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

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May 10, 2017

Stanford University

Before We Get Started…

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Kittur et al. (2013)

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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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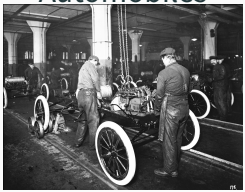
Piecework Payment for output rather than for time

Payment for *output* rather than for *time*

Textiles

Automobiles

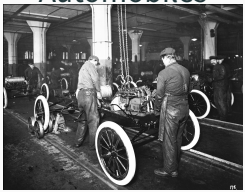


Metalwork

Payment for *output* rather than for *time*

Textiles

Automobiles



Metalwork

Crowd work

amazon mechanical turk

upwork

Gig Work

UBER

What will be the future of work?

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

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

The answers to these questions may predict the *reach* of 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.

Comparative Historical Analysis

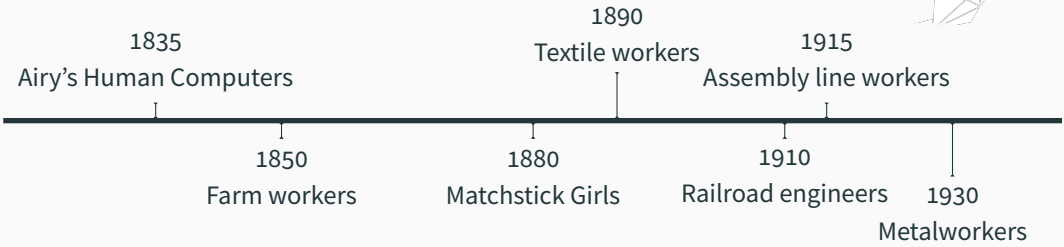
HCI researchers have used historical analysis to understand social systems before

Bødker (1993) and Wyche, Sengers, and Grinter (2006)

… But we haven't applied this method to make sense of on–demand work, which is a missed opportunity to…

- Provide some basic framing for *ostensibly* new phenomena
- *Explicate* our theoretical grounding
- Flesh out *differences* and their implications

A Timeline of Piecework



On–Demand Work

A Timeline of ~~Piecework~~

1835
Airy's Human Computers

1850
Farm workers

1880
Matchstick Girls

1890
Textile workers

1910
Railroad engineers

1915
Assembly line workers

1930
Metalworkers

2006
Mechanical Turk

2009
Drivers for hire

2010
Crowd Writing

2011
CrowdForge

2012
HCOMP

2014
Flash Teams

2016
Knowledge Accelerator

2017
Flash Organizations
(2 hours ago)

Ongoing Threads in Crowdsourcing Research

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)

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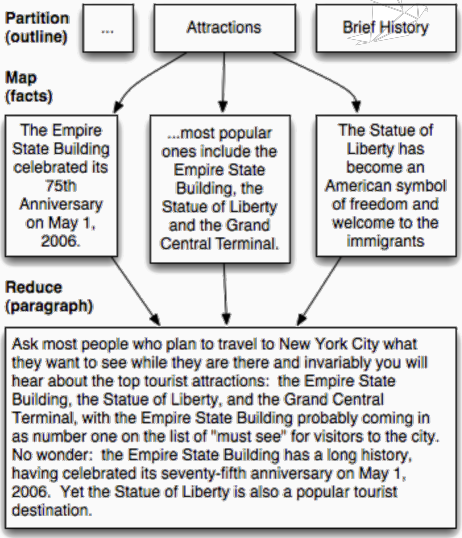
What Does On–Demand Work Say?

Build complexity into the process

- Apply CS methods to people
  Kittur et al. (2011)



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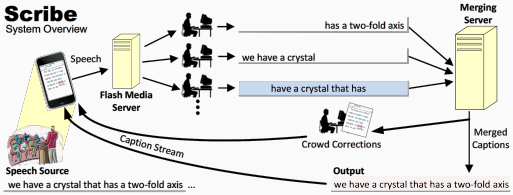

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- Crowdsourcing workflows as function state machines
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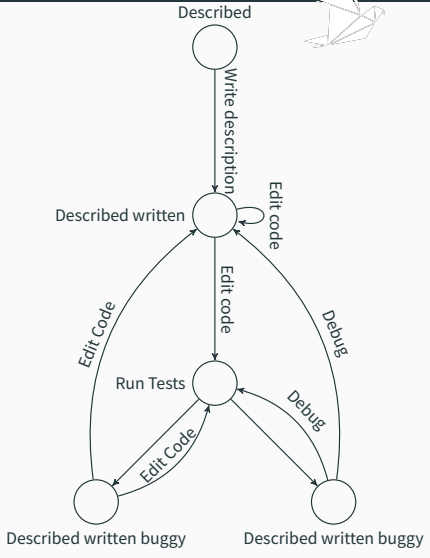

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- Challenges with *flexibility*
- Insights into task *specialization*

What Does Piecework Say?

George Airy. Astronomer. Crowd work requester.

Grier (2013)

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

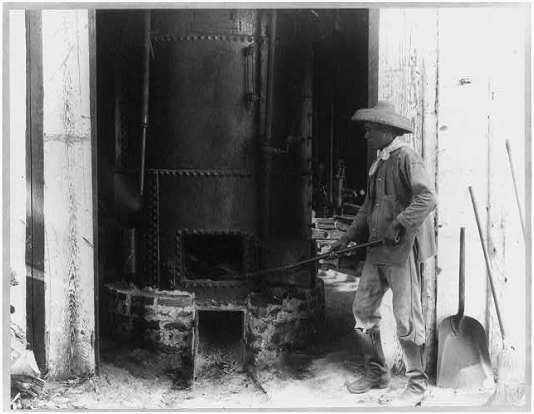
George Airy

Airy built complexity into the process, assigning *human computers* to calculate astronomical movements.

No. of Swing.	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 Rate $\frac{\text{Earnshaw}}{\text{Shelton}}$	Corrected Logarithm of Rate $\frac{\text{Earnshaw}}{\text{Shelton}}$
	Oct. h		h m s	h m s	h m s	h m s			
1	1. 23	22	3 19 36·505	21 23 28·764	4 0 23·100	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 46·029	1·0010686	0·00046384	0·00047194

Low Complexity

Farms



- Formalization of piecework:
  payment for results
  Chadwick (1865)
- Dynamic piece rates

Low Complexity

Textiles

- Distributed workers
- Assuming common skills

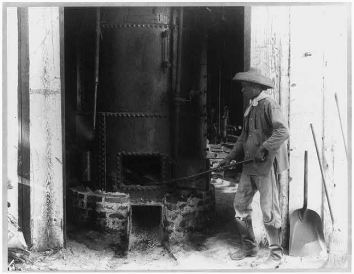
Low Complexity

- Strict management
- Formalizing work methods

Matchstick Girls

Low Complexity

Farms



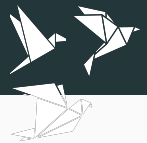
Textiles

Matchstick Girls

Planes, Trains, and Automobiles

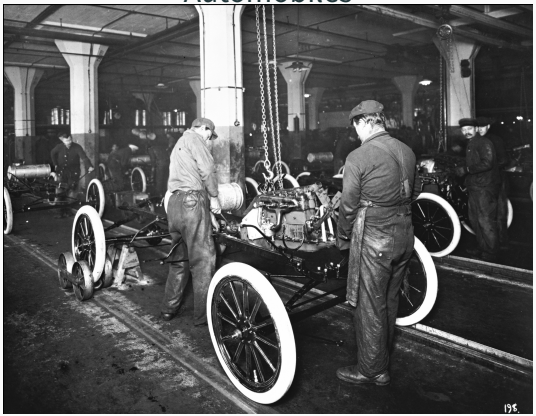
- “Efficiency experts” measured how long it would take to do various jobs
  Cunningham (1911)
- These measurements would be used to assign pay rates for each specific task
  Jewell (1921)

Planes, Trains, and Automobiles



- Consolidating and training workers (*Fordism*)
  Schoenberger (1988) and Tolliday and Zeitlin (1986)

Automobiles



- Measuring and evaluating workers by very carefully defined instructions (*Taylorism*)
  Taylor (1911)

Planes, Trains, and Automobiles

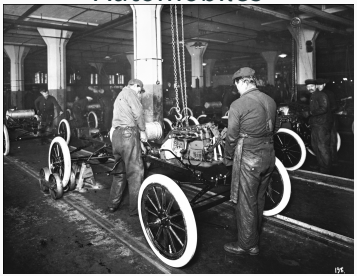
- Men drafted during World War II
- Factories turned to a new workforce who had neither conventional training nor experience
- **Specialized training and assignment**

Planes

Planes, Trains, and Automobiles

Trains

Automobiles

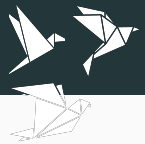


Planes

Comparisons

- Building complexity into the processes
- Challenges dealing with flexibility
    - *Building* planes versus *fixing* trains

Implications for On–Demand Work



Has technology shifted on–demand work?

In some ways, yes

- Technology makes *some* complex tasks relatively trivial
- Measuring workers is easier than ever

In other ways, no — we still don't have good end–to–end processes for arbitrarily complex work

We can make a routine out of building planes, but not out of fixing trains

Enhanced Cognition

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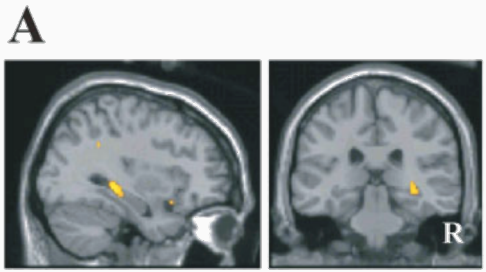
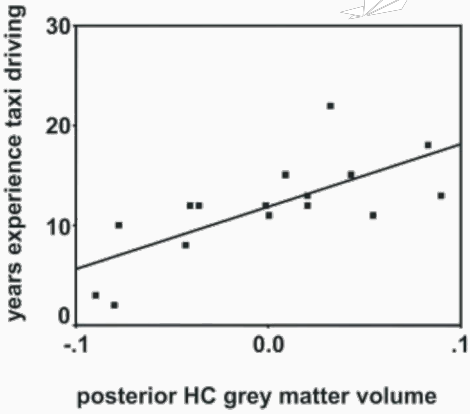
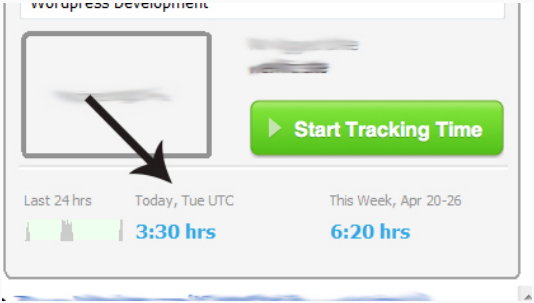




Enhanced Cognition

Tracking Work and Workers



Upwork has turned to logging workers' keystrokes and taking screenshots automatically every 10 minutes

Takeaways

- 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

Ongoing Threads in Crowdsourcing Research

Complexity

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Firms antagonized and frustrated workers, exploiting that they were independent and often transient for leverage; workers bonded and found solidarity in this image of independence. With the geographic dispersion to the internet, it's not clear if or how on–demand workers will accomplish the same.

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Decomposition

Scientific Management & Taylorism pushed decomposition by way of measuring & optimizing tasks; as this matured, measurement and evaluation informed more narrow expert task specialization. On–demand work could follow suit, driving a shift toward dramatically new requirements of workers in decomposed tasks.

Discussion

Several goals:

- 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

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.

Questions, Answers, etc…

Thanks to the Stanford Cyber Initiative for funding this research.

(And thanks for listening!)

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