

Promising Methods to Study Future Skills:

Projecting the Impact of Computers on Work in 2030

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Outline

- Approach for projecting future computer impact on work
 - Motivation for approach
 - Description of approach
 - Pilot version of approach with results
- Note: the essence of the proposed approach is its comparison of computer and human skills, not its use of O*NET

Motivation

- Why computers?
 - Likely most important impact on work
- Why 2030?
 - Earliest time can affect workforce with substantial change in K-12 education
 - Other issues: social security, climate change

Motivation

- Why look forwards instead of backwards?
 - Exponential change in computer power
 - 1 order of magnitude every 5 years
 - PCs reaching processing power of human brain in roughly 20 years
 - Computer ability to cheaply provide effectively all human work skills by 2100 (2050?)

Proposed Approach

- Computer technology through the lens of human skills
 - Mechanistic model of computer substitution
- Current research literature as a guide to computer capabilities in 2030
 - 10 years for refinement
 - 10 years for broad application

Pilot Version using O*NET

- Step 1: Use O*NET occupational data to define groups of human abilities and levels of difficulty
- Step 2: Sample research in artificial intelligence to assess current computer capabilities in terms of O*NET ability scales
- Step 3: Use O*NET occupational ratings to project future computer impact on work

Step 1: O*NET Ability Scales

- Focus on 22 out of 52 ability scales
 - Ignore 30 where machines already superior
ex. strength-related, arithmetic
- Combine into 4 groups
 - Language, Reasoning, Vision, Movement
 - Rationale:
 - Relatively similar within each group
 - Easy alignment to computer science literature

Step 1: O*NET Ability Scales

- Use anchoring tasks to define range for abilities
- Example: Language ability group
 - Low (level=2):
 - Read street sign
 - Make brief request of customer service rep
 - Medium (level=4):
 - Write recommendation letter
 - Give or understand multi-step instructions
 - High (level=6):
 - Lecture or book in technical area

Step 2: Sample of Research

- 12 recent articles from *AI Magazine*
- Example: current language research systems
 - Providing customer service for sales and repairs
 - Explaining answers to questions on AP chemistry test
 - Describing movement of cars on traffic video
 - Asking for directions
 - Giving a lecture with questions from the audience
 - Role-playing in training simulation with students about how a military officer should handle a car accident

Step 2: Computer Abilities in 2030

- Pilot results described in paper:
 - Language 4
 - Reasoning 5
 - Vision 3
 - Movement 3

Step 3: Occupational Ratings

Occupational Group	L	R	V	M
Top executives	5	5	4	2
Social scientists	5	5	3	1
* K-12 teachers	4	4	2	2
Health diagnosing/treating	5	5	4	3
* Food service	3	3	1	2
* Retail sales	4	3	3	2
Construction	3	3	3	4
Motor vehicle operators	4	4	3	4

Step 3: Overall Pilot Projection

- “Displace” occupations representing 60% of current employment
- What does “displacement” mean?
Example: K-12 teachers (4-4-2-2)
 - Teachers at (4-4-2-2) ability level will be gone
 - Teachers that are still needed will require
 - Higher language ability (5-4-2-2)
 - Higher vision-movement ability (4-4-4-4)
 - Objection: social and emotional role

Step 3: Overall Pilot Projection

- Important point is what will happen to the mix of required abilities, not what will happen to particular “occupations”
- Increase ability requirements of workforce
 - Language level 5 from 20% to 50%
 - Reasoning level 5 from 14% to 34%
 - Vision level 4 from 16% to 42%
 - Movement level 4 from 17% to 43%

Conclusion

- Projecting future computer abilities is an important part of projecting future skill demand
- Plausible projections of computer abilities from:
 - Using current research literature as a guide to broadly applied computer abilities in 20 years
 - Comparing computer and human abilities to identify occupations where computers will have a large impact in 20 years
- Results of the pilot version of the approach suggest the importance of doing it for real