NYU STERN
NEW YORK UNIVERSITY · LEONARD N. STERN SCHOOL OF BUSINESS

Occupational Exposure to AI

OECD Presentation – 15 Feb 2024

Rob Seamans – NYU Stern School of Business

There are many exciting applications for AI

- Mundane: predicting songs you like (Spotify, Pandora)
- Ground-breaking: autonomous vehicles
- Useful: Google maps, predictive typing
- Life-saving: radiology, predictive medicine
- Financial inclusion: credit worthiness using non-traditional metrics
- Workforce development: pairing skilled workers to appropriate jobs

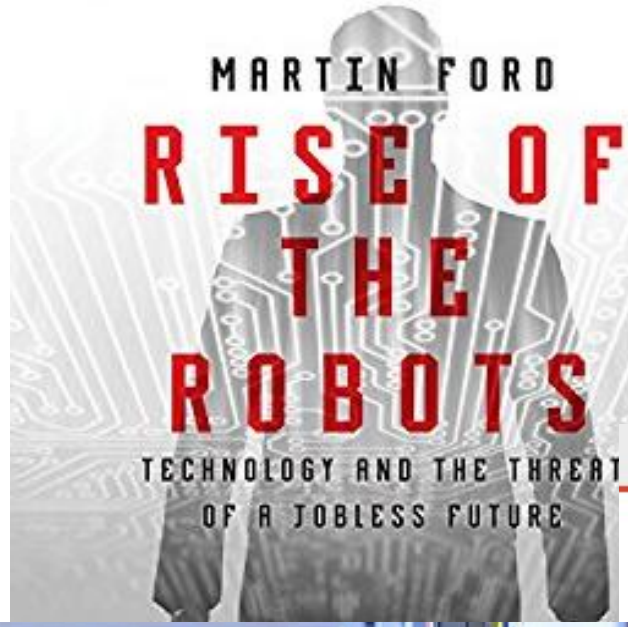
AI, robots & economic growth

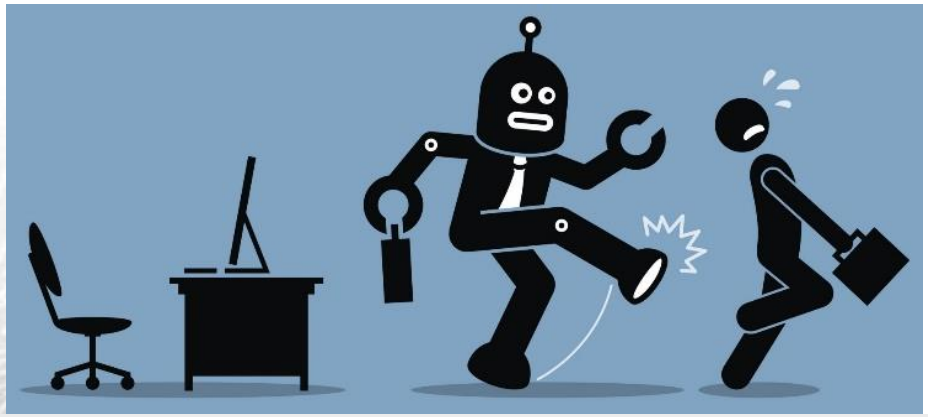
- Prior technologies have led to growth (Romer 1990)
  - Steam engines and 19thC UK productivity growth
  - Electrification and 20thC manufacturing productivity
  - IT and productivity growth
- Most recently, robots added an average of 0.4 percentage points of annual GDP growth 1993 - 2007; about one-tenth of GDP growth (Graetz and Michaels 2018)
- In principle, AI will also boost innovation and growth

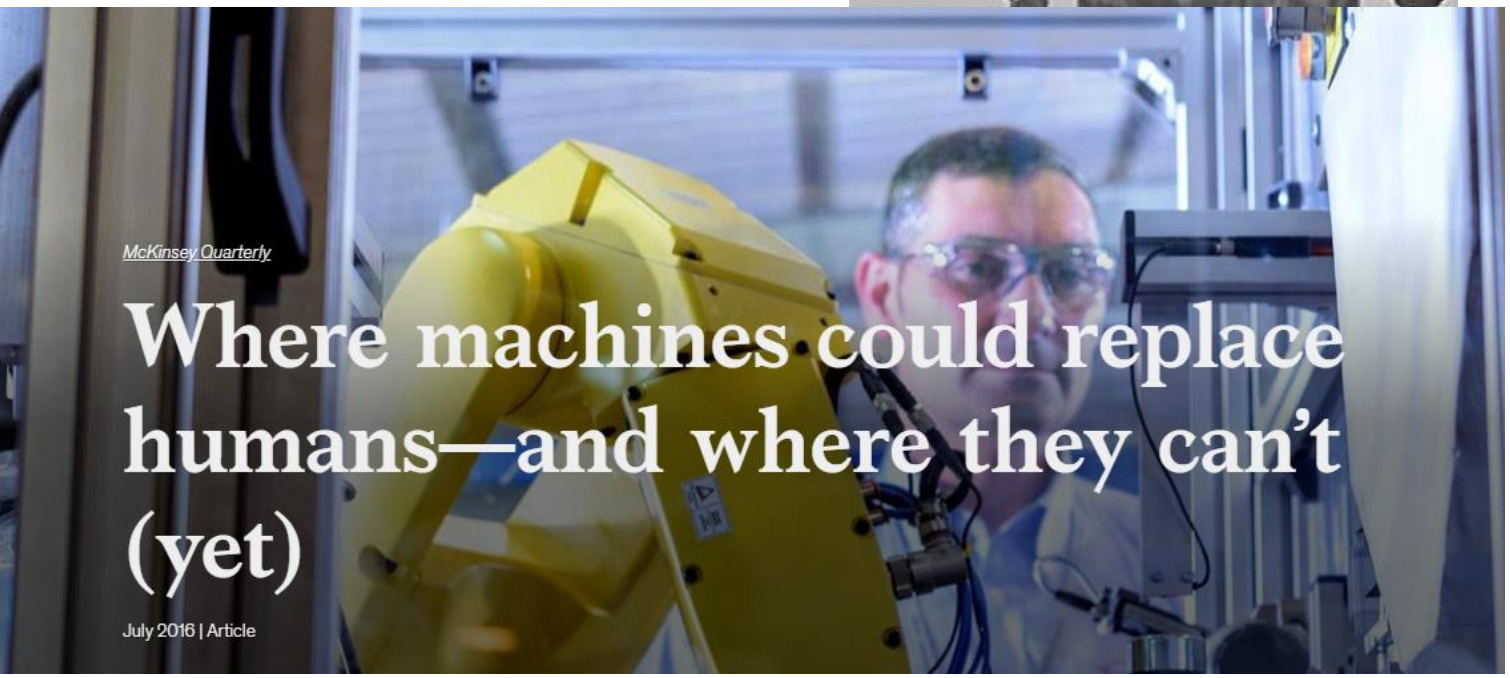
How will AI boost growth?

- There are multiple channels through which AI could affect the economy
- Make existing products and services more efficiently
  - e.g., supply chain efficiency, planting and harvesting predictions, document retrieval, etc
- Make existing products and services more cheaply
  - e.g., cost of autonomous vs human truck driver
- Create new products that consumers value
  - e.g., predictive typing, Spotify, art

AI and Robots Will Take All Our Jobs!







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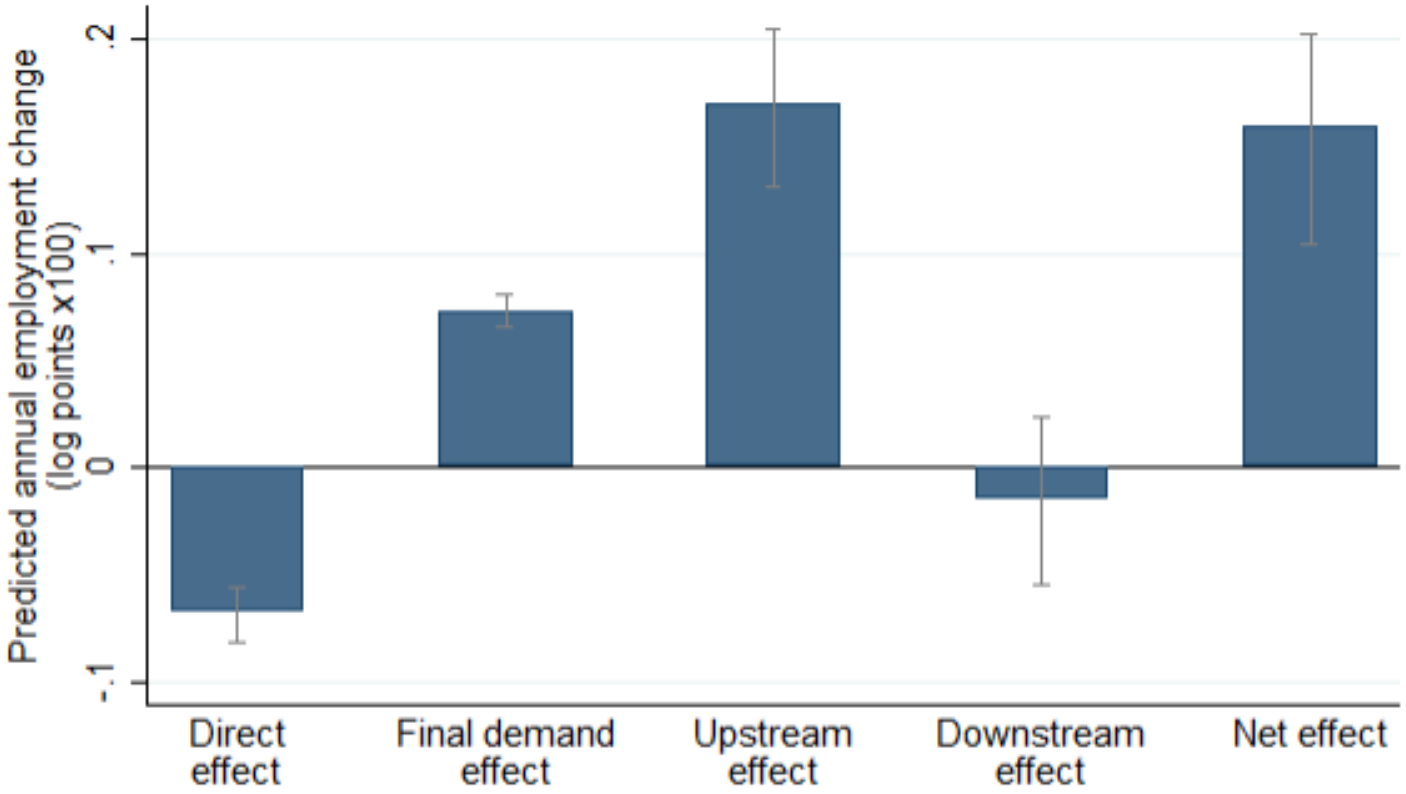
POLICY + POLITICS

Millennials vs. Robots—Who Will Win the Jobs?

Productivity growth & labor

Figure 1A: Predicted Effects of TFP Growth on Aggregate Employment, 1970 – 2007



- Takeaway: we should not be afraid of technologies that increase productivity
- But, we need to consider how technology affects different sectors, different occupations.

Source: Autor and Salomons, 2018

How to measure which jobs will be affected?

A Method to Link Advances in Artificial Intelligence to Occupational Abilities

Edward W. Felten
Manav Raj
Robert Seamans

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VOL. 108, MAY 2018
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How will Language Modelers like ChatGPT Affect Occupations and Industries?

36 Pages
Posted: 6 Mar 2023
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Date Written: March 1, 2023

SSRN

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Occupational Heterogeneity in Exposure to Generative AI

69 Pages
Posted: 19 Apr 2023

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STRATEGIC MANAGEMENT JOURNAL

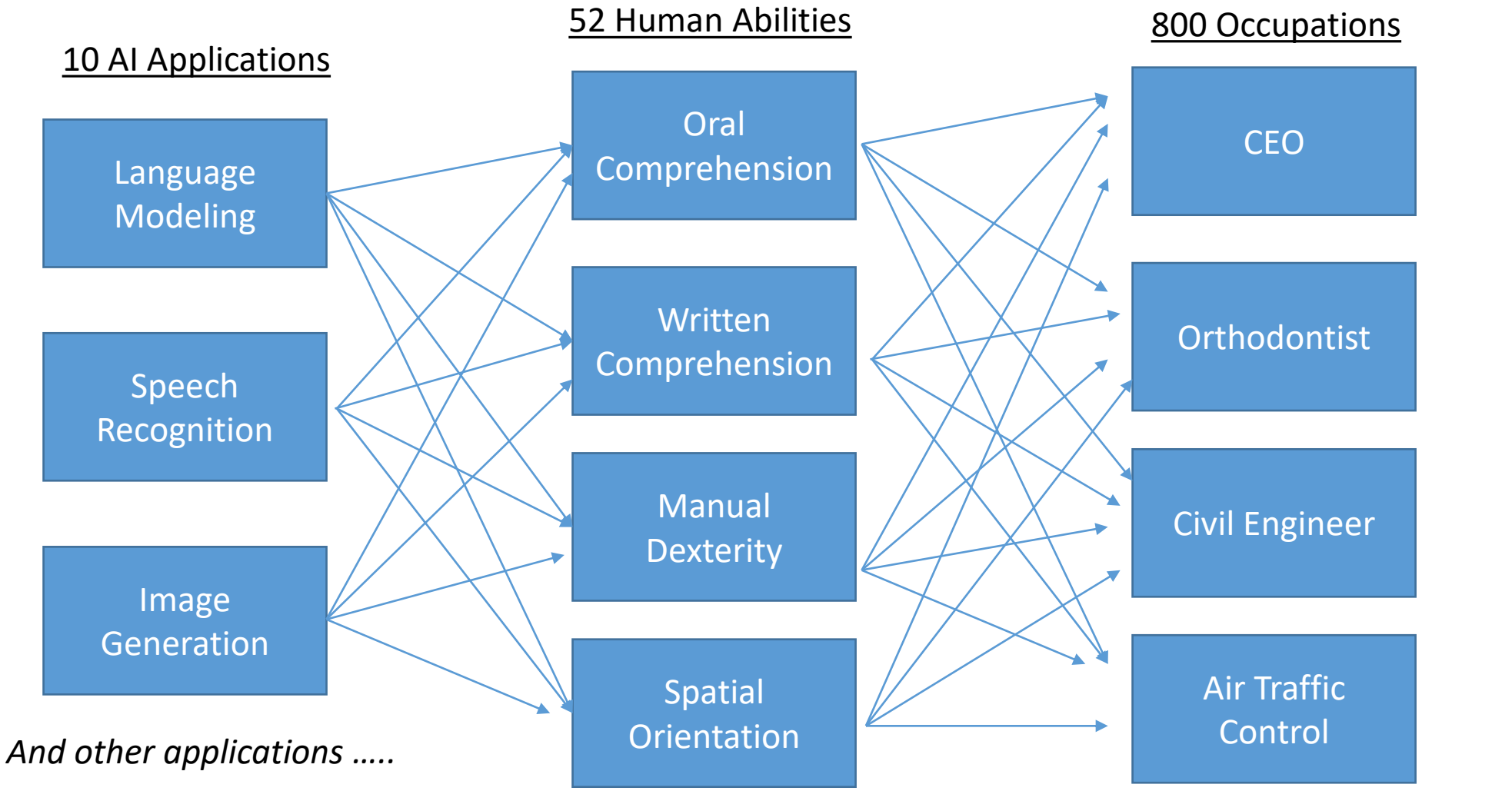
RESEARCH ARTICLE | Open Access

Occupational, industry, and geographic exposure to artificial intelligence: A novel dataset and its potential uses

Edward Felten, Manav Raj, Robert Seamans

First published: 28 April 2021 | https://doi.org/10.1002/smj.3286 | Citations: 3

High Level View of the Methodology



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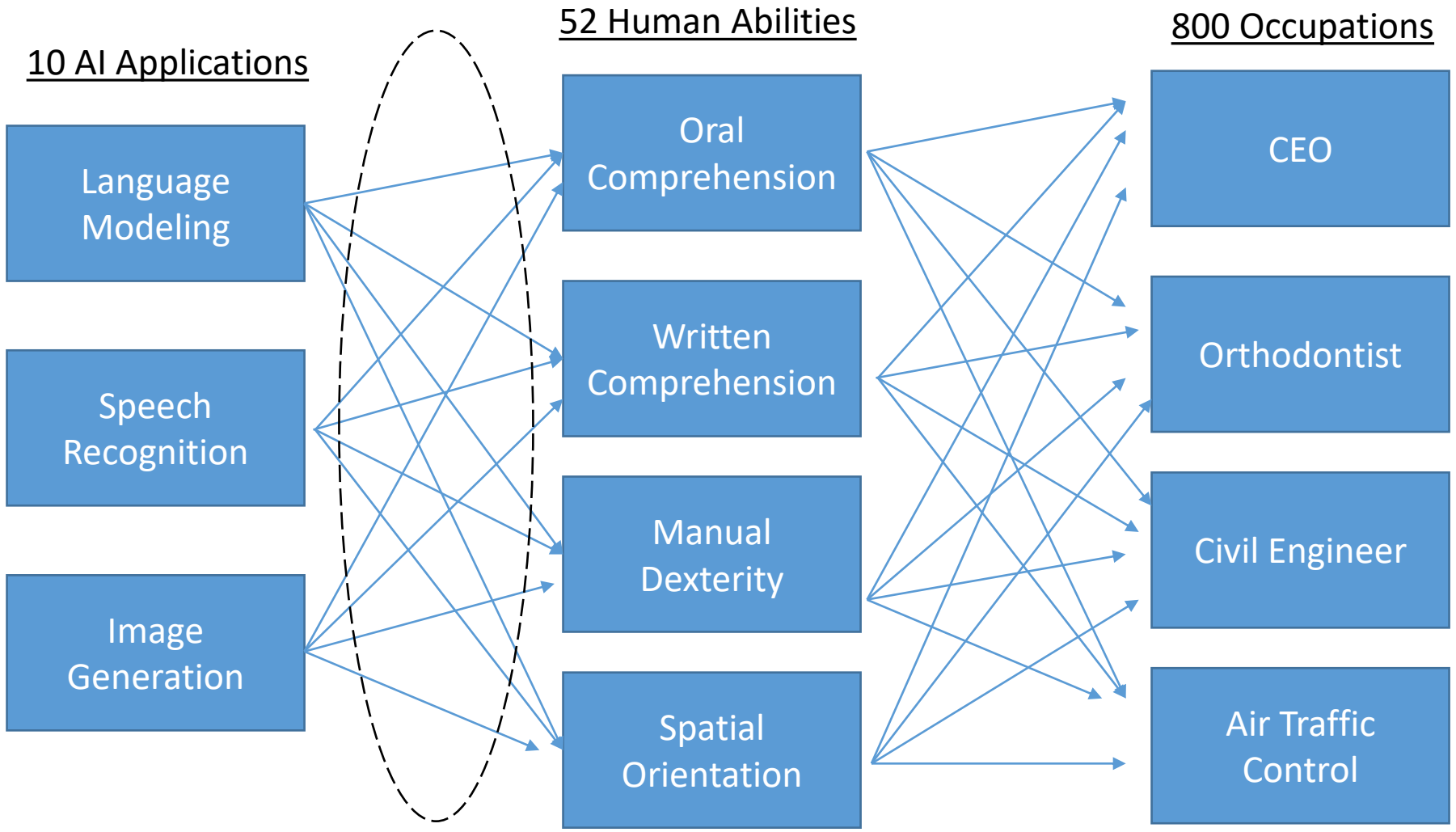
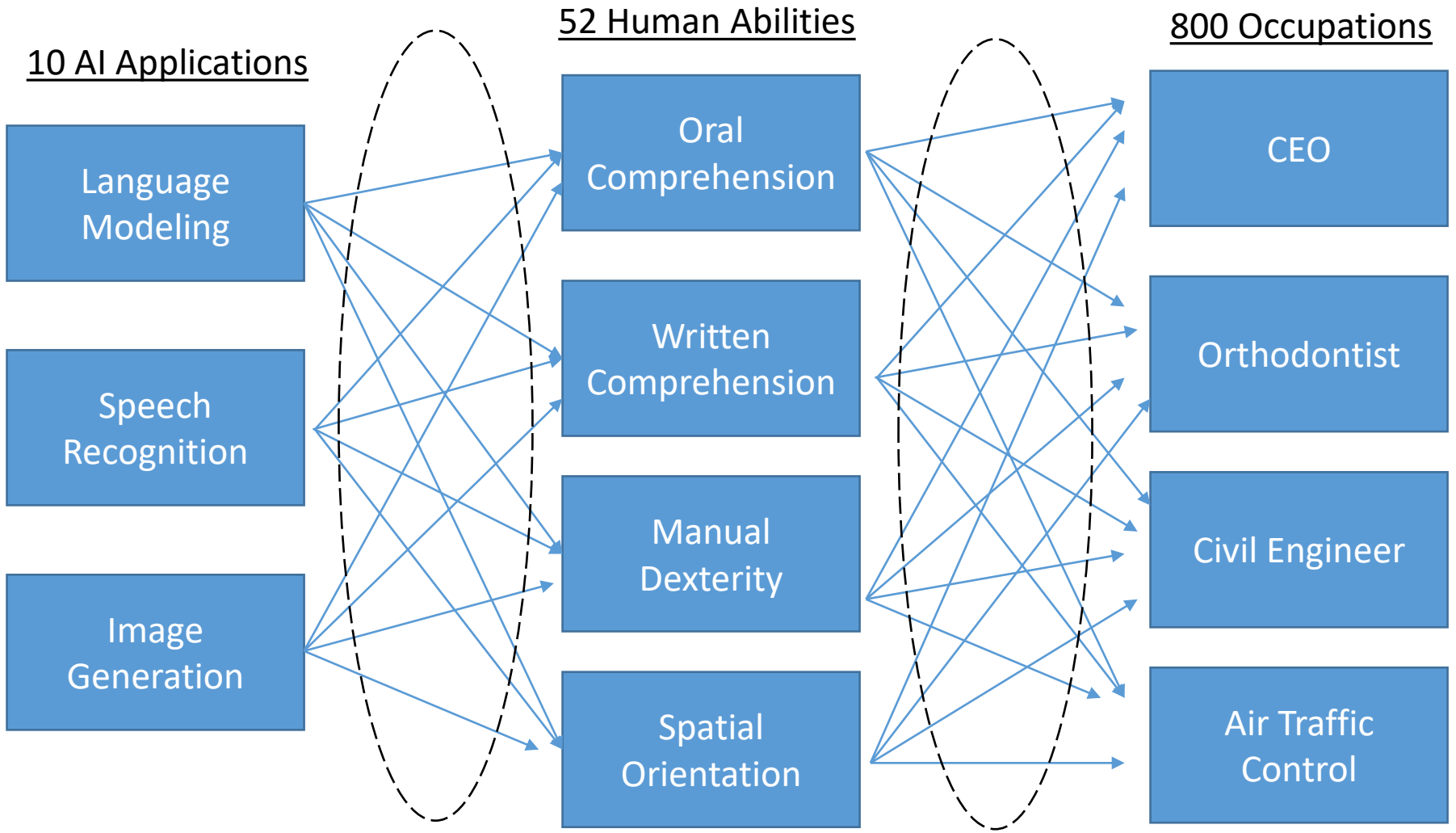


Our methodology (crowdsourcing)

High Level View of the Methodology



Our methodology (crowdsourcing)

*Weights from O*NET (U.S Bureau of Labor & Statistics*

Comparison between CEO and Dentist

O*NET-SOC Code	Title	Element Name	Data Value
11-1011.00	Chief Executives	Oral Comprehension	4.88
11-1011.00	Chief Executives	Written Comprehension	4.62
11-1011.00	Chief Executives	Oral Expression	5
11-1011.00	Chief Executives	Written Expression	4.62
11-1011.00	Chief Executives	Fluency of Ideas	4.62
11-1011.00	Chief Executives	Originality	4.25
11-1011.00	Chief Executives	Problem Sensitivity	5
11-1011.00	Chief Executives	Deductive Reasoning	5
11-1011.00	Chief Executives	Inductive Reasoning	5
11-1011.00	Chief Executives	Information Ordering	4
11-1011.00	Chief Executives	Category Flexibility	4.12
11-1011.00	Chief Executives	Mathematical Reasoning	3.88
11-1011.00	Chief Executives	Number Facility	4.12
11-1011.00	Chief Executives	Memorization	3.12
11-1011.00	Chief Executives	Speed of Closure	3.38
11-1011.00	Chief Executives	Flexibility of Closure	3.5
11-1011.00	Chief Executives	Perceptual Speed	2.88
11-1011.00	Chief Executives	Spatial Orientation	0.12
11-1011.00	Chief Executives	Visualization	3.88
11-1011.00	Chief Executives	Selective Attention	3.12
11-1011.00	Chief Executives	Time Sharing	2.88
11-1011.00	Chief Executives	Arm-Hand Steadiness	0
11-1011.00	Chief Executives	Manual Dexterity	0

O*NET-SOC Cod	Title	Element Name	Data Val
29-1023.00	Orthodontists	Oral Comprehension	4.12
29-1023.00	Orthodontists	Written Comprehension	4
29-1023.00	Orthodontists	Oral Expression	4
29-1023.00	Orthodontists	Written Expression	4
29-1023.00	Orthodontists	Fluency of Ideas	3.12
29-1023.00	Orthodontists	Originality	3.25
29-1023.00	Orthodontists	Problem Sensitivity	4.88
29-1023.00	Orthodontists	Deductive Reasoning	4
29-1023.00	Orthodontists	Inductive Reasoning	4
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29-1023.00	Orthodontists	Number Facility	2.62
29-1023.00	Orthodontists	Memorization	2.5
29-1023.00	Orthodontists	Speed of Closure	2.38
29-1023.00	Orthodontists	Flexibility of Closure	3
29-1023.00	Orthodontists	Perceptual Speed	2.88
29-1023.00	Orthodontists	Spatial Orientation	0
29-1023.00	Orthodontists	Visualization	3.5
29-1023.00	Orthodontists	Selective Attention	3.38
29-1023.00	Orthodontists	Time Sharing	2.88
29-1023.00	Orthodontists	Arm-Hand Steadiness	3.75
29-1023.00	Orthodontists	Manual Dexterity	3.88

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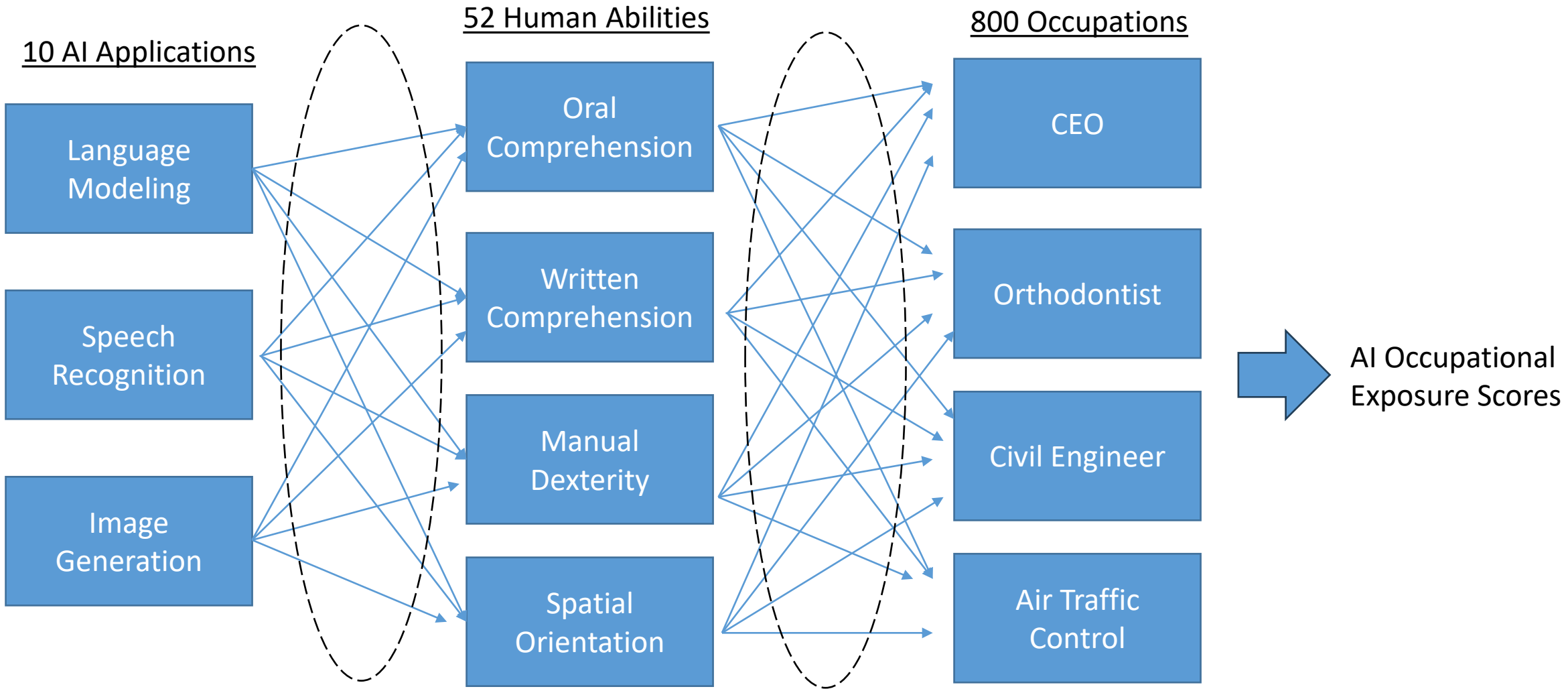

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Validation

- We validate our methodology and measure using several approaches:
  - Correlations across different sub-matrices that consider: 1) only individuals who have completed graduate studies; and 2) individuals whose highest degree is from computer science and engineering.
  - A qualitative check of the most and least affected occupations
  - In-depth comparison of several occupations
  - Correlation with Burning Glass data on AI skills required in a job

mTurk Survey Correlations

	Correlation Coefficient between Subsample and the Full Sample		
EFF AI Categories	Graduate Degree	Work in Computer Science or Engineering	Graduate Degree and work in Computer Science or Engineering
Abstract Strategy Games	0.97	0.92	0.89
Real-Time Video Games	0.96	0.87	0.80
Image Recognition	0.97	0.94	0.91
VQA	0.98	0.90	0.88
Image Generation	0.98	0.94	0.91
Reading Comprehension	0.99	0.95	0.93
Language Modeling	0.99	0.96	0.95
Translation	0.99	0.95	0.92
Speech Recognition	0.99	0.94	0.91

Highest, Lowest Scoring Occupations

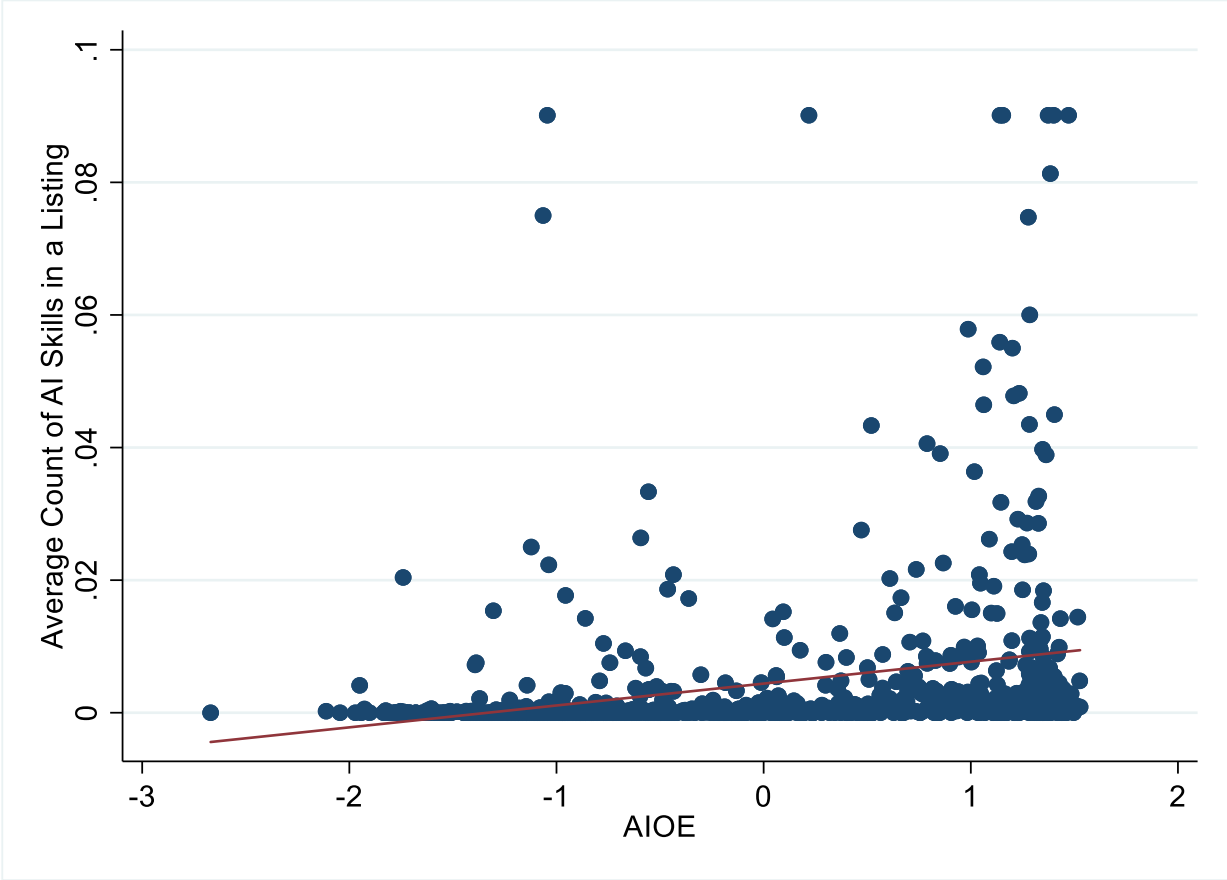
TABLE 2 Occupations with the highest and lowest AIOE measures

Rank	Highest scoring	Lowest scoring
1	Genetic counselors	Dancers
2	Financial examiners	Fitness trainers and aerobics instructors
3	Actuaries	Helpers—painters, paperhangers, plasterers, and stucco masons
4	Purchasing agents, except wholesale, retail, and farm products	Reinforcing iron and rebar workers
5	Budget analysts	Pressers, textile, garment, and related materials
6	Judges, magistrate judges, and magistrates	Helpers—Brickmasons, Blockmasons, stonemasons, and tile and marble setters
7	Procurement clerks	Dining room and cafeteria attendants and bartender helpers
8	Accountants and auditors	Fence erectors
9	Mathematicians	Helpers—roofers
10	Judicial law clerks	Slaughterers and meat packers
11	Education administrators, postsecondary	Landscaping and Groundskeeping workers
12	Clinical, counseling, and school psychologists	Athletes and sports competitors
13	Financial managers	Fallers
14	Compensation, benefits, and job analysis specialists	Structural iron and steel workers
15	Credit authorizers, checkers, and clerks	Cement masons and concrete finishers
16	History teachers, postsecondary	Terrazzo workers and finishers
17	Geographers	Rock splitters, quarry
18	Epidemiologists	Plasterers and stucco masons
19	Management analysts	Brickmasons and Blockmasons
20	Arbitrators, mediators, and conciliators	Roofers

Surgeons vs. meat slaughters

- “Surgeons” -- 52nd percentile of AIOE score
- “Slaughterers and meat packers” -- 2nd percentile of AIOE score
- Both require deft physical manipulation of human or animal tissue. Both require similar physical abilities (manual dexterity, finger dexterity, and arm-hand steadiness)
- But, cognitive abilities related to problem solving (problem sensitivity, deductive and inductive reasoning, flexibility of closure, and information ordering) are important for surgeons but not slaughterers

Our AI Score and Burning Glass AI Skills

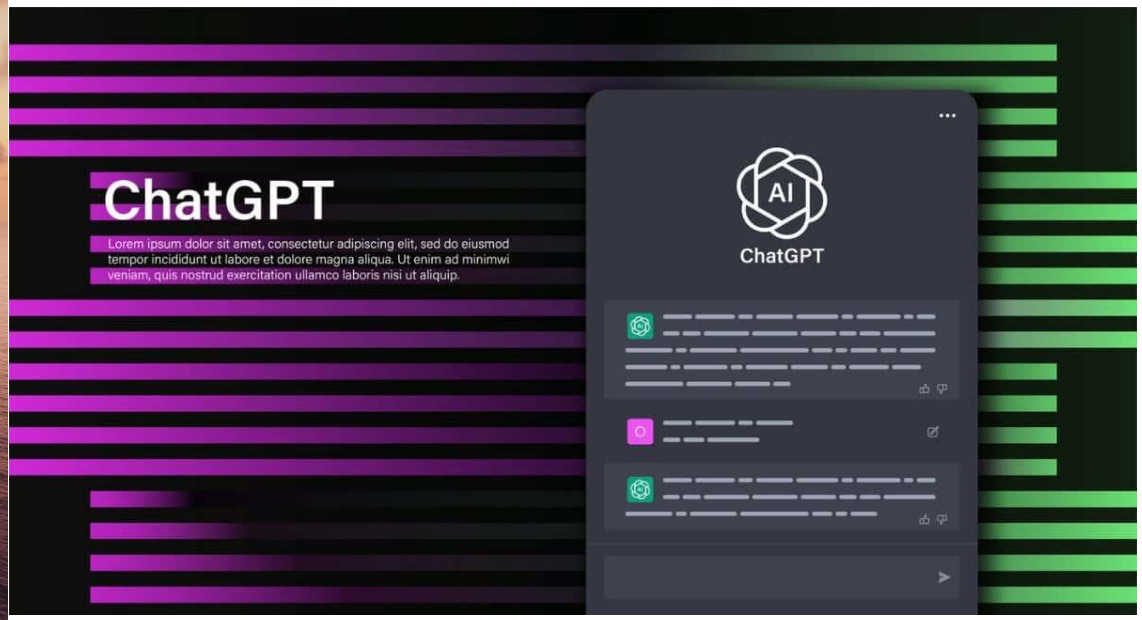


Potential of the Methodology

- The flexibility of our methodology offers the potential for variety of uses:
  - It can be updated as technology advances, new applications of AI emerge, or occupational definitions change.
  - It can be taken from the occupation-level to the industry-level or geographic-level using publicly available data, or to the firm level using data on occupations in the firm.
  - It can be used as a simulation tool to preview how future advances in AI or in categories of AI may affect occupations, industries, or geographies.

Fast Forward to 2022/2023

- Dramatic advances in image generation (Dall E-2, September 2022) and language modeling (ChatGPT, November 2022)



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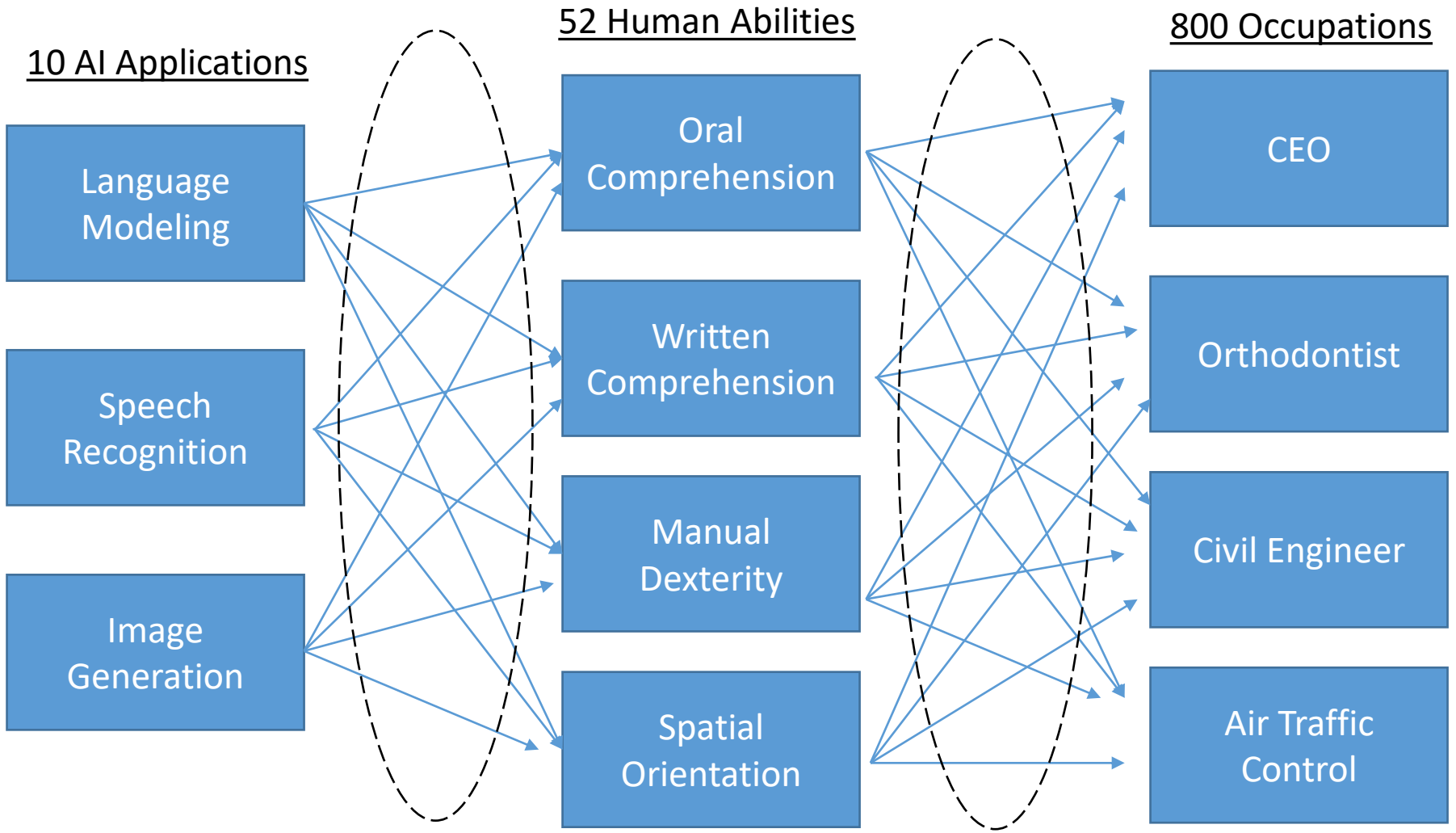
Updating the Methodology for Recent Advances



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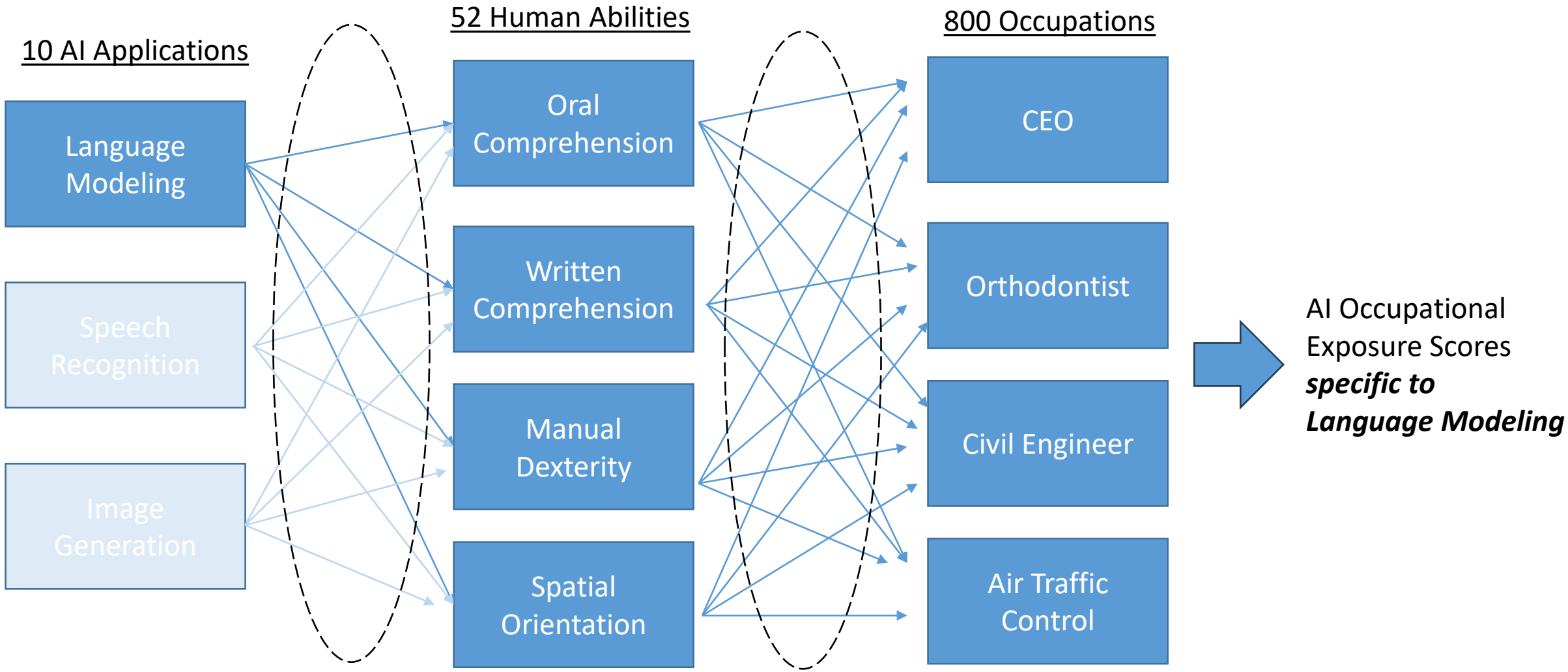


Our methodology (crowdsourcing)

*Weights from O*NET (U.S Bureau of Labor & Statistics*

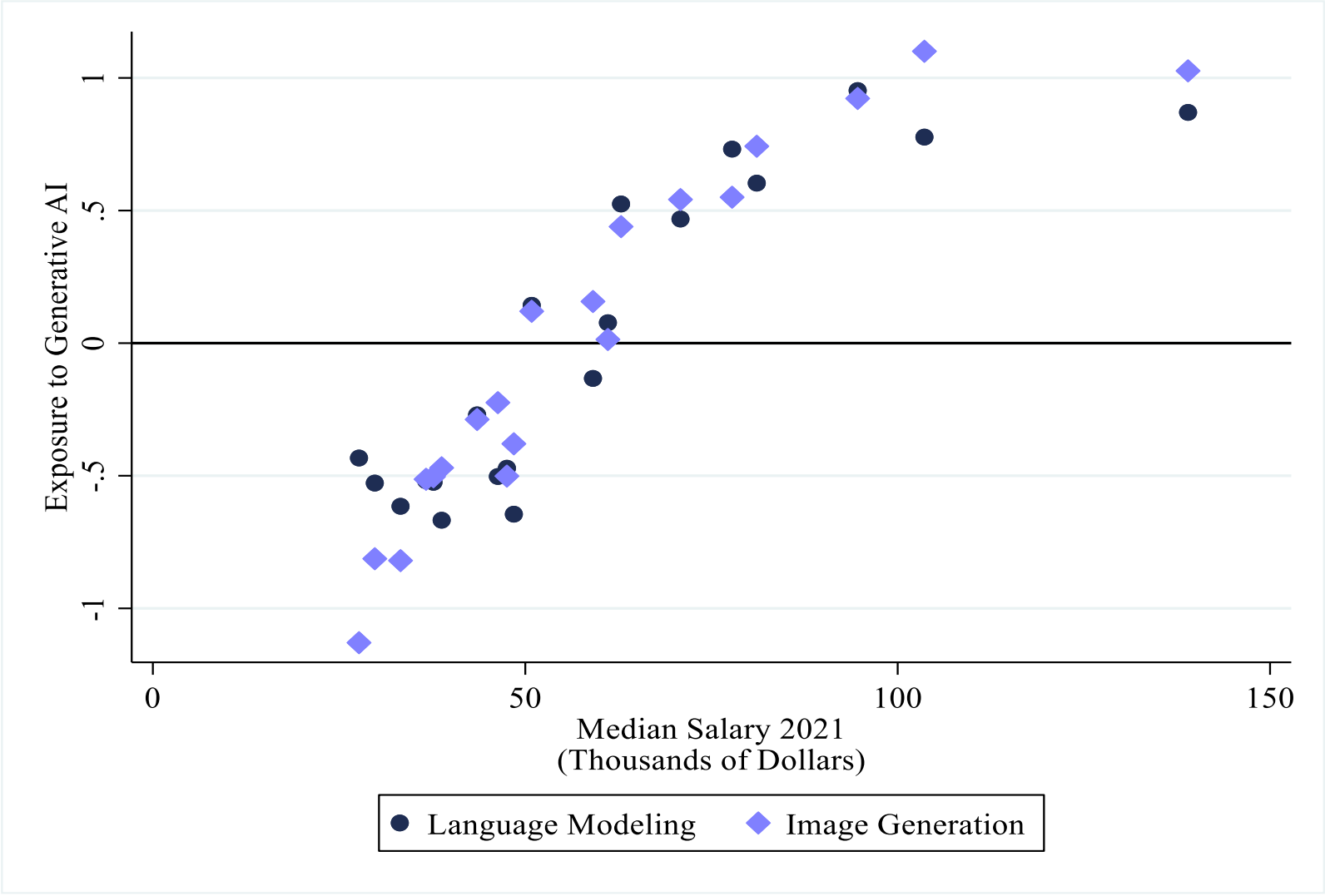
Occupations: Language Modeling & Image Generation

Rank	Language Modeling AIOE	Image Generation AIOE
1	Telemarketers	Interior Designers
2	English Language and Literature Teachers, Postsecondary	Architects, Except Landscape and Naval
3	Foreign Language and Literature Teachers, Postsecondary	Chemical Engineers
4	History Teachers, Postsecondary	Art Directors
5	Law Teachers, Postsecondary	Astronomers
6	Philosophy and Religion Teachers, Postsecondary	Mechanical Drafters
7	Sociology Teachers, Postsecondary	Mining and Geological Engineers, Incl Mining Safety Engineers
8	Political Science Teachers, Postsecondary	Civil Engineers
9	Criminal Justice and Law Enforcement Teachers, Postsecondary	Commercial and Industrial Designers
10	Sociologists	Film and Video Editors
11	Social Work Teachers, Postsecondary	Graphic Designers
12	Psychology Teachers, Postsecondary	Mathematicians
13	Communications Teachers, Postsecondary	Social Scientists and Related Workers, All Other
14	Political Scientists	Architectural and Civil Drafters
15	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	Air Traffic Controllers
16	Arbitrators, Mediators, and Conciliators	Environmental Engineers
17	Judges, Magistrate Judges, and Magistrates	Construction Managers
18	Geography Teachers, Postsecondary	Multimedia Artists and Animators
19	Library Science Teachers, Postsecondary	Desktop Publishers
20	Clinical, Counseling, and School Psychologists	Statistical Assistants

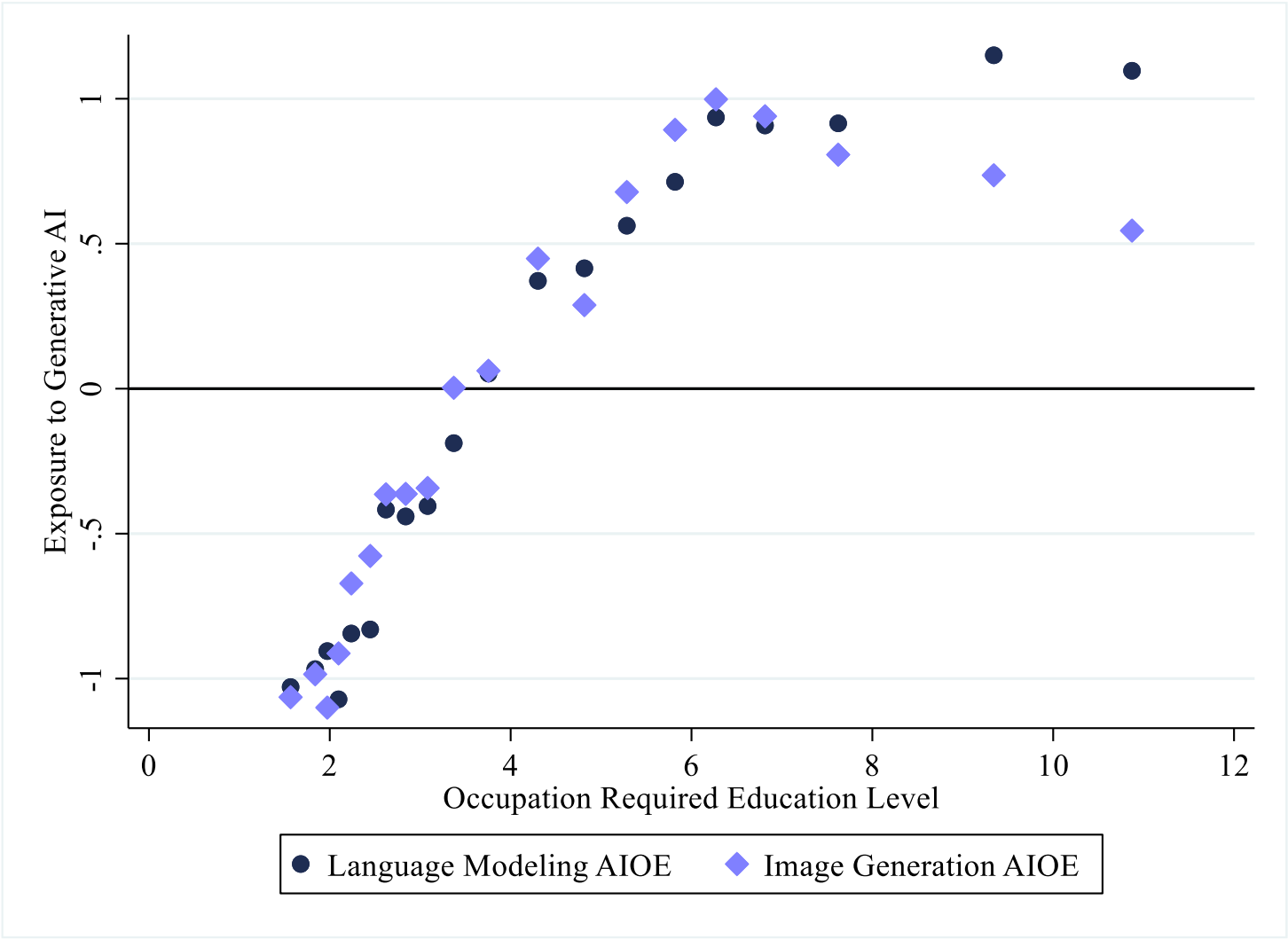
Industries: Language Modeling & Image Generation

Rank	Language Modeling	Image Generation
1	Legal Services	Architectural, Engineering, and Related Services
2	Securities, Commodity Contracts, and Other Financial Investments	Specialized Design Services
3	Agencies, Brokerages, and Other Insurance Related Activities	Accounting, Tax Preparation, Bookkeeping, and Payroll Services
4	Insurance and Employee Benefit Funds	Scientific Research and Development Services
5	Nondepository Credit Intermediation	Software Publishers
6	Agents and Managers for Artists, Athletes, Entertainers, and Others	Computer and Peripheral Equipment Manufacturing
7	Insurance Carriers	Computer Systems Design and Related Services
8	Other Investment Pools and Funds	Insurance and Employee Benefit Funds
9	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	Legal Services
10	Business Support Services	Securities, Commodity Contracts, and Other Financial Investments
11	Software Publishers	Management, Scientific, and Technical Consulting Services
12	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	Insurance Carriers
13	Business Schools and Computer and Management Training	Other Investment Pools and Funds
14	Credit Intermediation and Related Activities	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)
15	Grantmaking and Giving Services	Radio and Television Broadcasting
16	Travel Arrangement and Reservation Services	Monetary Authorities-Central Bank
17	Junior Colleges	Other Information Services
18	Computer Systems Design and Related Services	Data Processing, Hosting, and Related Services
19	Management, Scientific, and Technical Consulting Services	Navigational, Measuring, Electromedical, and Control Instruments Mfg.
20	Other Information Services	Newspaper, Periodical, Book, and Directory Publishers

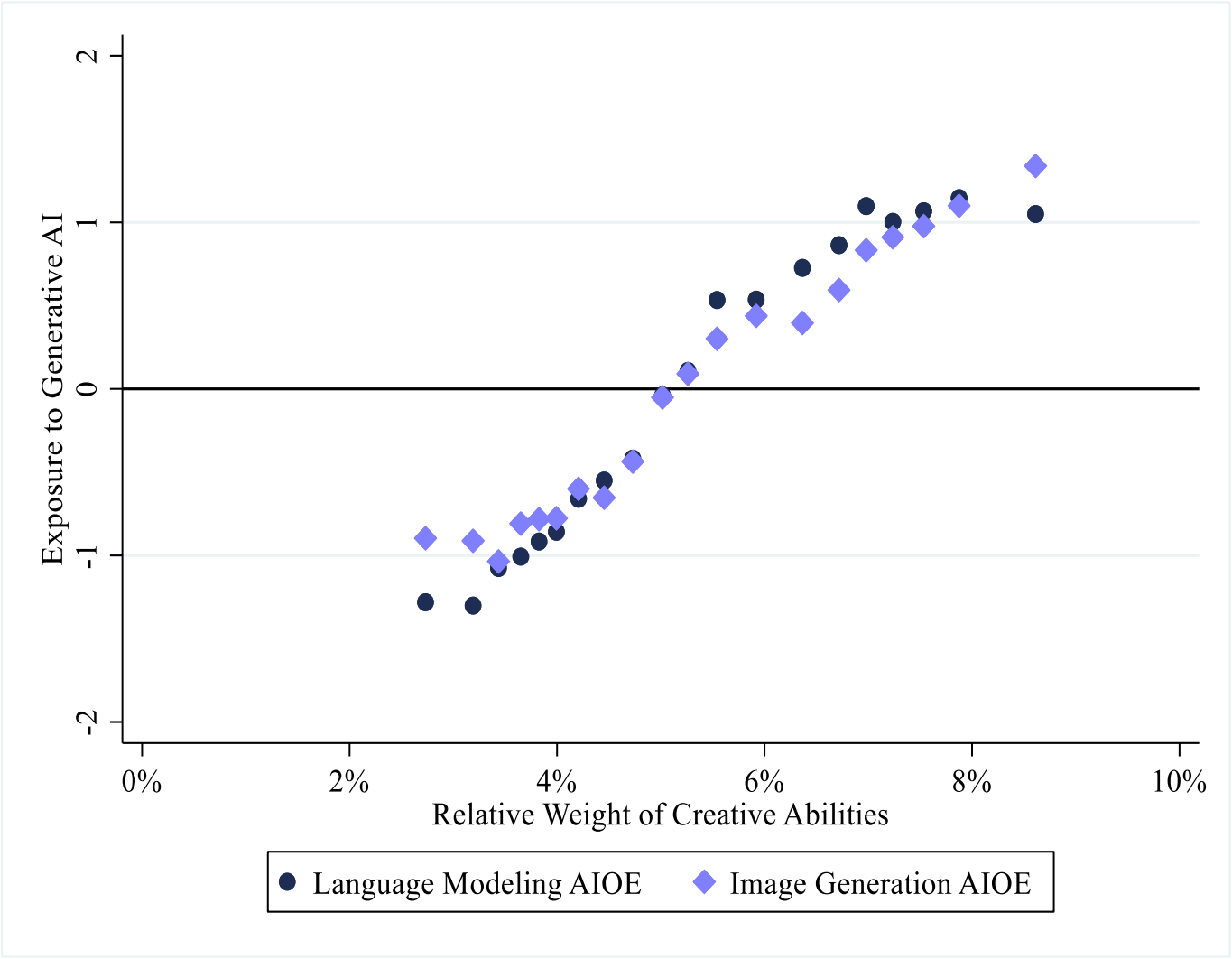
Exposure to Generative AI and Median Salary



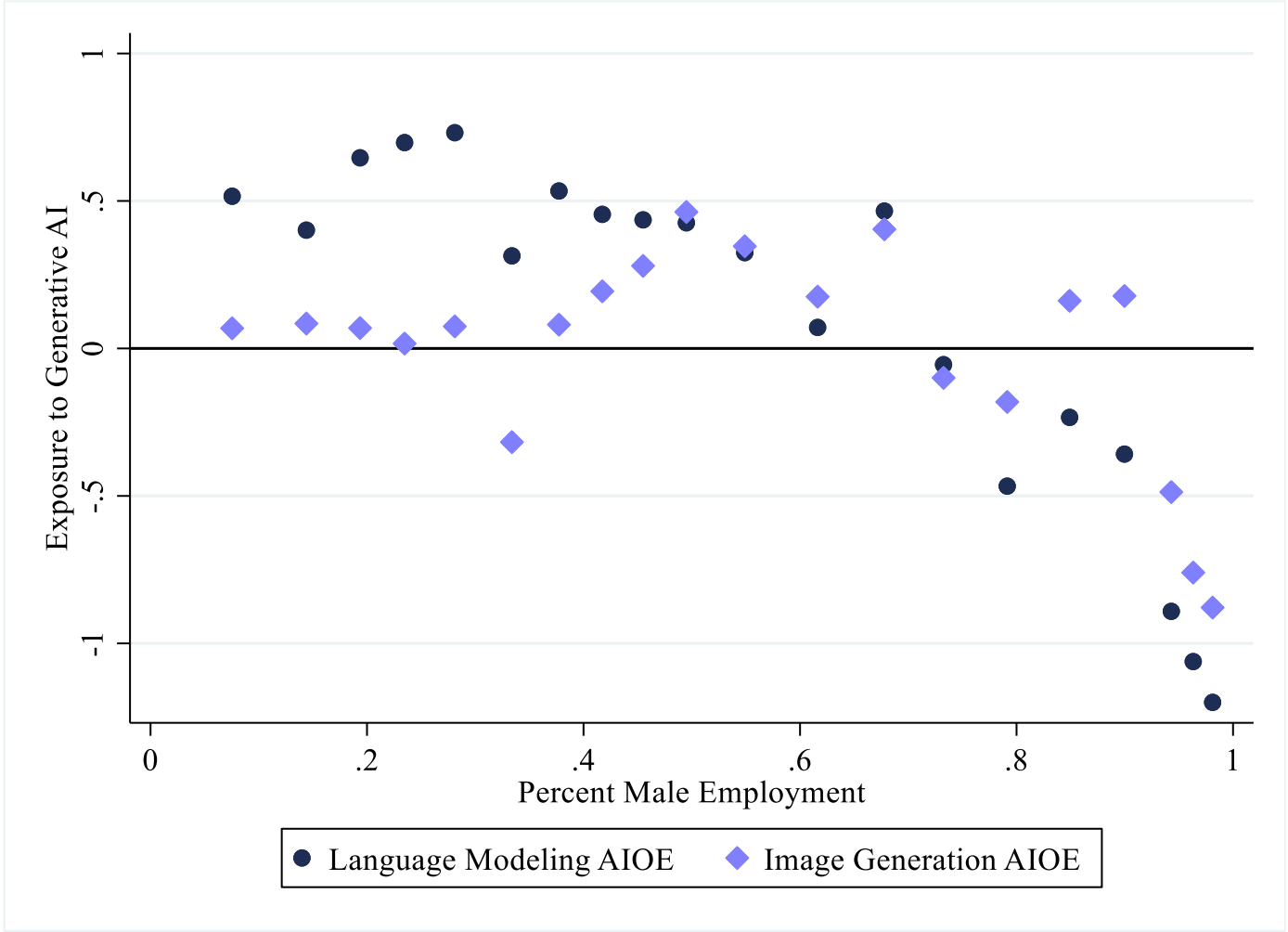
Exposure to Generative AI and Education



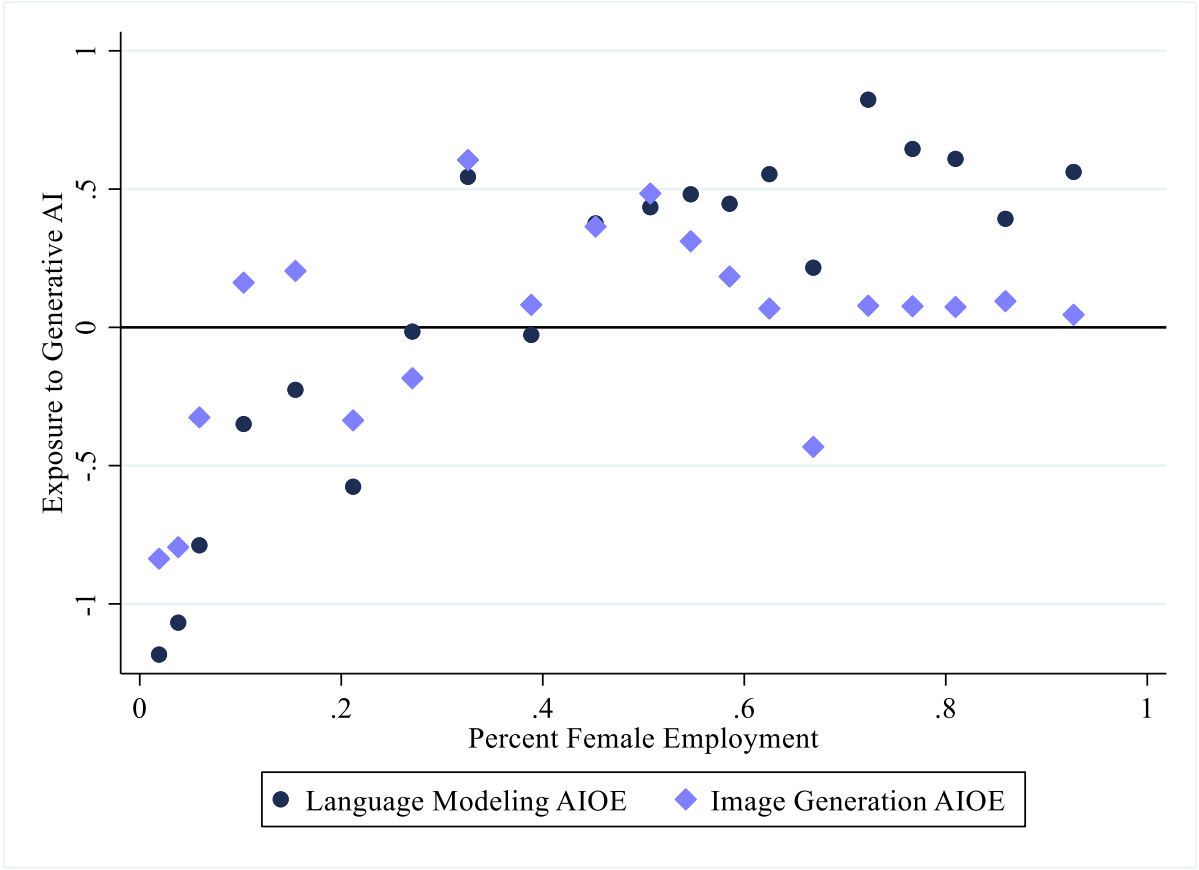
Exposure to Generative AI and Creativity



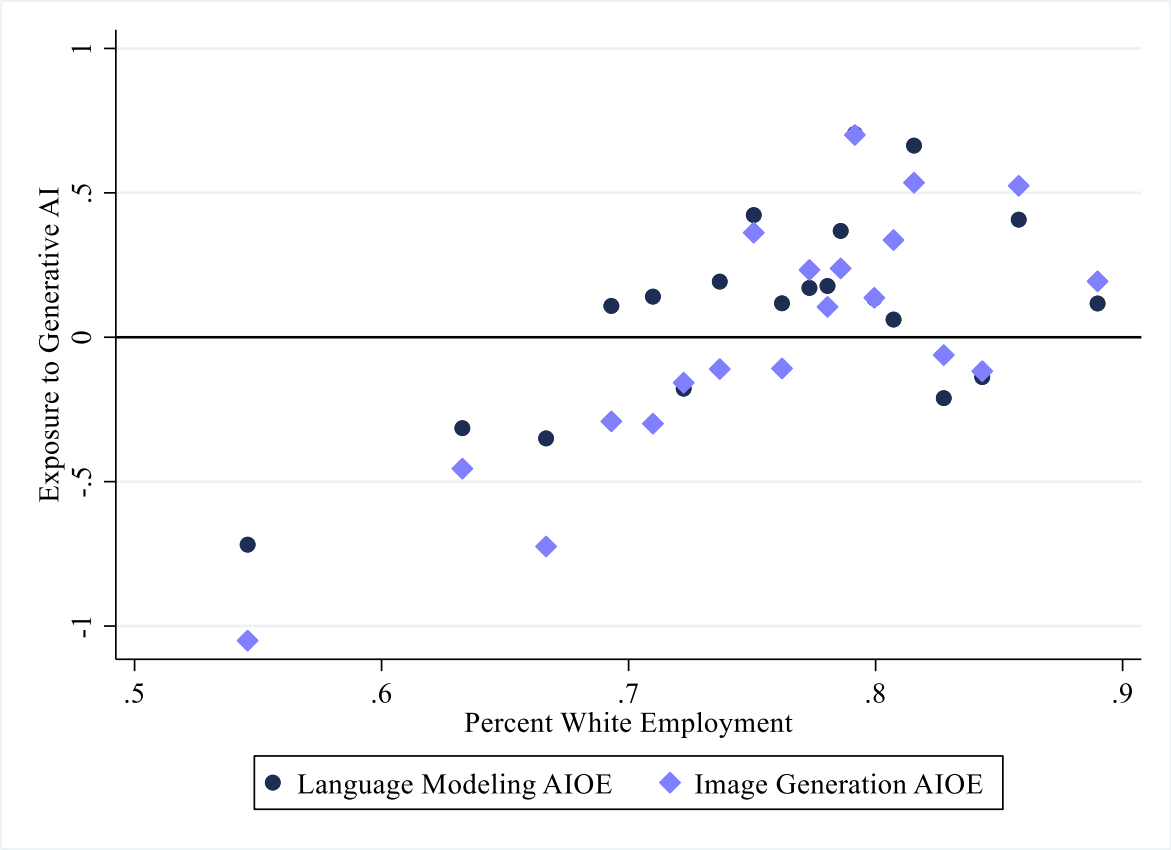
Exposure to Generative AI and Male



Exposure to Generative AI and Female

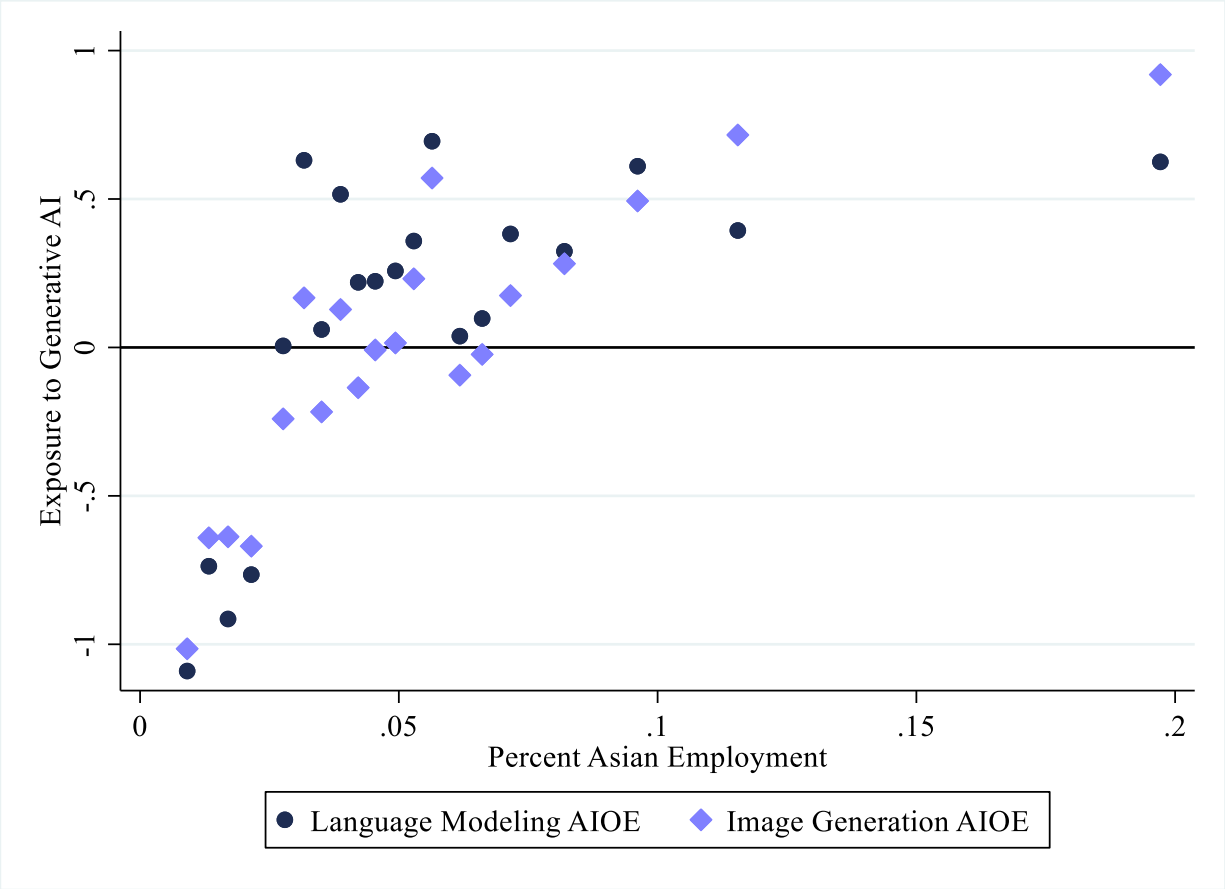


Exposure to Generative AI and White

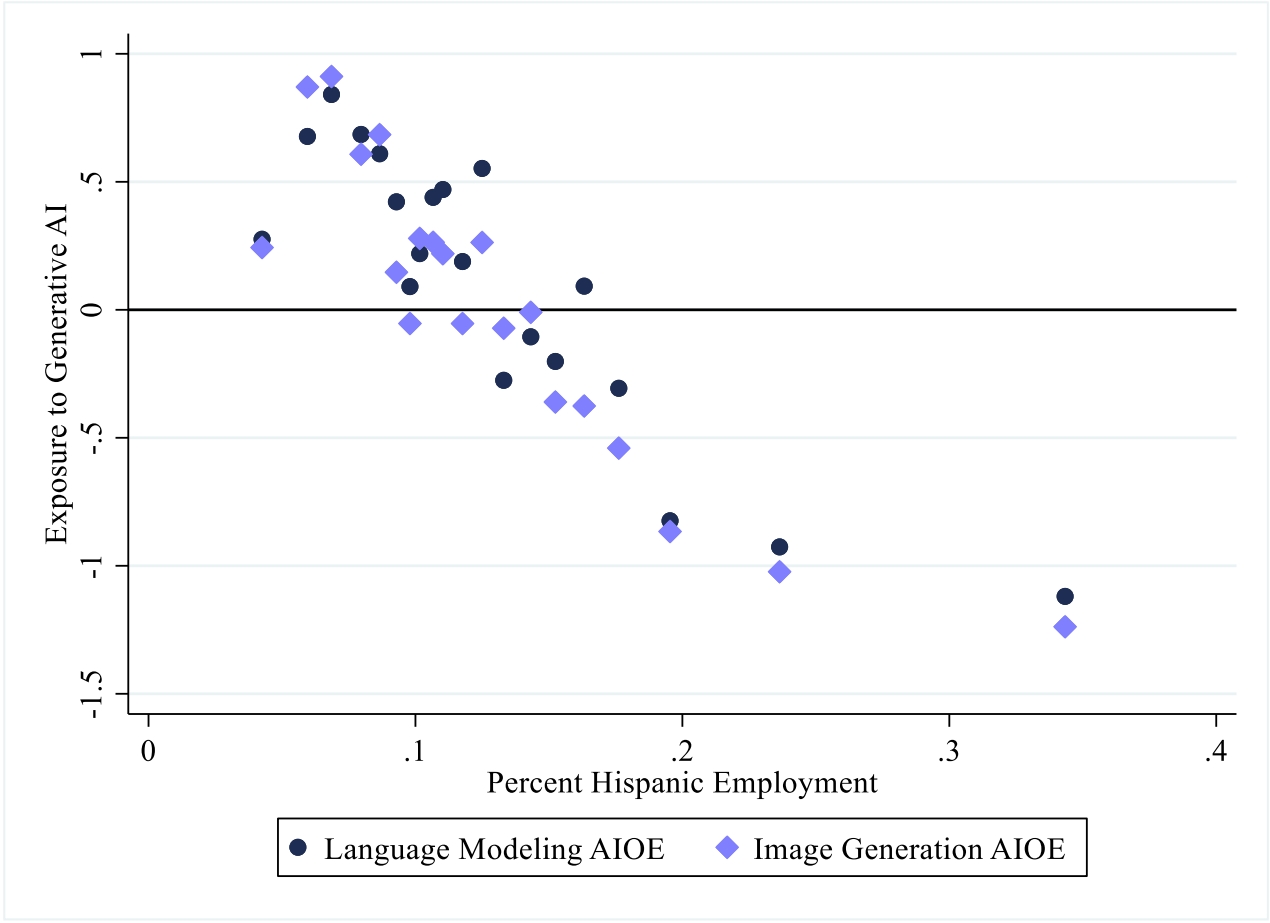


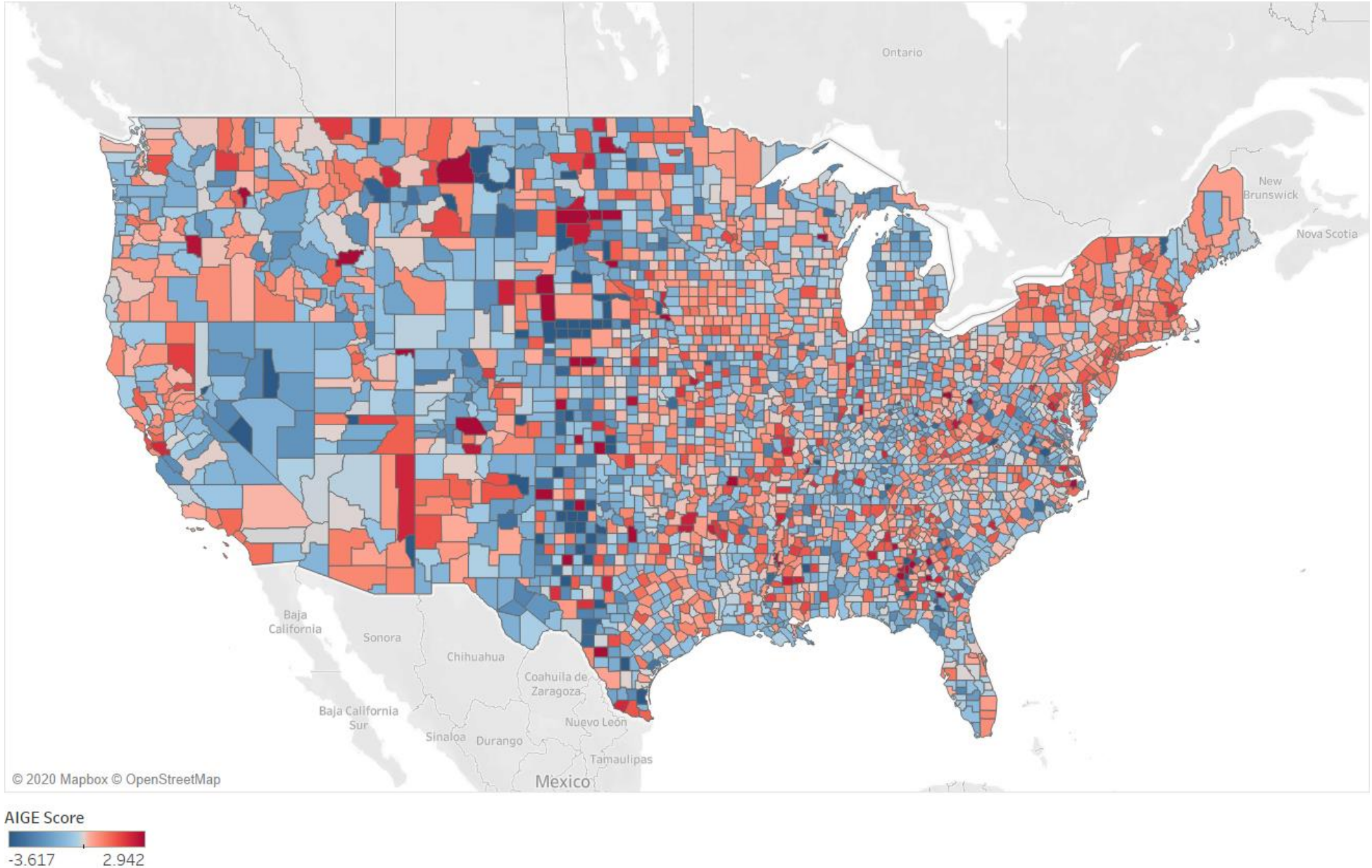
Exposure to Generative AI and Black

Exposure to Generative AI and Asian



Exposure to Generative AI and Hispanic

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AIGE Score
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