

# Examining Crowd Work and Gig Work Through The Historical Lens of Piecework

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Ali Alkhatib, Michael Bernstein, Margaret Levi

[ali.alkhatib@cs.stanford.edu](mailto:ali.alkhatib@cs.stanford.edu) || @\_alialkhatib

May 9, 2017

Stanford University



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**On-demand work** Crowd work and gig work, collectively

On-demand work is a modern instantiation of a much older phenomenon — **piecework**.

The historical arc of piecework can shed light on persistent questions in this ongoing phenomenon of on-demand work.



## Old Wine in New Bottles

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**Piecework** Payment for *output* rather than for *time*



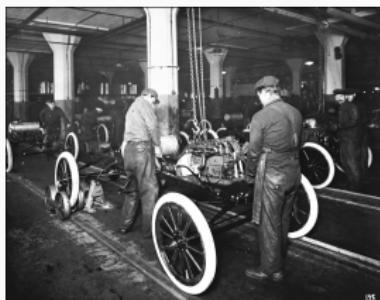
# What is piecework?

*Payment for **output** rather than for **time***

Textiles



Automobiles



Metalwork





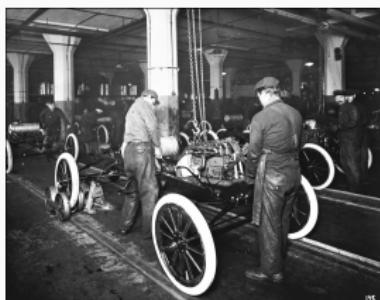
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Crowd work

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U B E R

**What will be the future of work?**



## What will be the future of work?

How will **technology** affect the complexity of the work that on-demand workers do?

What are the **limits** of complexity in on-demand work?



# Thesis

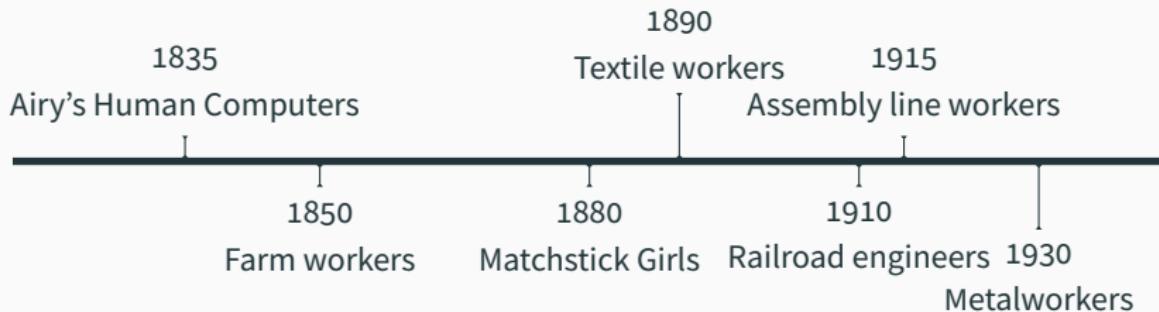
This question — and others like it — has been asked before.

History can help us answer them today.

We'll reach into the history of **piecework** — of human computers, match stick makers, and metalworkers — and show how the **history** of their work can inform answers to questions about the **future** of digital work.

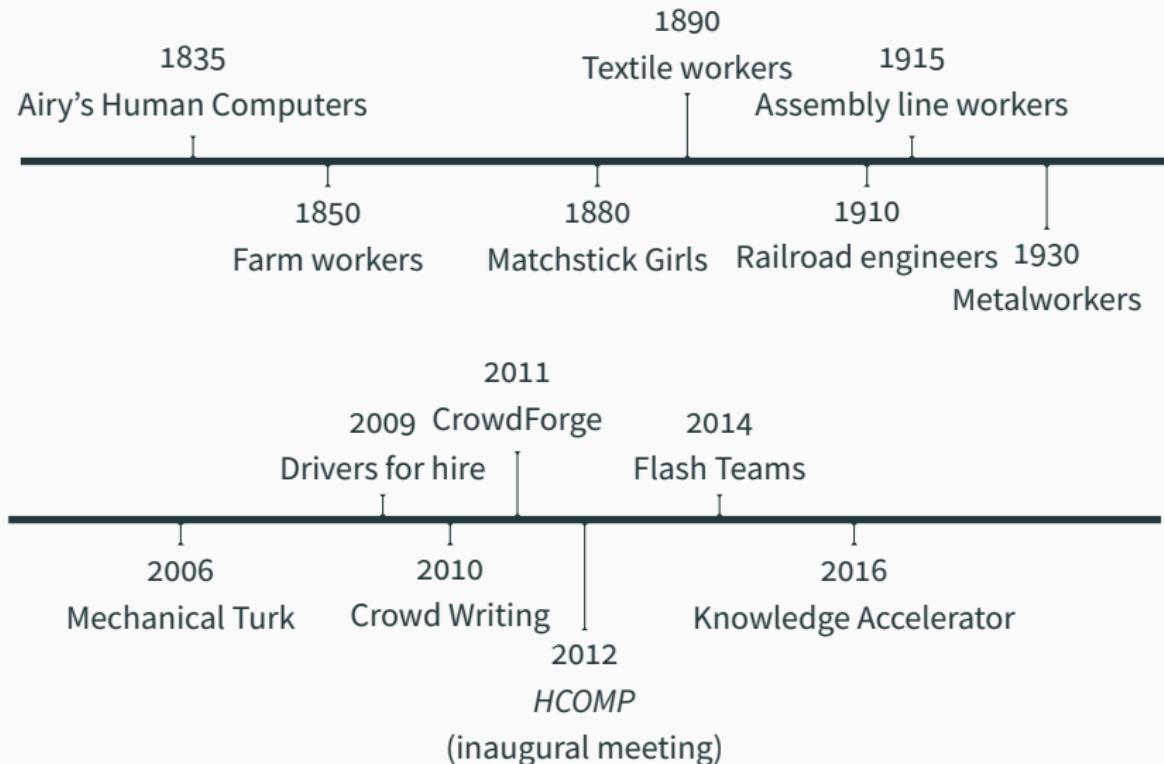


# A Timeline of Piecework



# On-Demand Work

## A Timeline of ~~Piecework~~





# Introduction

We hope to provide:

- A useful ontological lens for making sense of on-demand work as a resurgence of **piecework**
- A method for making sense of contemporary phenomena through **historical analysis**



# Comparative Historical Analysis

- Historical analysis isn't new
  - In general  
Rosenberg ([1994](#), [1982](#))
  - In HCI  
Bødker ([1993](#)) and Wyche, Sengers, and Grinter ([2006](#))
- Still, it's an underutilized method
  - Provide some basic framing for *ostensibly* new phenomena
  - *Explicate* our theoretical grounding
  - Flesh out *differences* and their implications

## Complexity

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# Complexity

What do we mean when we talk about complexity?

- Can crowds help you write something?

Bernstein et al. (2010), Kim et al. (2014), and Nebeling et al. (2016)



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- Can crowds create things from whole cloth?

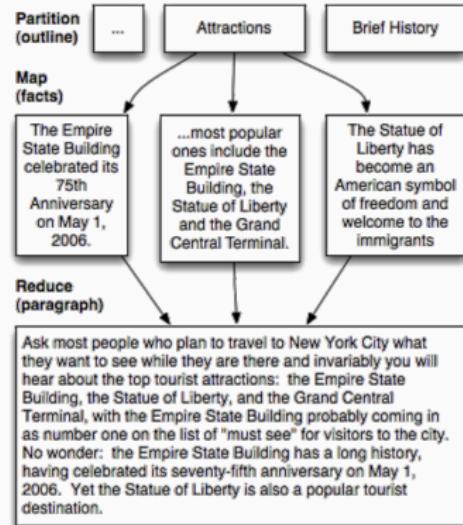
Hahn et al. (2016), Kim and Monroy-Hernández (2016), Kim et al. (2017), and Lasecki, Kushalnagar, and Bigham (2014)



# What Does Crowdsourcing Say?

- Build complexity into the process
  - Apply CS methods to people

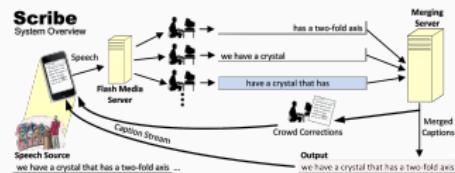
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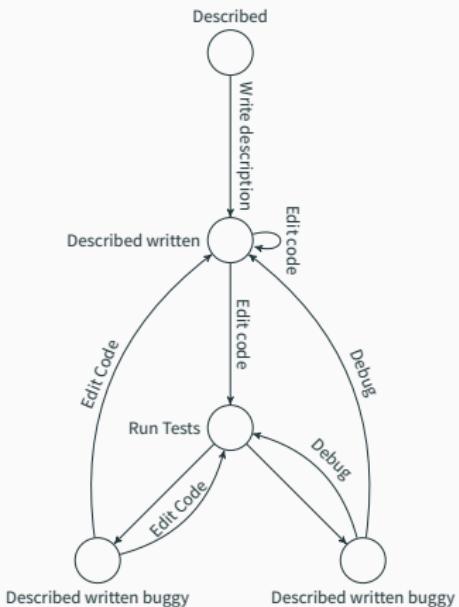
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  - Apply CS methods to people  
Kittur et al. (2011)
  - Humans as computational units  
Lasecki, Kushalnagar, and Bigham (2014)
  - Crowdsourcing workflows as function state machines  
LaToza et al. (2014)





# What Does Piecework Say?

George Airy (astronomer) used a very similar approach

Grier ([2013](#))



- Employed computers
- 13–20 years old
- no particularly strong background in mathematics
- A basic understanding of logarithms, algebra, etc...

# George Airy



Airy built complexity into the process, assigning *human computers* to calculate & verify the *right ascension* and *declination* of stars.

No. of Swings.	Approximate Time (Astronomical Reckoning).	Number of Signals.	Mean of Times by SHELTON.	Mean of Times by EARNSHAW.	Interval by SHELTON.	Interval by EARNSHAW.	Rate $\frac{\text{EARNSHAW}}{\text{SHELTON}}$	Logarithm of $\frac{\text{EARNSHAW}}{\text{SHELTON}}$	Corrected Logarithm of $\frac{\text{EARNSHAW}}{\text{SHELTON}}$
1	Oct. h 1. 23	22	3 19 36.505	21 23 28.764	h m s ...4 0 23.100	h m s 4 0 38.722	1.0010831	0.00047012	
2	2. 3	21	7 19 59.605	1 24 7.486	...3 58 21.652	3 58 37.400	1.0011011	0.00047793	
3	2. 7	21	11 18 21.257	5 22 44.886	...4 45 27.829	4 45 46.421	1.0010855	0.00047117	0.00047387
4	2. 11	29	16 3 49.086	10 8 31.307	...4 17 6.532	4 17 23.234	1.0010827	0.00046995	
5	2. 16	17	20 20 55.618	14 25 54.541	...3 13 21.898	3 13 34.795	1.0011116	0.00048249	
6	2. 19	25	23 34 17.516	17 39 29.336	...3 49 42.503	3 49 57.654	1.0010994	0.00047720	0.00047990
7	2. 23	31	3 24 0.019	21 29 26.990	...3 55 2.071	3 55 17.433	1.0010893	0.00047282	
8	3. 3	21	7 19 2.090	1 24 44.423	...4 2 41.510	4 2 57.445	1.0010944	0.00047503	
9	3. 7	25	11 21 43.600	5 27 41.868	...4 31 5.786	4 31 23.591	1.0010947	0.00047516	0.00046316
10	3. 11	22	15 52 49.386	9 59 5.459	...3 27 49.747	3 28 3.324	1.0010888	0.00047260	
11	3. 15	24	19 20 39.133	13 27 8.783	...3 59 47.292	4 0 3.188	1.0011049	0.00047959	
12	3. 19	24	23 20 26.425	17 27 11.971	...4 3 30.416	4 3 46.020	1.0010686	0.00046384	0.00047104



# Marginal Complexity

## Farms



- Formalization of piecework:  
*payment for results*  
Chadwick ([1865](#))
- Dynamic piece rates



# Marginal Complexity

## Textiles

- Distributed workers



- Assuming common skills



# Marginal Complexity

- Strict management
- Formalizing work methods

Matchstick Girls





# Marginal Complexity

Farms



Textiles



Matchstick Girls





# Planes, Trains, and Automobiles

## Trains



- “Efficiency experts” measured how long it would take to do various jobs  
Cunningham ([1911](#))
- These measurements would be used to assign values for each specific task  
Jewell ([1921](#))

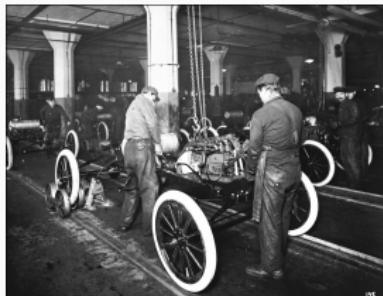


# Planes, Trains, and Automobiles

## Automobiles

- Consolidating and training workers  
*(Fordism)*

Schoenberger ([1988](#))  
and Tolliday and Zeitlin  
([1986](#))



- Measuring and evaluating workers by very carefully defined instructions  
*(Taylorism)*

Taylor ([1911](#))



# Planes, Trains, and Automobiles

## Planes

- Men drafted during World War II
- Factories turned to a new workforce who had neither conventional training nor experience
- **Specialized training and assignment**





# Planes, Trains, and Automobiles

Trains



Automobiles



Planes





## Comparisons

- Limited array of tasks versus arbitrarily complex work
  - *Building* planes versus *fixing* trains
- Has technology changed this?
  - Technology makes *some* complex tasks relatively trivial
  - Measuring workers is easier than ever



# Complexity

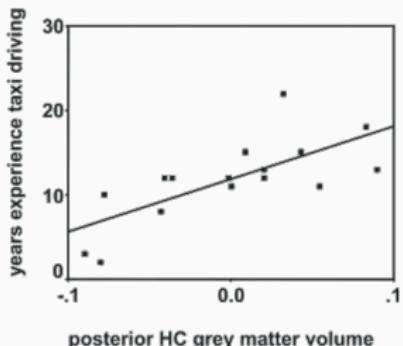
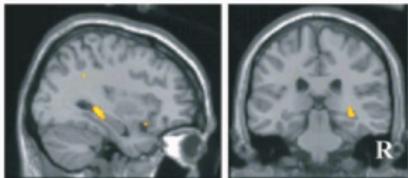




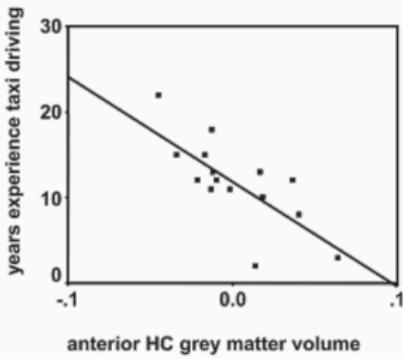
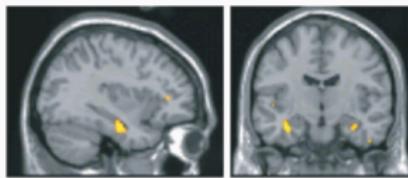
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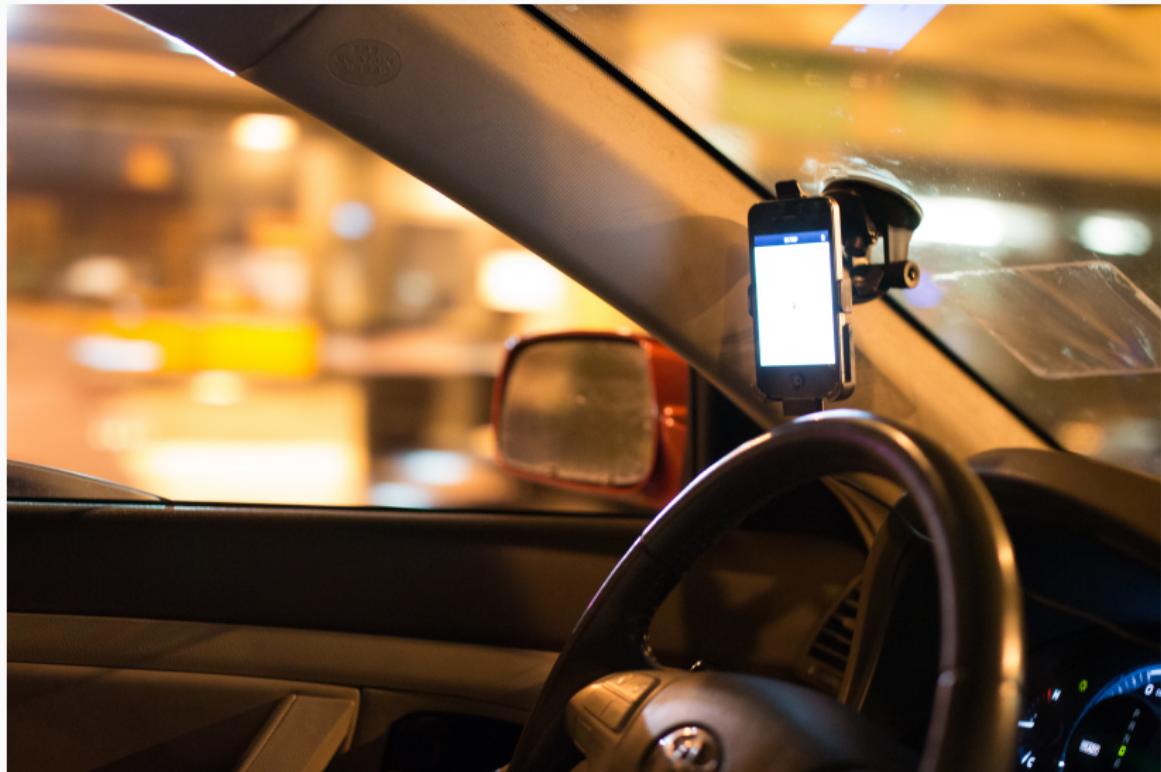


B





# Complexity





# Complexity

## notes

- I'm thinking of pointing to UpWork's screen recording tool as a way to measure workers
- also maybe google analytics and other ways of tracking web-based workers



## Implications

- We make stronger assumptions about workers' abilities thanks to technology
- Evaluation remains difficult, but we're trying to find stopgap solutions through decomposition
- We're still not solving the problems of inherently subjectively judged work



## Complexity

Hahn et al. (2016), Kim and Monroy-Hernández (2016), Kittur et al. (2011), Nebeling et al. (2016), Suzuki et al. (2016), Yu, Kittur, and Kraut (2016), and Yuan et al. (2016)

## Decomposition

Celis et al. (2016), Chang, Kittur, and Hahn (2016), Law et al. (2016), Lykourentzou et al. (2016), and Newell and Ruths (2016)



## Discussion

Twofold purpose:

- Give some historical context to **on-demand work**
- Answer some questions that have been difficult to answer
- Recapture attention toward a valuable sense-making methodology



## Contact

name: Ali Alkhatib

email: [ali.alkhatib@cs.stanford.edu](mailto:ali.alkhatib@cs.stanford.edu)

twitter: [@\\_alialkhattib](https://twitter.com/_alialkhattib)