

Health By Wealth: Computational tools and population level data uncover substantial inequalities in healthy aging over the very long run

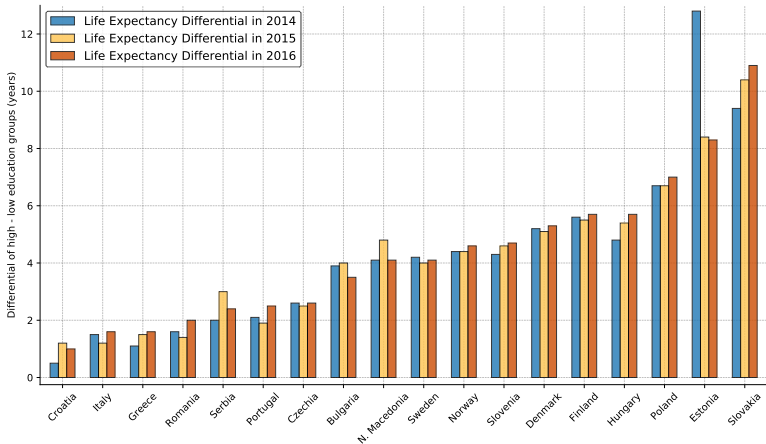
Charles Rahal

Leverhulme Centre for Demographic Science

IARU-ALH Keynote Talk, October 9th, 2025

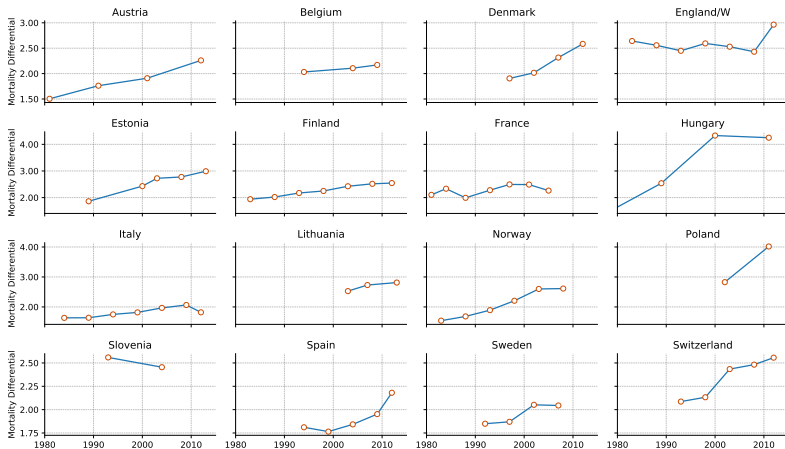


Inequalities in healthy aging are pervasive...



Source: Eurostat. Note: Not a selective subset – this is for **all** countries measured. Differential measured as life expectancy for those with 'Tertiary' education minus life expectancy of those with 'Less than primary, primary or lower secondary' education.

Inequalities in healthy aging are persistent..

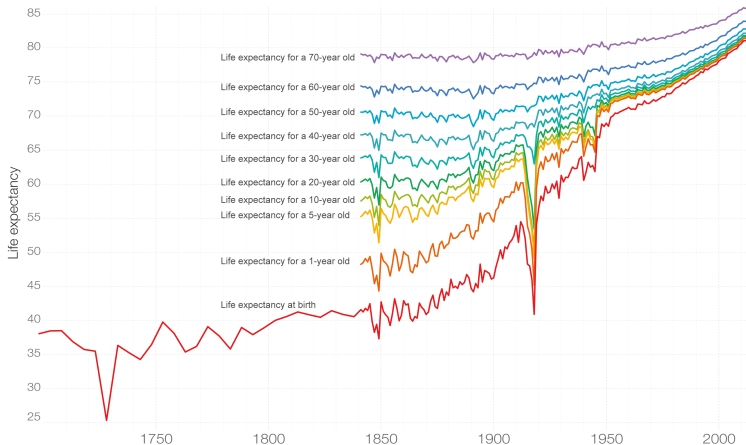


Source: Data from Mackenbach, J.P. et al. (2018). Trends in health inequalities in 27 European countries. *PNAS*, 15(25), 6440-6445. Specifically: their 'Relative Index of Inequality', harmonised across countries to International Standard Classification of Education 1997 categories. *y*-axis again relates to high-to-low education.

Historical data on health inequalities is rare

Life Expectancy by Age in England and Wales, 1700-2013

Shown is the total life expectancy given that a person reached a certain age.



“Medicine is a social science,
and politics nothing but medicine at a larger scale.”

— Rudolf Virchow, ca. July 1848–June 1849.

This leads us to make two relatively uncontroversial statements:

1. Society's poorer, less privileged members live in worse health and die younger than the rich, more privileged ones.
2. But until now, we've only had either cross-sectional data on mortality inequalities, or temporal general population indices

But **WHY** might there exist an association between SES and health disparities?

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But **WHY** might there exist an association between SES and health disparities?

Theory of fundamental causes has four key components:

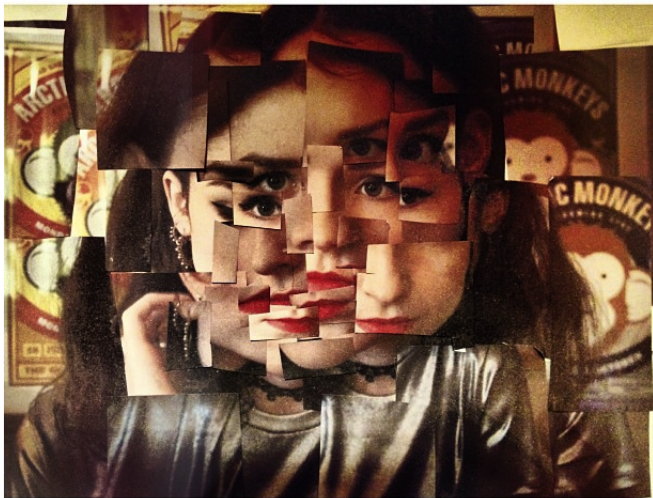
1. Multiple disease outcomes
2. Outcomes mediated through multiple risk factors
3. Access to resources allows risk avoidance and minimizes consequences of disease
4. SES-mortality gradient persists and reproduces despite changing conditions

Key resources: knowledge, money, power, prestige, beneficial social connections.

(Link and Phelan, 1995)



But, historical data is compiled through snapshots



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Chadwick (1842) in the Enquiry into the Sanitary Conditions of the Labouring Population. Average age at death in Liverpool (1840):

- 35 for professional persons,
- 22 for tradesmen,
- 15 for labourers, mechanics and servants.

Marmot (1994) and the influential 'WhiteHall Studies':

- Each hierarchical level of job seniority experienced a higher mortality rate than the group one step higher.

We use deep learning and optical character recognition to combine the most detailed analysis of health inequalities over the long run ever to be conducted.

Probate Records (1858-1995)**All wills and administrations**

Deceased person's wishes for distributing their assets.

Legal process for distributing assets when there is no will.

Wills

Administrations

Death Registry (1861-1991)**All 66m deaths**

John Doe

Parish

Date

Age

Family Trees**WikiTree database****Gender Estimation**

Ann

Brian

Camilla

David



Probate Records (1858-1995)

All wills and administrations

Deceased person's wishes for distributing their assets.

Legal process for distributing assets when there is no will.

Wills

Administrations

Death Registry (1861-1991)

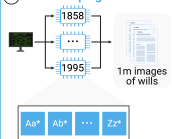
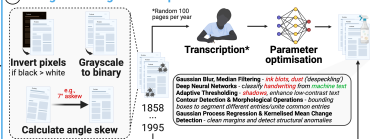
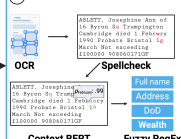
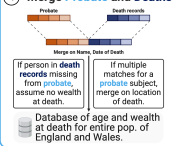
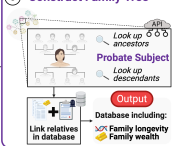
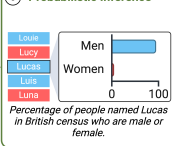
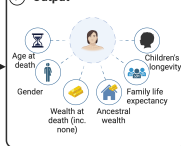
All 66m deaths

John Doe

Name Parish Date Age

Family Trees

WikiTree database

**Gender Estimation****1 Web Scraping****2 Image Cleaning with Computer Vision****3 Text Extraction and OCR****4 Merge Probate and Deaths****5 Construct Family Tree****6 Probabilistic Inference****7 Output**

Probate Records (1858-1995)

All wills and administrations

Deceased
person's wishes
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Wills

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Death Registry (1861-1991)

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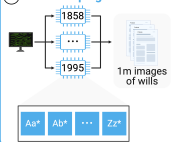
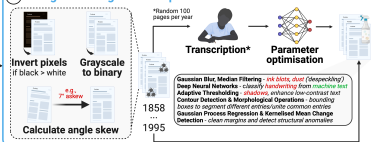
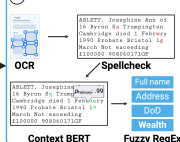
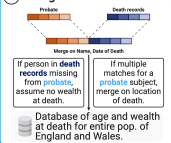
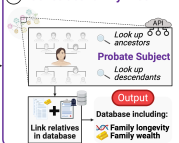
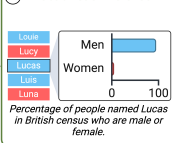
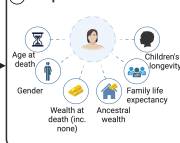
WikiTree database

Gender Estimation

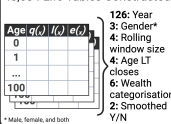
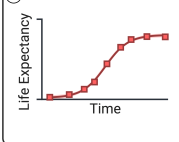
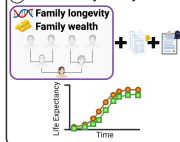
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○○○

Ann
Brian
Camilla
David

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→ ×
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1 Web Scrapping**2 Image Cleaning with Computer Vision****3 Text Extraction and OCR****4 Merge Probate and Deaths****5 Construct Family Tree****6 Probabilistic Inference****7 Output****(A) Life Tables**

48,034 Life Tables Constructed

**(B) Historical Trends****(C) Stratified by Wealth****(D) Stratified by Family Wealth**

Measuring wealth from Victorian and modern Britain

- The **Probate Registry Calendar** is a digitised collection of all the wills proved in the UK between 1858 and 1995.
- With very few exceptions (e.g., members of the royal family), **all individuals** who have left behind inheritance are listed in probate records.
 - **Wills:** individuals who have formally expressed a wish for their estate (big or small).
 - **Administration:** where a will was not created, but the estate was valued at (in today's money) $\approx$ £5,000.



DICKENS { Charles otherwise
Charles John
Huffham Esq.

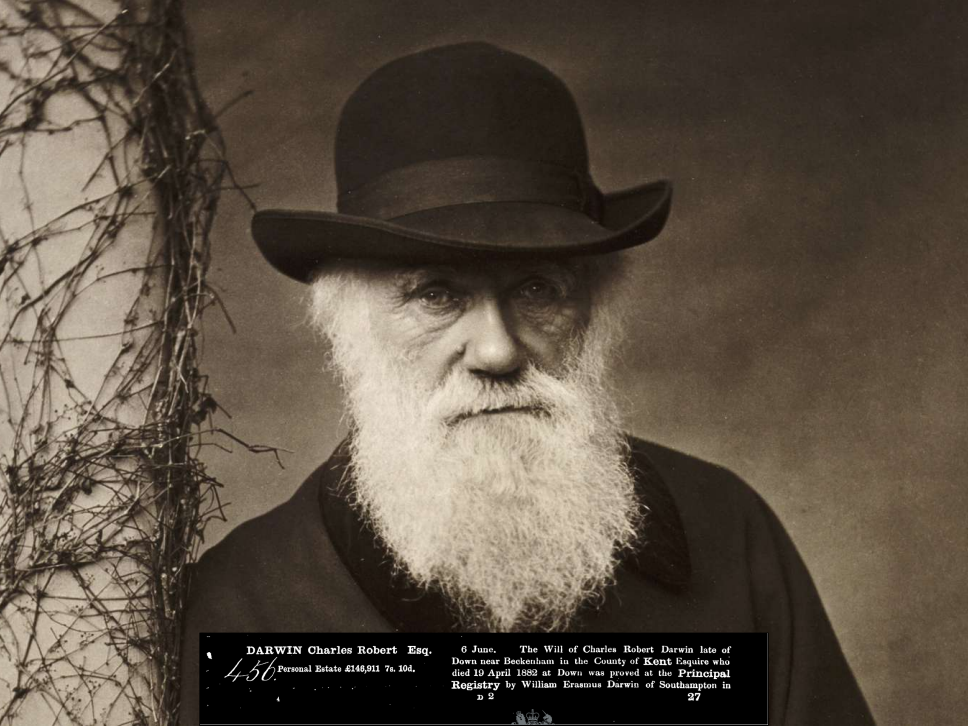
468

Effects under £80,000..

19 July.

The Will

with a Codicil of Charles otherwise Charles John Huffham Dickens late of Gads Hill Place near Rochester in the County of Kent Esquire deceased who died 9 June 1870 at Gads Hill Place aforesaid was proved at the Principal Registry by the oaths of Georgina Hogarth of Gads Hill Place aforesaid Spinster and John Forster of Palace Gate House Kensington in the County of Middlesex Esquire the Executors.



DARWIN Charles Robert Esq.

450

Personal Estate £146,911 7s. 10d.

6 June. The Will of Charles Robert Darwin late of Down near Beckenham in the County of Kent Esquire who died 19 April 1882 at Down was proved at the Principal Registry by William Erasmus Darwin of Southampton in

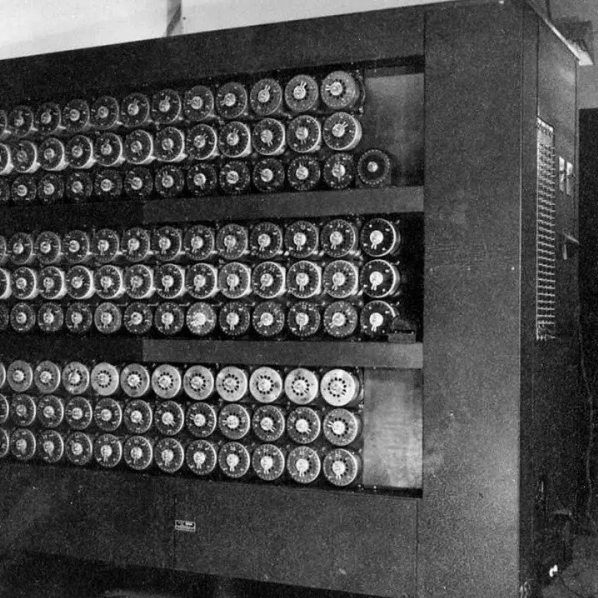
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27





WOOLF Adeline Virginia of Monks House Rodmell near **Lewes**
(wife of Leonard Sidney Woolf) died 28 March 1941 Probate
Llandudno 19 August to the said Leonard Sidney Woolf
publisher. Effects £16868 7s. 7d.
Resworn £14051 3s. 5d.



TURING Alan Mathison of Hollymeade Adlington-road Wilmslow
Cheshire died 8 June 1954 Probate **Manchester** 20 September
to Philip Nicholas Furbank librarian. Effects £4603 5s. 4d.



CHURCHILL the right honourable sir **Winston Leonard Spencer K.G. O.M. C.H.** of Chartwell Manor Westerham Kent and 28 Hyde Park Gate London S.W.7 died 24 January 1965 at 28 Hyde Park Gate Probate London 9 February to dame Clementine Ogilvy Spencer Churchill G.B.E.; widow Mary Soames married woman and John Rupert Colville C.B. C.V.O. banker. E304044.

...plus millions of more modest wills

- **John Croxton**; a labourer who died in December 1854 and left £5 (£600 today) to a farmer.
- **Lionel Abbot**; a commercial clerk who died in 1924 and left £65 (£4,000 today) to his son.
- **Susannah Chilvers**; a widow who died in 1964 and left £211 (£4,000 today) to her bricklayer son and homemaker daughter.

Web scraping the probate register

Stage	Step
1.	Set up 138 virtual machines (EC2, AWS) - one for each year.
2.	Sent requests ¹ at a rate of – on average – one request every 10 seconds (plus or minus noise). ²
3.	Use wildcard search to rattle through all surnames between Aa* and Zz*.
4.	Save image in AWS S3 bucket for processing.

Result: 1 million pages of probate records (or, stacked horizontally...)

¹With friendly user agent message providing contact details.

²This is well within normal traffic for server and abides by robots.txt guidelines.

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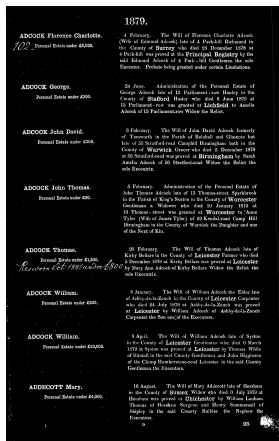
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Image cleaning with computer vision



1. Invert colours if black pixels > white pixels
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3. Calculate angle of pixels and deskew
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8. Bounding boxes around each entry
9. Resize page based on optimal extraction^a

^aHuge thanks to RAs who created training set per year!

Image cleaning with computer vision

	1879.
ADCOCK Florence Charlotte. 102. Personal Estate under £500.	4 February. The Will of Florence Charlotte ADCOCK (Wife of Edward ADCOCK) late of 4 Parkhill Rowland in the County of Surrey who died 25 November 1878 at 4 Parkhill was proved at the Principal Registry by the said Edward ADCOCK of 4 Parkhill Gardens the sole Executor. Probate being granted under certain Limitations.
ADCOCK George. Personal Estate under £500.	26 June. Administration of the Personal Estate of George ADCOCK late of 12 Parliament Street Hanley in the County of Staffordshire who died 6 June 1878 at 12 Parliament Street was granted to EDWARD to Anna ADCOCK of 12 Parliament Street Widow the Sole.
ADCOCK John David. Personal Estate under £500.	9 February. The Will of John David ADCOCK formerly of Turbarn in the Parish of Betchell and Gloucester late of 26 Stratford Road Churchill Birmingham late in the County of Warwick Deceased who died 8 November 1878 at 26 Stratford Road was proved at Birmingham by Sarah Anna ADCOCK of 20 Stratford Road Widow the Sole the sole Executor.
ADCOCK John Thomas. Personal Estate under £50.	3 February. Administration of the Personal Estate of John Thomas ADCOCK late of 15 Thamestreet Spitalfields in the Parish of King's Norton in the County of Worcester Gentleman a Widower who died 29 January 1873 at 15 Thamestreet was granted at Worcester to Anna Tyler (Wife of James Tyler) of 18 Knollmead Group Hill Birmingham in the County of Warwick the Daughter and one of the Next of Kin.
ADCOCK Thomas. Personal Estate under £500. <i>Received 6th 1880 under £500</i>	28 February. The Will of Thomas ADCOCK late of Kirby Bellars in the County of Leicestershire who died 2 November 1874 at Kirby Bellars was proved at Leicester by Mary Ann ADCOCK of Kirby Bellars Widow the Sole the sole Executor.
ADCOCK William. Personal Estate under £500.	3 January. The Will of William ADCOCK the Elder late of Ashby-de-la-Zouch in the County of Leicestershire Carpenter who died 24 July 1873 at Ashby-de-la-Zouch was proved at Leicester by William ADCOCK of Ashby-de-la-Zouch Carpenter the Son one of the Executors.
ADCOCK William. Personal Estate under £500.	4 April. The Will of William ADCOCK late of Syston in the County of Leicestershire Gentleman who died 9 March 1873 at Syston was proved at Leicester by Thomas White of Syston in the said County Gentleman and John Hargreaves of the Church Haverham-road Leicester in the said County Gentleman the Executors.
AUDSCOTT Mary. Personal Estate under £500.	16 August. The Will of Mary ADCOCK late of Borden in the County of Surrey Widow who died 2 July 1870 at Borden was proved at Chichester by William Ludlow Thomas of Borden Deacon and Henry Stannard of Selsey in the said County Bailiff the Executor the Executor.

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ADCOCK Florence Charlotte. Personal Estate under £6,000.	4 February. The Will of Florence Charlotte ADCOCK (Wife of Edward ADCOCK) late of 4 Parkhill Belmont in the County of Surrey who died 20 December 1878 at 4 Parkhill was proved at the Principal Registry by the said Edward ADCOCK of 4 Park Hill Gardens the sole Executor. Probate being granted under certain Limitations.
ADCOCK George. Personal Estate under £100.	21 Jan. Administration of the Personal Estate of George ADCOCK late of 11 Parliament-street Haxley in the County of Stafford Haxley who died 4 June 1879 at 11 Parliament-street was granted at Lichfield to Anna ADCOCK of 20 Parkmansmore Widow the Heir.
ADCOCK John David. Personal Estate under £100.	3 February. The Will of John David ADCOCK formerly of Tamworth in the Parish of Balsall and Gloucestre but late of 20 Stratford-road Churchill Birmingham both in the County of Warwick Gloucestre who died 2 December 1878 at 20 Stratford-road was proved at Birmingham by Sarah Anna ADCOCK of 68 Stratford-road Widow the Heir the sole Executrix.
ADCOCK John Thomas. Personal Estate under £25.	5 February. Administration of the Personal Estate of John Thomas ADCOCK late of 13 Thornecroft Spoutbrook in the Parish of King's Norton in the County of Worcester Gloucestre a Widower who died 10 January 1879 at 13 Thorne-street was proved at Worcester to Anne Taylor (Wife of James Taylor) of 22 Roodford Lane Hill Birmingham in the County of Warwick the Daughter and one of the Next of Kin.
ADCOCK Thomas. Personal Estate under £1,000. <i>Residuary Estate £1,000-£1,500</i>	10 February. The Will of Thomas ADCOCK late of Kirby Bellus in the County of Leicestershire Farmer who died 8 December 1878 at Kirby Bellus was proved at Leicester by Mary Ann ADCOCK of Kirby Bellus Widow the Heir the sole Executrix.
ADCOCK William. Personal Estate under £100.	1 January. The Will of William ADCOCK the Elder late of Ashby-de-la-Zouch in the County of Leicestershire Carpenter who died 24 July 1878 at Ashby-de-la-Zouch was proved at Leicester by William ADCOCK of Ashby-de-la-Zouch Carpenter the Son and the Executor.
ADCOCK William. Personal Estate under £10,000.	8 April. The Will of William ADCOCK late of Syden in the County of Leicestershire Gentleman who died 12 March 1879 at Syden was proved at Leicester by Thomas White of Bressall in the said County Gentleman and John Whigmore of the Chapel Hamlet near Leicestershire in the said County Gentleman the Executors.
ADDSOOTY Mary. Personal Estate under £1,000.	10 August. The Will of Mary ADDSOOTY late of Haxham in the County of Bedford Widow who died 2 July 1878 at Haxham was proved at Chichester by William Ludlow Thomas of Haxham Esquire and Henry Mansfield of Shipley in the said County Bailiff the Executors.

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Image cleaning with computer vision

1879.

ADCOCK Florence Charlotte.

Personal Estate under £6,000.

4 February. The Will of Florence Charlotte Adcock (Wife of Edward Adcock) late of 4 Parkhill Mansions in the County of Surrey who died 20 December 1933 at 4 Parkhill was proved at the Principal Registry by the said Edward Adcock of 4 Park Hill Gardens the sole Executor. Probate being granted under certain Limitations.

ADCOCK George.

Personal Estate under £100.

24 June. Administration of the Personal Estate of George Adcock late of 11 Parliament-street Haxley in the County of Stafford Haxley who died 4 June 1929 at 11 Parliament-street was granted at Lichfield in the County of Stafford to the said George Adcock the sole Executor.

ADCOCK John David.

Personal Estate under £100.

3 February. The Will of John David Adcock formerly of Teworth in the Parish of Rotherham and Gloucester but late of 20 Stratford-road Chapel Birmingham both in the County of Warwick Gloucester who died 2 December 1933 at 20 Stratford-road was proved at Birmingham by Sarah Adcock Adcock of 69 Stratford-road Wilton the sole Executor.

ADCOCK John Thomas.

Personal Estate under £25.

5 February. Administration of the Personal Estate of John Thomas Adcock late of 13 Thorne-croft Sparkbrook in the Parish of King's Norton in the County of Worcester Gloucestershire a Widower who died 10 January 1930 at 13 Thorne-croft was proved at Worcester by Anne Taylor (Wife of James Taylor) of 22 Rotherham Camp Hill Birmingham in the County of Warwick the Daughter and one of the next of Kin.

ADCOCK Thomas.

Personal Estate under £1,000.

Residuary Estate under £1,000.

30 February. The Will of Thomas Adcock late of Kirby Bellus in the County of Leicestershire Farmer who died 8 December 1933 at Kirby Bellus was proved at Leicester by Mary Ann Adcock of Kirby Bellus Widow the Sole and one of the Executors.

ADCOCK William.

Personal Estate under £100.

4 January. The Will of William Adcock late of Esher late of Ashby-de-la-Zouch in the County of Leicestershire Carpenter who died 24 July 1933 at Ashby-de-la-Zouch was proved at Leicester by William Adcock of Ashby-de-la-Zouch Carpenter the Sole and one of the Executors.

ADCOCK William.

Personal Estate under £10,000.

5 April. The Will of William Adcock late of Sydenham in the County of Leicestershire Gloucestershire who died 12 March 1933 at Sydenham was proved at Leicester by Thomas White of Esher in the said County Gloucestershire and John William of the City of Nottingham Leicestershire in the said County Gloucestershire the Executors.

ADBOOTH Mary.

Personal Estate under £1,000.

10 August. The Will of Mary Adbooth late of Haxley in the County of Stafford Haxley who died 2 July 1933 at Haxley was proved at Lichfield by William Ludlow Thomas of Haxley Regent and Henry Mansfield of Shipley in the said County Stafford the Executors.

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Image cleaning with computer vision

1879.

ADCOCK Florence Charlotte.

Personal Estate under £6,500.

4 February. The Will of Florence Charlotte Adcock (Wife of Edward Adcock) late of 4 Parkhill Mansions in the County of Surrey who died 20 December 1920 at 4 Parkhill was proved at the Principal Registry by the said Edward Adcock of 4 Park Hill Gardens the sole Executor. Probate being granted under certain Limitations.

ADCOCK George.

Personal Estate under £100.

24 June. Administration of the Personal Estate of George Adcock late of 11 Parliament-street Haxley in the County of Stafford Haxley who died 4 June 1920 at 11 Parliament-street was granted at Lichfield to Amelia Adcock of 20 Parkmansmore Widow the Heir.

ADCOCK John David.

Personal Estate under £100.

3 February. The Will of John David Adcock formerly of Teworth in the Parish of Rotherham and Gloucester but late of 20 Stratford-road Chapel Birmingham both in the County of Warwick Gloucester who died 2 December 1920 at 20 Stratford-road was proved at Birmingham by Sarah Amelia Adcock of 20 Stratford-road Widow the Heir the sole Executrix.

ADCOCK John Thomas.

Personal Estate under £25.

5 February. Administration of the Personal Estate of John Thomas Adcock late of 13 Thornecroft Spoutbrook in the Parish of King's Norton in the County of Worcester Gloucestershire a Widower who died 10 January 1920 at 13 Thornecroft-street was proved at Worcester to Anne Taylor (Wife of James Taylor) of 22 Rindford-road Camp Hill Birmingham in the County of Warwick the Daughter and one of the Next of Kin.

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Personal Estate under £1,000.

Residuary Estate under £1,000.

30 February. The Will of Thomas Adcock late of Kirby Bellus in the County of Leicestershire Farmer who died 8 December 1920 at Kirby Bellus was proved at Leicester by Mary Ann Adcock of Kirby Bellus Widow the Heir the sole Executrix.

ADCOCK William.

Personal Estate under £100.

4 January. The Will of William Adcock the Elder late of Ashby-de-la-Zouch in the County of Leicestershire Carpenter who died 24 July 1920 at Ashby-de-la-Zouch was proved at Leicester by William Adcock of Ashby-de-la-Zouch Carpenter the Son one of the Executors.

ADCOCK William.

Personal Estate under £10,000.

5 April. The Will of William Adcock late of Syden in the County of Leicestershire Gentleman who died 12 March 1920 at Syden was proved at Leicester by Thomas White of Bressall in the said County Gentleman and John Whigham of the Chapel Hamlet near Leicestershire in the said County Gentleman the Executors.

ADBOOTH Mary.

Personal Estate under £1,000.

10 August. The Will of Mary Adbooth late of Haxham in the County of Bedfordshire Widow who died 2 July 1920 at Haxham was proved at Chichester by William Ludlow Thomas of Haxham Bedfordshire and Henry Somerset of Shipley in the said County Bedfordshire the Executors.

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Image cleaning with computer vision

1879.

ADCOCK Florence Charlotte.

102 Personal Exemption \$6,000

4 February. The Will of Florence Charlotte Adcock (Wife of Edmund Adcock) late of 4 Park-hill Richmond in the County of Surrey who died 28 December 1939 at 4 Park-hill was proved at the Principal Registry by the said Edmund Adcock of 4 Park-hill Gentlemen the sole Executor. Probate being granted under certain Limitations.

ADDOCK Geste.

Personal Estate under 60000

24 June. Administration of the Personal Estate of George Adcock late of 12 Parliament-row Hanley in the County of Stafford Healer who died 6 June 1879 at 23 Parliament-row was granted at Lichfield to Amelia Adcock of 12 Parliament-row Widow the Heiress.

ADCOCK John David

Personal Estate under £200k

8 February. The Will of John David Adcock formerly of Tansworth in the Parish of Balsall and Gloucester but late of 26 Stratford-road Camphill Birmingham both in the County of Warwick Groomer who died 2 December 1878 at 26 Stratford-road was proved at Birmingham by Sarah Amelia Adcock of 26 Stratford-road Widow the Relict the sole Executrix.

ADDOCK John Thomas

Personal Estate under \$500

6 February. Administration of the Personal Estate of John Thomas Adcock late of 13 Thomastreet Spaldwick in the Parish of King's Norton in the County of Worcester Gentleman & Widower who died 16 January, 1859 at 13 Thomastreet was granted at Worcester to Anne Tyler (Wife of James Tyler) of 29 Kestrel-road Camp Hill Birmingham in the County of Warwick the Daughter and one of the Next of Kin.

ADOCK Thomas

Personal Estate under £1,000

Reveries Oct. 1881 and Dec. 1880.

00 February. The Will of Thomas Ashbock late of Kirby Bellars in the County of Leicester Farmer who died 5 December 1578 at Kirby Bellars was proved at Leicester by Mary Ann Ashbock of Kirby Bellars Widow the Executrix the sole Executrix.

ADONIS 0001-8781(2001)0000-0000

Personal Estate under \$100

8 January. The Will of William Adcock the Elder late of Ashby-de-la-Zouch in the County of Leicestershire Carpenter who died 24 July 1679 at Ashby-de-la-Zouch was proved at Leicester by William Adcock of Ashby-de-la-Zouch Carpenter the Son and of the Executors.

ADOCK William

Personal Estate under \$50,000

8 April. The Will of William Adcock late of Sydenham in the County of Leicester Gentleman who died 6 March 1879 at Spain was proved at Leicester by Thomas White of Bristol in the said County Gentleman and John Higginson of the Clump Hambleton-road Leicester in the said County Gentleman the Executors.

ADDEOTT Mary

Personal Income under \$4,000

10 August. The Will of Mary Addicott late of Hordham in the County of BERKSHIRE Widow who died 3 July 1819 at Hordham was proved at **Chichester** by William Lushen Thomas of Hordham Surgeon and Henry Sommersell of Shipley in the said County Bailiff the Nephew the Executors.

1. Invert colours if black pixels $>$ white pixels
2. From greyscale to binary (black-white)
3. Calculate angle of pixels and deskew
4. Blob removal (e.g., ink blots)
5. Margin detection using Gaussian Process Regression
6. Remove handwriting; keep typewriting
7. Speckle removal (e.g., dust)
8. Bounding boxes around each entry
9. Resize page based on optimal extraction^a

^aHuge thanks to RAs who created training set per year!

Image cleaning with computer vision

1879.

ADCOCK Florence Charlotte.

Personal Estate under £500.

4 February. The Will of Florence Charlotte Adcock (Wife of Edward Adcock) late of 4 Parkhill Mansions in the County of Surrey who died 20 December 1920 at 4 Parkhill was proved at the Principal Registry by the said Edward Adcock of 4 Park Hill Gardens the sole Executor. Probate being granted under certain Limitations.

ADCOCK George.

Personal Estate under £500.

24 June. Administration of the Personal Estate of George Adcock late of 11 Parliament-street Haxley in the County of Stafford Haxley who died 4 June 1920 at 11 Parliament-street was granted at Lichfield to Anna Adcock of 20 Parkmansmore Widow the Heiress.

ADCOCK John David.

Personal Estate under £500.

3 February. The Will of John David Adcock formerly of Tamworth in the Parish of Bolehall and Gloucesters but late of 20 Stratford-road Churchill Birmingham both in the County of Warwick Gloucesters who died 2 December 1920 at 20 Stratford-road was proved at Birmingham by Sarah Anna Adcock of 20 Stratford-road Widow the Heiress the sole Executrix.

ADCOCK John Thomas.

Personal Estate under £500.

5 February. Administration of the Personal Estate of John Thomas Adcock late of 13 Thorneycroft Sparkbrook in the Parish of King's Norton in the County of Worcester Gloucesters a Widower who died 10 January 1920 at 13 Thorneycroft was proved at Worcester to Anne Taylor (Wife of James Taylor) of 22 Rindall-road Camp Hill Birmingham in the County of Warwick the Daughter and one of the Heiresses.

ADCOCK Thomas.

Personal Estate under £500.

30 February. The Will of Thomas Adcock late of Kirby Bellas in the County of Leicestershire Farmer who died 5 December 1920 at Kirby Bellas was proved at Leicester by Mary Ann Adcock of Kirby Bellas Widow the Heiress the sole Executrix.

ADCOCK William.

Personal Estate under £500.

4 January. The Will of William Adcock the Elder late of Ashby-de-la-Zouch in the County of Leicestershire Carpenter who died 24 July 1920 at Ashby-de-la-Zouch was proved at Leicester by William Adcock of Ashby-de-la-Zouch Carpenter the Son one of the Executors.

ADCOCK William.

Personal Estate under £500.

5 April. The Will of William Adcock late of Syden in the County of Leicestershire Gloucesters who died 12 March 1920 at Syden was proved at Leicester by Thomas White of Bressall in the said County Gloucesters and John Whigham of the Clay Workmen Leicesters in the said County Gloucesters the Executors.

ADDSOOTH Mary.

Personal Estate under £500.

10 August. The Will of Mary Addsooth late of Haxham in the County of Bedfordshire Widow who died 3 July 1920 at Haxham was proved at Hitchinbury by William Ludlow Thomas of Haxham Bedfordshire and Henry Somerset of Shipley in the said County Bedfordshire the Executors.

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Image cleaning with computer vision

1879.

ADCOCK Florence Charlotte.
Personal Estate under £500.

4 February. The Will of Florence Charlotte Adcock (Wife of Edward Adcock) late of 4 Parkhill Mansions in the County of Surrey who died 20 December 1920 at 4 Parkhill was proved at the Principal Registry by the said Edward Adcock of 4 Parkhill Gardens the sole Executor. Probate being granted under certain Limitations.

ADCOCK George.
Personal Estate under £500.

21 June. Administration of the Personal Estate of George Adcock late of 11 Parliament-street Haxley in the County of Stafford Haxley who died 4 June 1920 at 11 Parliament-street was granted at Lichfield in the County of Stafford to the said George Adcock the sole Executor.

ADCOCK John David.
Personal Estate under £500.

3 February. The Will of John David Adcock formerly of Tamworth in the Parish of Bolehall and Gloucestershire late of 20 Stratford-road Campbell Rowington both in the County of Warwick Gloucestershire who died 2 December 1920 at 20 Stratford-road was proved at Birmingham by Sarah Adcock late of 68 Stratford-road Whiter the Widow the sole Executrix.

ADCOCK John Thomas.
Personal Estate under £50.

5 February. Administration of the Personal Estate of John Thomas Adcock late of 13 Thrommestreet Sparkbrook in the Parish of King's Norton in the County of Worcester Gloucestershire a Widower who died 10 January 1920 at 13 Thrommestreet was proved at Worcester by Anne Taylor (Wife of James Taylor) of 22 Roodersland Camp Hill Birmingham in the County of Warwick the Daughter and one of the Next of Kin.

ADCOCK Thomas.
Personal Estate under £100.

30 February. The Will of Thomas Adcock late of Kirby Bellows in the County of Leicestershire Farmer who died 5 December 1920 at Kirby Bellows was proved at Leicester by Mary Ann Adcock of Kirby Bellows Widow the Widow the sole Executrix.

ADCOCK William.
Personal Estate under £500.

1 January. The Will of William Adcock the Elder late of Ashby-de-la-Zouch in the County of Leicestershire Carpenter who died 24 July 1920 at Ashby-de-la-Zouch was proved at Leicester by William Adcock of Ashby-de-la-Zouch Carpenter the Son one of the Executors.

ADCOCK William.
Personal Estate under £500.

8 April. The Will of William Adcock late of Syden in the County of Leicestershire Gentleman who died 12 March 1920 at Syden was proved at Leicester by Thomas White of Bressall in the said County Gentleman and John Whigham of the Clay Workmen Leicestershire in the said County Gentlemen the Executors.

ADDSOOTY Mary.
Personal Estate under £1,000.

10 August. The Will of Mary Addsooty late of Haxham in the County of Bedfordshire Widow who died 2 July 1920 at Haxham was proved at Chichester by William Ludlow Thomas of Haxham Bedfordshire and Henry Somerset of Shipley in the said County Bedfordshire the Executors.

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Image cleaning with computer vision

1879.

ADCOCK Florence Charlotte.

Personal Estate under £5,000.

4 February. The Will of Florence Charlotte Adcock (Wife of Edward Adcock) late of 4 Parkhill Mansions in the County of Surrey who died 25 December 1928 at 4 Parkhill was proved at the Principal Registry by the said Edward Adcock of 4 Park Hill Gardens the sole Executor. Probate being granted under certain Limitations.

ADCOCK George.

Personal Estate under £500.

21 Jan. Administration of the Personal Estate of George Adcock late of 11 Parliament-street Haxley in the County of Stafford Haxley who died 4 June 1929 at 11 Parliament-street was granted at Lichfield to Anna Adcock of 20 Parkmansmore Widow the Heir.

ADCOCK John David.

Personal Estate under £100.

9 February. The Will of John David Adcock formerly of Tenworth in the Parish of Bolehall and Gloucestre last late of 20 Stratford-road Churchill Birmingham last in the County of Warwick Gloucestre who died 2 December 1923 at 20 Stratford-road was proved at Birmingham by Sarah Anna Adcock of 69 Stratford-road Widow the Heir the sole Executrix.

ADCOCK John Thomas.

Personal Estate under £50.

5 February. Administration of the Personal Estate of John Thomas Adcock late of 13 Thomsenstreet Sparkbrook in the Parish of King's Norton in the County of Worcester Gloucestre a Widower who died 10 January 1929 at 13 Thomsen-street was proved at Worcester to Anne Taylor (Wife of James Taylor) of 22 Rindford-road Camp Hill Birmingham in the County of Warwick the Daughter and one of the Next of Kin.

ADCOCK Thomas.

Personal Estate under £1,000.

30 February. The Will of Thomas Adcock late of Kirby Bellars in the County of Leicestershire Farmer who died 5 December 1924 at Kirby Bellars was proved at Leicester by Mary Ann Adcock of Kirby Bellars Widow the Heir the sole Executrix.

ADCOCK William.

Personal Estate under £100.

4 January. The Will of William Adcock late of Elder late of Ashby-de-la-Zouch in the County of Leicestershire Carpenter who died 24 July 1923 at Ashby-de-la-Zouch was proved at Leicester by William Adcock of Ashby-de-la-Zouch Carpenter the Son one of the Executors.

ADCOCK William.

Personal Estate under £10,000.

8 April. The Will of William Adcock late of Syden in the County of Leicestershire Gentleman who died 12 March 1929 at Syden was proved at Leicester by Thomas White of Bressall in the said County Gentleman and John Whigham of the Clay Workhouse Leicestershire in the said County Gentleman the Executors.

ADDSOOTY Mary.

Personal Estate under £1,000.

10 August. The Will of Mary Addsooty late of Haxham in the County of Bedford Widow who died 2 July 1923 at Haxham was proved at Chichester by William Ludlow Thomas of Haxham Bedford and Henry Stanswell of Shipley in the said County Bedford the Executors.

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Image cleaning with computer vision

1879.	
ADCOCK Florence Charlotte Personal Estate under £600.	11 February. The Will of Florence Charlotte Adcock (Wife of Edward Adcock) late of 4 Parkhill Mansions in the County of Surrey who died 21 December 1878 at 4 Parkhill was proved at the Principal Registry by the said Edward Adcock of 4 Parkhill Gardens the sole Executor. Probate being granted under certain Limitations.
ADCOCK George. Personal Estate under £100.	21 June. Administration of the Personal Estate of George Adcock late of 11 Parliament-street Hanley in the County of Stafford Bachelor who died 4 June 1878 at 11 Parliament-street was granted to Litchfield in Assets Adcock of 33 Parliament-street Widow the Heir.
ADCOCK John David. Personal Estate under £100.	1 February. The Will of John David Adcock formerly of 57 Tottenham in the Parish of St. Paul and Glenside late late of 20 Shaftesbury-road Camphill Birmingham born in the County of Warwick Gloucester died 2 December 1878 at 20 Shaftesbury-road was proved at Birmingham by Sarah Anna Adcock of 68 Shaftesbury-road Widow the Heir the sole Executrix.
ADCOCK John Thomas. Personal Estate under £50.	2 February. Administration of the Personal Estate of John Thomas Adcock late of 13 Unnamer-street Spetchworth in the Parish of King's Norton in the County of Worcester Gentleman as Widower who died 10 January 1878 at 13 Thomas-street was proved at Worcester by Anne Thelma Adcock (Wife of John Thelma) of 22 Kensington Camp Hill Birmingham in the County of Warwick the Daughter and sole of the Testator.
ADCOCK Thomas. Personal Estate under £100.	10 February. The Will of Thomas Adcock late of Kirby Muxton in the County of Leicester Farmer who died 3 December 1875 at Kirby Muxton was proved at Leicester by Mary Ann Adcock of Kirby Muxton Widow the Heir the sole Executrix.
ADCOCK William. Personal Estate under £100.	1 January. The Will of William Adcock the Elder late of Ashby-de-la-Zouch in the County of Leicestershire Gentleman who died 24 July 1878 at Ashby-de-la-Zouch was proved at Leicester by William Adcock of Ashby-de-la-Zouch Carpenter the Heir the sole of the Testator.
ADCOCK William. Personal Estate under £100.	1 April. The Will of William Adcock late of Boston in the County of Leicestershire Gentleman who died 18 March 1878 at Boston was proved at Leicestershire by Thomas White of Boston in the said County of Leicestershire and John Whigham of the Claydon Rectory in the County of Leicestershire the Executors.
ADBOOYT Mary. Personal Estate under £100.	10 August. The Will of Mary Adbooyt late of Haxby in the County of York Widow who died 4 July 1878 at Haxby was proved at Chichester by William Leckham Thomas of Haxby Bishop and Henry Somerset of Bishop in the said County of York the Executors.

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9. Resize page based on optimal extraction^a

^aHuge thanks to RAs who created training set per year!

Image cleaning with computer vision

1879.	
ADCOCK Florence Charlotte. Personal Estate under £5,000.	4 February. The Will of Florence Charlotte Adcock (Wife of Edward Adcock) late of 4 Parkhill Mansions in the County of Surrey who died 21 December 1878 at 4 Parkhill, was proved at the Principal Registry by the said Edward Adcock of 4 Parkhill Gardens her sole Executor. Probate being granted under certain Limitations.
ADCOCK George. Personal Estate under £100.	21 June. Administration of the Personal Estate of George Adcock late of 11 Parliament-row Haverly in the County of Stafford Haverly who died 4 June 1878 at 11 Parliament-row was granted to Litchfield. In Adcock Adcock of 30 Parliament-row Widow her Heir.
ADCOCK John David. Personal Estate under £100.	1 February. The Will of John David Adcock formerly of Tottenham in the Parish of St. Paul and Glenside late son of 20 Shaftesbury-road Churchill Birmingham born in the County of Warwick Gloucester died 2 December 1878 at 20 Shaftesbury-road was proved at Birmingham by Sarah Anna Adcock of 68 Shaftesbury-road Widow her Heir the sole Executrix.
ADCOCK John Thomas. Personal Estate under £50.	2 February. Administration of the Personal Estate of John Thomas Adcock late of 13 Unnamer-row Spetchworth in the Parish of King's Norton in the County of Worcester Gloucester a Widower who died 10 January 1878 at 13 Thomas-street was granted to Worcester to Anne-Phoebe Wilkin (Daughter) of 22 Kensington Camp Hill Birmingham in the County of Warwick (the Daughter and sole of the Testator's Son).
ADCOCK Thomas. Personal Estate under £1,000.	10 February. The Will of Thomas Adcock late of Kingtonham in the County of Leicestershire formerly of 3 Beaumont 1875 at 317 York Buildings was proved at Leicester by Mary Ann Adcock of Kirtby (Widow) her Sole Heir the sole Executrix.
ADCOCK William. Personal Estate under £100.	1 January. The Will of William Adcock the Elder late of Ashby-de-la-Zouch in the County of Leicestershire Gloucester who died 24 July 1878 at Ashby-de-la-Zouch was proved at Leicester by William Adcock of Ashby-de-la-Zouch Carpenter (the Son) of the Testator.
ADCOCK William. Personal Estate under £10,000.	14 April. The Will of William Adcock late of Ryton in the County of Leicestershire Gloucester who died 18 March 1878 at Ryton was proved at Leicestershire by Thomas White of Ryton in the County of Leicestershire and John Whigham of the Claydon Rectory Leicestershire (the Heir) County Gloucester the Executors.
ADBOOYTT Mary. Personal Estate under £1,000.	16 August. The Will of Mary Adbooytt late of Haverly in the County of Bedford Gloucester who died 2 July 1878 at Haverly was proved at Leicestershire by William Leach Thomas of Haverly Bedford and Henry Beaumont of Stirling in the County of Bedford. Heirs, the Executors.

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Image cleaning with computer vision

1879.

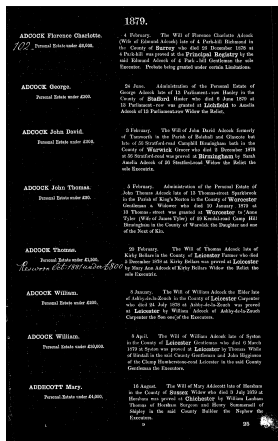
ADDOCK Florence Charlotte. Personal Estate under £5,000.	4 February. The Will of Florence Charlotte Addock (Wife of Edward Addock) late of 4 Parkhill Mansions in the County of Surrey who died 20 December 1920 at 4 Parkhill was proved at the Principal Registry by the said Edward Addock of 4 Parkhill Gardens the sole Executor. Probate being granted under certain Limitations.
ADDOCK George. Personal Estate under £500.	26 June. Administration of the Personal Estate of George Addock late of 11 Parliament-street Hanley in the County of Staffordshire who died 4 June 1920 at 11 Parliament-street was granted at Lichfield to Anna Addock of 20 Parkmansmore Widow the Heir.
ADDOCK John David. Personal Estate under £100.	9 February. The Will of John David Addock formerly of Tamworth in the Parish of Bolehall and Gloucestershire late of 20 Bradford-road Campbell Rowingham both in the County of Warwickshire who died 2 December 1920 at 20 Bradford-road was proved at Birmingham by Sarah Anna Addock of 69 Stratford-road Widow the Heir the sole Executrix.
ADDOCK John Thomas. Personal Estate under £50.	2 February. Administration of the Personal Estate of John Thomas Addock late of 13 Thomsenstreet Sparkhill in the Parish of King's Norton in the County of Worcester Gloucestershire & Wales who died 10 January 1920 at 13 Thomsen-street was granted at Worcester to Anne Taylor (Wife of James Taylor) of 22 Rindford-road Camp Hill Birmingham in the County of Warwick the Daughter and one of the Joint Heirs.
ADDOCK Thomas. Personal Estate under £1,000.	30 February. The Will of Thomas Addock late of Kirby Bellars in the County of Leicestershire Farmer who died 5 December 1920 at Kirby Bellars was proved at Leicester by Mary Ann Addock of Kirby Bellars Widow the Heir the sole Executrix.
ADDOCK William. Personal Estate under £100.	9 January. The Will of William Addock the Elder late of Ashby-de-la-Zouch in the County of Leicestershire Carpenter who died 24 July 1920 at Ashby-de-la-Zouch was proved at Leicester by William Addock of Ashby-de-la-Zouch Carpenter the Son one of the Executors.
ADDOCK William. Personal Estate under £50,000.	9 April. The Will of William Addock late of Syden in the County of Leicestershire Gentleman who died 12 March 1920 at Syden was proved at Leicester by Thomas White of Berrill in the said County Gentleman and John Whigham of the Clay Workmen's-road Leicester in the said County Gentleman the Executors.
ADDOCK Mary. Personal Estate under £1,000.	10 August. The Will of Mary Addock late of Haslem in the County of Bedfordshire Widow who died 3 July 1920 at Haslem was proved at Chichester by William Ludlow Thomas of Haslem Bedfordshire and Henry Somersall of Shipley in the said County Bedfordshire the Heirs the Executors.

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9. Resize page based on optimal extraction^a

^aHuge thanks to RAs who created training set per year!

Image cleaning with computer vision



1. Invert colours if black pixels $>$ white pixels
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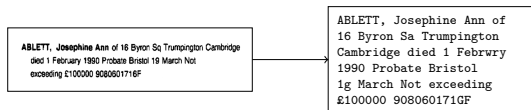
^aHuge thanks to RAs who created training set per year!

Text extraction with OCR, BERT, and RegEx

ABLETT, Josephine Ann of 16 Byron Sq Trumpington Cambridge
died 1 February 1990 Probate Bristol 19 March Not
exceeding £100000 9080601716F

Amazon Web Services. (2023). *Amazon Textract* (Version 1.4.5). URL: aws.amazon.com/textract/
 OCRfixr development team. (2023). *OCRfixr* (Version 1.5.1) [Python package]. URL: pypi.org/project/OCRfixr/
 FuzzyWuzzy development team. (2020). *fuzzywuzzy* (Version 0.18.0) [Python package]. URL: pypi.org/project/fuzzywuzzy/

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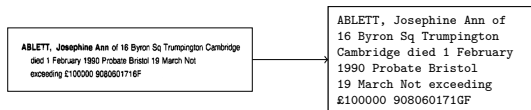
Text extraction with OCR, BERT, and RegEx

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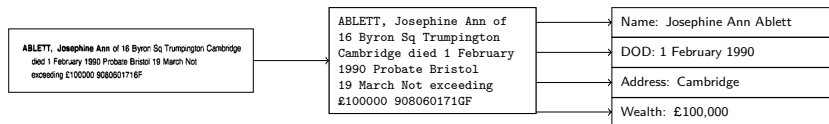


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Introducing the FreeBMD Project

- **FreeBMD** (Free Births, Marriages, and Deaths)'s mission is to provide free Internet access to the Civil Registration index information for England and Wales.
- One of the **first ever crowdsourcing projects** (active since 1998).
- A team of **12,767 volunteers** have transcribed **396,762,700 records** of births, marriages, and deaths.
- As of 27 September 2024, 100% of death records from 1837 to 1990 have been transcribed (1991 onwards in progress...)

Transcribing records

AGE	SURNAME	GIVEN NAME	AGE	DISTRICT	VOLUME	PAGE	TRANSCRIBER
95	BURROWS	MARY A.	95	IPSWICH	4A	907	jscoleman

Entry Information

This entry was created from the following transcription:

Surname Given Name Age District Volume Page Transcriber

Deaths Jun 1919

BURROWS Mary A. 95 Ipswich 4a 907 [jscoleman](#)

Surname: Burrows

Given name: Mary A.

Age at death: 95

District: Ipswich

County: Suffolk

Combining probate and death records

probate

surname	name	middlename	location	dod	wealth
ackroyd	william	herbert	ruislip	02-03-1940	5898
acland	arthur	charles	cheltenham	26-11-1939	3025
acock	john	<NA>	bristol	03-01-1940	543
acomb	thomas	nicholson	york	22-03-1940	585

Combining probate and death records

probate

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ackroyd	william	herbert	ruislip	02-03-1940	5898
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acock	john	<NA>	bristol	03-01-1940	543
acomb	thomas	nicholson	york	22-03-1940	585

deaths_q1y1940_q1

surname	name	middlename	location	age
ackroyd	william	herbert	middlesex	73
acock	john	<NA>	bristol	85
acomb	thomas	nicholson	york	28
...	...	...	...	...

deaths_q1y1939_q4

surname	name	middlename	location	age
acland	arthur	charles	cheltenham	61
...	...	...	...	...

Combining probate and death records

probate

surname	name	middlename	location	dod	wealth
ackroyd	william	herbert	ruislip	02-03-1940	5898
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deaths_q1y1940_q1

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acock	john	<NA>	bristol	85
acomb	thomas	nicholson	york	28
...	...	...	...	...

deaths_q1y1939_q4

surname	name	middlename	location	age
acland	arthur	charles	cheltenham	61
...	...	...	...	...

Combining probate and death records

probate

surname	name	middlename	location	dod	wealth
ackroyd	william	herbert	ruislip	02-03-1940	5898
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deaths_q1y1940_q1

surname	name	middlename	location	age
ackroyd	william	herbert	middlesex	73
acock	john	<NA>	bristol	85
acomb	thomas	nicholson	york	28
...	...	...	...	...

deaths_q1y1939_q4

surname	name	middlename	location	age
acland	arthur	charles	cheltenham	61
...	...	...	...	...

output

surname	name	dod	wealth	age
ackroyd	william	02-03-1940	5895	73
acock	john	03-01-1940	543	85
acland	arthur	26-11-1939	3025	61
...	...	...	...	...

Combining probate and death records

probate

surname	name	middlename	location	dod	wealth
ackroyd	william	herbert	ruislip	02-03-1940	5898
acland	arthur	charles	cheltenham	26-11-1939	3025
acock	john	<NA>	bristol	03-01-1940	543
acomb	thomas	nicholson	york	22-03-1940	585

deaths_q1y1940_q1

surname	name	middlename	location	age
ackroyd	william	herbert	middlesex	73
ackroyd	william	<NA>	middlesex	5
ackroyd	william	scott	dorset	37
ackroyd	william	herbert	york	28

Combining probate and death records

probate

surname	name	middlename	location	dod	wealth
ackroyd	william	herbert	ruislip	02-03-1940	5898
acland	arthur	charles	cheltenham	26-11-1939	3025
acock	john	<NA>	bristol	03-01-1940	543
acomb	thomas	nicholson	york	22-03-1940	585

deaths_q1y1940_q1

surname	name	middlename	location	age
ackroyd	william	herbert	middlesex	73
ackroyd	william	<NA>	middlesex	5
ackroyd	william	scott	dorset	37
ackroyd	william	herbert	york	28

Combining probate and death records

probate

surname	name	middlename	location	dod	wealth
ackroyd	william	herbert	ruislip	02-03-1940	5898
acland	arthur	charles	cheltenham	26-11-1939	3025
acock	john	<NA>	bristol	03-01-1940	543
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Combining probate and death records

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surname	name	middlename	location	dod	wealth
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deaths_q1y1940_q1

surname	name	middlename	location	age
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ackroyd	william	scott	dorset	37
ackroyd	william	herbert	york	28

output

surname	name	dod	wealth	age
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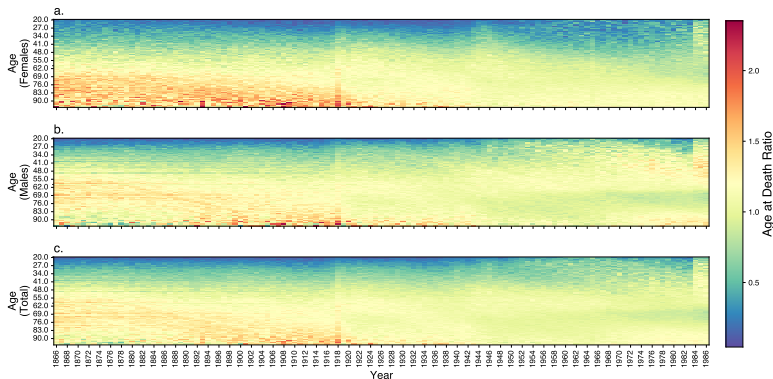
Demographic methods

- This results in $3 \times 45 \times 3 \times 3 \times 4 \times 2 = 9,720$ life table attempts.
- We do not use abridged life tables.
- If final person in any sample dies before the closing window – and we aren't using graduation – we cannot build a LT.
 - Unless we use `pclm` smoothing.
 - We borrow a `pclm` function from `Demotools` (Riffe et al., 2021)
 - This is run in parallel on twenty 4700k cores, and takes about ~ 60 minutes to run.
- Our code is developed in Python 3.12, and will be released alongside a pre-print at:

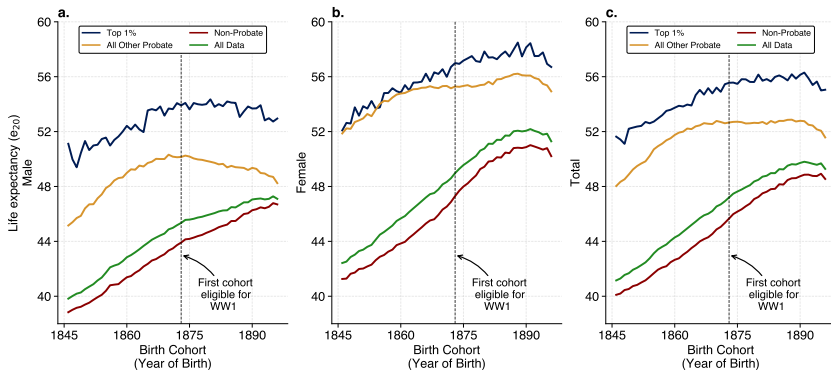
github.com/reeves-projects/health-wealth

Riffe, T. et al. (2019). DemoTools: An R package of tools for aggregate demographic analysis. [R package]. URL: <https://github.com/timriffe/DemoTools/>

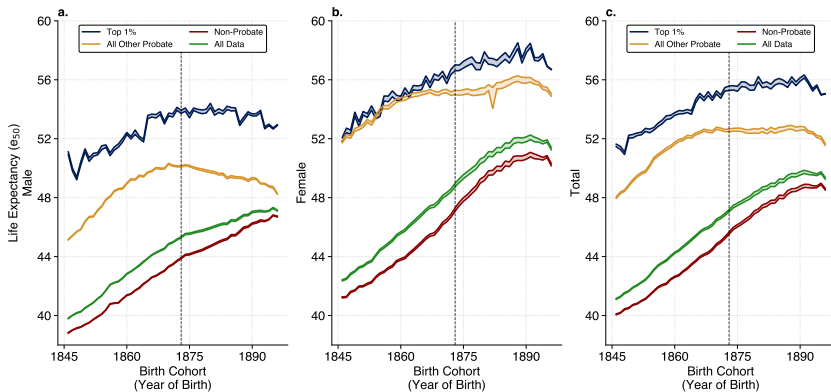
Age at death: probate vs. non-probate populations



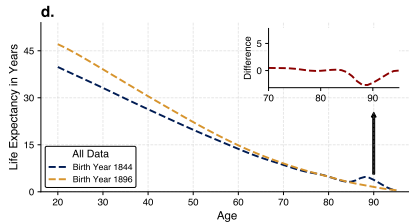
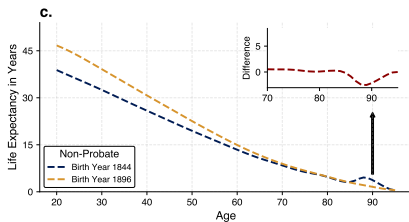
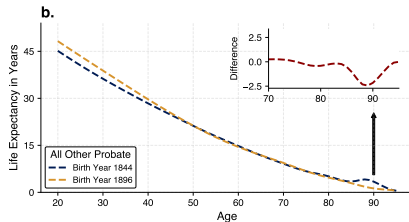
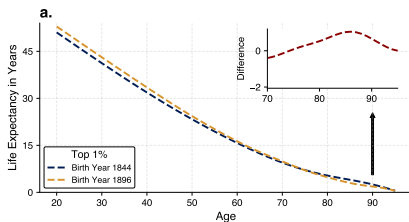
Cohort Life Expectancy



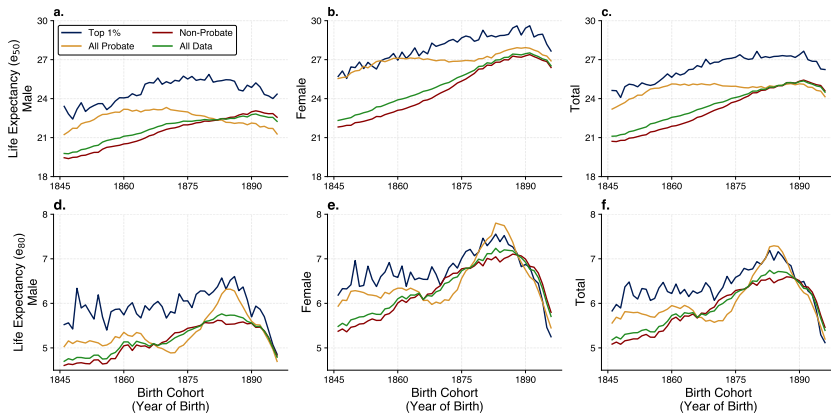
Cohort Life Expectancy



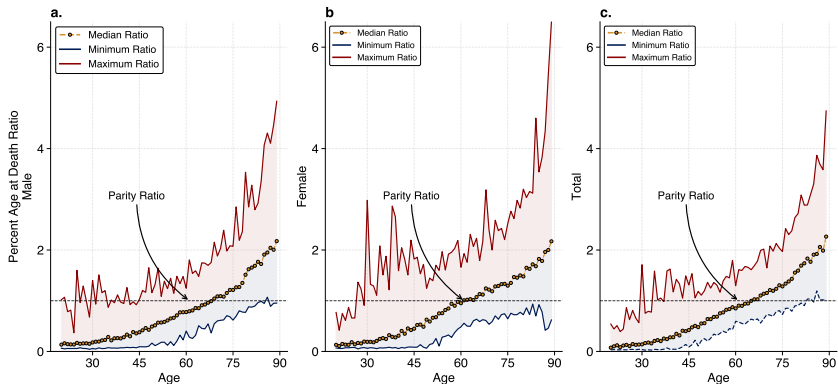
Cohort Life Expectancy



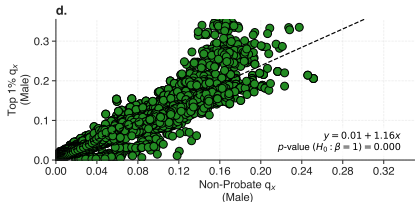
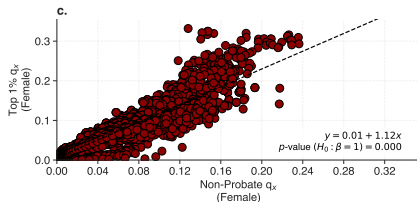
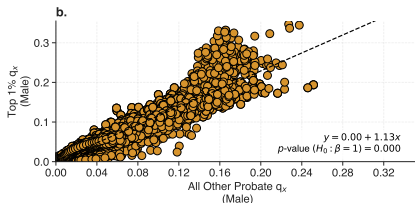
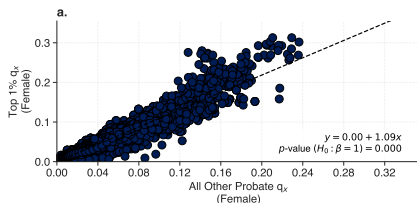
Cohort Life Expectancy



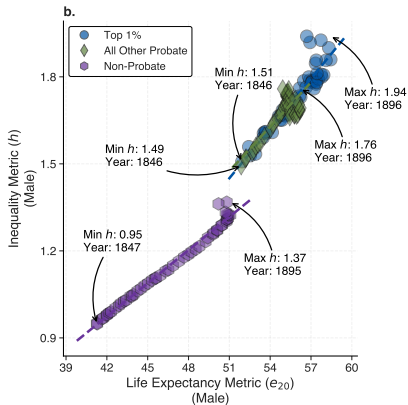
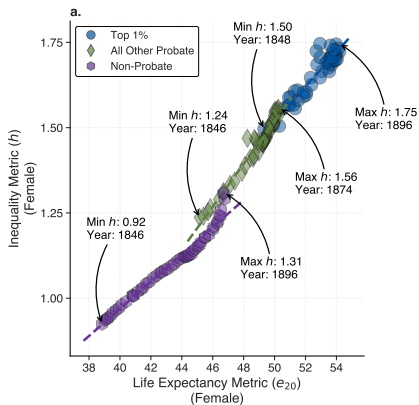
Age at Death



Analysing Survival Probabilities (q_x)



Lifespan Inequalities



Building Genealogies!

Introducing the fabulous WikiTree resource:



- Genealogy website that allows users to research and to contribute to **their own family trees**....
- ... while building and collaborating on a **singular worldwide family tree** within the same system.
- Their **API** allows access to **36 million records** globally (as of October 2023).
- Allows us to calculate e_0 stratified **parental wealth at death**.

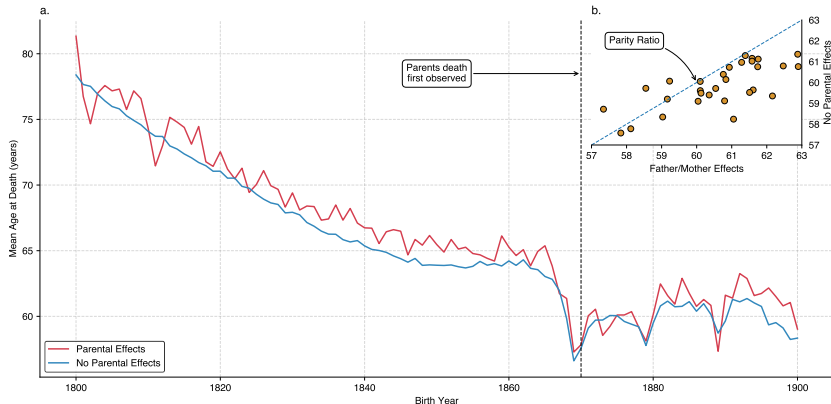
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Building Genealogies!



Thanks to some truly excellent coauthors!

