Validating the Quality of Digitized Books for Long-Term Preservation

[Some] Findings on Digitization Error and Archival Quality

INSTITUTE of Museum and Library SERVICES

Outline of Presentation

- Archival quality in an archival context
- Selective findings (more with poster and on website)
- Implications for practice and theory

Project Website: http://hathitrust-quality.projects.si.umich.edu/

45 People Are Involved

- Planning: Andrew W. Mellon Foundation [$49,000]
- Research: Institute of Museum and Library Services [$674,722]

Research Team (Michigan)

- Paul Conway, School of Information, PI
- Ed Rothman, LSA Statistics, co-PI
- John Wilkin, HathiTrust (5%)
- Leighann Ayers, oversight and space (5%)
- Jeremy York, liaison (10%)
- Jackie Bronicki, MLibrary, coordination (100%)
- Ken Guire, CSCAR, statistician (10%)
- Ryan Rotter, MLibrary, system design (75%)
- Stacy Maat, SI, physical review coordinator (25%)
- Melissa Chalmers, SI, user research (50%)
- Eugene Malin & Nina Elias, SI, website (10%)
- Sarah Jones, qualitative coder
- Jennifer Wright, qualitative coder
- Cherie Edmonds, qualitative coder
- Sarah Helm, qualitative coder
- Jenny Vainberg, qualitative coder
- Nadia Sion, qualitative coder
- Naomi Scheinemann, qualitative coder
- Siqi Wei, qualitative coder

Research Team (Minnesota)

- John Butler, leadership
- Jason Roy, liaison
- Ahnna Mahoney, coordination
- Kelly Frosch, qualitative coder
- Megan Scherer, qualitative coder
- Rui Zhao, qualitative coder
- Christina Graber, qualitative coder

Advisory Board

- ✓ Roy Tennant, OCLC
- ✓ Oya Rieger, Cornell University
- ✓ Ed Van Gemert, Wisconsin
- ✓ Robin Dale, LYRASIS
- ✓ Besiki Stvilia, Florida State Univ.

13 School of Information Volunteers

Julia Corrin, Natalie Bond, Graham Hukill, Jacqueline DiOrio, Janice Wong, Laura Brubacher, Brendan Coates, Laura Andrews, Holly Little, Monique Lowe, Molly Des Jardin, Amelia Lowry, David Fulmer

INSTITUTE of Museum and Library SERVICES

Archival Quality – A Value Proposition

- Archival nature
  - 1939 on : distinguishing characteristics of archives
  - 2000 on: significant properties of digital objects
- Preservation
  - 1961 on : media longevity [e.g., microfilm and acid-free paper]
  - 1985 on : processes to protect against loss [archival processes]
  - 1990 on: digitization image quality [archival master]
- Reliability [InterPARES]
  - 1995 on : completeness and process control

> "… degree of completeness and degree of control of the procedure of creation are the **only** two factors that determine reliability of records." [Duranti 1995, p. 6]

Archival Quality in Archival Theory

- Seamus Ross : digital libraries are digital archives

> "A library … is first of all an archive or repository in which society can find what it has already learned." [Kaplan 1964]

> "But if we think more carefully about digital libraries we easily observe that they may be libraries by name, but they are archives by nature." [Ross 2007, p. 8].

- Terry Cook: context of creation

> "This new paradigm for [has] a renewed focus on the context, purpose, intent, interrelationships, functionality, and accountability of the record, its creator, and its creation processes, wherever these occur." [Cook 1997, p. 48]

- Geoffrey Yeo: boundary objects & persistent representation

> "Records are "persistent representations of activities… or other occurrents… created by participants or observers of those occurrents or by their authorized proxies…" [Yeo 2008, p. 136]

Archival Quality is Archival Science [Thomassen 2001]

- Object of Archival Science:
  - defining the nature of "process-bound information," which is "information itself and the processes that have generated and structured that information."
- Aims of Archival Science:
  - "the **establishment and maintenance of archival quality**, that is to say: of the optimal visibility and durability of the records, the generating work processes, and their mutual bond."
- Methodology of Archival Science:
  - "maintaining the formal quality of process-bound information, by ensuring its availability, readability, completeness, relevance, representativeness, topicality, authenticity and reliability."

Thomassen, Theo. (2001). "A First Introduction to Archival Science," *Archival Science* 1: 373-385.

Research Environment – Digitization

- New preservation reality: from vertical integration to distributed management
  - Preservation programs used to exercise end-to-end control of reformatting
  - Now: preserving digitized content: “take what we can get”
  - End-user trust turns on validating “fitness-for-use”

- Two Research Questions for our project
  - What is quality? [definition, measurement, distribution]
  - What difference does lack of quality make for users? [barriers, acceptance testing]

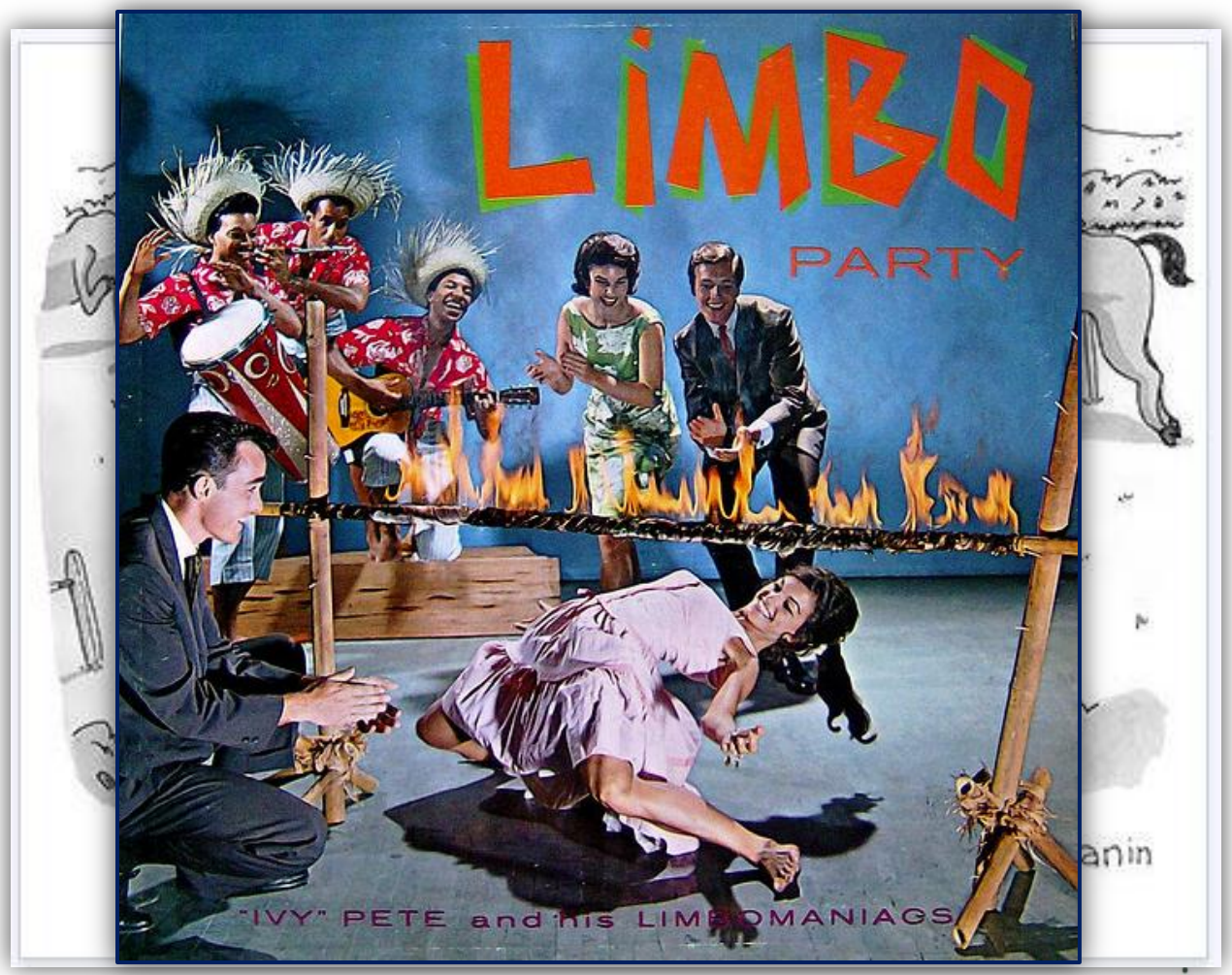
Testbed: HathiTrust Digital Library
- [http://www.hathitrust.org/]

Andrew W. Mellon Foundation [planning]

IMLS NLG [research, reporting]

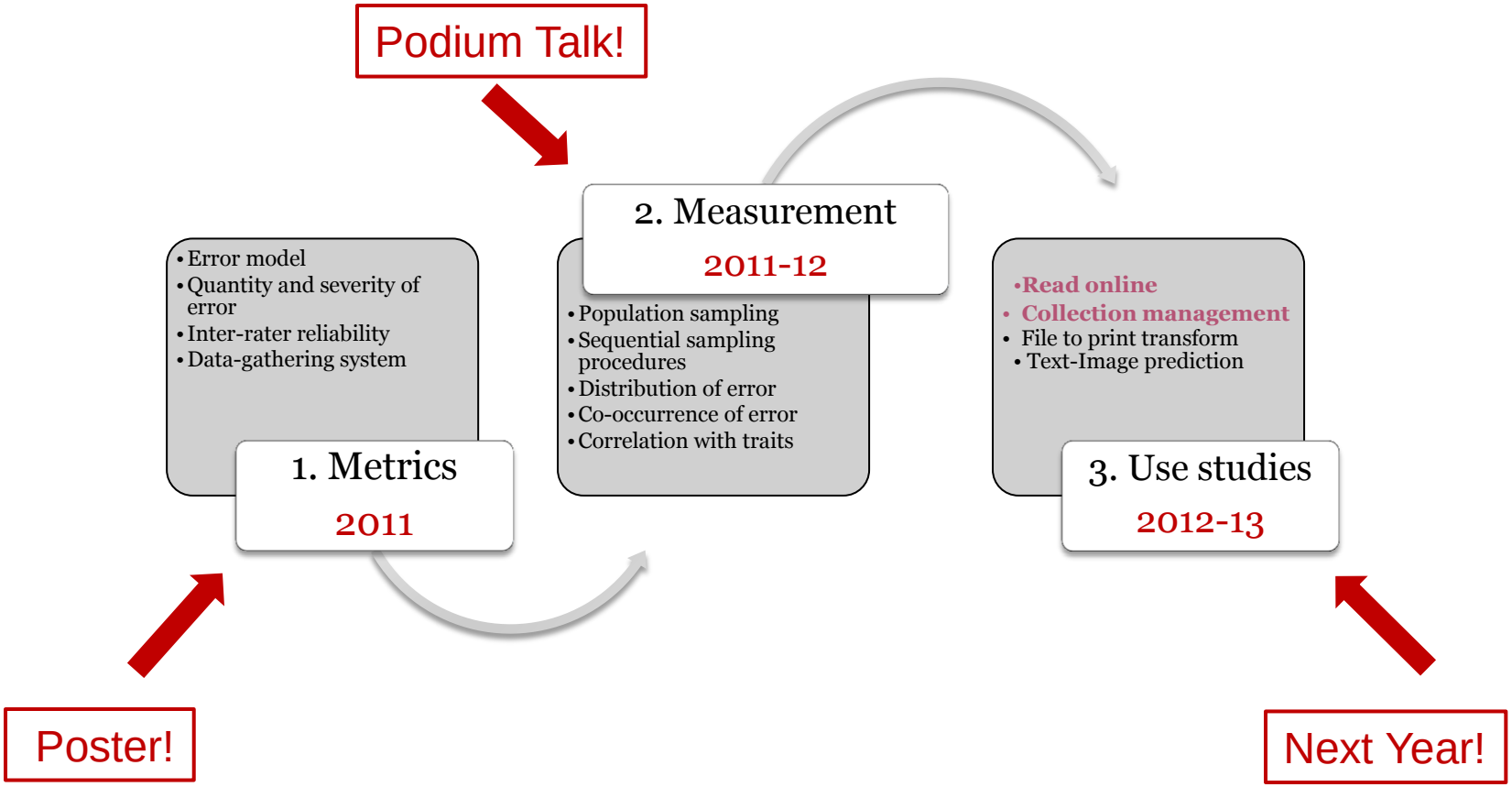
HATHI TRUST

Rethinking Quality for Preservation and Access



Zachary Kanin, *The New Yorker*, November 7, 2011.

Research Workflow [2011-13]



Phase 1 [2011] – Metrics of Digitization Error

Level of Abstraction	*Possible Cause of Error*
LEVEL 1: DATA/INFORMATION	
1.1 Text: thick text [fill, excessive]	Source or post-processing
1.2 Text: broken text [character breakup]	Source or post-processing
1.3 Illustration: scanner effects [moiré, gridding]	Scanning or post-processing
1.4 Illustration: tone, brightness, contrast	Scanning, post-processing or source
1.5 Illustration: color imbalance, gradient shifts	Scanning, post-processing or source
LEVEL 2: ENTIRE PAGE	
2.1 Blur [distortion]	Scanning or source
2.2 Warp [text alignment]	Post-processing
2.3 Skew [page alignment]	Scanning, source or post-processing
2.4 Crop [gutter, text block]	Source or post-processing
2.5 Obscured/cleaned [portions not visible]	Scanning or post-processing
2.6 Colorization [text bleed, low contrast]	Source or post-processing
LEVEL 3: WHOLE VOLUME	
3.1 Fully obscured [foldouts or objects]	Scanning
3.2 Missing pages [one or more]	Source or scanning
3.3 Duplicate pages [one or more]	Source or scanning
3.4 Order of pages	Source or scanning
3.5 False pages [not part of Original Content]	Scanning or post-processing

Phase 1 [2011] - Error Severity Scale

0 - Error is undetectable on the page.

1 - Error has negligible affect on Original Content.

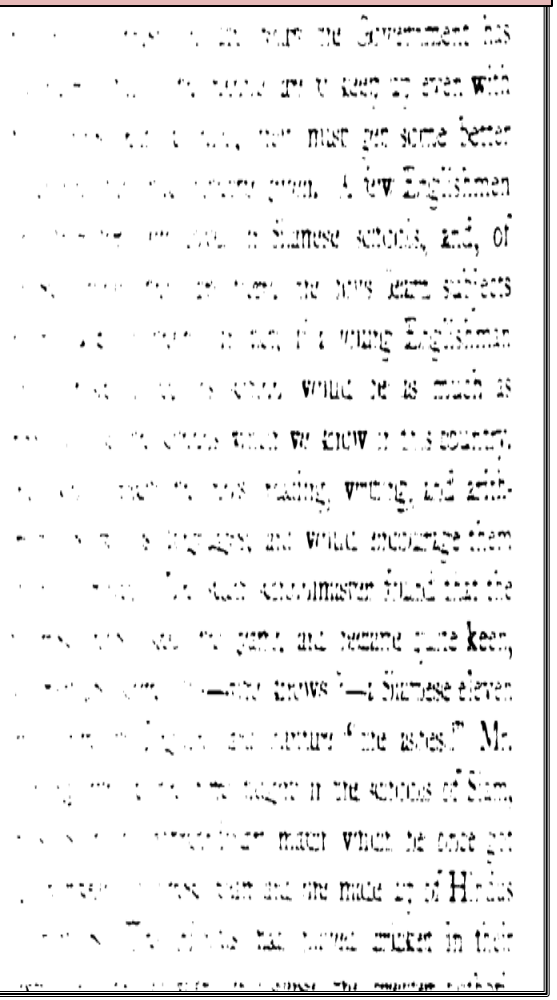
2 - Error alters appearance of Original Content.

3 - Error has affects readability of Original Content.

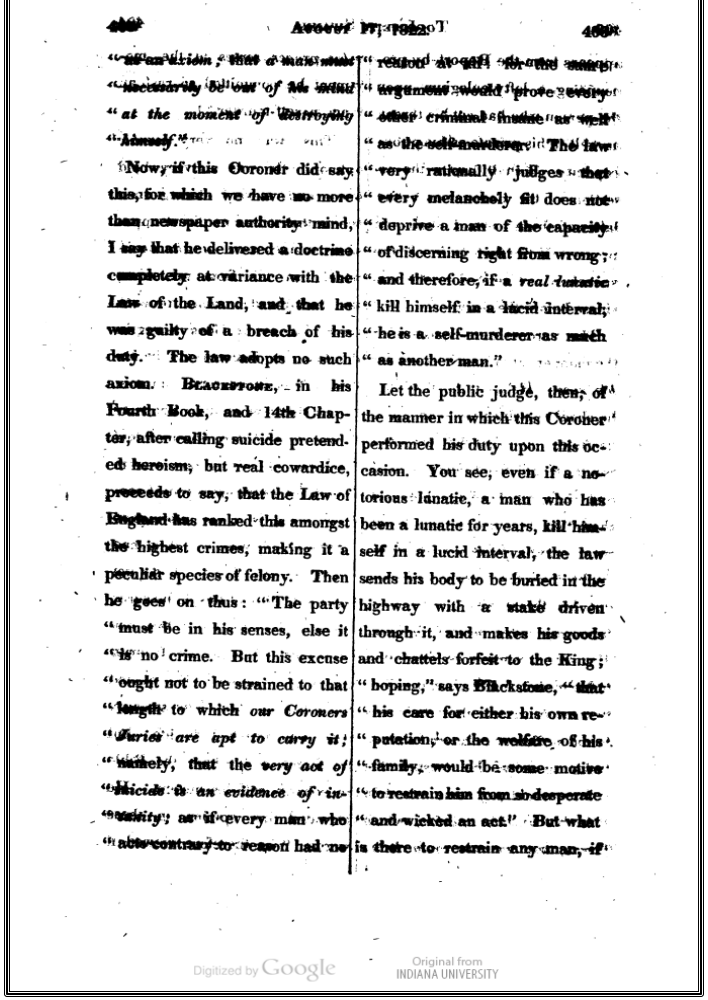
4 - Error requires significant inference to read Original Content.

5 - Error renders Original Content undecipherable.

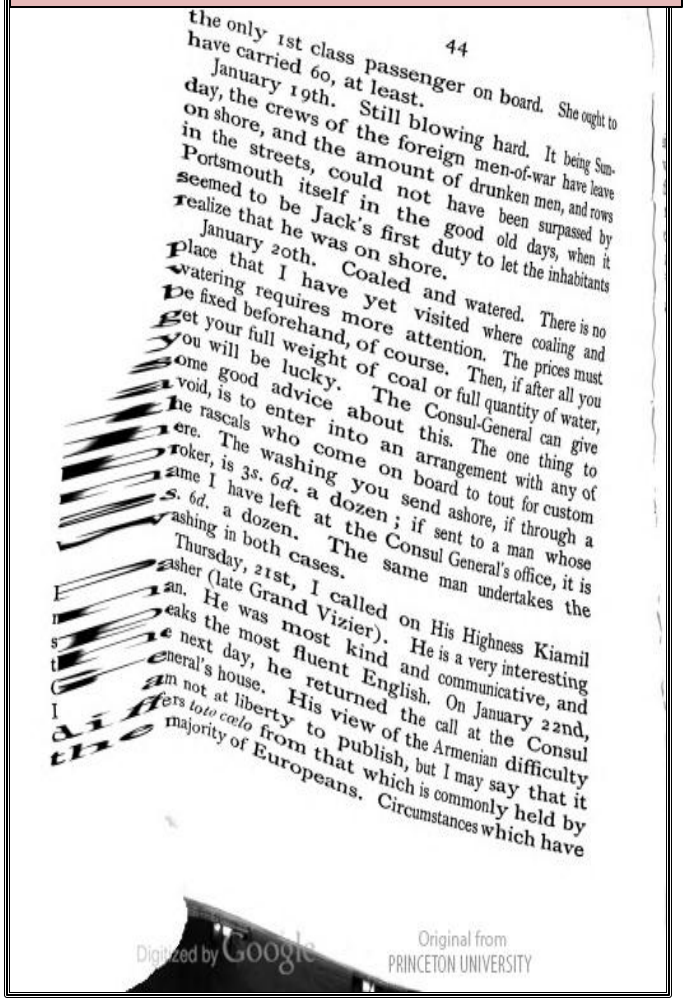
Error Type - Broken



Error Type - Thick



Error Type - Warp



44

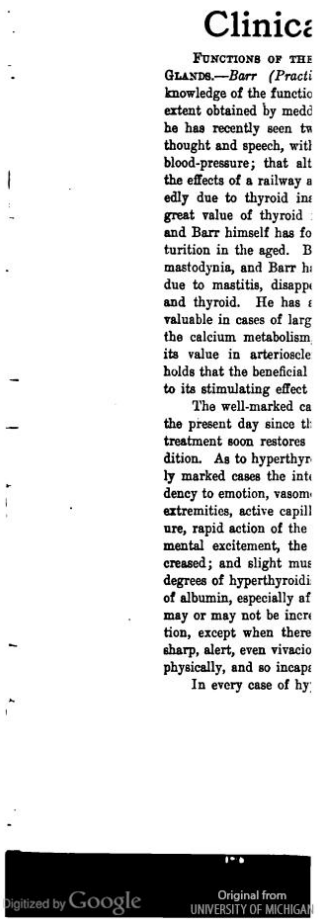
the only 1st class passenger on board. She ought to have carried 60, at least.

January 19th. Still blowing hard. It being Sunday, the crews of the foreign men-of-war have leave on shore, and the amount of drunken men, and rows in the streets, could not have been surpassed by Portsmouth itself in the good old days, when it seemed to be Jack's first duty to let the inhabitants realize that he was on shore.

January 20th. Coaled and watered. There is no place that I have yet visited where coaling and watering requires more attention. The prices must be fixed beforehand, of course. Then, if after all you get your full weight of coal or full quantity of water, you will be lucky. The Consul-General can give some good advice about this. The one thing to void, is to enter into an arrangement with any of he rascals who come on board to tout for custom ere. The washing you send ashore, if through a roker, is 3s. 6d. a dozen; if sent to a man whose ame I have left at the Consul General's office, it is s. 6d. a dozen. The same man undertakes the ashing in both cases.

Thursday, 21st, I called on His Highness Kiamil asher (late Grand Vizier). He is a very interesting an. He was most kind and communicative, and eaks the most fluent English. On January 22nd, e next day, he returned the call at the Consul eneral's house. His view of the Armenian difficulty m not at liberty to publish, but I may say that it ers *toto cœlo* from that which is commonly held by majority of Europeans. Circumstances which have

Error Type – Crop



Clinica

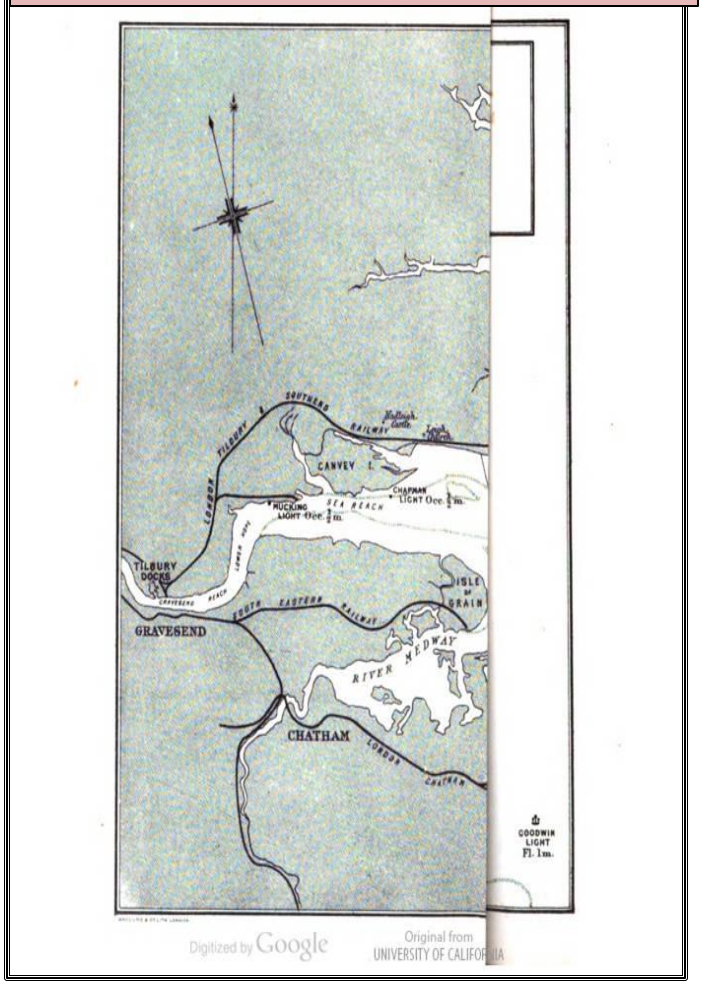
FUNCTIONS OF THE GLANDS.—*Barr (Practi*

knowledge of the functio
extent obtained by medd
he has recently seen tw
thought and speech, with
blood-pressure; that alt
the effects of a railway a
edly due to thyroid ins
great value of thyroid
and Barr himself has fo
turition in the aged. B
mastodynia, and Barr h
due to mastitis, disappe
and thyroid. He has
valuable in cases of larg
the calcium metabolism
its value in arterioscle
holds that the beneficial
to its stimulating effect

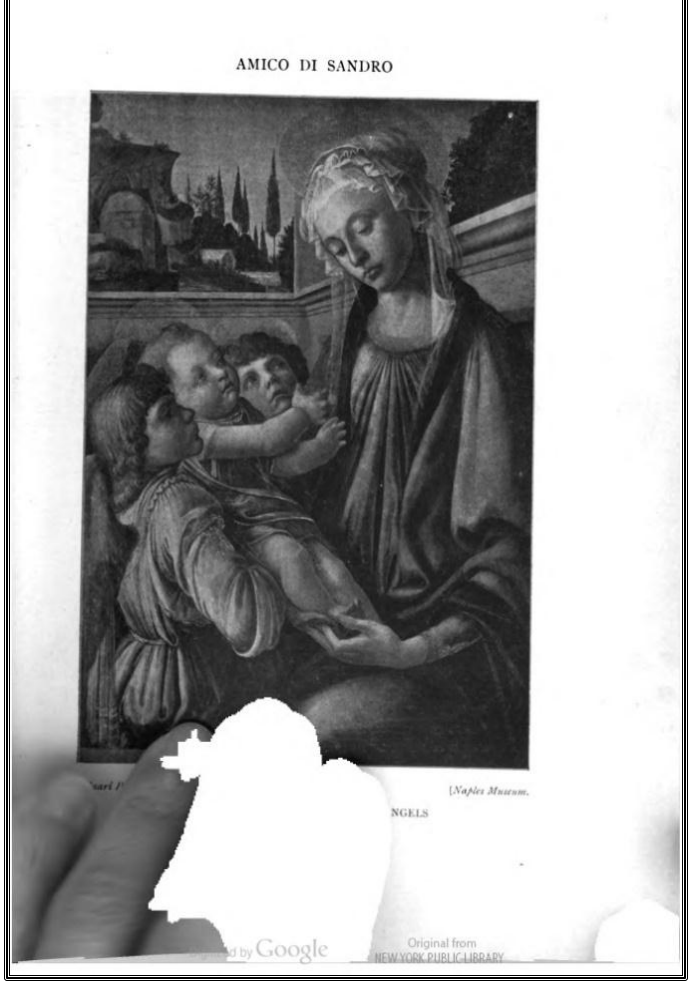
The well-marked ca
the present day since th
treatment soon restores
dition. As to hyperthyr
ly marked cases the int
dency to emotion, vasom
extremities, active capill
ure, rapid action of the
mental excitement, the
creased; and slight mus
degrees of hyperthyroidi
of albumin, especially af
may or may not be incr
tion, except when there
sharp, alert, even vivacio
physically, and so incap

In every case of hy

Error Type – Obscured (Material – Foldout not opened)



Error Type – Obscured (Processing)



Phase 2 [2011-12] - Error Detection, Coding, Analysis

- Random Samples of Digital Volumes
  - Populations: pre-1923 N= 1.3 million post-1923 N=6.5 million
  - Samples: 1,000 volumes per study
    1. Google (pre-1923, English)
    2. Google (post-1923, English, no serials)
    3. Internet Archive (pre-1923, English)
    4. non-Roman scripts (250 volumes in four alphabets)
  - Systematic sampling strategy within each volume
    - Up to 100 pages per volume, evenly distributed front to back
    - Up to 25% of a volume, evenly distributed

- Coding: page-level, whole volume, physical inspection
  - Coding of 456,217 page-images [for 11 errors]
    - Double coding of 10% of each sample [ca. 45,000 page-images]
  - Coding of 2,000 whole volumes [for volume level errors]
  - Coding of 1,490 physical volumes for book/bib. characteristics

Findings: Comparison of Most Frequent Errors

Total coding of 178,297 page-images digitized by Google

	Severity = 0		Severity = 1			Severity = 4		Severity = 5	
	<<<< 1923 >>>>		*<<<< 1923 >>>>*			*<<<< 1923 >>>>*		*<<<< 1923 >>>>*	
Text									
Thick	62.04%	67.52%	**25.66%**	**21.00%**		0.19%	**0.40%**	0.11%	**0.42%**
Broken	61.00%	73.37%	**29.96%**	**19.18%**		0.19%	**0.41%**	**0.25%**	**0.36%**
Page									
Crop	99.37%	98.85%	0.27%	**7.05%**		0.02%	0.04%	0.15%	**0.25%**
Warp	29.22%	45.78%	**60.18%**	**48.93%**		0.04%	0.04%	0.05%	0.06%
Obscure	16.88%	56.83%	**78.05%**	**41.69%**		0.08%	0.02%	**0.46%**	0.16%
			182,205			490		972	
Portion of Total Error (pre-1923)			**96.9%**			**82.5%**		**87.9%**	
				113,682			795		1,077
Portion of Total Error (post-1923)				**90.5%**			**87.9%**		**86.5%**

Findings: Comparison of Most Frequent Errors

Total coding of 85,535 page-images digitized by Internet Archive

	Severity = 0	Severity = 1		Severity = 4	Severity = 5
	<<<< 1923	<<<< 1923		<<<< 1923	<<<< 1923
Text					
Thick	**93.23%**	**4.12%**		0.01%	0.00%
Broken	**81.71%**	**11.77%**		0.19%	0.10%
Illustration					
Tone	**69.00%**	**24.65%**		0.17%	0.01%
Page					
Crop	**99.61%**	0.22%		0.02%	0.07%
Warp	**41.13%**	**57.00%**		0.00%	-
Obscure	**56.93%**	**39.61%**		0.02%	0.07%
Colorization	**47.56%**	**45.22%**		0.00%	0.03%
Skew	**90.24%**	**9.33%**		-	-
Blur	**94.22%**	**4.28%**		0.04%	0.03%
		95,293		**199**	**206**
Portion of "Big Five" Errors		**57.40%**		**52.00%**	**77.40%**

Findings: Distribution of Severe Error

- Proportion of volumes with severe error
- Level 4 or 5 severity in any error type on any page-image

Pages w/ Severe Error		Number of Volumes			Cumulative Percent		
		Google		Internet Archive		Google	
<<<< 1923 >>>>		<<<< 1923 >>>>		<<<< 1923	<<<< 1923	<<<< 1923 >>>>	
0	0	555	637	876	93.19%	59.55%	69.16%
1	1	167	131	43	97.99%	77.47%	83.39%
2	2	76	50	7	98.51%	85.62%	88.82%
3	3	39	29	2	98.72%	89.81%	91.97%
4	4	24	11	0	98.72%	92.38%	93.16%
5	5	12	8	3	99.04%	93.67%	94.03%
6	6	12	6	3	99.36%	94.96%	94.68%
7	7	8	3	0	99.36%	95.82%	95.01%
8	8	6	3	2	99.57%	96.46%	95.33%
9	9	1	2	0	99.57%	96.57%	95.55%
10	10	4	3	0	99.57%	97.00%	95.87%
11 to 21	11 to 28	20	28	1	99.68%	99.10%	98.97%
22 to 68	38 to 168	8	10	3	100.00%	100.00%	100.00%
		932	921	940			

Phase 1 [2011] – Metrics of Digitization Error

Level of Abstraction	*Possible Cause of Error*
LEVEL 1: DATA/INFORMATION	
1.1 Text: thick text [fill, excessive]	Source or post-processing
1.2 Text: broken text [character breakup]	Source or post-processing
1.3 Illustration: scanner effects [moiré, gridding]	Scanning or post-processing
1.4 Illustration: tone, brightness, contrast	Scanning, post-processing or source
1.5 Illustration: color imbalance, gradient shifts	Scanning, post-processing or source
LEVEL 2: ENTIRE PAGE	
2.1 Blur [distortion]	Scanning or source
2.2 Warp [text alignment]	Post-processing
2.3 Skew [page alignment]	Scanning, source or post-processing
2.4 Crop [gutter, text block]	Source or post-processing
2.5 Obscured/cleaned [portions not visible]	Scanning or post-processing
2.6 Colorization [text bleed, low contrast]	Source or post-processing
LEVEL 3: WHOLE VOLUME	
3.1 Fully obscured [foldouts or objects]	Scanning
3.2 Missing pages [one or more]	Source or scanning
3.3 Duplicate pages [one or more]	Source or scanning
3.4 Order of pages	Source or scanning
3.5 False pages [not part of Original Content]	Scanning or post-processing

Whole Book Errors – Preliminary Findings [one sample]

- Average number of pages per volume with whole book error.
- Certainty of loss of Original Content on some part of a page.

Mean = 4.93 pages/volume

Mean = 5.56 pages/volume

Variable	n	Mean	Std. Dev.	Minimum	Maximum
Pages per Volume	997	397.49	272.75	8	1628
Whole Book Error					
Obscured Content	997	3.36	20.82	0	366
Missing Page(s)	997	0.67	6.529	0	155
Duplicate Page(s)	997	0.62	4.48	0	92
Out of Order	997	0.24	2.185	0	43
False Page (s)	997	0.04	0.343	0	8
Page-level Quality Errors in a Volume					
Sure Loss 1/3 page	996	2.44	11.69	0	177
Sure Loss 2/3 page	996	0.72	4.22	0	68
Sure Loss all page	996	0.58	0.046	0	59
Unsure Loss 1/3 page	996	1.51	7.94	0	156
Unsure Loss 2/3 page	996	0.11	0.603	0	9
Unsure Loss all page	996	0.206	1.49	0	28

Impact of Physical Characteristics on Error

Number of Pages per Volume with at least 1 severe error

Characteristic of Volume		1 - 3 Pages	≥ 7 Pages	Chi-Square (p value)
Publication Year	: < 1860	70	19	<0.0001
	: 1866-1899	70	11	
	: ≥ 1900	110	7	
Gutter Margin	: More than 1.0 cm	184	20	0.002
	: Less than 1.0 cm	66	17	
Graphic Content	: No	153	20	0.004
	: Yes	97	17	
Parts of Pages Missing	: No	241	37	0.06
	: Yes	9	0	
Binding	: Fully Intact	190	27	0.06
	: Loose	41	4	
	: Not Intact	12	6	
	: Missing All/Part	3	0	

Next step in analysis: map physical characteristics to specific error types.

More Data Gathering – 2012

- Special focus on graphics and illustrations
  - Compile examples of digitization error
  - Get diagnosis from panel of imaging scientists
  - Explore options for correcting error

- Digitization processes documentation and analysis
  - Google digitization/post-processing techniques
  - Internet Archive post-processing techniques
  - HathiTrust ingest and re-ingest routines
  - Costs and limitations of manual review of digitization error

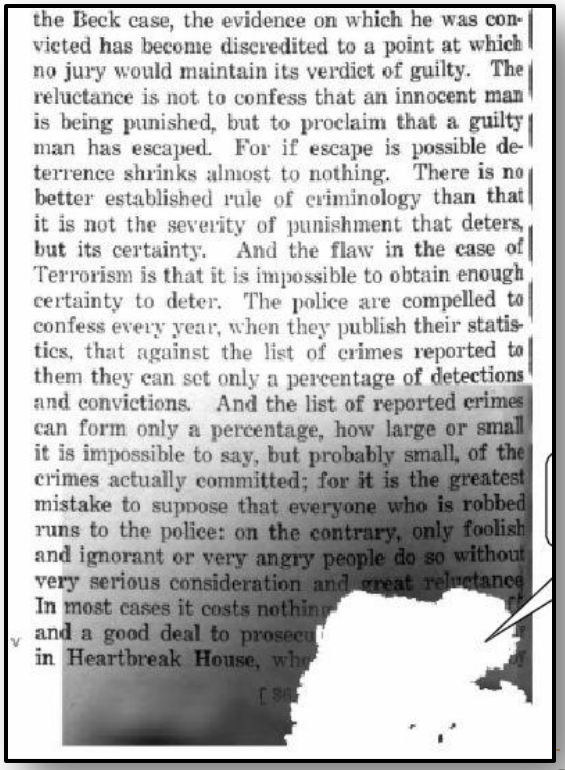
Study Phase 3 [2012-13] – Two Major User Studies

- Reading online – Error threshold for user rejection
  - Concepts: Text legibility; illustration interpretability
  - Scholarship: IQ (intrinsic); Relevance clues (object); Readability
  - Population: Digital humanities scholars who use books as primary sources
  - Goal: Identify thresholds of acceptability (limbo bar)

- Managing library print collections
  - Concepts: Low cumulative error; completeness; redundancy
  - Scholarship: "Last copy" criteria and policy
  - Population: HathiTrust members: collection development and preservation librarians
  - Goal: Certify individual volumes as "fit for use"(high bar)

Study Phase 3 [2012] – Process Study

- Predicting error from text to/from page-image
  - Spatial mapping of error text landscapes [training set] with hOCR text file [Google, IA, JSTOR]
  - Partnership with SI Professor Qiaozhu Mei's research team



the Beck case, the evidence on which he was convicted has become discredited to a point at which no jury would maintain its verdict of guilty. The reluctance is not to confess that an innocent man is being punished, but to proclaim that a guilty man has escaped. For if escape is possible deterrence shrinks almost to nothing. There is no better established rule of criminology than that it is not the severity of punishment that deters, but its certainty. And the flaw in the case of Terrorism is that it is impossible to obtain enough certainty to deter. The police are compelled to confess every year, when they publish their statistics, that against the list of crimes reported to them they can set only a percentage of detections and convictions. And the list of reported crimes can form only a percentage, how large or small it is impossible to say, but probably small, of the crimes actually committed; for it is the greatest mistake to suppose that everyone who is robbed runs to the police: on the contrary, only foolish and ignorant or very angry people do so without very serious consideration and great reluctance
In most cases it costs nothing
and a good deal to prosecu
in Heartbreak House, wh

The Beck case, the evidence on which he was convicted has become discredited to a point at which no jury would maintain its verdict of guilty. Th@ reluctance is not to confess that an innocent ma@ is being punished, but to proclaim that a guilty man has escaped. For if escape is possible deterrance shrinks almost to nothing. There is n@ better established rule of criminology than that it is not the severity of punishment that deters, but its certainty. And the flaw in the case of@ Terrorism is that it is impossible to obtain enough certainty to deter. The police are compelled t@ confess every year, when they publish their statistics, that against the list of crimes reported to them they can set only a percentage of detections and convictions. And the list of reported crimes can form only a percentage, how large or smal@ it is impossible to say, but probably small, of the crimes actually committed; for it is the greatest mistake to suppose that everyone who is robbed runs to the police: on the contrary, only foolis@ and ignorant or very angry people do so without very serious consideration and @reat reluctanc@
In most cases it costs nothing t@
And a good deal to prosecut
In Heartbreak House, wh@
[36

Deliverables [2013]

- Report findings on website
  - Tables, analysis, links to data
  - http://hathitrust-quality.projects.si.umich.edu/

- Publish peer-reviewed articles & proceedings
  - American Archivist, Archival Science, JASIST, IJDL, IJIQ
  - JCDL, iPres, IS&T Archiving
  - College & Research Libraries, First Monday

- Distribute Quality Review web-application(s)
  - Three tools that use sampling strategies
  - One tool for volume-by-volume certification

Summary

- What is quality?
  - Absence of page-image error relative to expected uses.
  - Presence of intrinsic character sufficient to inspire trust.
  - "Fit for purpose" – exploring the limits of "one size fits all"

- How bad is it?
  - Very low incidence of very severe error?
    - Likely findable with automated processing
  - High incidence of low-severity text error (Google)
  - Very low incidence of whole volume error
    - Unlikely findable with machine processing algorithms
  - Very high incidence (likely) of scanner effects on book illustrations

- Why does error occur?
  - Physical book characteristics have little or no impact
  - Faith of digitizers in post-scan image processing at scale

Implications for Practice

- Lowering the bar on image quality is not necessarily an ethical or professional compromise
- New tools and techniques for measuring quality will emerge from this study
- Communicating error to users is important
- Need for automated quality validation routines
  - Error models as first steps toward machine processing
  - Distinguishing errors that matter from those that don't

- Proposition: Certification of trustworthy repositories must encompass the qualities of the content within.

Implications for Archival Theory

- An archival principal [archival quality] can be described empirically.
  - Scoping the "intrinsic value" of copies [Boon 2010]
- Reaffirm value of digital surrogates as preservable products
  - Preservation trumps access as a compelling archival rationale
- Establish the archival nature of digitized surrogates
  - "Archivalness" derives from creation processes [reliability]
  - Provenance derives in part from digital curation
  - Appraisal of value through assessment of use

References

- Boon, Marcus. (2010). *In Praise of Copying*. Cambridge: Harvard University Press.
- Conway, Paul. (2011). "Archival Quality and Long-term Preservation: A Research Framework for Validating the Usefulness of Digital Surrogates." *Archival Science* 11 (3).
- Cook, Terry. (1995). "Electronic Records, Paper Minds: The revolution in information management and archives in the post-custodial and post-modernist era." *Archives and Manuscripts* 22 (2): 300-328.
- Cook, Terry. (1997). "What is Past is Prologue: A History of Archival Ideas Since 1898, and the Future Paradigm Shift." *Archivaria* 43 (Spring): 17-63.
- Duranti, Luciana. (1995). "Reliability and Authenticity: The Concepts and Their Implications," *Archivaria* 39 (Spring): 5-10.
- Henry, Charles & Smith, Kathlyn. (2010). "Ghostlier demarcations: Large-scale text digitization projects and their utility for contemporary humanities scholarship." In *The idea of order: Transforming research collections for 21st century scholarship*. Washington: CLIR, pp. 106-115.

References

- Kaplan, Abraham. (1964). "The Age of Symbol: A Philosophy of Library Education," *Library Quarterly* 34 (1964): 297.
- Rieger, Oya. (2008). *Preservation in the age of large-scale digitization: A white paper*. Washington: CLIR.
- Ross, Seamus. (2007). *Digital Preservation, Archival Science and Methodological Foundations for Digital Libraries*, Keynote Address at the 11th European Conference on Digital Libraries (ECDL), Budapest (September 17).
- Taylor, Hugh. (1987-88). "Transformation in the Archives: Technological Adjustment or paradigm Shift?."*Archivaria* 25 (Winter): 12-28.
- Thomassen, Theo. (2001). "A First Introduction to Archival Science," *Archival Science* 1: 373-385.
- Yeo, Geoffrey. (2008). "Concepts of Record (2): Prototypes and Boundary Objects." *American Archivist* 71 (Spring-Summer): 118-143.
- York, Jeremy. (2010). "Building a future by preserving our past: The preservation infrastructure of HathiTrust digital library." *Proceedings of 76th IFLA General Congress and Assembly*, 10-15 August, Gothenberg, Sweden.

VALIDATING QUALITY IN LARGE-SCALE DIGITIZATION

Project Summary

IN LESS THAN A DECADE the large-scale digitization of books has begun transforming the way we read and learn and changing how research libraries manage and preserve their collections.

DIGITIZED BOOKS made by third-party vendors are being preserved in online repositories. In this new preservation environment, the quality of what is preserved becomes an important factor in inspiring trust that digitized books are fit for the purposes envisioned for them.

INNOVATIVE RESEARCH presented at this website is developing and testing methods for measuring the severity of detectable errors in digitized books and validating the impact of error on the end-user. Here you will find information on the project, selected findings, and links to the project's reports, presentations, publications, and products.

HATHITRUST DIGITAL LIBRARY serves as a testbed of digitized books and serials for the project, which has three overlapping phases.

- Phase 1 (2011) - Define a model of digitization error and a severity scale for recording observed error consistently and accurately.
- Phase 2 (2011-12) - Apply the research methodology to representative samples of digitized volumes.
- Phase 3 (2012-13) – Validate the results of the error analysis for specific use-case scenarios.

THE SCHOOL OF INFORMATION at the University of Michigan is leading a multi-year collaboration with the University of Michig... Digital Library, and th... esota Libraries. Th...

Questions?

Thank you for your attention!

Project Website: http://hathitrust-quality.projects.si.umich.edu/

Paul Conway, Associate Professor
University of Michigan School of Information pconway@umich.edu

INSTITUTE of Museum and Library SERVICES