

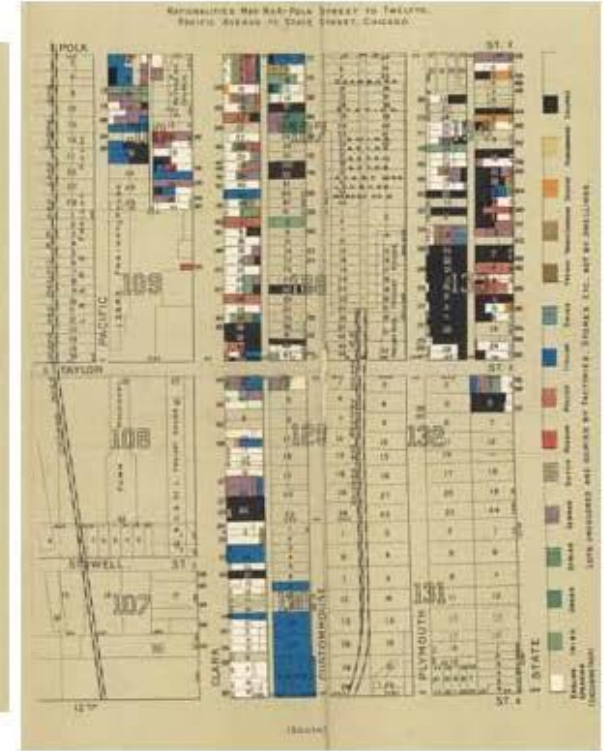
Sweatshops, Smallpox, and Statistics: Florence Kelley in 1890s Chicago

Winter Lecture at the Georgia Chapter of the
American Statistical Association, December 14, 2021

Sharon L. Lohr

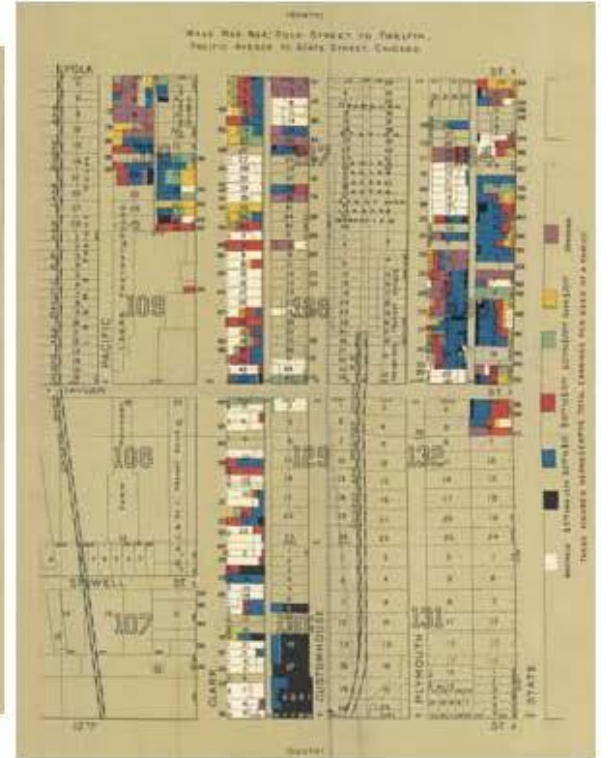
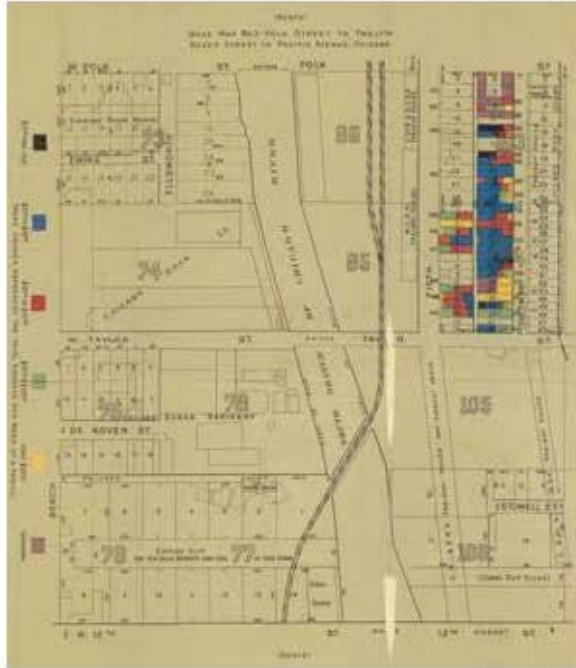
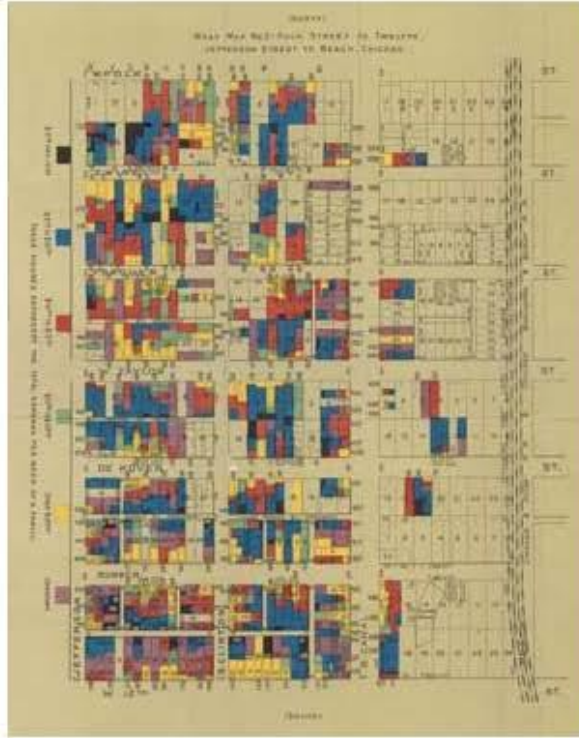
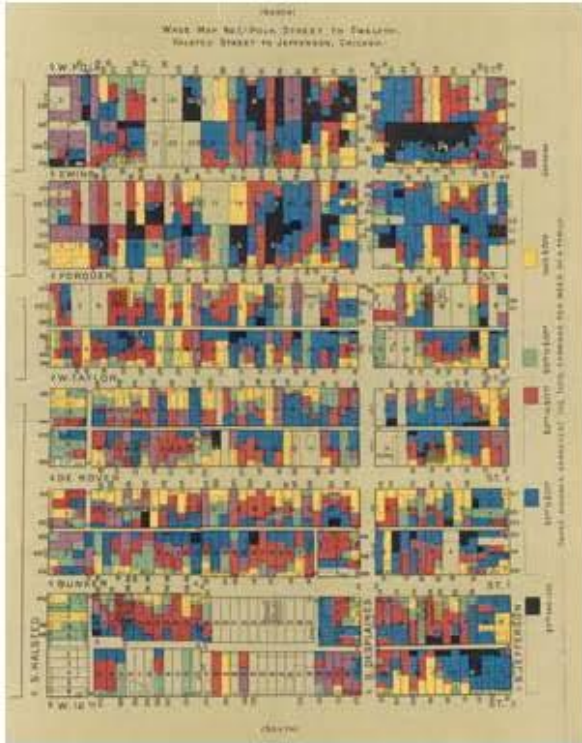
www.sharonlohr.com

Hull-House Maps and Papers, 1895

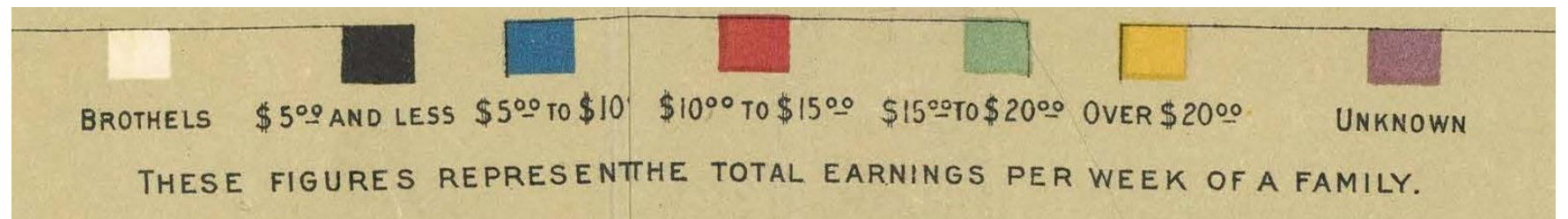


Nationalities Maps

Hull-House Maps and Papers, 1895



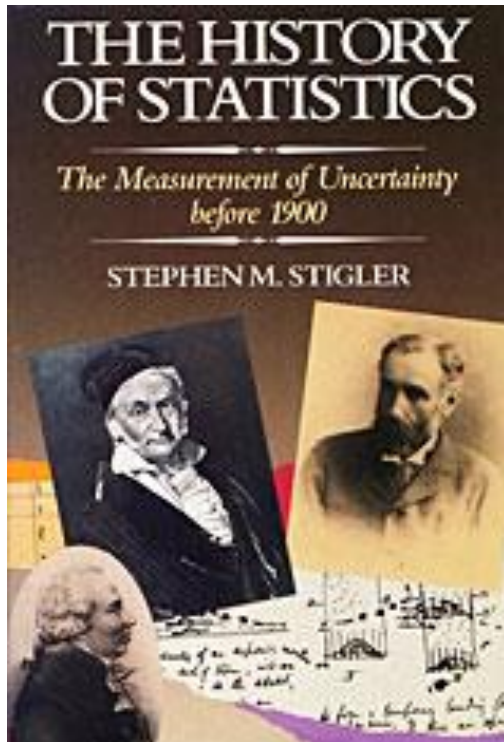
Wage Maps



Outline

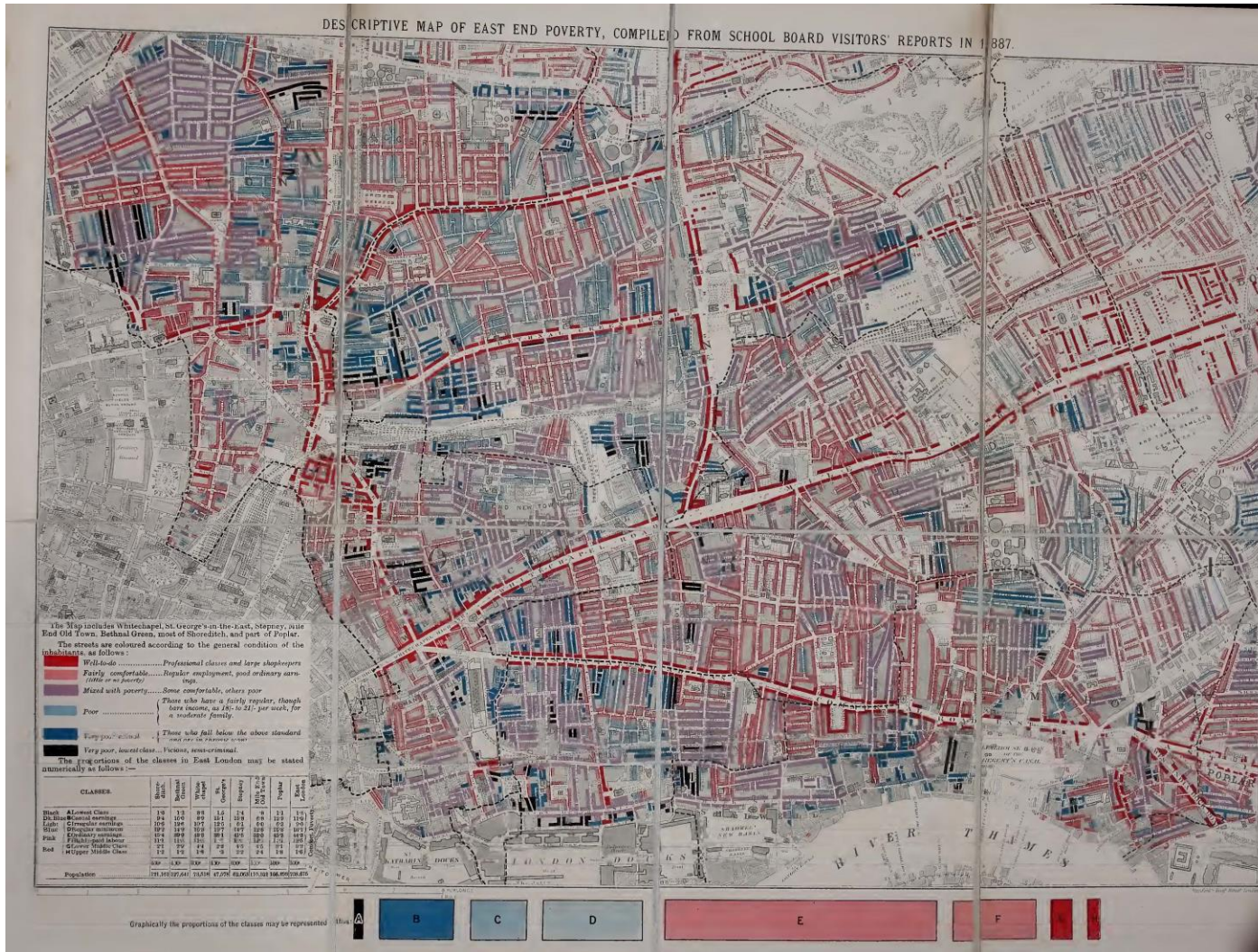
- State of statistics in 1890
- Florence Kelley's journey to statistical work
- Kelley's sweatshop investigations, 1892
- Smallpox investigations, 1893
- *Hull-House Maps and Papers*, 1895
- Connections (including connection to Georgia)
- Legacy for today

The State of Statistics in the 1890s

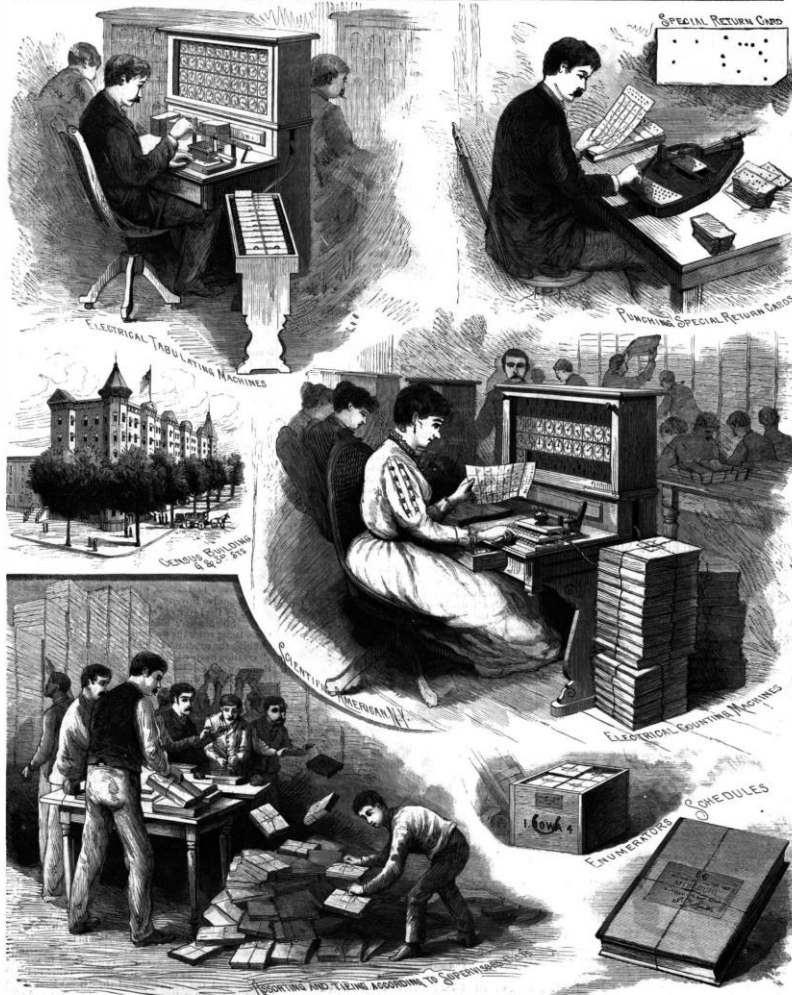


- **Central limit theorem**
de Moivre, 1733; Laplace, 1810; Lyapunov, 1901
- **Skewed distributions**
Helmert, 1876; McAlister, 1879; DeForest, 1882; Pearson, 1894
- **Significance tests to compare means**
Laplace, 1823; Edgeworth, 1885
- **Least squares** (Legendre, 1810)
- **Regression** (Galton, 1885; Yule, 1899)
- **Variance components** (Edgeworth, 1885)
- **Correlation** (Galton, 1888; Edgeworth, 1893)

Life and Labour of the People of London



- Charles Booth
- Volume 1 in 1889
- “Descriptive Map of East End Poverty, Compiled from School Board Visitors’ Reports in 1887”

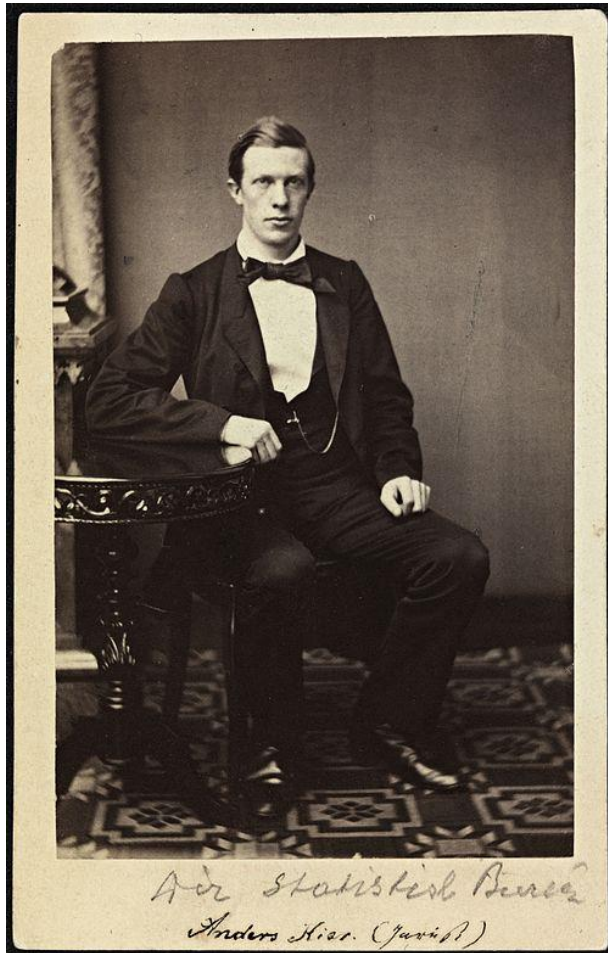


THE NEW CENSUS OF THE UNITED STATES—THE ELECTRICAL ENUMERATING MECHANISM.—[See page 129.]

1890 U.S. Census

- First census to use Hollerith electric tabulating machines
- Experienced clerk could process 80 cards/minute
- Tabulations finished in less than 3 years (1880 census: 8 years)
- Census cost approximately doubled \$6 M in 1880, \$12 M in 1890.
- With better computing, more cross-tabulations: More statistics drove up the cost!

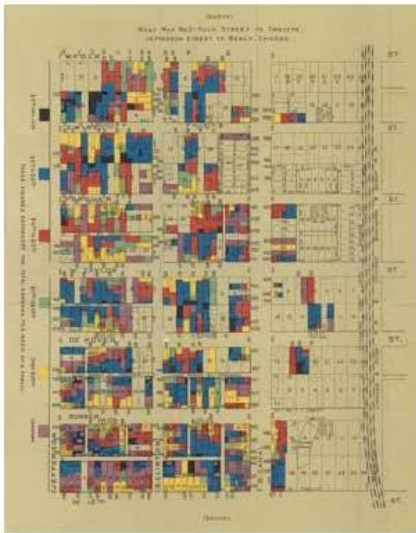
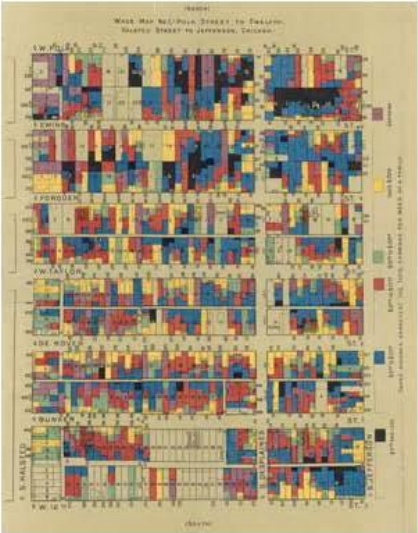
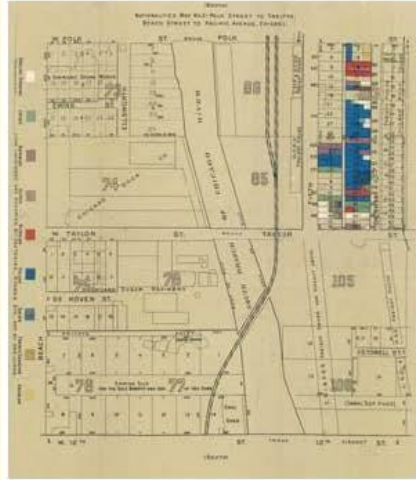
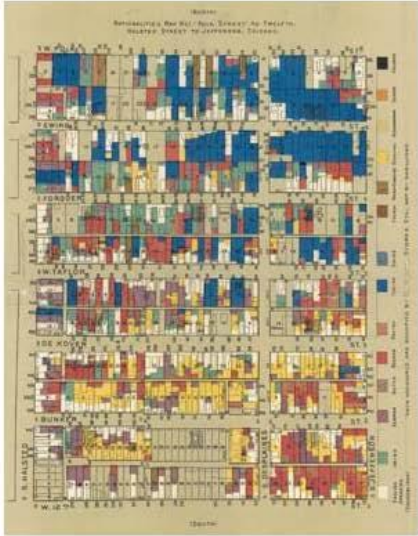
Representative Samples, 1895



Anders Kiaer

- Anders Kiaer, Norway Central Bureau of Statistics
- ISI, 1895: “Observations et expériences concernant les dénombrements représentatifs”
- Some statisticians at meeting enthusiastic
- Georg von Mayr
 - Kiaer’s proposal is “dangerous”
 - “One cannot replace actual observations with calculations”

Hull-House Maps and Papers, 1895



Florence Kelley
and
Agnes Sinclair Holbrook

Florence Kelley, 1859-1932



- William Darrah Kelley
 - A founder of Republican party
 - Pennsylvania Congressman, 1861-1890
- Caroline Bonsall Kelley
 - Quaker abolitionist family
- Family friends included
 - Abraham Lincoln
 - Susan B. Anthony

Florence Kelley in 1925

<https://www.loc.gov/pictures/item/2003669896/>

Florence Kelley Early Education

- Her five sisters died in childhood
- Educated at home
- Age 10, systematic reading of father's library
- Started at ceiling of southwest corner
- She read
 - Novels, poetry
 - James Madison, Daniel Webster
 - Chemistry books, natural sciences
 - Government reports from Library of Congress

Cornell University, 1876, age 17



- Cornell first admitted women in 1872
- Graduated 1882
- Thesis: “On Some Legal Changes in the Status of the Child Since Blackstone”
 - Read reports of state bureaus of labor statistics
 - “deplorable meagerness of American official information about women and children in industry”
 - Exception: “valuable” report by Carroll Wright, then Chief of Massachusetts Bureau of Labor Statistics

Florence Kelley at Cornell

<https://commons.wikimedia.org/wiki/File:FlorenceKelley.jpg>

Europe and New York City, 1883-1891

- Denied admission for graduate work at University of Pennsylvania
- Attended lectures in politics, economics, law at University of Zurich
- Active in socialist movement
- Translated Friedrich Engels book; continued writing
- 1884 married Russian medical student Lazare Wischnewetzky
- Three children, 1885-1888
- Moved to New York City, 1886

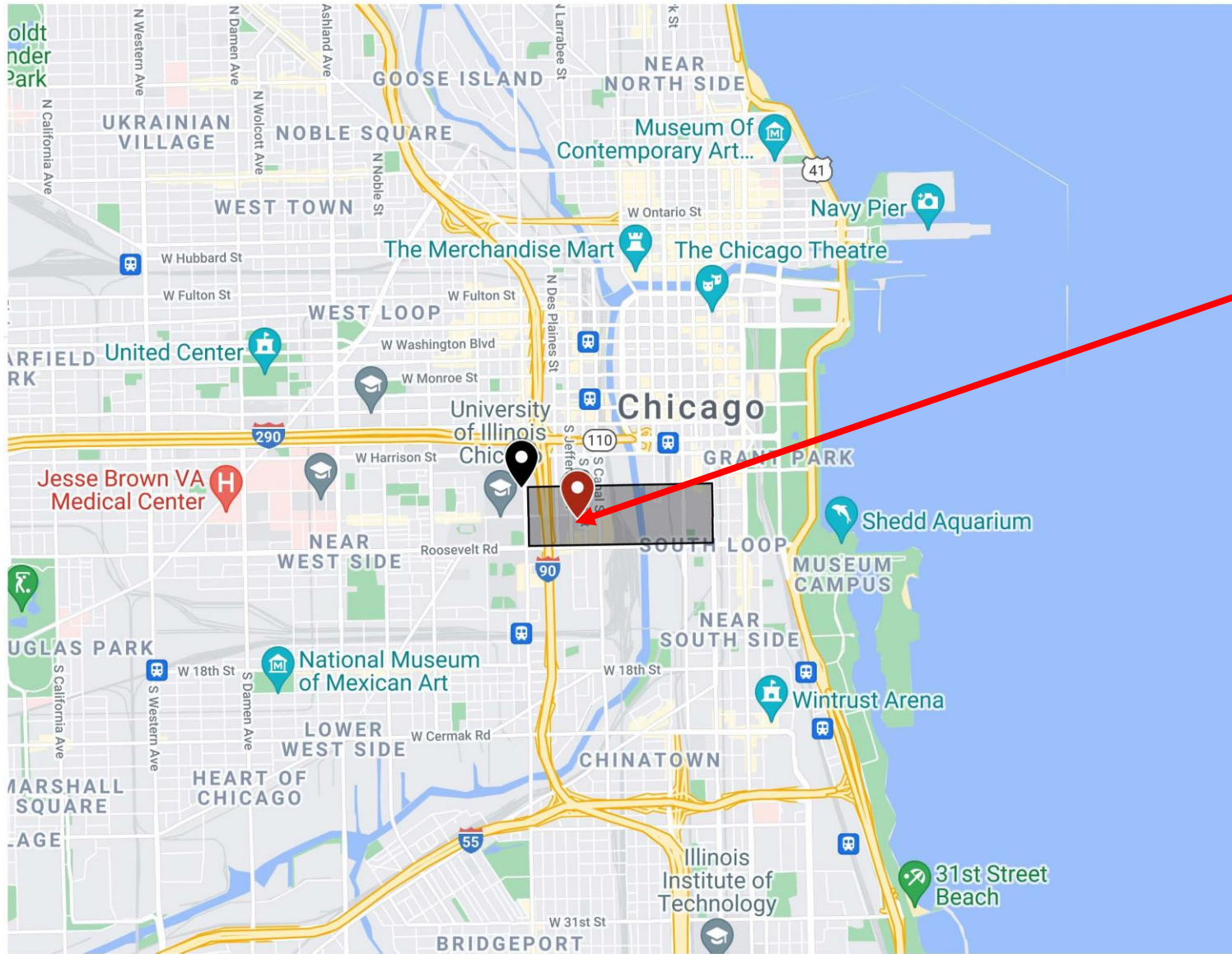
Arrival in Chicago: December 1891



Hull House

<https://www.nps.gov/places/hull-house.htm>

- Hull-House founded 1889 by Jane Addams and Ellen Gates Starr
- First U.S. “Settlement House”
- Offer social services to community
- Child care, legal and employment aid, health, sanitation, education, arts ...
- Social reformers lived (“settled”) in the community they served



Great Chicago Fire of 1871
started here

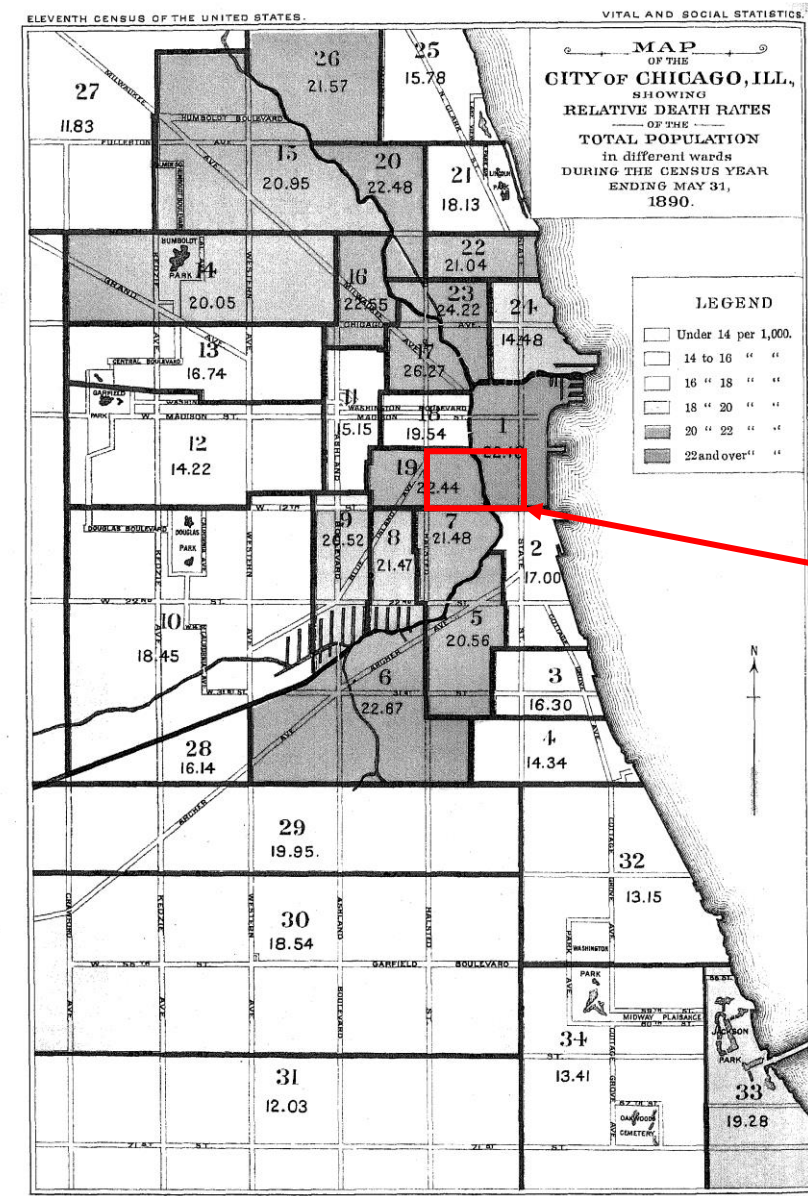


Hull House Map area;
Hull House just to west

Chicago, 1890

- Rapid population growth
300,000 → 1.1 million
1870 1890
- 19th ward:
 - High population density
 - High death rate
Diarrheal diseases,
tuberculosis, pneumonia

Death Rates, 1890 Census



Hull House Map Area

Collecting Data: May, 1892

- Special agent for Illinois Bureau of Labor Statistics
- Collected data on sweatshops and workers
- Goal: census of Chicago sweatshops
- Challenges
 - No sampling frame listing shops
 - Much garment manufacturing contracted out to small operations, often located in homes
 - Shops opened, closed, and moved frequently
 - Garment “finishers” did piecework in their homes, moved frequently from tenement to tenement as financial circumstances changed

Snowball Sample

- Observed that shops were highly clustered
- Began in areas known to have high density of sweatshops
- From there “extended their inquiries, and the search for these, often obscure, places in every direction until no more could be found or heard of. No suggestion nor rumor was unheeded, and every clue was diligently followed up in order to make the enumeration as complete and full as possible” (Illinois Bureau of Labor Statistics, 1893, p. 369)
- Supplemented with shops listed in press, by Health Department inspectors, and by people interviewed

Assessing Quality of Sample

- Found 666 shops and 10,933 workers
- How many were missed?
- Informal capture-recapture estimate, based on outlying shops/workers found
- “Upper bound” of 800 shops, 13,000 workers
- Captured shops within major garment manufacturing areas
 - Number, demographics, wages, working hours of employees
 - Types of clothing manufactured
 - Sanitary conditions; cubic feet of air per person;
 - Disease and infection (tuberculosis, typhoid, scarlet fever, diphtheria)

State Factory Inspector, July 1893

- Kelley testified about report to legislature
- Illinois Factories and Workshops Act, 1893
 - Workshops must be separate from living areas
 - No employment of children under 14
 - 8-hour working days for women
 - New position, factory inspector, to enforce the law
- Offered to Henry Demarest Lloyd, who recommended Kelley
- First woman to hold statewide office in Illinois

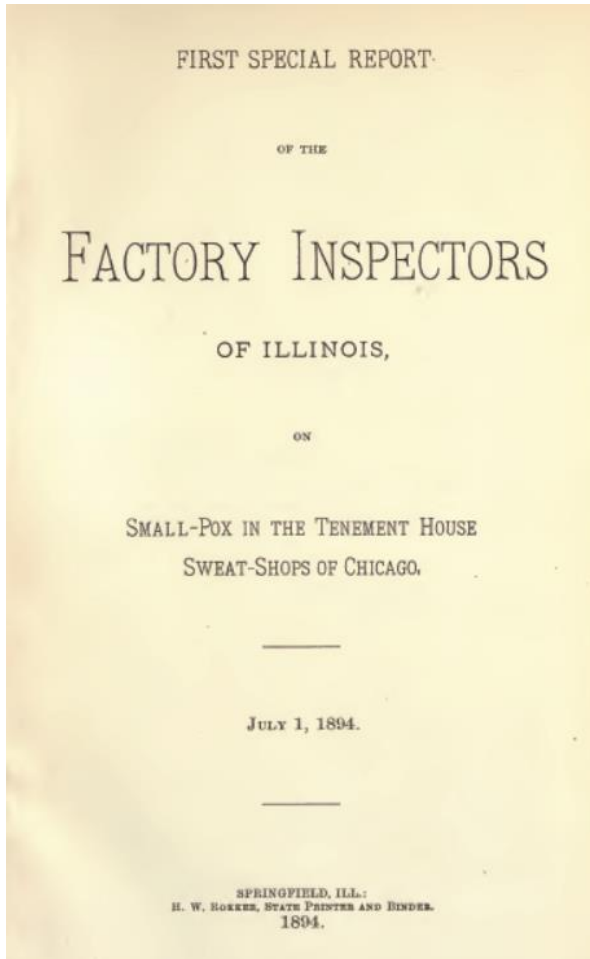
Smallpox in Chicago



Chicago smallpox poster, date unknown

- 1840s: three-pronged approach
 - Vaccination campaign (1848)
 - Quarantine at home
 - Isolate in Smallpox Hospital “Pest House”
- 1868: compulsory vaccination
 - Estimated 95% vaccination rate
 - Sporadic minor outbreaks (1881-1882)
- Vaccination rates declined
 - Unvaccinated persons immigrated to city
 - Chicago-born children not vaccinated
 - 1893 Exposition, 25 million visitors
- 1893-1894 outbreak in garment district

Florence Kelley and Smallpox



Kelley, 1894

- Authorized by Factories and Workshops Act to “condemn and destroy” infectious articles
- Garment manufacturers uncooperative
- How to measure and control outbreak?

Kelley's Statistical Approach, 1894

- “How to reach the relatively few wholesalers and through them the multitude of tenement house workers?”
- Rejected census, “random search”: “out of the question” because 1,000 shops and 25,000-30,000 other rooms
- Obtained lists of infected cases from
 - Chicago Board of Health (incomplete)
 - District physicians
- Made immediate inspections of shops near case addresses
- Another use of snowball sampling (contact tracing)
- Early example of adaptive cluster sampling

Data and Analysis

- Published list of shops on streets with infections
- Recorded number of people, infections, vaccinated people in each tenement
- Observed patterns in smallpox close to sweatshops
- Identified areas with high infection
- Vaccination rate in infected areas < 5 %

Marvin Street.

<i>Small-Pox.</i>	<i>Tenement House Shop.</i>
33, Kravetzky..... April 28	42, C. Erickson, custom tailor.
234, Dolezal, 2 cases..... May 3	232, J. Beranek, custom tailor.
240, Kezel..... June 4	245, Albert Mayer, custom tailor.
	247, Joz. Cerny, custom tailor.
	248, John Kocka, custom tailor.

South May Street.

652, Martinek, 2 cases..... May 13	646, Frank Neosinal, custom tailor.
672, Kazin..... May 15	602, Frank Smith, home finisher.
	678, Mrs. Wagausch, finisher.
	680, Frank Schuk, coat maker.
	680, Mrs. Peters, home finisher.
	682, Mrs. Popatka, finisher.
	693, A. Sticka, custom tailor.
696, Ecek..... May 18	696, B. Bosek, custom tailor for The American Tailors,
696,..... May 24	Clark and Monroe sts.
696,..... June 11	
699, Staw..... May 11	
1103, Saukub..... June 6	

West Nineteenth Street.

206, Keating..... April 22	202, A. Havlin.
443, Dudas..... May 21	442, Frank Klava,
	444, Frank Jisa, coat maker for Simon, Leopold & Solomon, 165, 167 Market st.
	444, J. Mydlil, coat maker for Hart, Schaffner & Marx, Jackson and Market sts.
436, Shulda, 2 cases..... May 8	450, M. Baumrucker.
	450, J. Bismieck.
	450, F. Coas.
	453, V. Tyler, custom tailor.
	458, J. Kucera.
	460, A. Cimelik.
463, Ofchada, 4 cases..... May 16	469, Jos. Matthous, custom tailor for Nicoll the Tallor,
461,..... June 6	Adams and Clark sts.
471,..... May 4	495, Mrs. Fister, shirts.
	504, F. Prucha, custom tailor.
	510, Wm. Gavis, custom tailor.
	510, B. Kuuk.
	548, James Kalat.
	549, Peter Daruret.
	550, Jos. Tourek.
	552, Mrs. Jeka, shirts.
	557, Mrs. Burman, shirts.
	558, F. Prucha.
562, Krossman..... May 8	565, Jos. Hronek.
	567, M. Williams.
	567, Frank Hrawicka.
	567, Bohonek.
	568, A. Gepschek.
	568, Thos. Kaiser.
	587, Mrs. Hengurisch, finisher.
	616, Aug. Teski.
628, Harrington..... March 13	630, Mrs. Fremach, shirts.
	640, H. Zitnek.
	644, Ber. ha Pease.
646,..... April 22	646, Mrs. Mineschek, shirt maker, working for A. Lewin & Sons, 187 Market st.
	654, A. Koslovska, custom tailor.
674,..... June 11	674, J. Winbach, cigars.
	678, Minnie Mohr.
	679, A. Bennett.
	679, J. Zieck.

Aftermath of Kelley's Smallpox Investigation

- Kelley destroyed infected goods, but had no public health authority
- Board of Health ignored her pleas for immediate vaccination
- Communities ignored (or hid) the smallpox notice cards; milkmen came, families went to work and grocery store as usual
- “Many infants and little children we found concealed on closet shelves, wrapped in bundles, sometimes to keep them from being vaccinated, sometimes to keep them—with the disease so fully developed that concealment was unthinkable—from being sent to the sorely dreaded hospital.” (Kelley, 1986)

Aftermath

- Vaccination laws obeyed only after Illinois governor Altgeld threatened embargo of Chicago garments
- Illinois Manufacturer's Association opposed Kelley's, Altgeld's activities
- 1897: New Illinois governor John Tanner fired Kelley
- 1899: Kelley moved to New York, director of National Consumer League
- Advocated
 - Better working conditions, 8-hour day
 - Better data collection, consistent from year to year
 - “We are shamefully without adequate, trustworthy, official figures showing the earnings of women in industry” (Kelley, 1906)
 - Use of statistics to guide public policy (evidence-based policymaking)

Another Data Collection, 1893



Carroll D. Wright, about 1892

- Carroll Wright, U.S. Commissioner of Labor
- Directed by Congress in 1892 to “make a full investigation relative to what is known as the slums of cities.”
- All cities with > 200,000 people
- Appropriated \$20,000
- Restricted to small areas in Baltimore, New York, Philadelphia, Chicago

Kelley Supervised Chicago Data Collection

- Chose small rectangle just east of Hull House
- Four men from Bureau of Labor collected data, April-June 1893
- Turned schedules in to Kelley each day
- Hull-House residents copied data before forwarding to Wright

SEVENTH SPECIAL REPORT
 OF THE
 COMMISSIONER OF LABOR.

THE SLUMS

OF

BALTIMORE, CHICAGO, NEW YORK, AND
 PHILADELPHIA.

PREPARED IN COMPLIANCE WITH A JOINT RESOLUTION OF THE CONGRESS
 OF THE UNITED STATES, APPROVED JULY 20, 1892.

BY

CARROLL D. WRIGHT,
 COMMISSIONER OF LABOR.

WASHINGTON:
 GOVERNMENT PRINTING OFFICE.
 1894.

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262 SPECIAL REPORT OF THE COMMISSIONER OF LABOR.

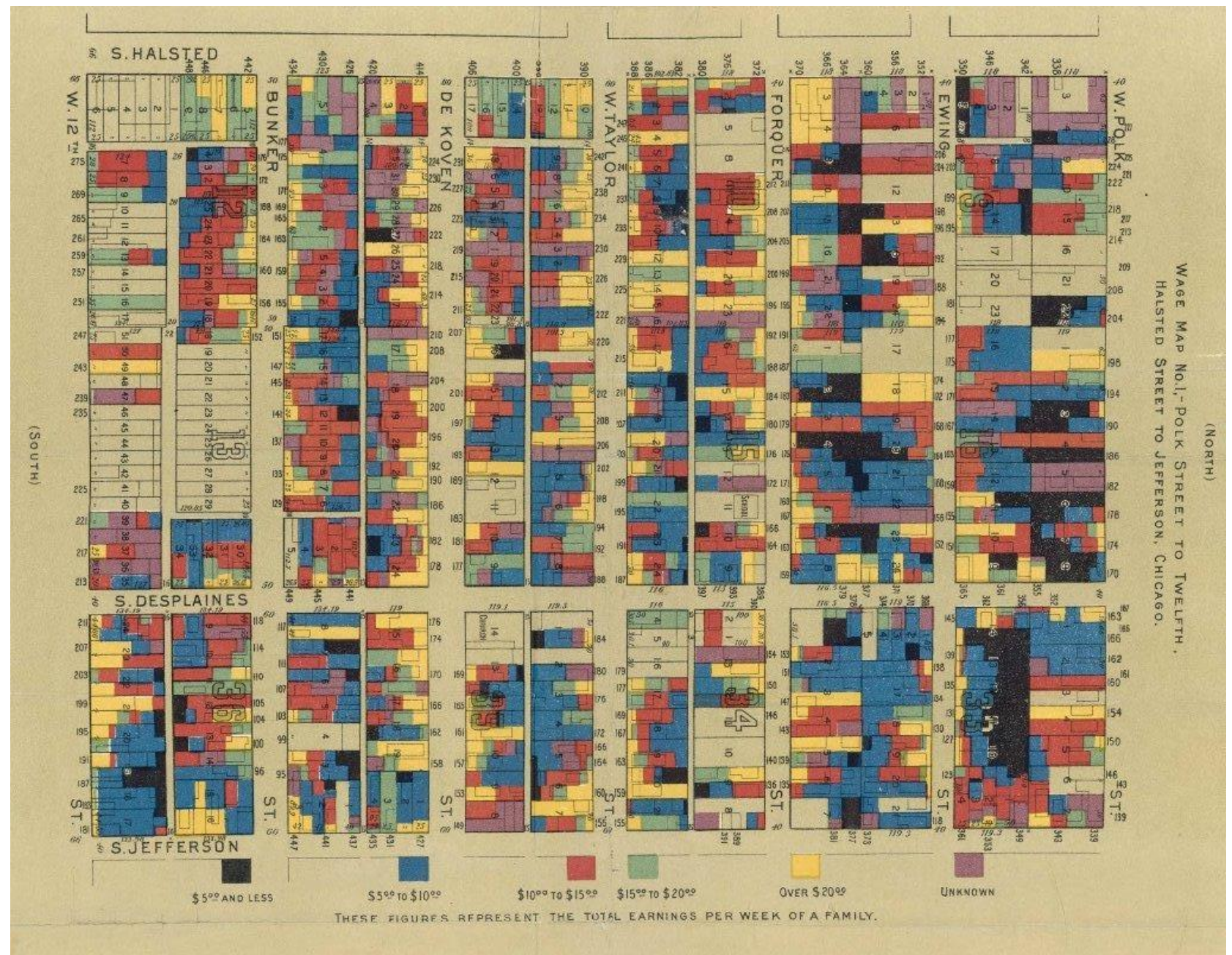
TABLE XVII.—WEEKLY EARNINGS AND DAYS AND HOURS OF LABOR, BY OCCUPATION AND SEX—Continued.

CHICAGO—Continued.

Occupation.	Average weekly earnings.	Days per week.	Hours per week.	Individuals.		
				Male.	Female.	Total.
PROFESSIONAL.—concluded.						
Officials, government	\$12.50	6	00	1		1
	15.00	6	48	4		4
	16.00	7	55	1		1
	18.00	6	48	1		1
	19.20	6	(a)	1		1
	19.33	6	48	1		1
	20.00	6	48	1		1
	25.00	6	53	1		1
	25.00	7	54	1		1
	35.00	6	48	1		1
	(a)	6	48	1		1
	(a)	(a)	(a)	1		1
Total				15		15
Organ grinders	3.50	6	72	1		1
	7.00	6	72	1		1
	7.00	6	(a)	1		1
	(a)	7	65	1		1
	(a)	(a)	(a)	1		1
Total				5		5
Physicians and surgeons	15.00	7	56	1		1
	30.00	6	50	1		1
	(a)	5	40	1		1
	(a)	7	49	1		1
	(a)	7	54	1		1
	(a)	(a)	(a)	4		4
Total				9		9
Teachers	2.50	6	24	1		1
	3.75	5	20	1		1
	4.00	6	24	1		1
	5.00	6	36	2		2
	7.00	7	56	1		1
	8.00	6	54	1		1
	8.00	6	56	1		1
	10.00	6	36	1		1
	10.00	7	49	2		2
	13.43	6	36	1		1
	15.00	5	40	1		1
	17.00	5	35	1		1
	20.00	5	25	1		1
	24.00	5	35	1		1
	25.00	6	45	1		1
	(a)	(a)	(a)	2		2
Total				14	6	20
Veterinary surgeons	15.00	(a)	(a)	1		1
	(a)	(a)	(a)	1		1
Total				2		2
Others in professional pursuits	5.00	6	48	1		1
	9.00	6	48	1		1
	11.00	6	60	1		1
	(a)	6	38	1		1
	(a)	(a)	(a)	2		2
Total				4	2	6
DOMESTIC AND PERSONAL SERVICE.						
Barbers and hairdressers	4.00	7	51	1		1
	5.00	6	72	1		1
	5.00	7	78	1		1
	6.00	7	79	1		1
	6.00	7	80	2		2
	6.00	7	82	1		1
	7.50	6	69	1		1

a Not reported.

Hull House Wage Map



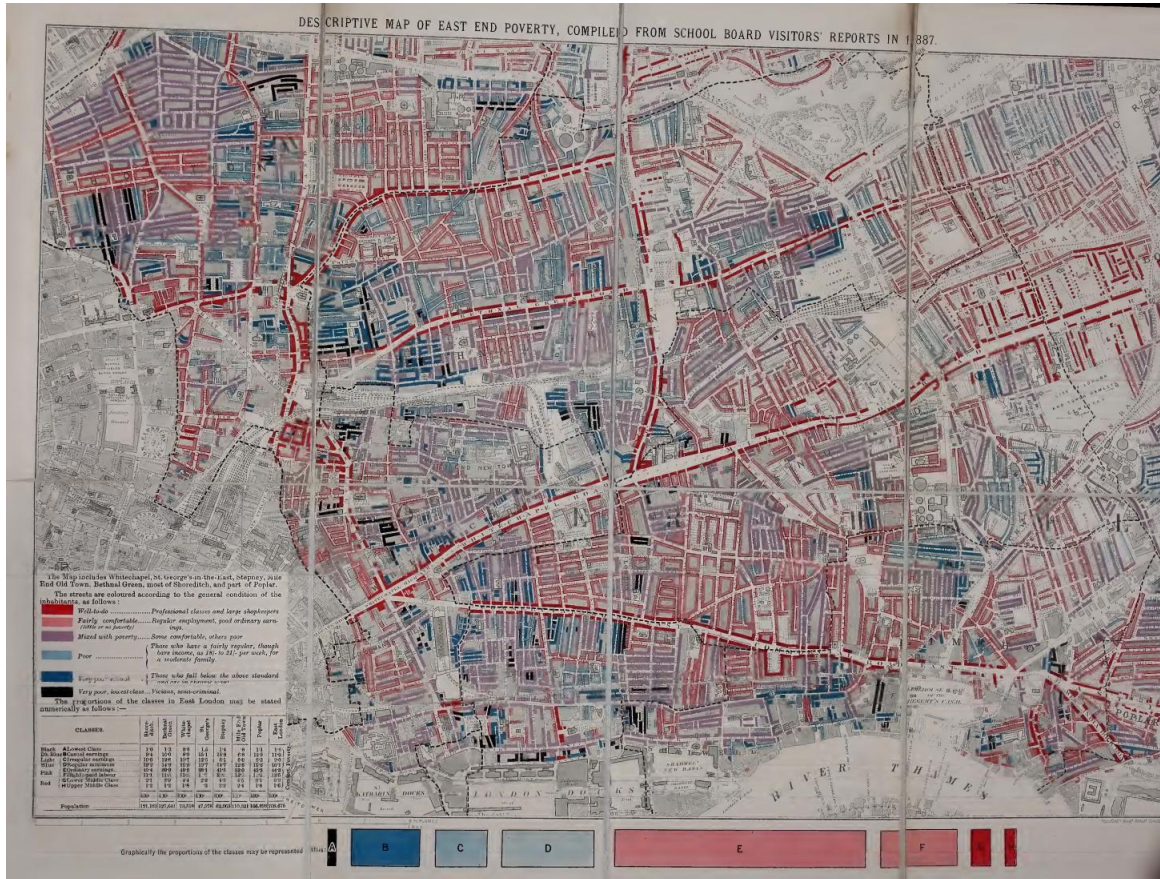
Agnes Sinclair Holbrook, 1867-1896

- Map design and coloring
- Bachelor of Science, Wellesley, 1892
- Hull House, 1892-1895
- Holbrook (1895) “Map Notes and Comments”

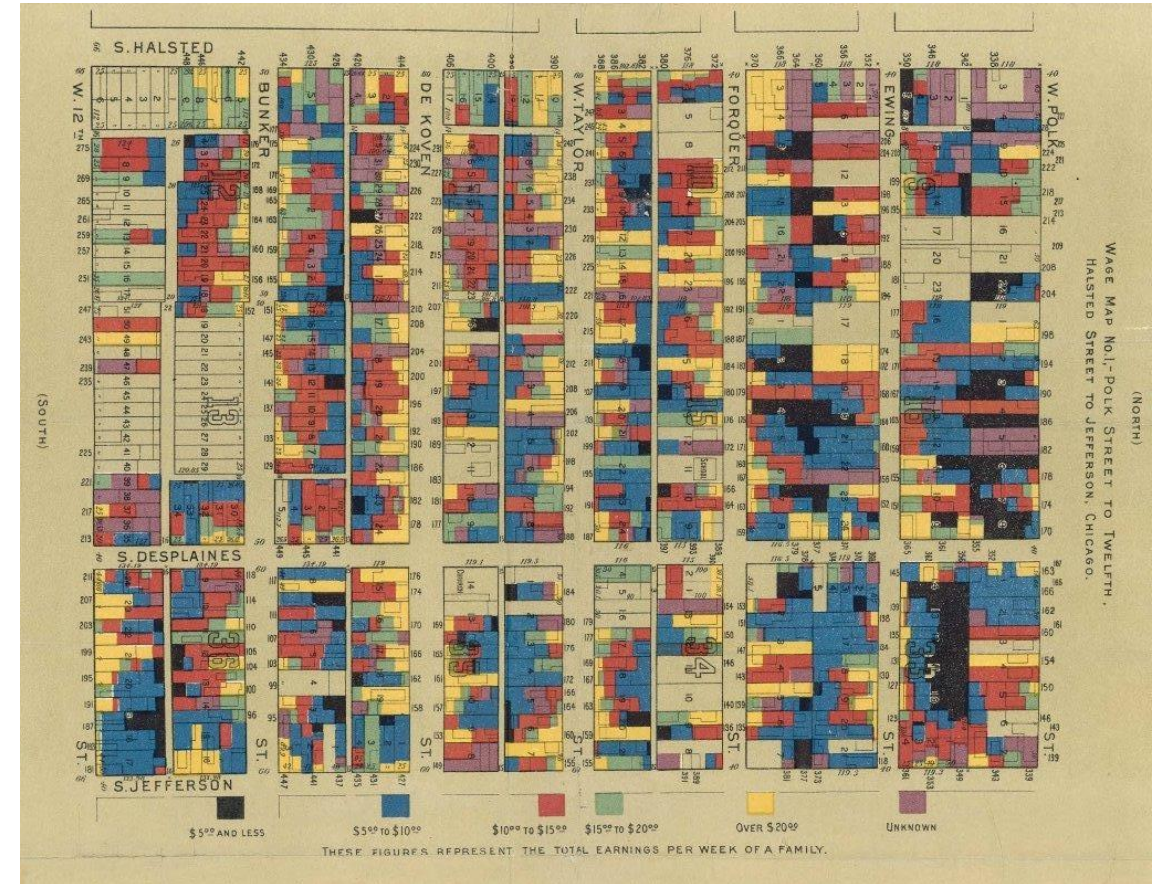
Decisions: What Data to Display?

- Hull House neighborhood
 - Mostly immigrants from Europe
 - High poverty
- Nationality
- Average family wage (precedent from Booth's wage maps)
- Number of weeks unemployed (recorded data but no map)

Decisions: How to Display the Data?



Booth's wage map



Hull House wage map

Improvements: Data Quality

Booth

- Conveniently available data
- School Board Visitors enforced attendance, collected data from families with school-age children
- Booth's team interviewed the School Board Visitors (Visitors not paid for interview time)

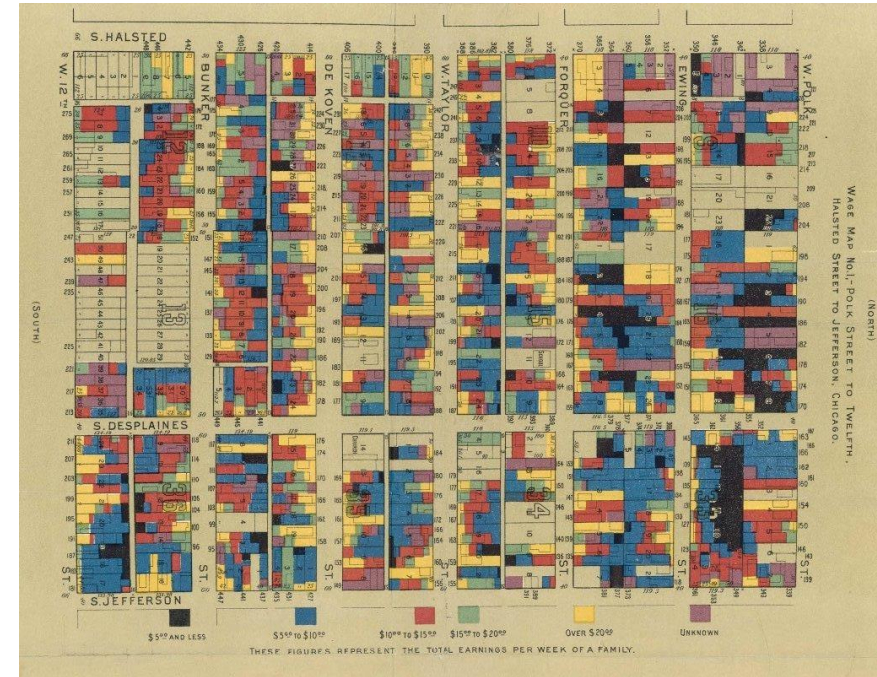
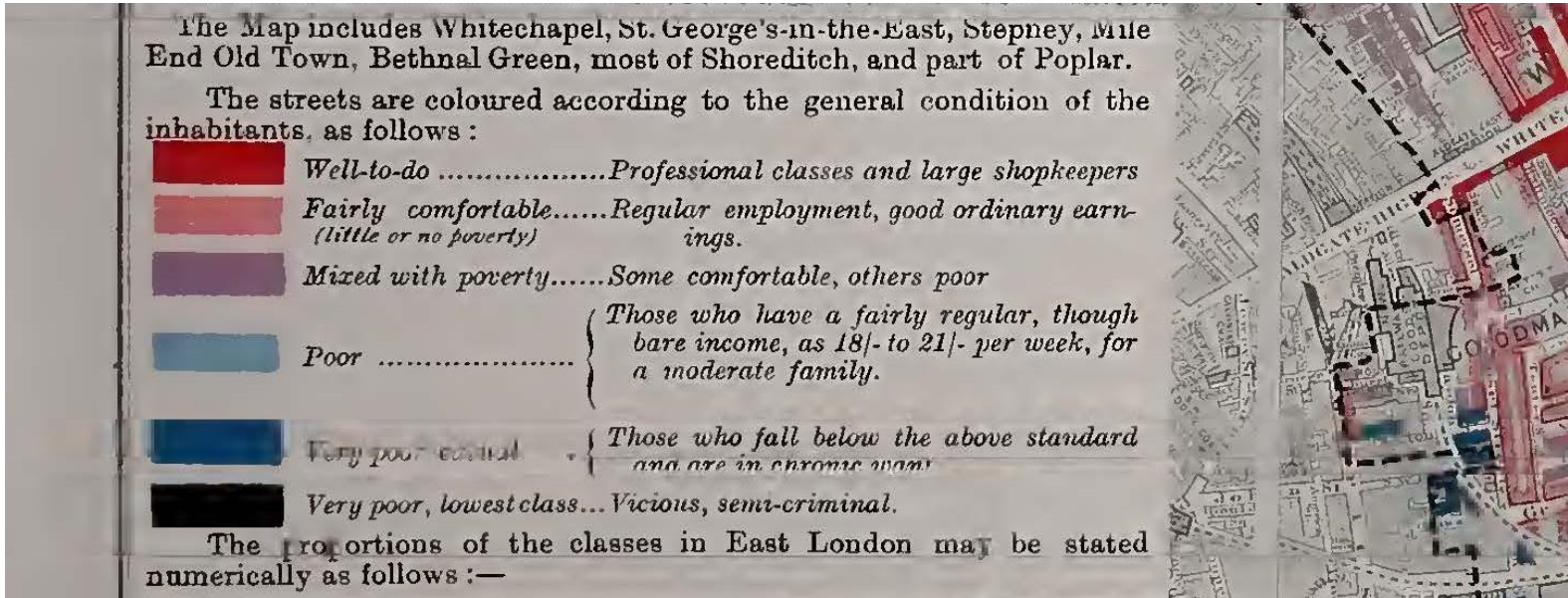
Hull House

- Professional data collectors
- Schedules asked what investigators wanted to know
 - Based on 1890 census forms
 - Results could be compared with census

Holbrook (1895) on Data Quality

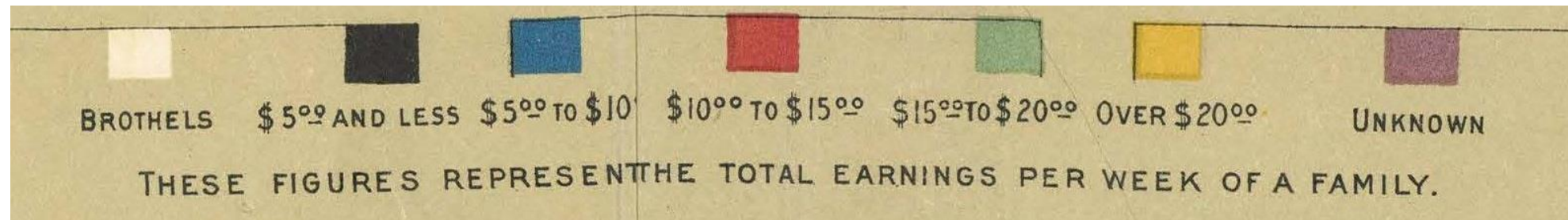
- “the facts set forth are **as trustworthy as personal inquiry and intelligent effort could make them**. Not only was each house, tenement, and room visited and inspected, but **in many cases the reports obtained from one person were corroborated** by many others.”
- “Although experience in similar investigation and long residence in the neighborhood enabled the **expert in charge** to get at all particulars with more accuracy than could have attended the most conscientious efforts of a novice, it is **inevitable that errors** should have crept in.”
 - Measurement error from incorrect responses
 - Frequent change of occupation, residences

Improvements: Color Coding



Objective scale

Includes "missing"



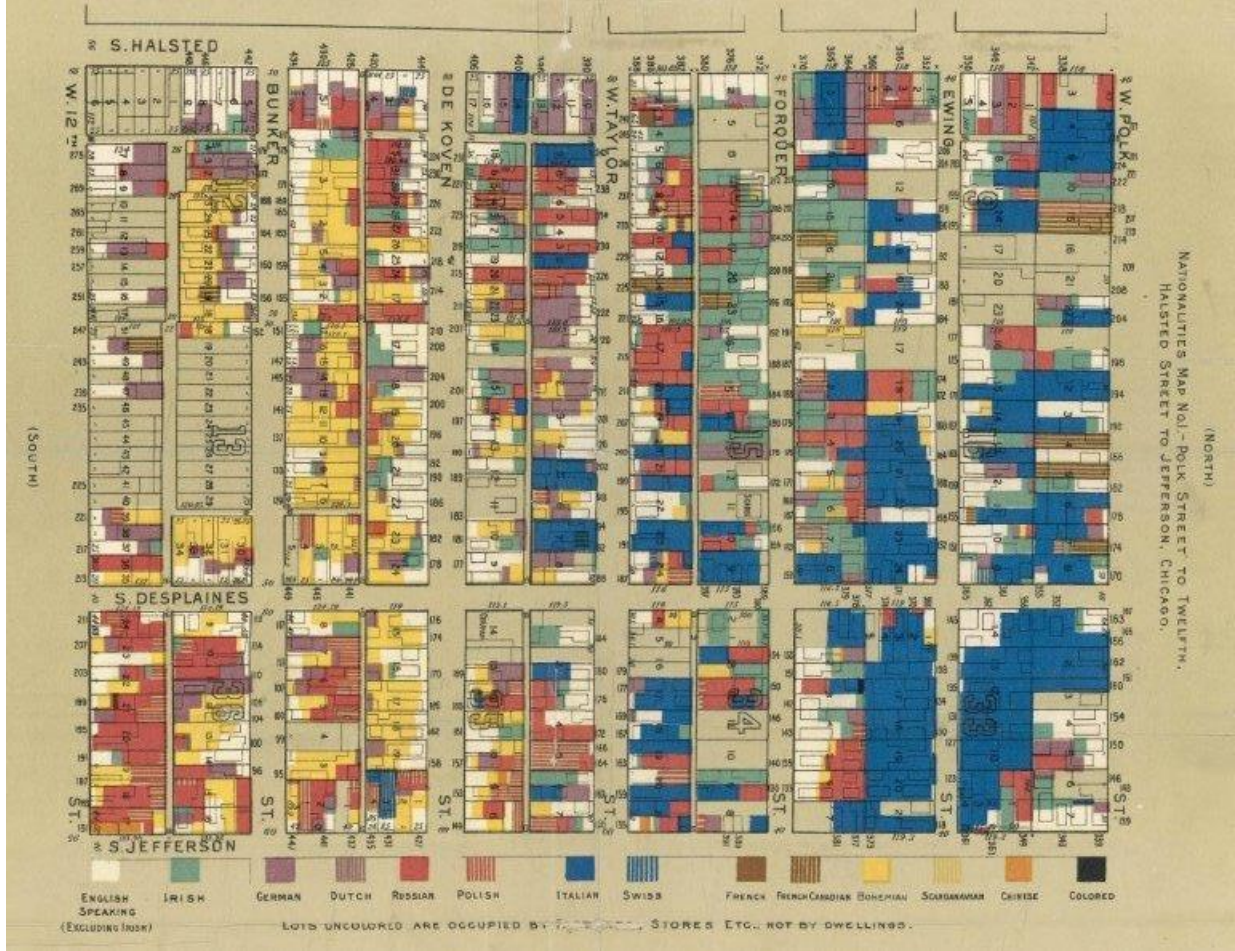
Improvements: Granularity

- Booth
 - Each city block was one color
- Hull House
 - Proportional coloring within houses
 - House having 2 families with \$7 wage, 1 family with \$12 wage will be 2/3 blue, 1/3 red
 - Allows reader to see degree of within-house homogeneity
- Holbrook wanted to display population density too, but did not see how
- Text: 60 men who sleep in one basement room

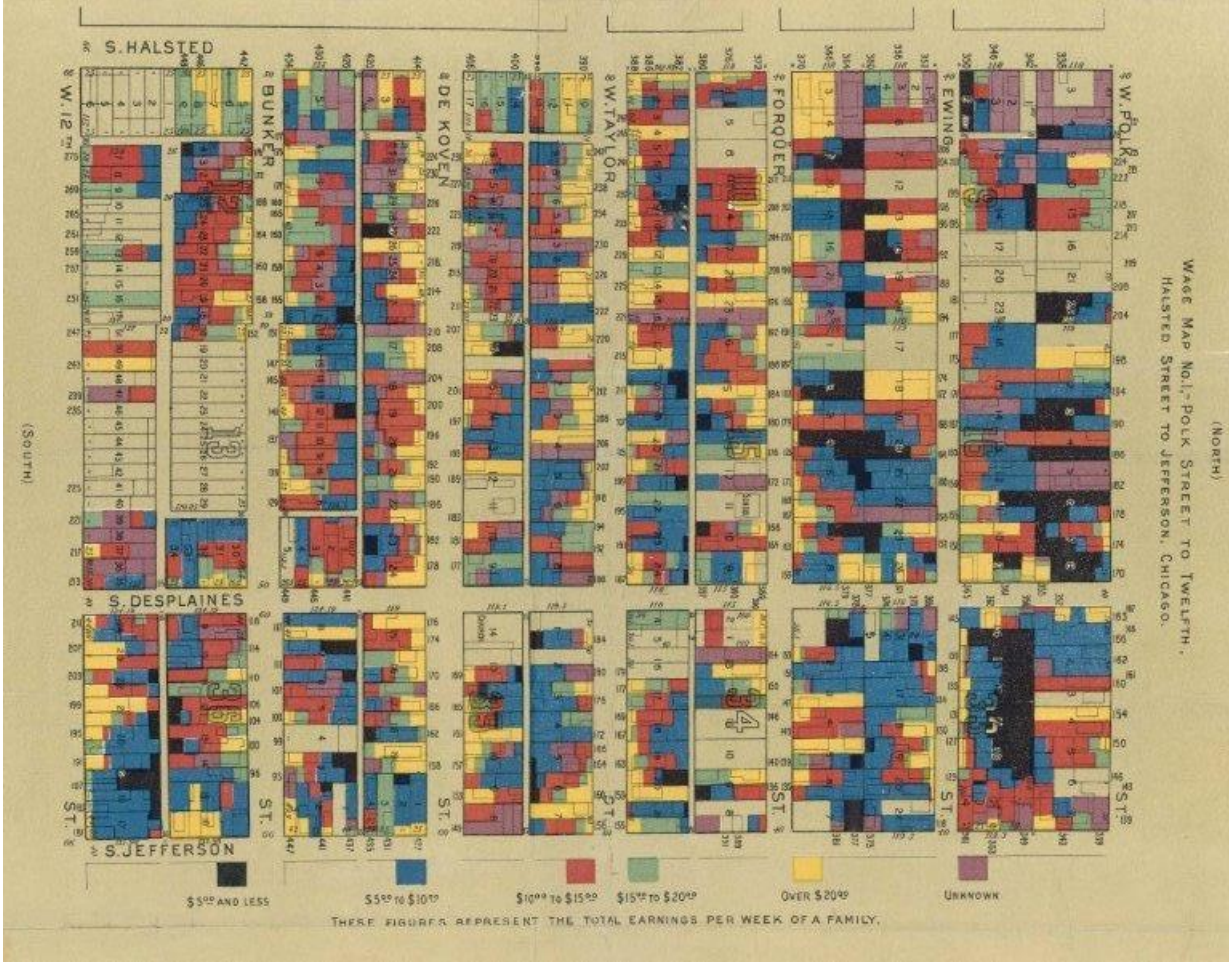
Statistical Reasoning in Holbrook (1895)

- **Display the data as accurately as possible:** “bring within reach of the public exact information concerning this quarter of Chicago rather than to advise methods by which it may be improved”
- **Document** the steps in collecting the data and making the graphs.
- **State limitations of the data**
- **Measurement errors** from respondents giving incorrect information or changing employment or residence.
- Explore **associations and correlations:** “A comparison of the two sets of outlines may also be of interest, showing in a general way which immigrants receive the highest, and which the lowest rates.”

Nationality Map



Wage Map



W.E.B. Du Bois (1899)

Publications
 OF THE
 University of Pennsylvania
 SERIES IN
 Political Economy and Public Law
 NO. 14
 THE PHILADELPHIA NEGRO
 A SOCIAL STUDY *100465*

BY
 W. E. BURGHARDT DU BOIS, Ph. D.

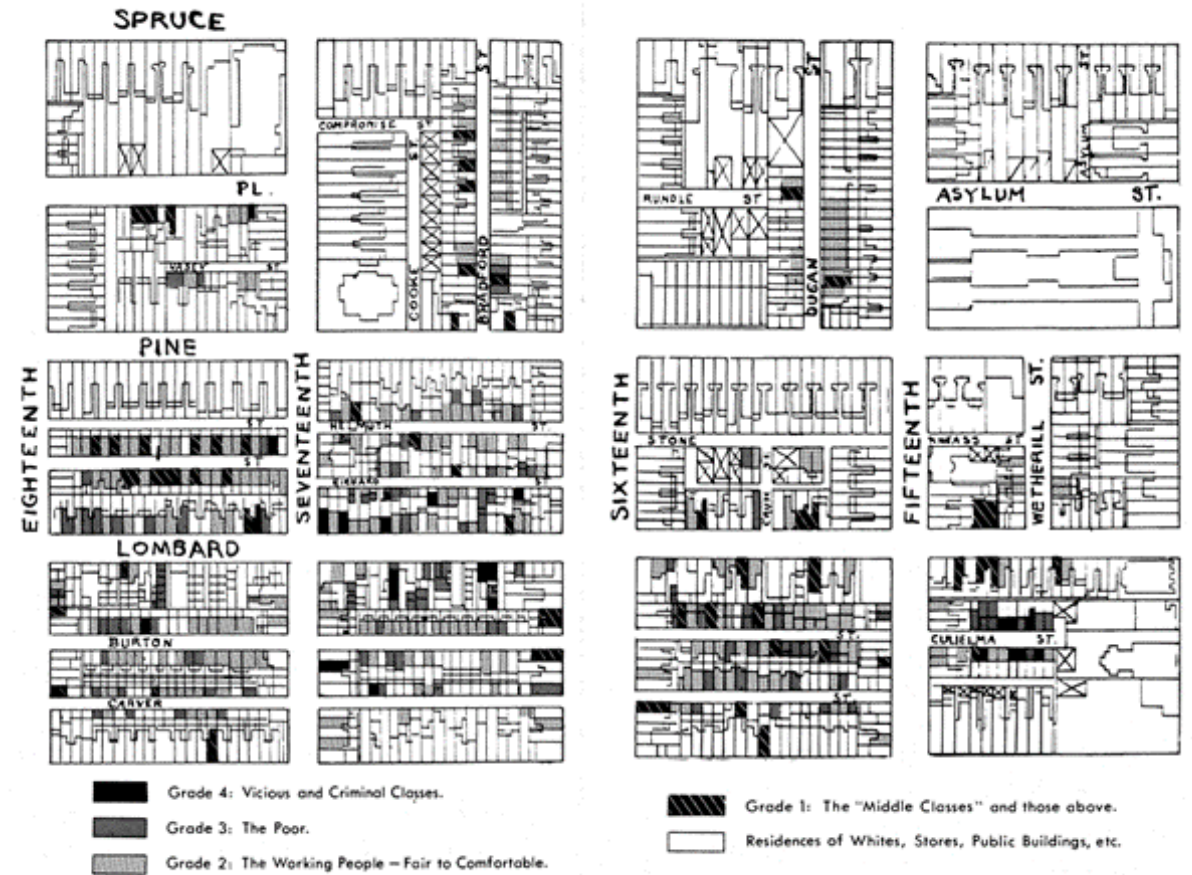
Some time Assistant in Sociology in the University of Pennsylvania; Professor of Economics and History in Atlanta University; Author of "The Suppression of the African Slave-Trade."

TOGETHER WITH
 A SPECIAL REPORT ON DOMESTIC SERVICE

BY
 ISABEL EATON, A. M.
 Fellow of the College Settlements' Association

Published for the University
 PHILADELPHIA
 1899

GINN & Co., Selling Agents, Tremont Place, Boston, Mass.



(continued)

Last 20% of book written by Isabel Eaton
 Hull House resident, 1893
 Wrote chapter in *Hull House Maps & Papers*

W.E.B. Du Bois, 1868-1963



W.E.B. Du Bois, 1904

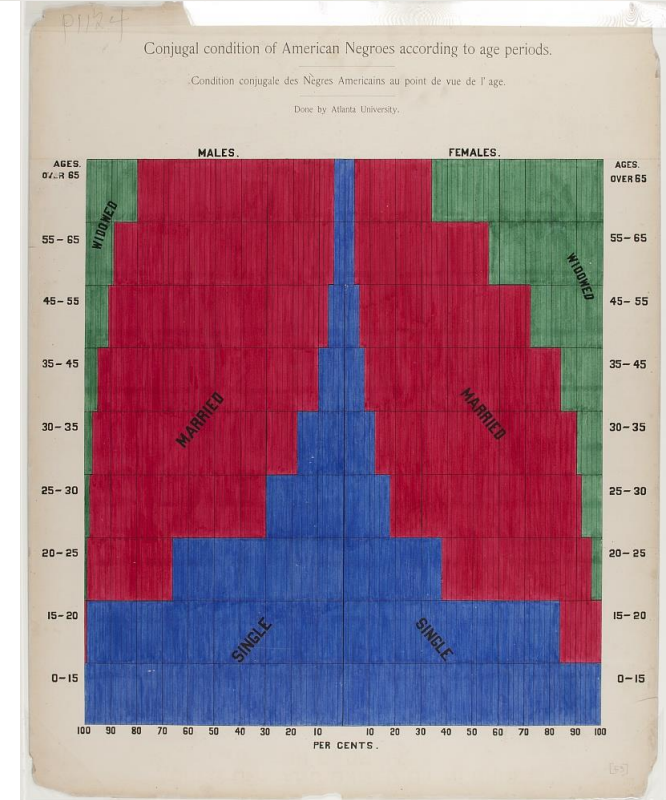
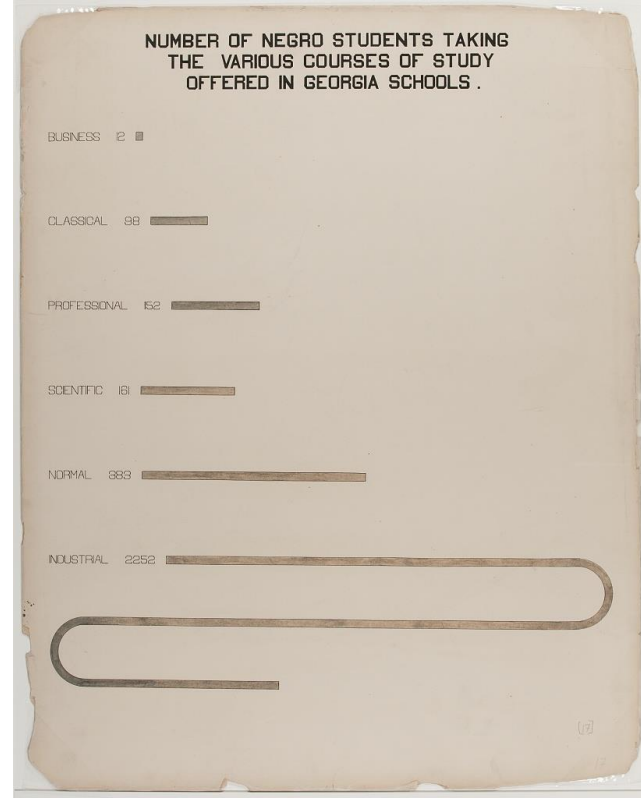
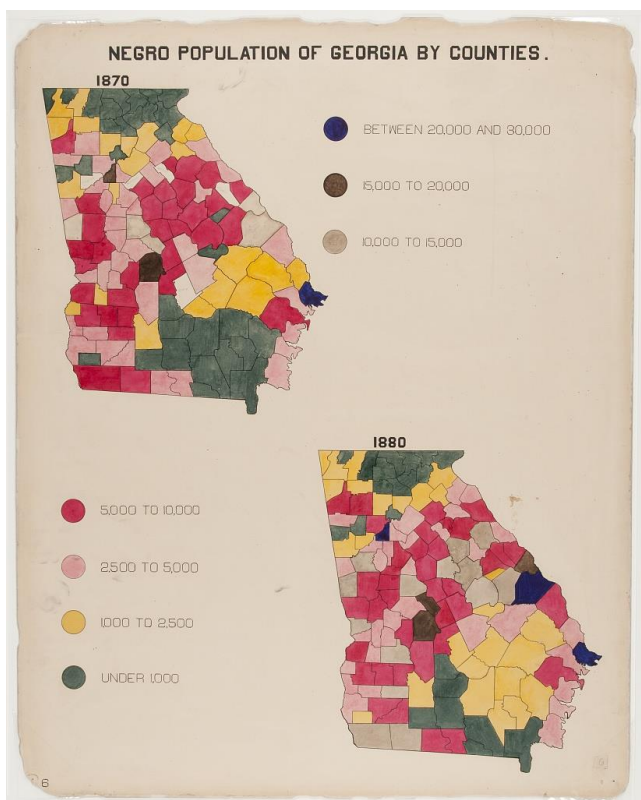
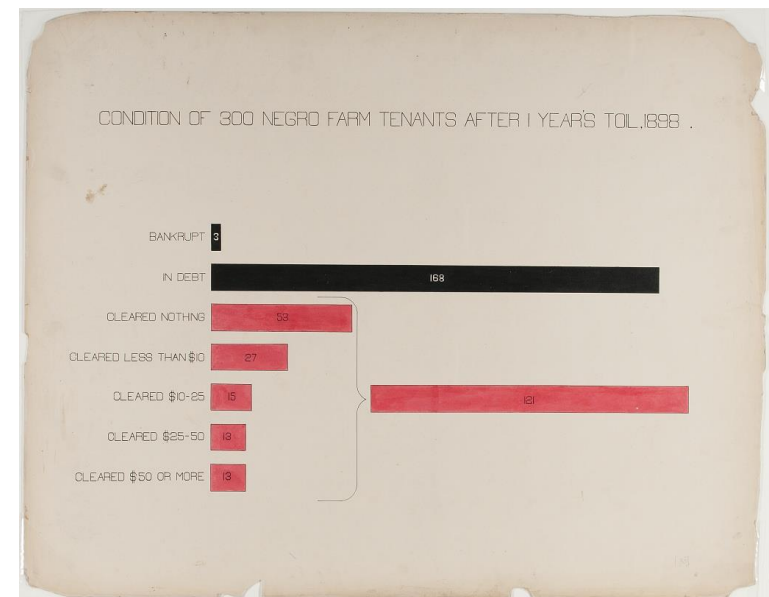
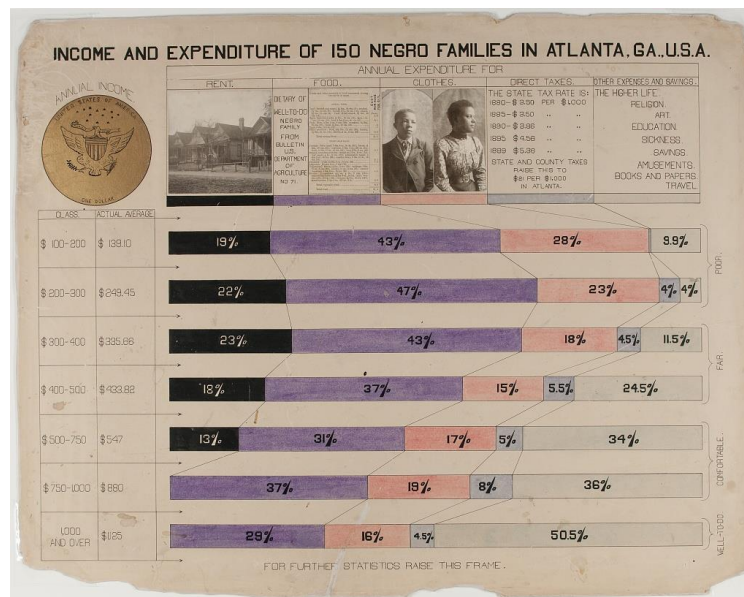
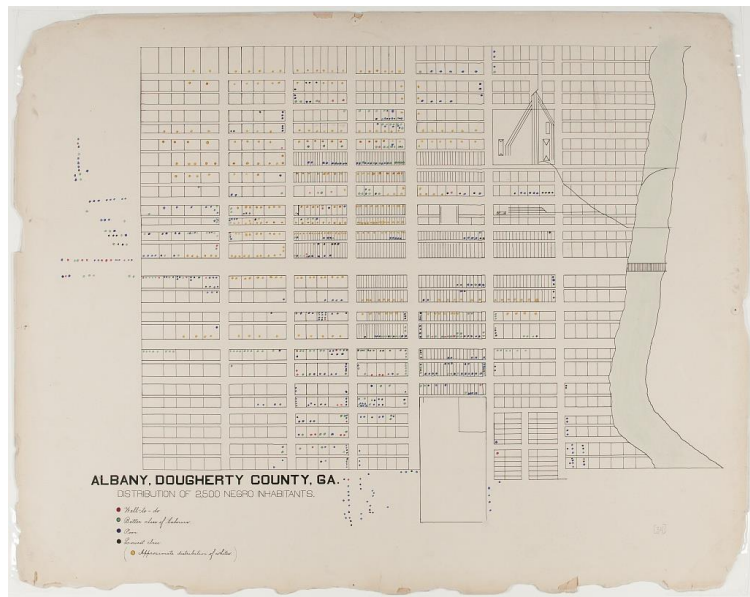
<https://loc.gov/pictures/resource/cph.3a29260/>

- PhD Harvard, 1896
- Atlanta University, 1897-1910
- Lifelong friendship with Jane Addams, Florence Kelley, Isabel Eaton
 - Co-founders of NAACP
 - Kelley visited Atlanta University
- Exhibit on African-American life at Paris 1900 *Exposition Universelle*
 - Won gold medal

Du Bois exhibit in Paris, 1900



- First 32 graphics are of Georgia statistics
- See full collection at <https://www.loc.gov/pictures/collection/coll/item/2005679642/>
- Reproduced, with commentary, in Battle-Baptiste and Rusert (2018)
- Lohr (2019d)

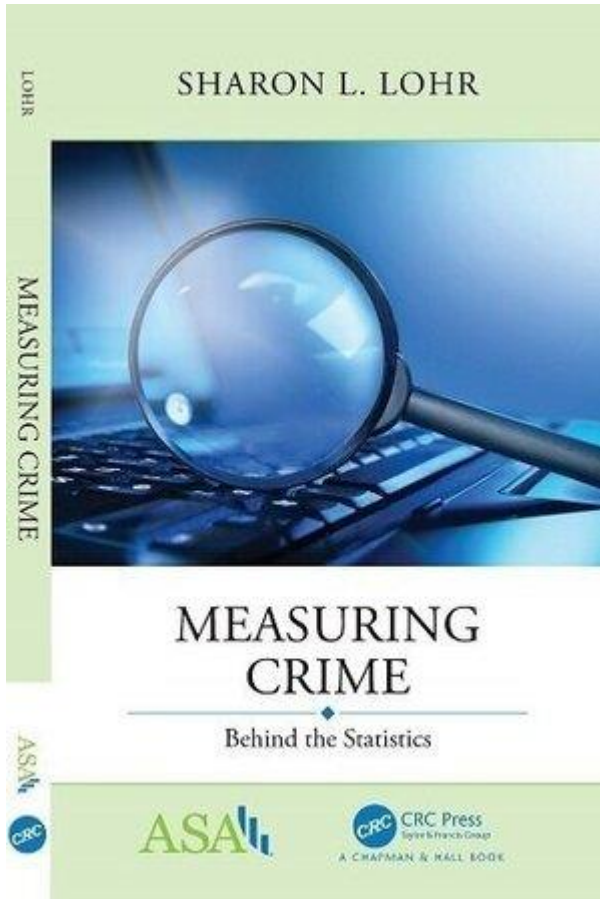


Measuring Crime: Behind the Statistics

- Statistical reasoning for general audience
- How to judge the quality of a statistic
- Good statistics come from good procedures
- Running example: crime statistics
- Book review, Dec. 1915 *Publications of the ASA*

“Statistics Relating to Crime in Chicago.” By Edith Abbott, Ph.D. 88 pp. Reprinted from Report of a City Council on Crime of the City of Chicago. Chicago School of Civics and Philanthropy, 1915.

In this statistical study of crime in Chicago, Dr. Abbott had done a good piece of work. The figures had to be collected from four different sources and when all the available material was collected the data were still lacking for a complete study of the social status of the offenders. The report is divided into two parts: the first covering the statistics of arrest



Edith Abbott, 1876-1957



Edith Abbott

https://commons.wikimedia.org/wiki/File:Edith_Abbott.jpg

- PhD Economics, 1905
- Research for Carroll Wright, 1906
- Correspondent of Florence Kelley
- Hull House resident, 1908-1920
- Statistician, Chicago City Council Committee on Crime 1914-1915
- ASA Fellow, 1945 (6th woman)

Abbott (1915)

Statistics Relating to Crime in Chicago

by

MISS EDITH ABBOTT, Ph. D., CHICAGO SCHOOL OF CIVICS
AND PHILANTHROPY

- Model of statistical reasoning
 - Lohr (2019 a,b,c)
- Arguments apply today
- Need accurate statistics
 - Use police resources efficiently
 - Dispel myths about crime
- Multiple sources of data
 - More complete picture
 - Evaluate quality of data sources
- Effects of missing data
- Good data collection → results easy to calculate, communicate

Social, Health, and Economic Statistics

- Pre-1940s: Census
- 1940s-today: Probability samples
 - One of greatest achievements of mathematical statistics
 - Generalize from sample to rest of population – without model assumptions
 - Inference comes from random variables associated with sample selection
- But
 - Response rates for surveys declining
 - Want faster, more granular data
 - Return to censuses, “big data”?

Same Problems that Faced Kelley, Abbott

- Need accurate data for public policy (“evidence-based policymaking”)
- Alternative sources for data
 - Administrative records
 - “Big data”
 - Kelley chose granular data for small area
 - Now have granular data for large parts of population
- Multiple data sources (Lohr, 2021)
 - How to combine?
 - How to assess quality?

Legacy for Today

- Mapping and statistical graphics
- Transparency and documentation
- Assess quality of data
- Fidelity to the data
 - Kelley, Holbrook, Eaton, Abbott had sympathies with those they studied
 - “paint faithfully the character of the region”
 - “photographic reproduction” (Holbrook, 1895)
- Time to claim them as statistical pioneers!

Thank you!

Slides and References

www.sharonlohr.com