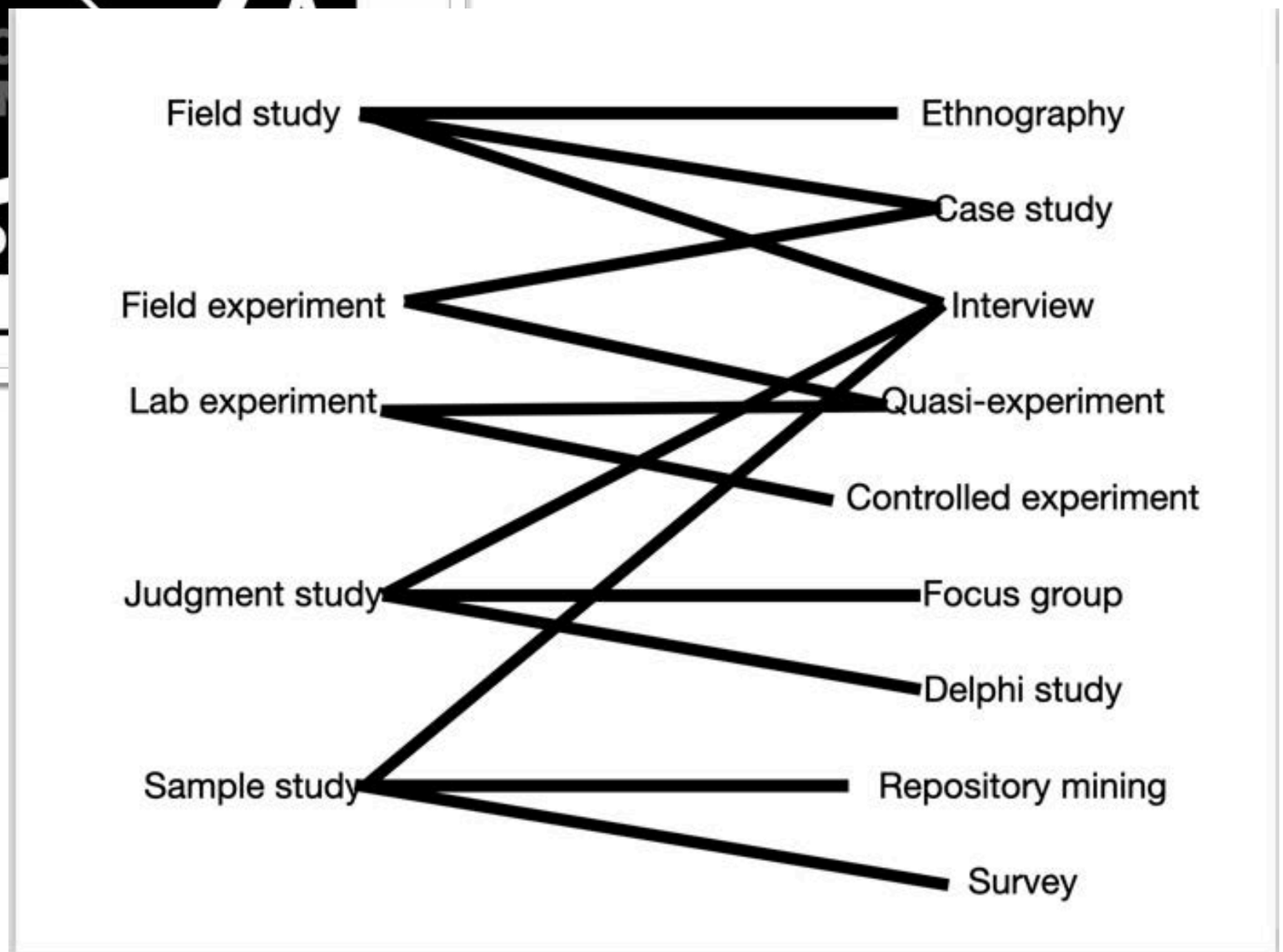
Sterre van Breukelen, Ann Barcomb, Sebastian Baltes, Alexander Serebrenik: "STILL AROUND": Experiences and Survival Strategies of Veteran Women Software Developers. ICSE 2023: 1148-1160


CONTROL
REALISM
CONTRIVED
NEUTRAL
NATURA
LAB EXP.
EXP. SIM.
JUDGEM. STUDY
FIELD EXP.
SAMPLE STUDY
FIELD STUDY
FORM. THEO
NON-EMP
GENERIC


Field study
Ethnography
Case study
Field experiment
Interview
Lab experiment
Quasi-experiment
Controlled experiment
Judgment study
Focus group
Delphi study
Sample study
Repository mining
Survey



What **research strategy and method(s)** were chosen in the paper you brought today?



INTERVIEW

https://www.nonprofitmarketingguide.com/blog/wp-content/uploads/2017/05/bigstockphoto_Interview_Time_4408972.jpg

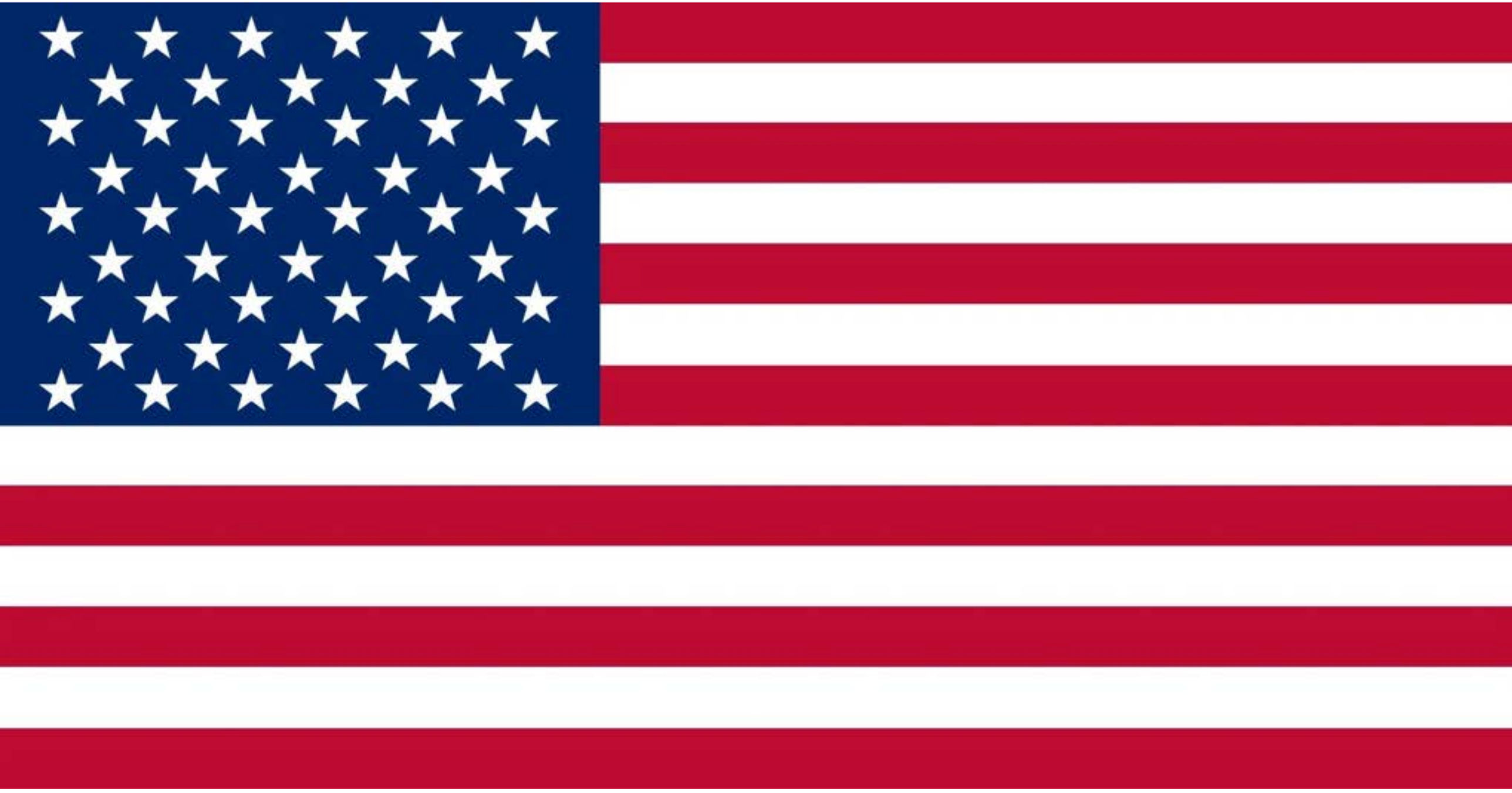
What age- and gender-specific experiences have **veteran software developers of marginalized genders** had in their careers?

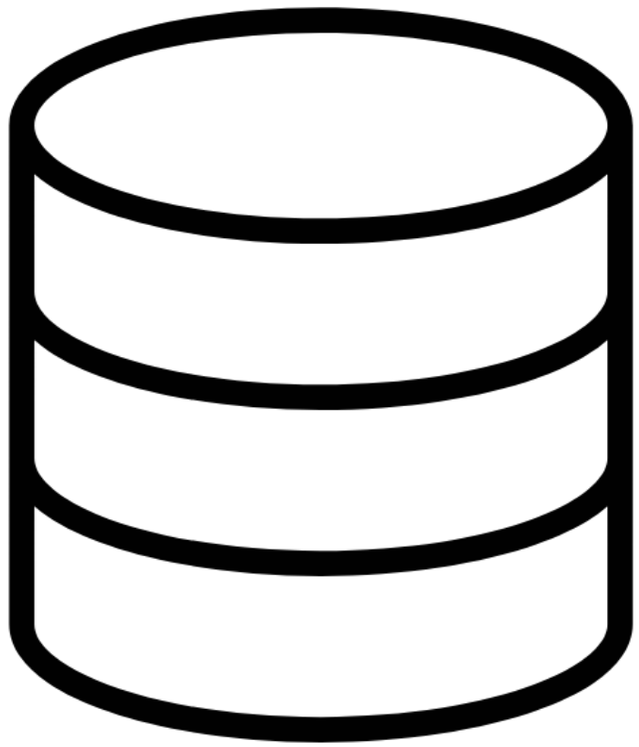
Sterre van Breukelen, Ann Barcomb, Sebastian Baltes, Alexander Serebrenik: "STILL AROUND": Experiences and Survival Strategies of Veteran Women Software Developers. ICSE 2023: 1148-1160

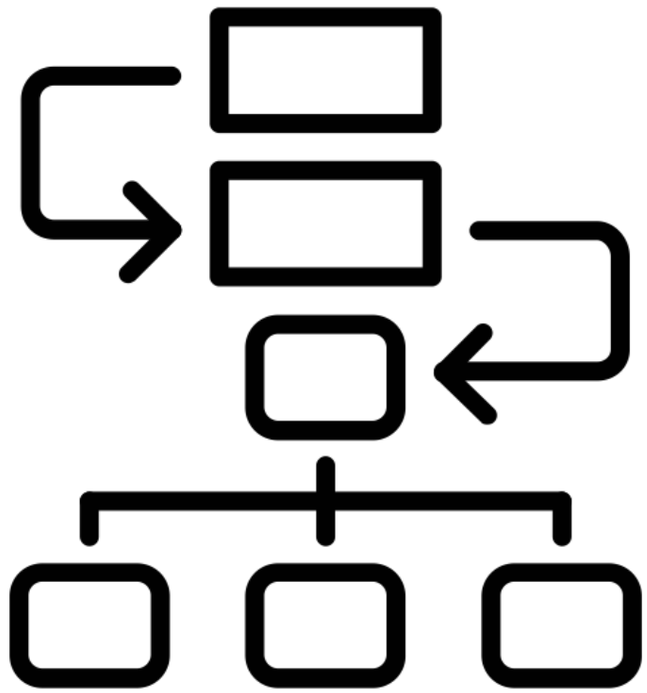
HOW OLD IS "OLD"?

30 or older	4
35 or older	3
35-40 or older	2
40 or older	**7**
45 or older	2
50 or older	1
Not stated explicitly	5

Sebastian Baltes, George Park, Alexander Serebrenik. Is 40 the new 60? How popular media portrays the employability of older software developers, IEEE Software, 37(6):26-31, 2020



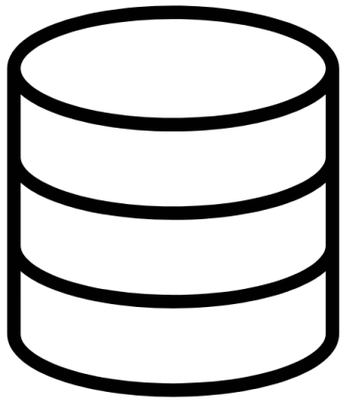




Alexander Serebrenik. How to Ask about Gender Identity of Software Engineers and “Guess” it from the Archival Data, Equity, Diversity, and Inclusion in Software Engineering: Best Practices and Insights (Damian et al. eds.) 2024.

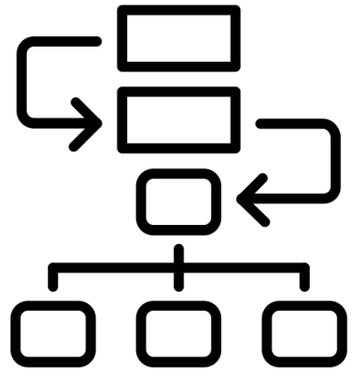
Best answers possible

Limited number of responses



Good but possibly outdated answers

Few datasets record gender explicitly



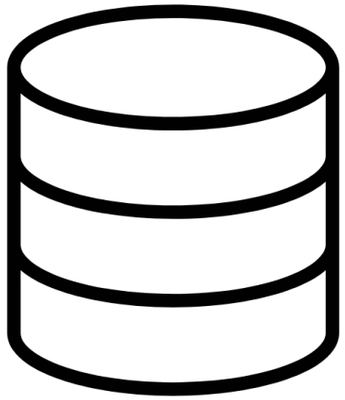
As many data points as needed

Imprecise, unreliable, ethics?

Alexander Serebrenik. How to Ask about Gender Identity of Software Engineers and “Guess” it from the Archival Data, Equity, Diversity, and Inclusion in Software Engineering: Best Practices and Insights (Damian et al. eds.) 2024.

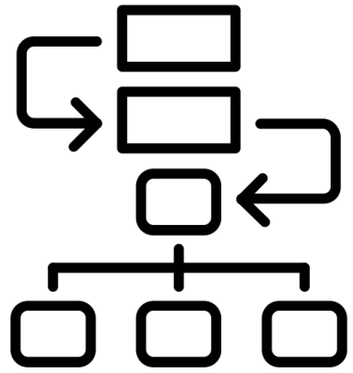
Best answers possible

Limited number of responses



Good but possibly outdated answers

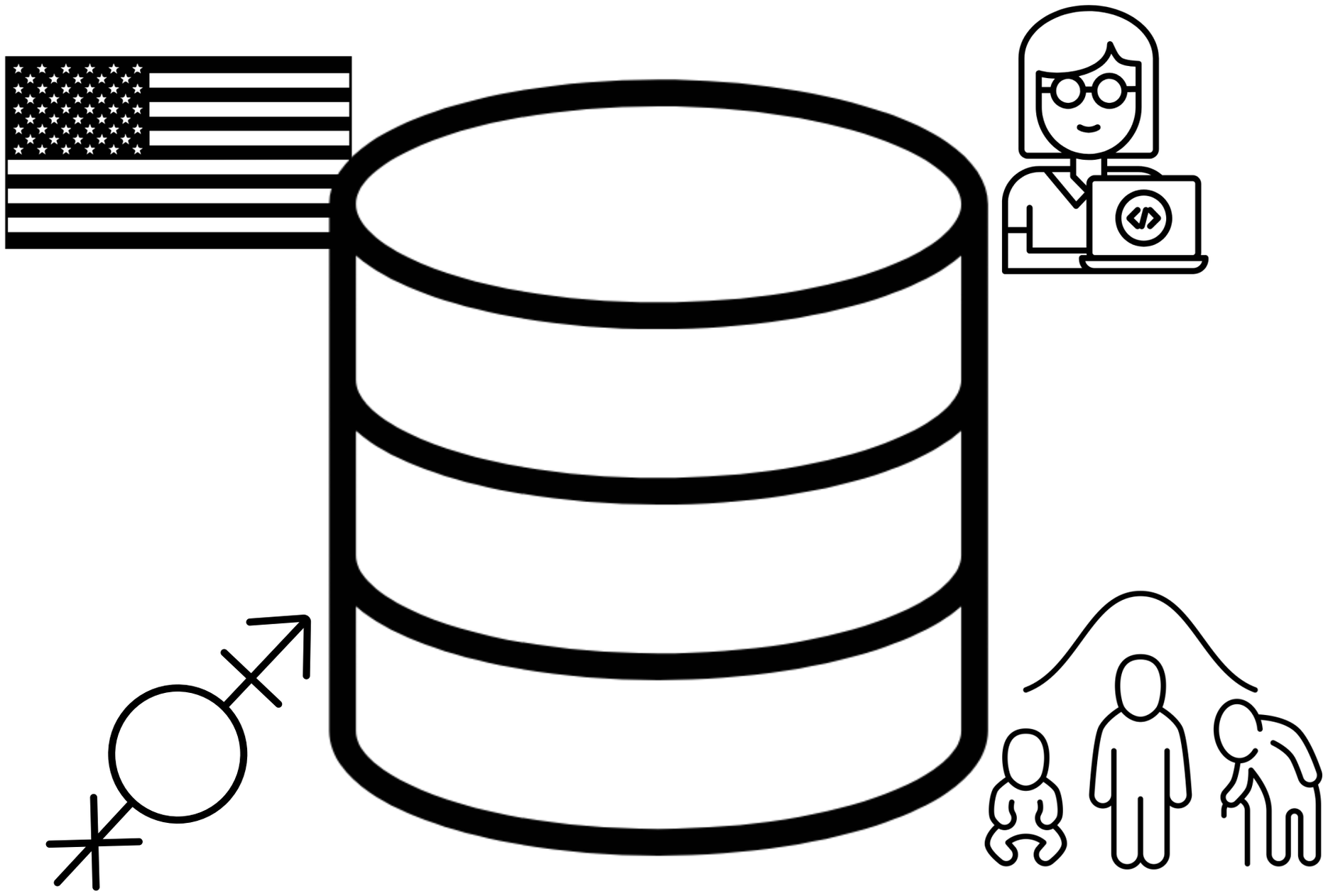
Few datasets record gender explicitly



As many data points as needed

Imprecise, unreliable, ethics?

Alexander Serebrenik. How to Ask about Gender Identity of Software Engineers and “Guess” it from the Archival Data, Equity, Diversity, and Inclusion in Software Engineering: Best Practices and Insights (Damian et al. eds.) 2024.



Tracy Chou 🌻
@triketora

congrats to all the young people but can we also give a massive shout-out to the older women in tech who have survived all the bullshit and are STILL AROUND it's like hunger games survival skills to still be here after 10, 20, 30+ years

11:21 PM · Dec 1, 2020

254 Retweets **173** Quotes **2,431** Likes **28** Bookmarks

lykyk* @_ewus · Dec 1, 2020

18 years and counting 💪

1

Johanna

43 years in tech & counting. My alternatives were much worse. Not sure any work was different then.

Tracy Ch

castic.

Kahve

16 years. But tech is also not a monolith. After doing a job in a smaller start-up:ish company which was horrible in many ways, I'm now with huge global companies. Not the same planet. The odd sexist joke but these are grownup places with procedures and proper hr depts etc.

1

e after

Magee

30+ years. Been chased around a server room, had my phone number given by a boss currying favor to her boss, had to fend off a FSO who showed up at a US Embassy residence I was staying at hoping for... Better now, but we shouldn't have to age out of sexism right into ageism.

Elizabeth

Thanks for calling this out. Women of all generations need to lift each other up in tech. I started in 1985 when I moved from LA to start at Apple.

1 40

Elizabeth Gebhardt @egebhardt · Dec 2, 2020

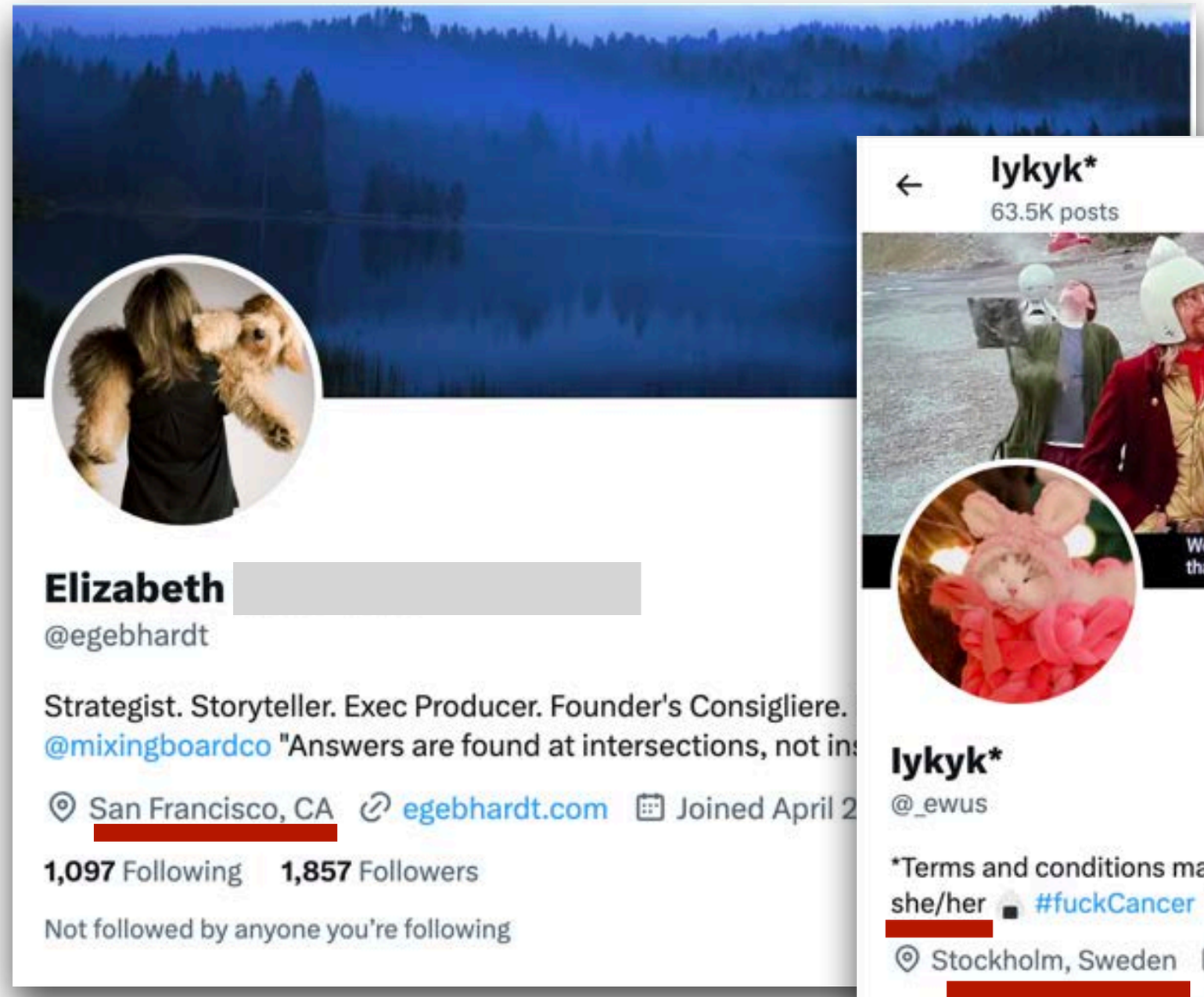
Thanks for calling this out. Women of all generations need to lift each other up in tech. I started in 1985 when I moved from LA to start at Apple.

1 40

lykyk* @_ewus · Dec 1, 2020

18 years and counting 💪🏻

1 41



Elizabeth [redacted]

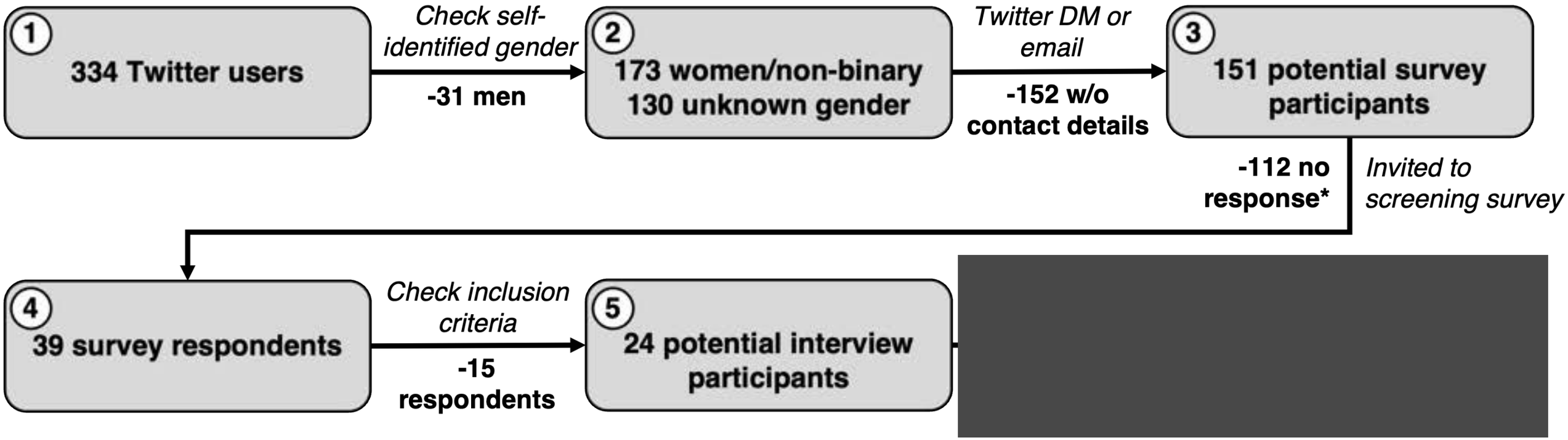
@egebhardt

Strategist. Storyteller. Exec Producer. Founder's Consigliere.
@mixingboardco "Answers are found at intersections, not ins

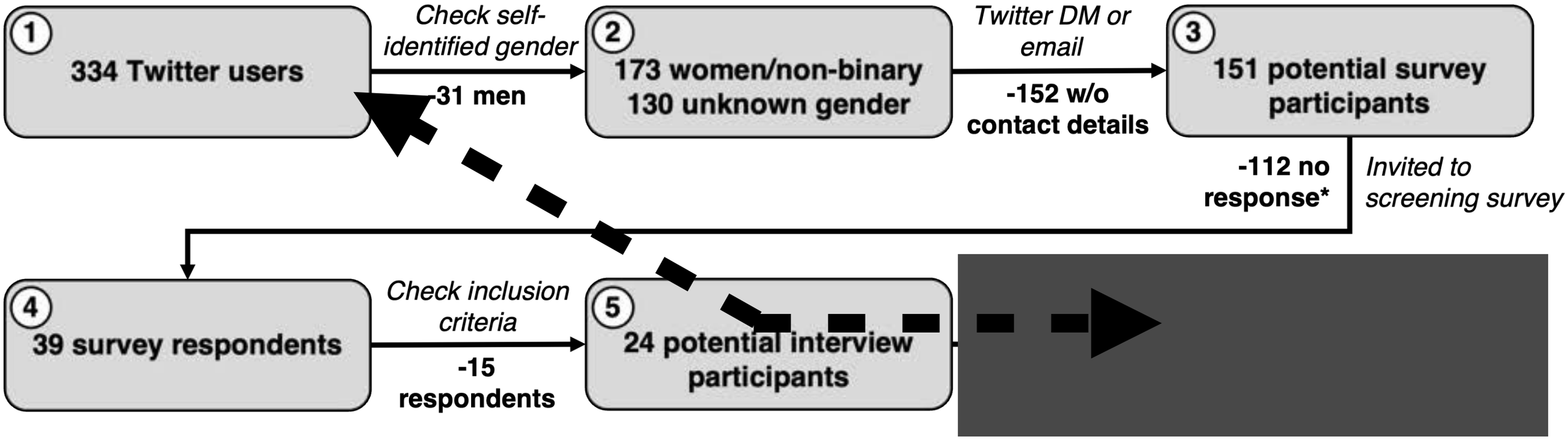
San Francisco, CA egebhardt.com Joined April 2

1,097 Following **1,857** Followers

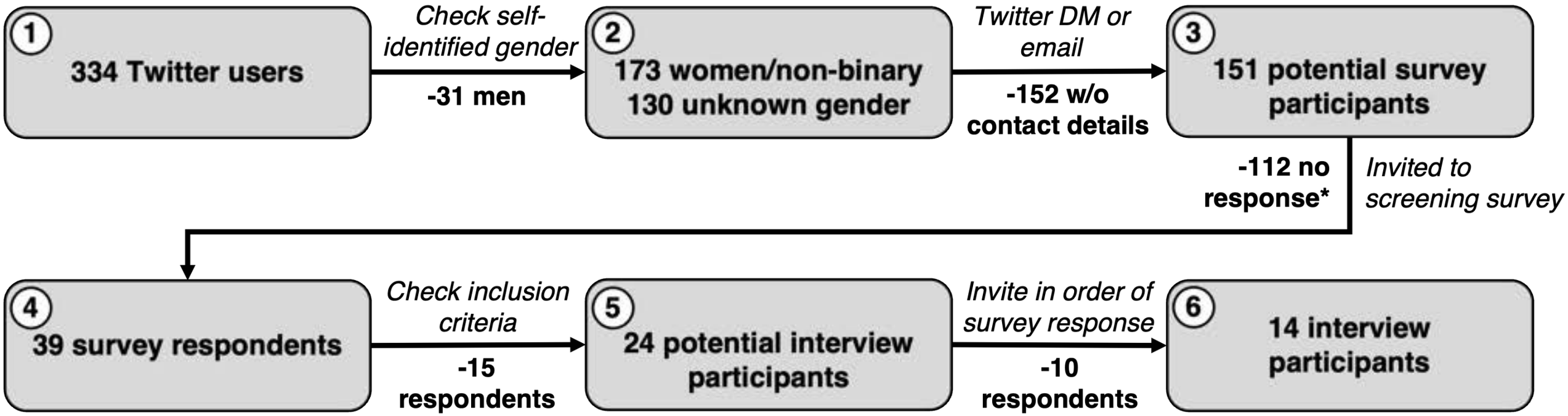
Not followed by anyone you're following



Sterre van Breukelen, Ann Barcomb, Sebastian Baltes, Alexander Serebrenik: "STILL AROUND": Experiences and Survival Strategies of Veteran Women Software Developers. ICSE 2023: 1148-1160



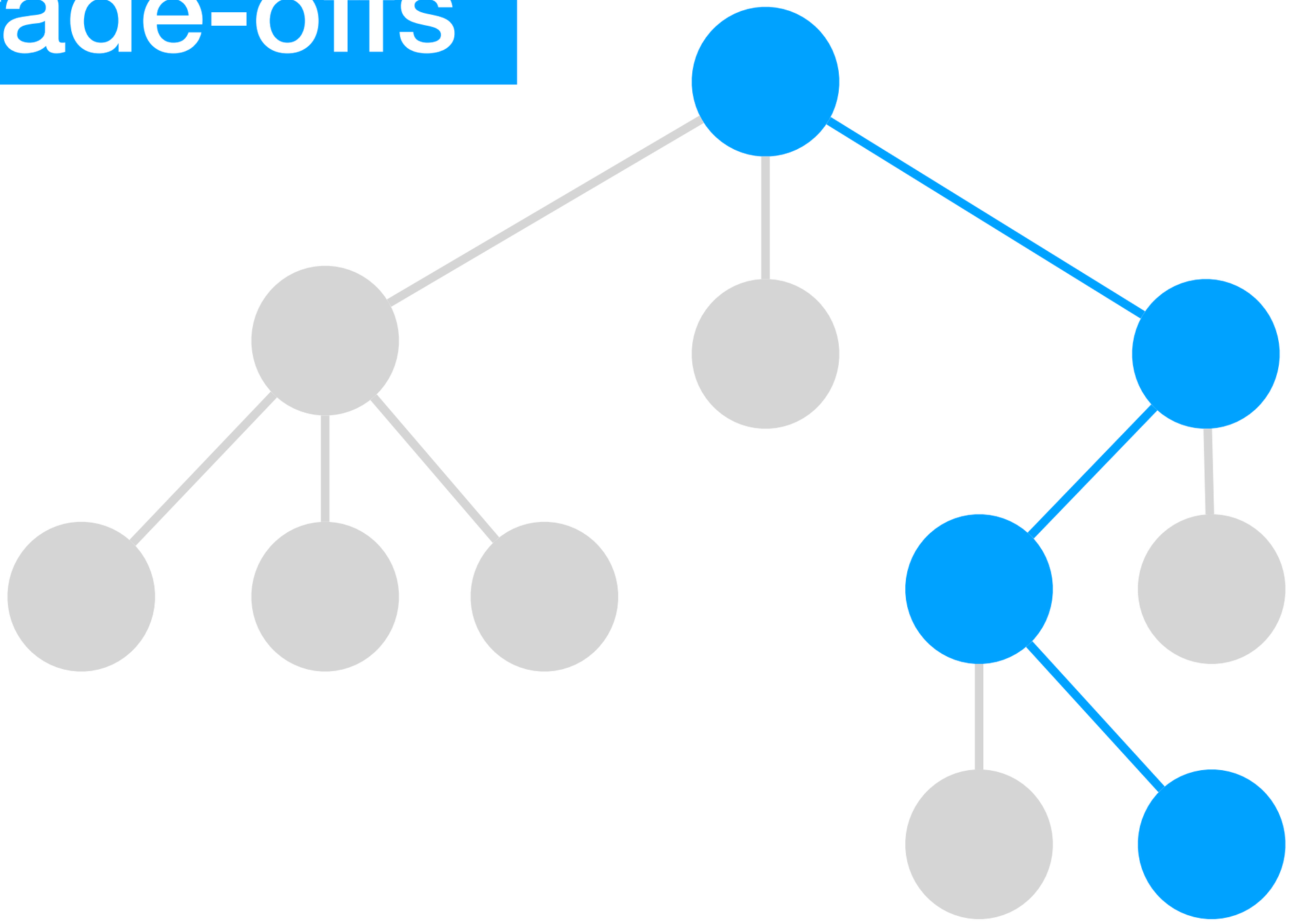
Sterre van Breukelen, Ann Barcomb, Sebastian Baltes, Alexander Serebrenik: "STILL AROUND": Experiences and Survival Strategies of Veteran Women Software Developers. ICSE 2023: 1148-1160



Sterre van Breukelen, Ann Barcomb, Sebastian Baltes, Alexander Serebrenik: "STILL AROUND": Experiences and Survival Strategies of Veteran Women Software Developers. ICSE 2023: 1148-1160

Greta Hoffman from Pexels

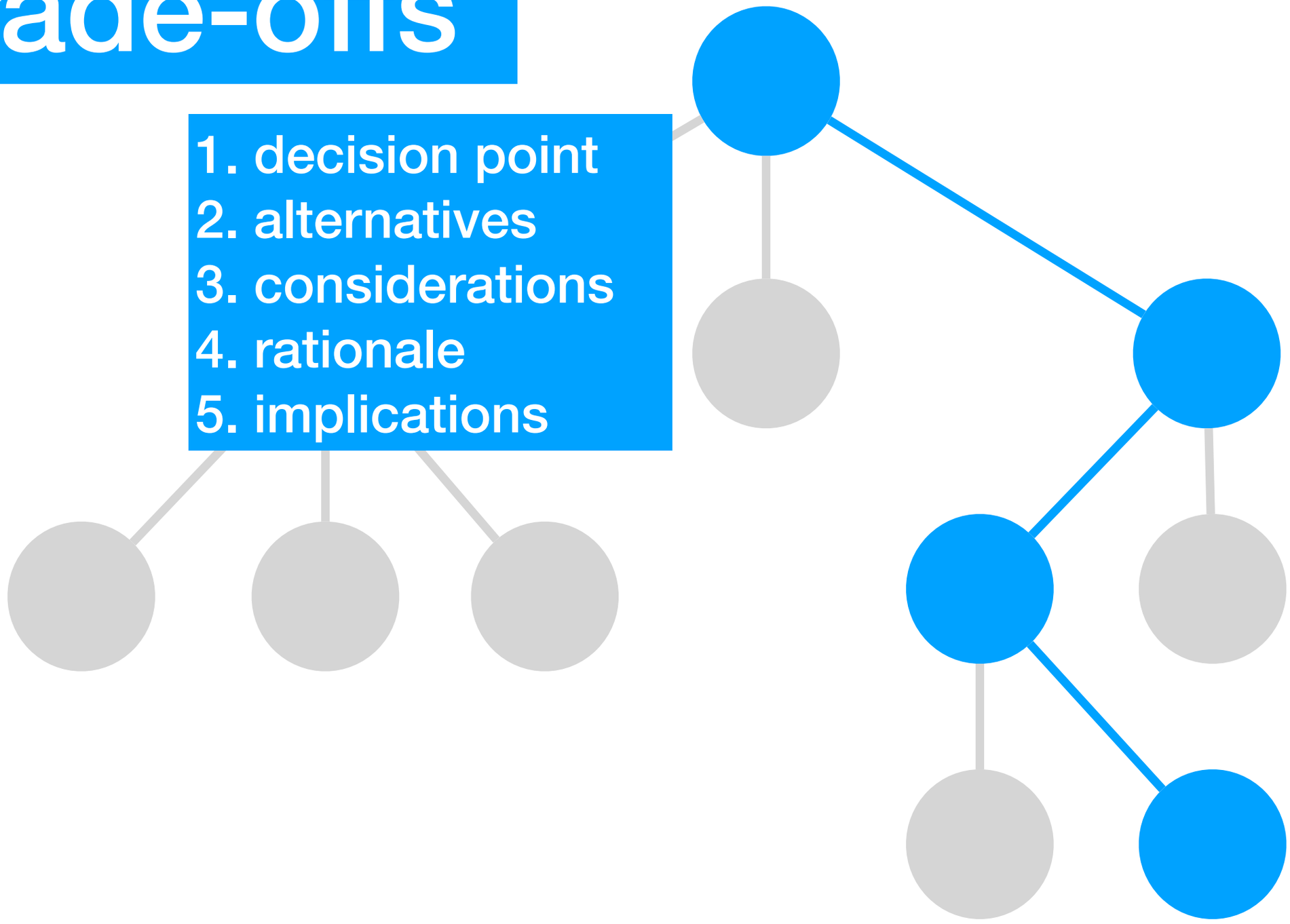
Trade-offs



Martin P. Robillard, Deeksha M. Arya, Neil A. Ernst, Jin L. C. Guo, Maxime Lamothe, Mathieu Nassif, Nicole Novielli, Alexander Serebrenik, Igor Steinmacher, Klaas-Jan Stol: Communicating Study Design Trade-offs in Software Engineering. ACM Trans. Softw. Eng. Methodol. 33(5): 112:1-112:10 (2024)

Trade-offs

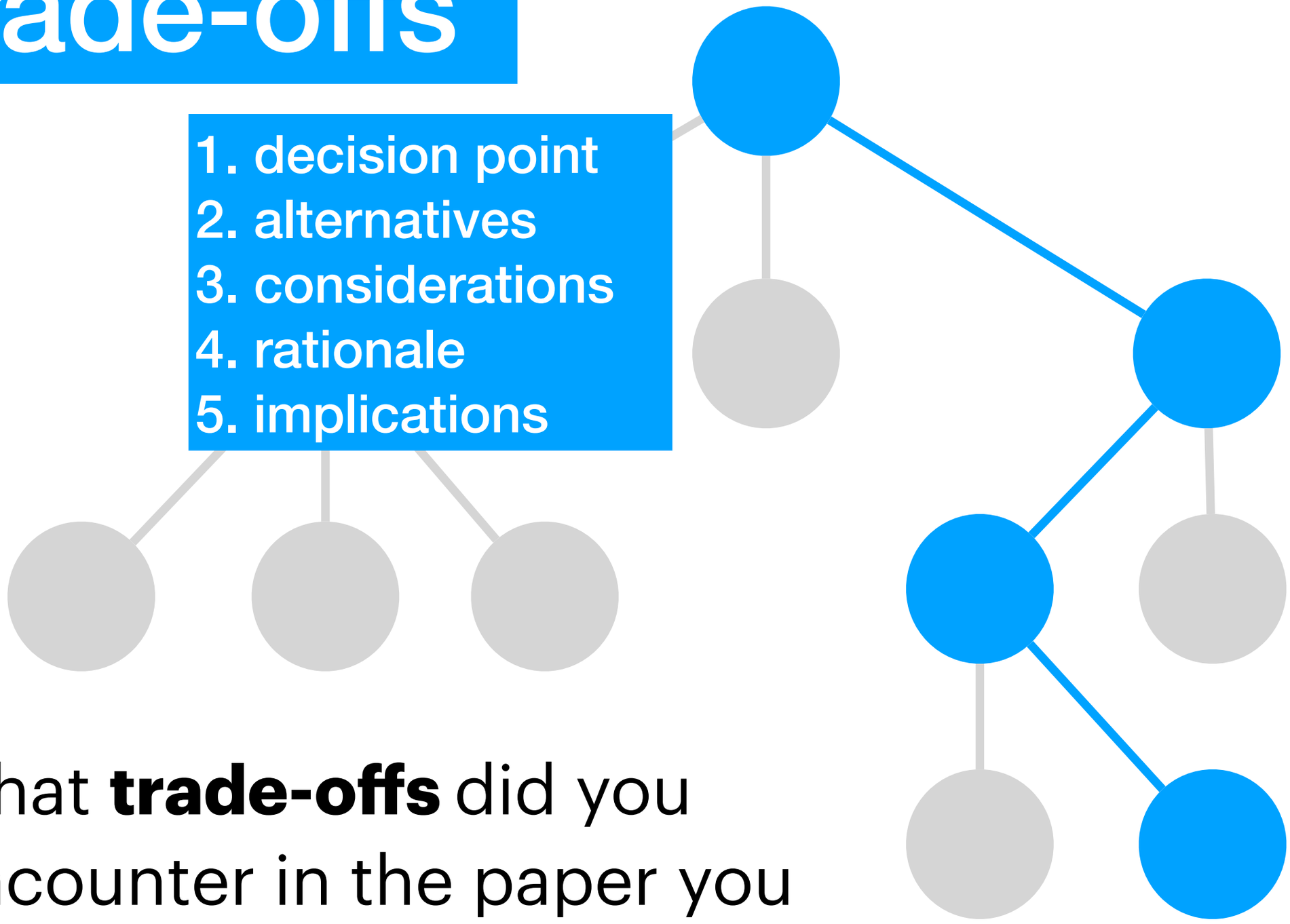
1. decision point
2. alternatives
3. considerations
4. rationale
5. implications



Martin P. Robillard, Deeksha M. Arya, Neil A. Ernst, Jin L. C. Guo, Maxime Lamothe, Mathieu Nassif, Nicole Novielli, Alexander Serebrenik, Igor Steinmacher, Klaas-Jan Stol: Communicating Study Design Trade-offs in Software Engineering. ACM Trans. Softw. Eng. Methodol. 33(5): 112:1-112:10 (2024)

Trade-offs

1. decision point
2. alternatives
3. considerations
4. rationale
5. implications



What **trade-offs** did you encounter in the paper you brought today?

Martin P. Robillard, Deeksha M. Arya, Neil A. Ernst, Jin L. C. Guo, Maxime Lamothe, Mathieu Nassif, Nicole Novielli, Alexander Serebrenik, Igor Steinmacher, Klaas-Jan Stol: Communicating Study Design Trade-offs in Software Engineering. ACM Trans. Softw. Eng. Methodol. 33(5): 112:1-112:10 (2024)

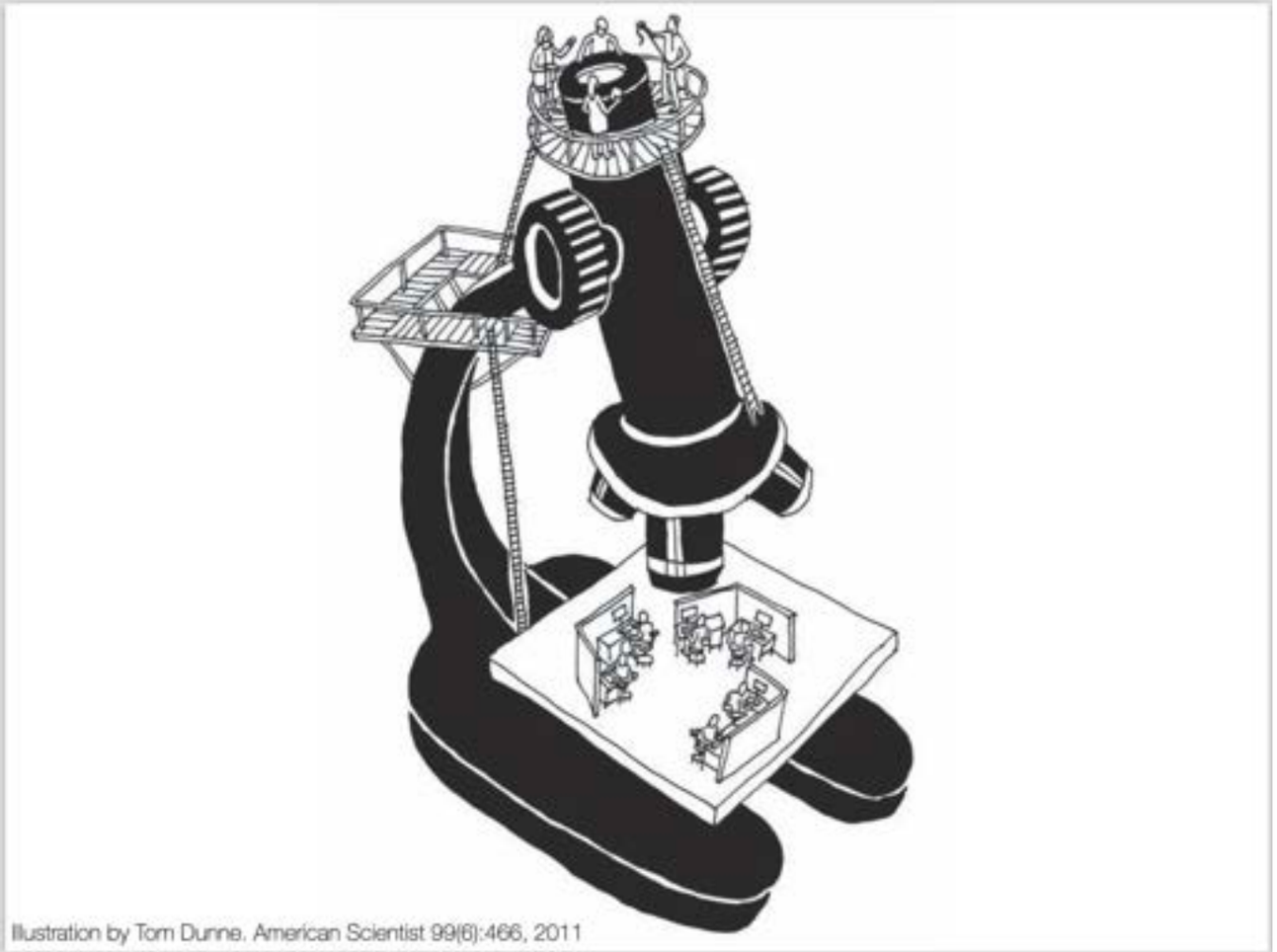
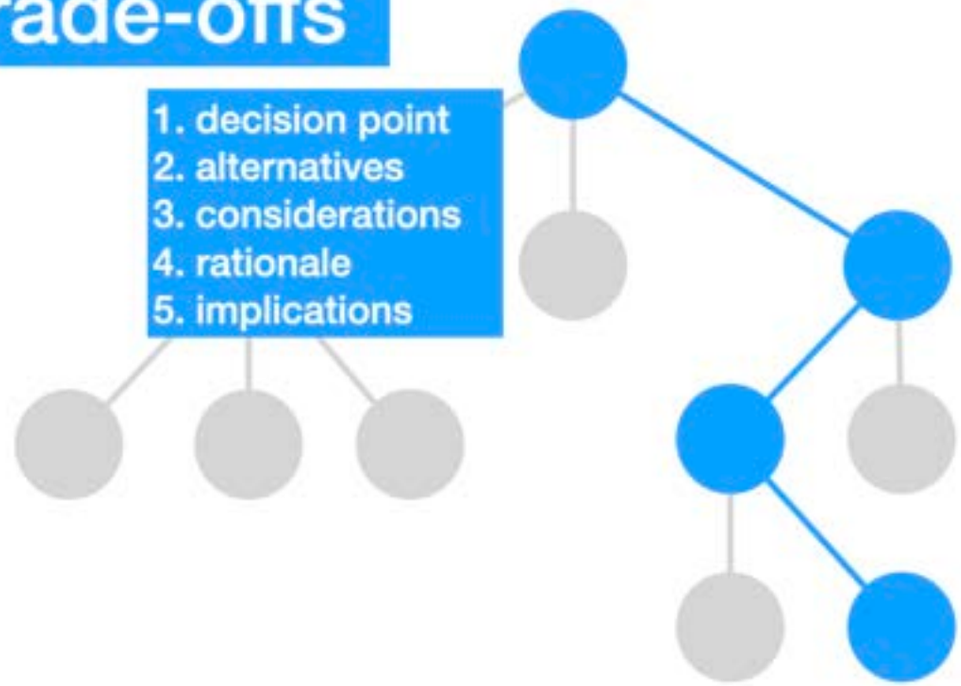


Illustration by Tom Dunne. American Scientist 99(6):466, 2011

Illustration by Tom Dunne. American Scientist 99(6):466, 2011

Trade-offs

1. decision point
2. alternatives
3. considerations
4. rationale
5. implications



Martin P. Robillard, Deeksha M. Arya, Neil A. Ernst, Jin L. C. Guo, Maxime Lamothe, Mathieu Nassif, Nicole Novielli, Alexander Serebrenik, Igor Steinmacher, Klaas-Jan Stol: Communicating Study Design Trade-offs in Software Engineering. ACM Trans. Softw. Eng. Methodol. 33(5): 112:1-112:10 (2024)

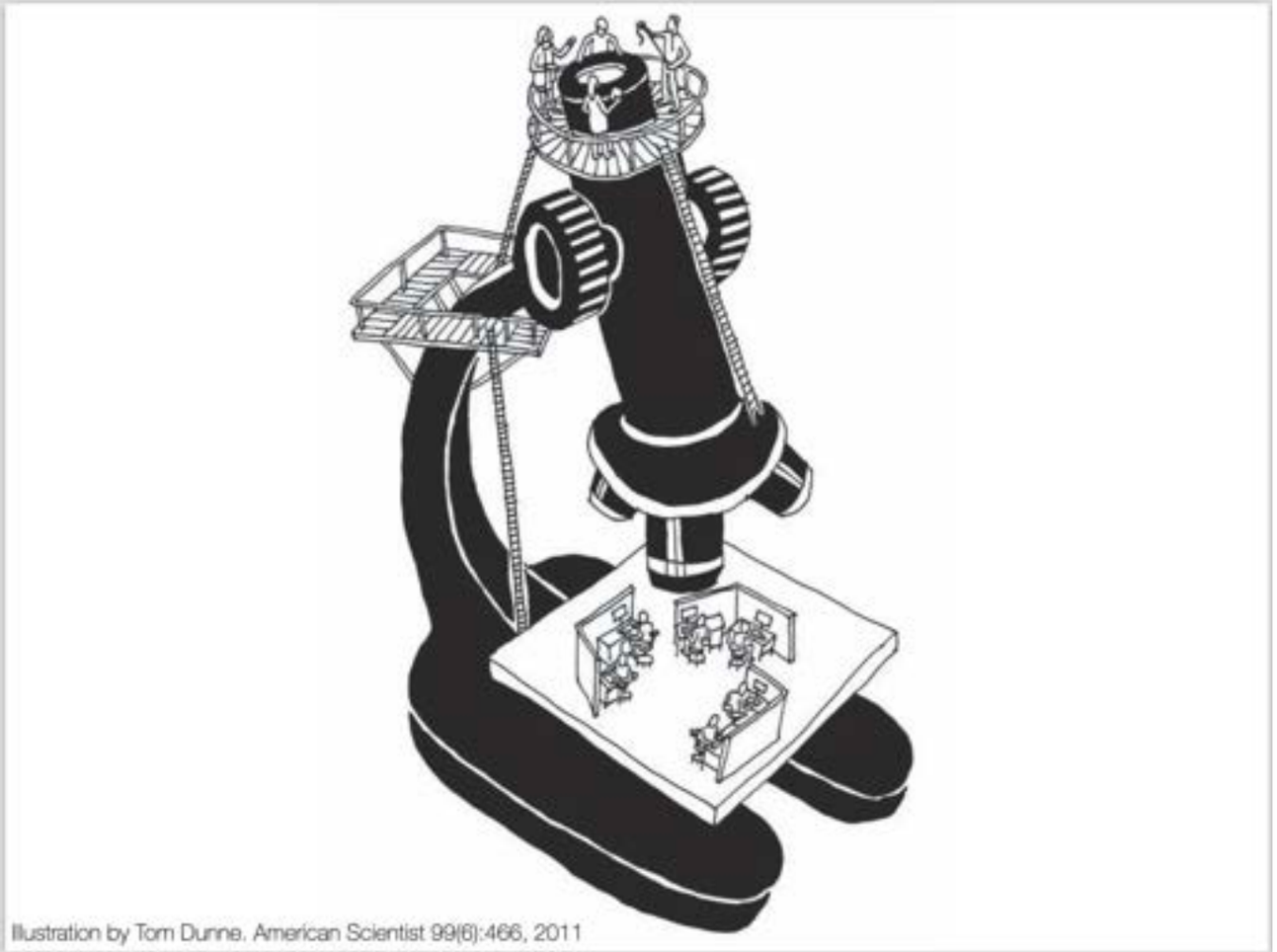
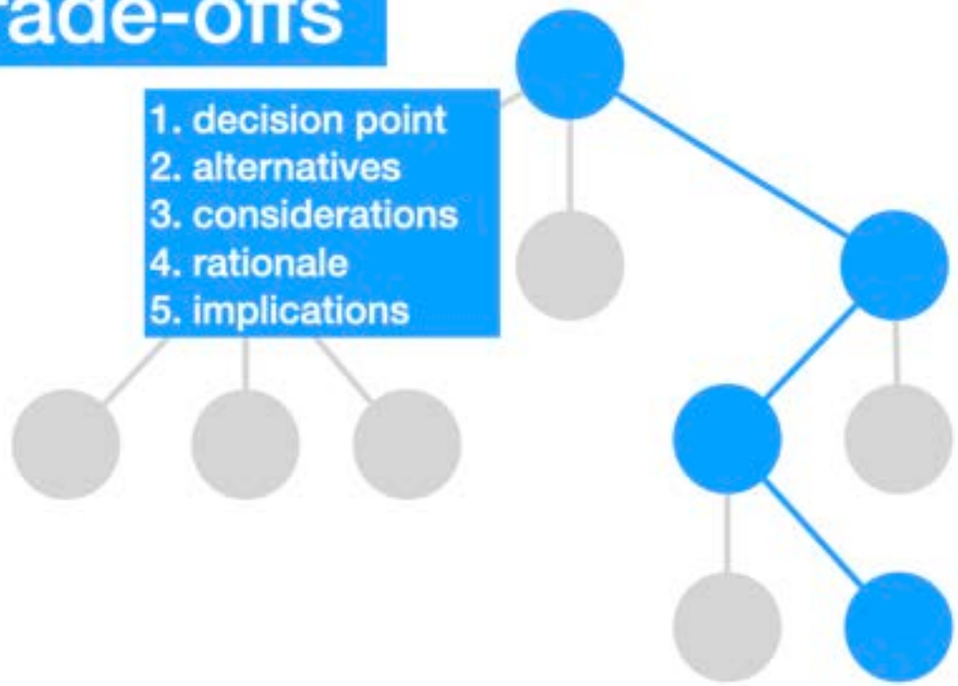


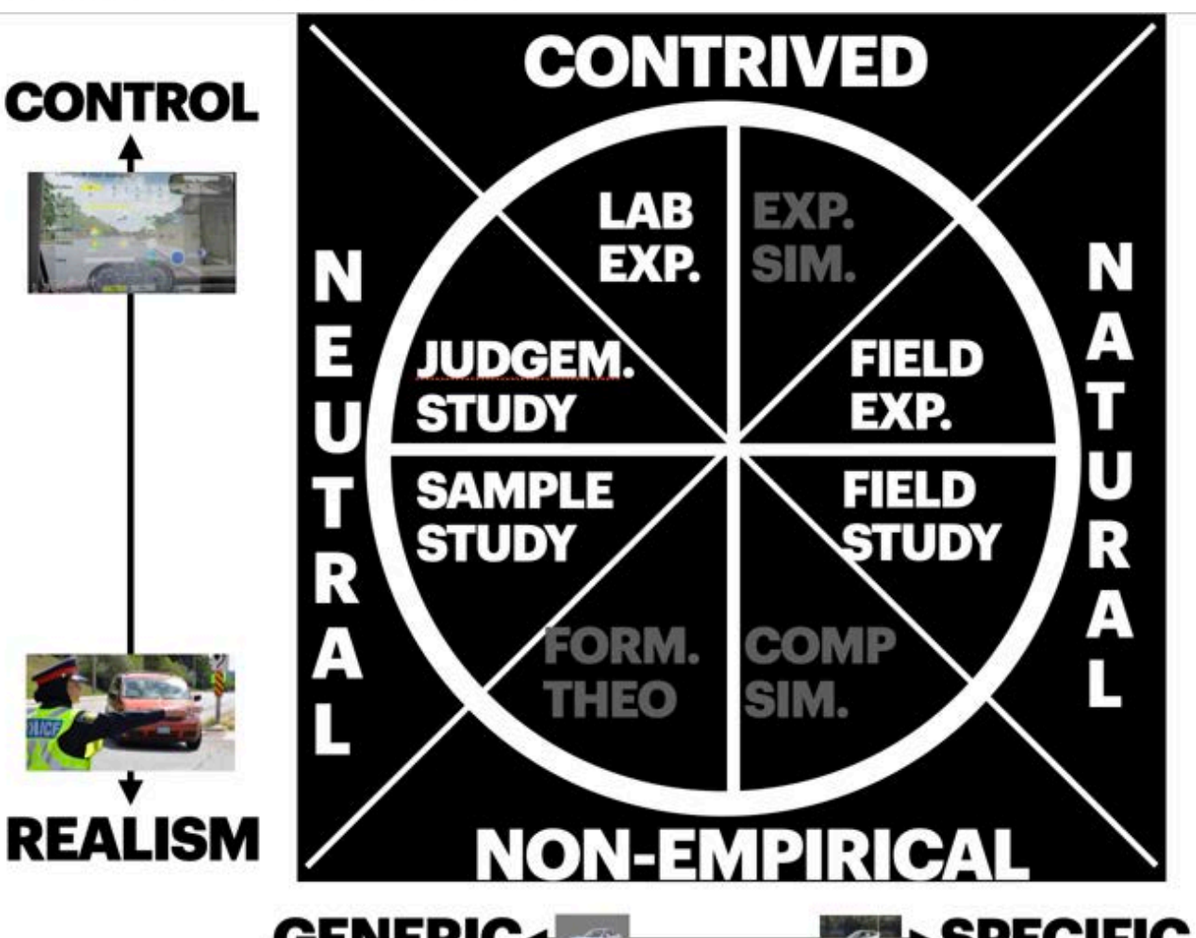
Illustration by Tom Dunne. American Scientist 99(6):466, 2011

Trade-offs

1. decision point
2. alternatives
3. considerations
4. rationale
5. implications



Martin P. Robillard, Deeksha M. Arya, Neil A. Ernst, Jin L. C. Guo, Maxime Lamothe, Mathieu Nassif, Nicole Novielli, Alexander Serebrenik, Igor Steinmacher, Klaas-Jan Stol: Communicating Study Design Trade-offs in Software Engineering. ACM Trans. Softw. Eng. Methodol. 33(5): 112:1-112:10 (2024)



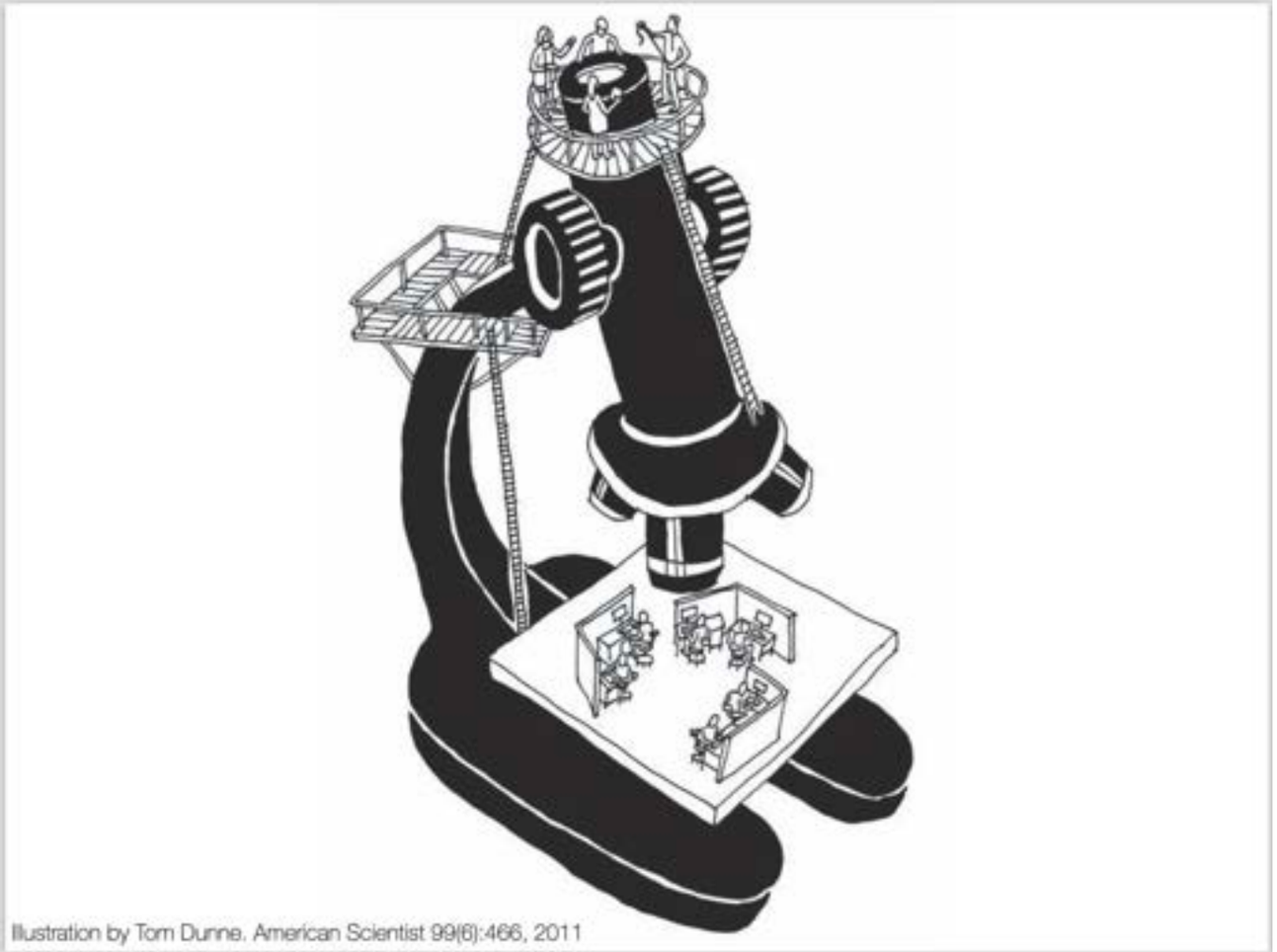
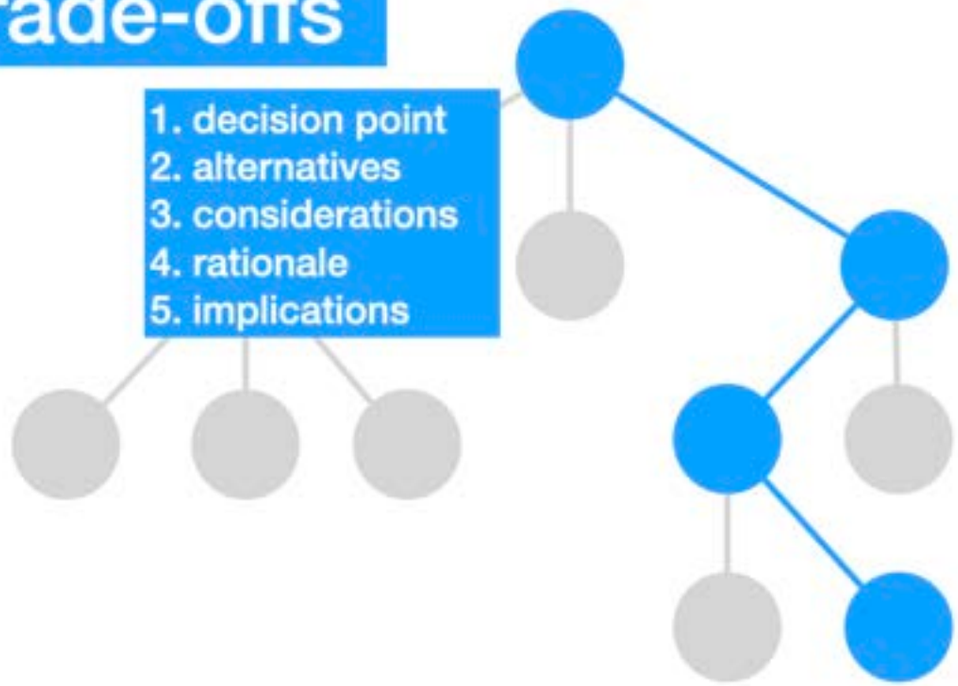
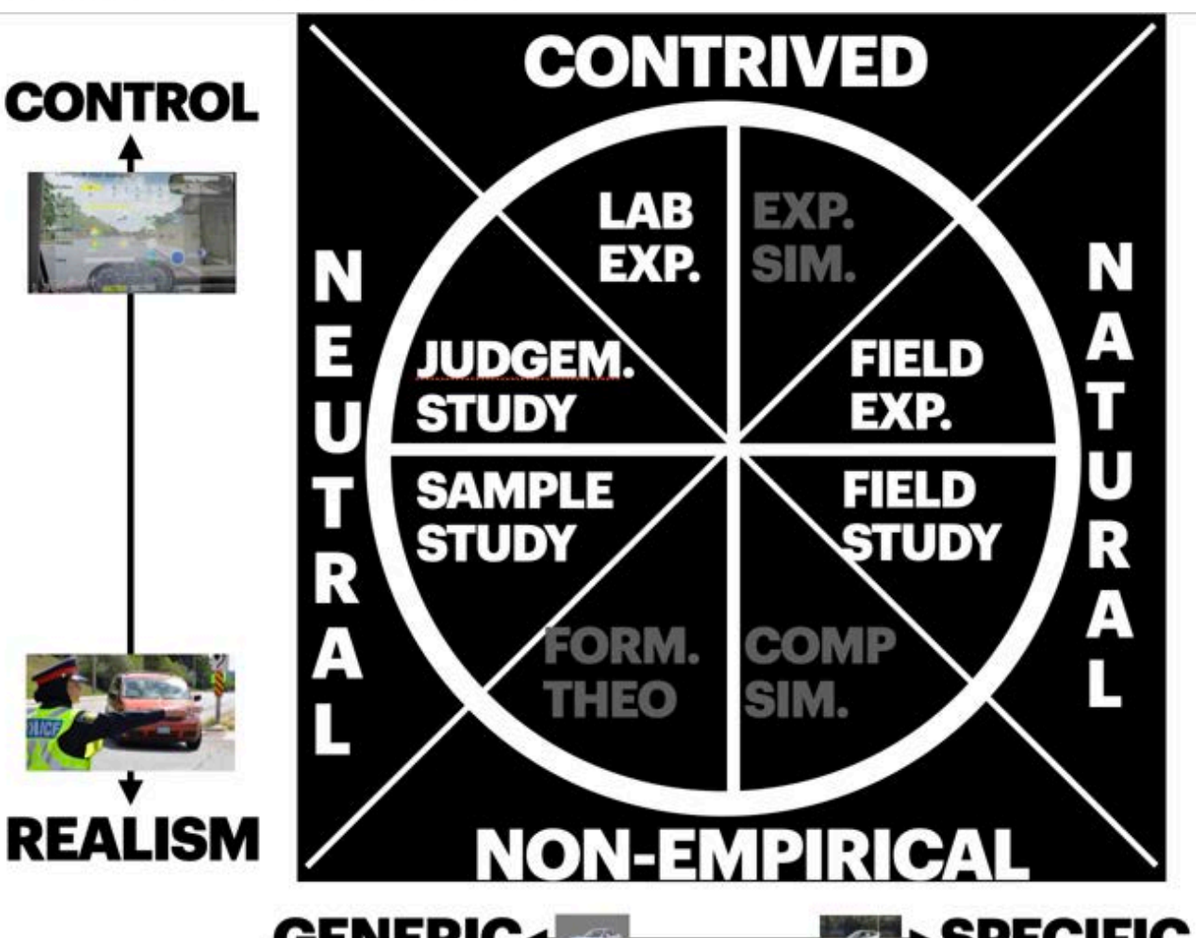
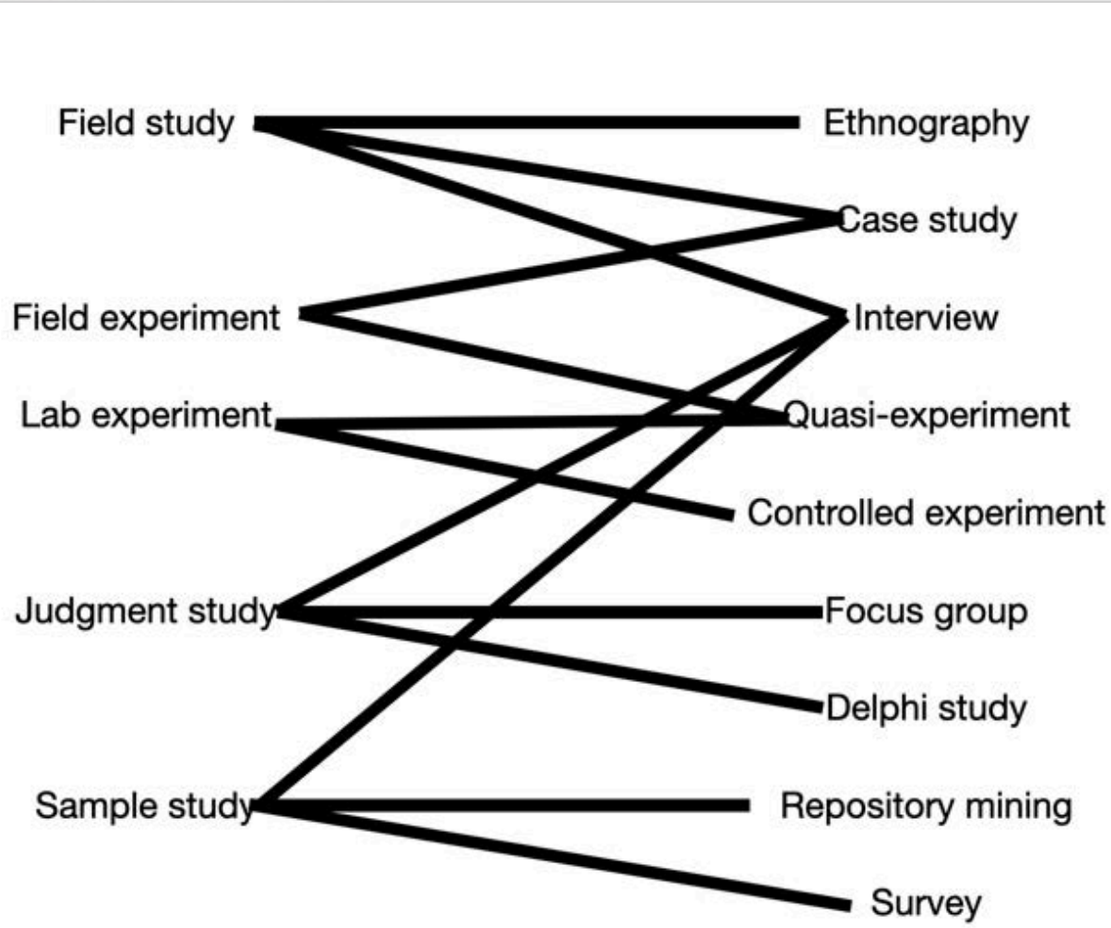


Illustration by Tom Dunne. American Scientist 99(6):466, 2011

Trade-offs

1. decision point
2. alternatives
3. considerations
4. rationale
5. implications



Martin P. Robillard, Deeksha M. Arya, Neil A. Ernst, Jin L. C. Guo, Maxime Lamothe, Mathieu Nassif, Nicole Novielli, Alexander Serebrenik, Igor Steinmacher, Klaas-Jan Stol: Communicating Study Design Trade-offs in Software Engineering. ACM Trans. Softw. Eng. Methodol. 33(5): 112:1-112:10 (2024)