Book Scanning – Technologies and Techniques

> Mike Mansfield Director of Content Engineering Ancestry.com / Genealogy.com

#### Outline

Project Analysis
Scanning Parameters
Book Scanners

#### Project Analysis Overview

Scope
Goals
Project and Customer Requirements
Content Evaluation

## **Project Analysis**

#### Assessment

- Selection
- Information Representation – Goals and Metrics
- Funding
- Planning and resource assignment
- Prepare the originals for digitization

#### Scanning

- Quality Assurance
- Post-Processing OCR, Compression, Format Conversion
- Return originals to the collection
- Host the data
- Archiving and preservation

#### Book Scanning Parameters Overview

Resolution Bit Depth Dynamic Range Tonal Sensitivity **Geometrical Corrections** De-Skew Curve Correction Text Crushing Masking and Cropping

### Resolution

Samples Per Inch (SPI), Dots Per Inch (DPI), Pixels Per Inch (PPI)
Archival Quality
Access Quality
"Faithful" Representation of the page

#### **Resolution and OCR**

Most OCR engines are optimized for 300 DPI images with typefaces in point sizes between 10 and 14.

In cases where the font size of characters on an image are very small (point size of 6 or less), scanning images at 400 DPI can improve character recognition

### **Bit Depth**

Number of colors or "tones" a scanner can differentiate

BitonalGrayscaleColor



## Dynamic Range

A scanner's dynamic range is a measure of how well the device can record changes in the brightness of the image it's scanning



## **Tonal Sensitivity**

The ability of a scanner to accurately represent similar, adjacent tonal values as distinct from each other



#### **Geometrical Corrections**

Deskew
 Bookfold Corrections

 Curve Correction
 Text Crushing

#### Deskew

#### Skew detection and correction

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#### Bookfold Corrections Curve Correction and Text Crushing Pages of bound books are three dimensional surfaces





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#### Curve Correction and Text Crushing Compensation

Straighten curves and preserve uniform distances in the drape and gutters of scanned book pages



## Finger Masking

Methods to remove the images of the operator's fingers holding down the pages during scanning



### Cropping and Page Splitting

Detecting and cropping edges to remove portions of the image containing the book cover, end-papers, spine edges, and page fan-outs.

Splitting double page images.

### Not What We Want



#### Ekaterina Gordeeva and Sergei Grinkov

Sergei Grinkov sends a clear message that not even up a can take good health for granted. Grinkov's sudden deal massive heart attack on November 20, 1995, ended one of most romantic and appealing success storiesurning that a family history of heart disease should never lightly.

Gordeeva and Grinkov were products of the old Social system. Paired somewhat reluctantly at the tender ages of 14, they worked together for years "as brother and size ning their first world championship when Gordeeva with an Olympic championship when she was 16. The elder G dated other women and tended to view his skating parts talented little girl. Only after they turned profess ning their fourth world championship in 1990 did their nin ship take on a deeper pitch.

Traveling with the Tom Collins Tour of World Char in 1990 and 1991, Gordeeva and Grinkov became as ince-off the ice as they were on. They married in 1991, had a d ter, Daria, 18 months later, and returned almost immedi pairs skating. Both were thrilled when they discovered th change in Olympic rules would allow them to participate the 1994 Winter Games. They wanted to see if the exit they felt as unattached "children" in 1988 could be enha the lasting romance that had developed between them and Their expectations were fulfilled. Sort

a home in Connecticut. There in Viktor Petrenko and Oksana Barra

training facility, in preparation for fur

Grinkov were practicing a new motion

On November 20, 1995, Genker

beautiful long program to the st Beethoven's "Moonlight Sonata," they the judges with their artistry and thritered dience with their obvious passion for a - could just see how much they other loved each other. You would Of the many former champions wotch them and just wish turned from the pros to the Olympic Gordeeva and Grinkov were the on win a gold medal. They returned to n sional ranks soon after Lillehammer a

you had that sort of relation ship with someone. We all wish we could find that kind of feeling, that perfect ruclear life. So few people actually do." -Imerican skatar Paul While an

Historia Gordeevo and Seron Sentor

New York, when Grinkov became dizzy and collapsed on New York, when Ormanov accame array and collapsed on Wihim moments, as a "family" of fellow skaters looked https://directing.and turned blue. He never revived. An second two blocked arteries and evidence of a serious Touching and tragic, the story of Ekaterina C mak within the 24 hours preceding his death. Gordeeva made arrangements to return her husband's body

bengland for funeral and burial, nagging questions re-How could anyone suffer a major heart attack and not How long had Grinkov been skating impaired? The anreled the pitfalls of a life dedicated to athleticism: be customed to skating in pain from various in probably overlooked the signs of heart trouble. And Grinkov led such an active life, never smoked or abused and was not overweight, he tended to minimize the fact and most overweight, he tended to minimize the fact controuble ran in his family. Routine procedures such as its and echocardiograms would have revealed the coronary dicise and perhaps have saved the skater's life. However certainly would have been seriously jeopardized, if not wh cortailed, by the illness,

the wake of the tragedy, as Gordeeva has gone on with her and her skating, the philosophical questions about Grinkov's time have faded. What remains are images of a superlative stater who moved soundlessly across the ice and held his at every with his own, As Newstatech contributor Mark Starr the sports world, where greatness is a judgment too ca makted and superstar' a term too frequently bestowed skwa and Grinkov's] performances will remain the standard

#### Medalists 1988

Fort Stoffer-Pat

Ekstering Gordneye, Sessel Grakey, Saviet Union 2. Eless Voleve, Oleo Vasilley, Soviet Union, 2.4 r Occepterd, U.S.A., 4.2 1024

Kitty Ceruthen, Paler Consthers, 8.5.4., 2.8
 Lanza Soleznove, Oleo Rokorav, Soviet Unior

G&G corner 163

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1. Elena Volcyp. Oleo Vossilley, Soviet Union, 1.4

#### The Collection Deponent, the was always work when

Figur

Sk

ating

was brought unto her, and her fits m violent than at another time. And the after the faid Florence was committee Taughall, the Deponent was not trou but was very well till a little while : the faid Florence was removed to Corke, then the Deponent was as ill as ever be And the Major of Toughall one Mr. May then fent to know whether the faid Flore were bolted (as the Deponent was told) a finding the was not, order was given put the bolts on her, which being done Deponent faith fhe was well again, and hath continued ever fince. And being all whether the had fuch like fits before the fa Florence gave her the kils, the faith the new had any, but believes that with that kifs a bewitcht her, and the rather becaufe I hath heard from Nicholas Pyne and other that the faid Florence had confelled as mu

This Mary Longdon having closed up Evidence, Florence Newton peep'd at her it were betwixt the heads of the byftand that interpoled betwixt her and the la Mary, and lifting up both her hands tog ther as they were manacled caft them an angry violent kind of motion ( as w feen and observed by W. Allon, ) towards the faid Mary, as if the intended to ftrike a her if fhe could have reacht her, and fait

#### Beily on the morowe foote men with theyr ares /made a grete firengthe of theeloes.and fet hem togpder. @ hadd the mayftrp. ne had be b the flormas ferned to flet/Reing harolde flode on his fete by his banes with his two bre by The by the baner was after warde (ene to the affer was after warde (ene to the affer for Ammana the night byfore the batapile (hour ben) of ber (printes a were boulled ersh ou p mos row: fote men @ archeis were let in p bataple. g thene tangates worth worn ges on erther fibr/Duke Wollyam co forted his mey to the batapile .g was waar that his haberion was touned in g out. and anunded b happe with a borde. And land the fires igthe of au a botor, that tourne in to a bringdoup eiloun (ball tourne in to a bringdoup Sut er that the (hotcus came togyds one of the flormans called Caplefer call his florero ann plareb byfoir che boolt and flerge a banpour of Englif the men that cam avent hymand of De efte the lame of a nothery Ello be flewe the thride. a was flary bymielf Thene anone the forers finote togy ders with Roulondes fonge that was bigon on the formans foor/The ba taple endured from bnder u of p dape to enenfonce tome / And nepther pars

of Relations. Now the is down. Upon which the maid

fell fuddainly down to the ground-like a thone, and fell into a moft violent fit, that all the People that could come to lay hands on her could fearce hold her, the biting her

own Arms and threeking out in a molt hi-

deous manner to the amazement of all the beholders. And continuing to for about a

quarter of an hour ( the faid Florence Newton

itting by her felf all that while pinching

her own Hands and Arms as was fworn by

fome that observed her) the maid was or-

dered to be carried out of Court and taken

into a house. Whence feveral Perfons af-

ter that, brought word that the Maid was

in a Vomiting fit, and they brought in fe-veral crooked Pins and Straws and Wool,

in white foam like fpittle in great propor-

tions. Whereupon the Court having taken notice that the Maid had faid the had been very

well when the faid Florence was in bolts, and ill again when out of them, till they

were again put on her, demanded of the

Gaoler if the were in bolts or no, to which

he faid fhe was not, but onely manacled.

Upon which order was given to put on her bolts, and upon putting them on the cryed out, the was killed, the was undone, the

was spoiled, why do you torment me thus? and so continued complaining grievoully for half a quarter of an hour. And then

came

polychoromicon Liber letus

nno gre caule Chold be demed by dynt of fwer

the wolde workdrawe/Dut the bas archers had there forth / Themes duke made a token to his men. the de/And prayed god only that he fol delemi de deme bytwene theyny two/ Thene the booltes of eyther lybe came to the they Cholde feyne to flee/And wple Englyfibe men were beg place of the batavie .ou favnt fairt the pope, the rim? day of October. on a Saterdaye.in the place where that bape of Dataple is buyloc.as we ben oplaraped beny as it were to pu and loo to recte outbeyr enn whay Engleth men were loo our araye/ The Dormans arayed be enformeo/ The nyghte byfore the bas taple Englyilhe men paur ben to los ge & to dipnite.and walted all nyght lyfibe mey that were out of ara chaced bern on every fpde/He lan ; colde was impten worth an arone loft his one eye. and was bute ou bravne and felle domne in the End one of the knyghtes (more in the thrabe whyle he lave there , End therefore Welliam put that he bte oute of the chrualine.for be done an pncunninge dede/Tha he had/ End were flyched bi 2but he have been foo that no came out of his body/ Whou the tory was done. Wyllyan bury men that were flarne End a his enmyco to doo the lame wold/And fente haroldes bol roldes moder wethoute ony n the bad prayed/ Zind the buryed at Walthany in thabbay of Lbd that frazolde bad founded/ 12. Giraldus Lambrenlis in bis be called Itinecarius wold meane Barolde hao many woundes.an te his lefte epe worth the thu artower/and was ourcomer an ped to the countier of Chefter. ued chere bolip, as me troubt a bers lpf in fante James cell fan Et iobns chiche.g made a gode

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#### mas knower by his lafte confet and the comute fame acordeth alis in layar Comardes 2 rebilin the ende there be la a harold other deped wertchid the elcaped & was preferred to tringe faroldes deth was ind bringe faroldes deth was ind te crice of forchumberlonde & and the bill portpanisherion of a perial ED why a comparison of the phane perial ED why a comparison of the phane periphenelle of place, other more to be what the proves were when are bacapile of florgames un to London & toke her lpl artha faroldes whe and fente a Chefter/ And they e Alloredus debyllhop of Poste.and f Lon-spompled that they wolde ma baar Adelpinge hynge.and figh pm/But for the orede of Yoil fed they withdrewe beny led not that thei had promi to alle thele with other noble to Willyam, a vaue by pled to fware bym feute and dyde CExplicit liber fextus

Incipit liber leptimus

CCapitulum primum

s fan Willvam came to London. and was couned at Weltmel ter of Aldredus asche billhop of poste.and borded Strgandus

byth the gentplines, and namely the Erles Edward and Bachatus. & Ed gard Adelpinge/And mood ipecyally Stygandus the asthebylihop/though he wythttode in that wyth all that be mpghte/he lade hpm worth hpm.as it were for to doo hpm worthpp/Dut his meanynge was (pecyally for noo terpfor) boloe be done in bis ablence/ in Englonde by auctoryte of Stigan dus/ Climonge all other it is harde for to telle bow grete worthpp be dys de to Stygandus/ for he wolde ary? le and come agaput byin worth pro ? cellpon/End that with grete boott @ arape / Dut all that was cloted and bydde in that dooinge.came oute af % terwarde clere pnough/ Whan the pos pes Legat came in to Englande, and peo kuga tamire to to inginitor and made a countrefule by the affert of the hgg//s-Stigando was depoled g let a down:g prayed belip b leting of his grace/ The hgge excuted bielef with fayt wooden.as he coude well yrough a (and het witch und a same d as e lard b be might not do apenti p po per beel/End to be beloe Setigandus to boondes arte Dopuchetter terme of b) bolonos are whicheler terms of bio lift, [2] Allt, for after aganti Wynter lynge Wyllyam came in to Englyllo and putter a typut booy Englyllo meng gretter than they mi ygbt bor? And bylego Ecceter that was thele agantic byth, a bake the other / Orthan the counter that are

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#### What We Do Want

#### 194NEW YORK MARRIAGES.

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1761.	Oct.	17.	Hulet, William, and Abigail Still,	"	v.
1780.	Nov.	21.	Hulett, Elizabeth, and William Maffett,	**	XXX.



William Daston

sons and three daughters of Robert and Mary (Carpenter) Barton, the former a native of Dutchess County, and the latter a native of Ulster Co., N. Y. His parents came to Troy in 1803. His father at that time was a fanningmill maker; was afterwards in the grocery and provision business, and still later in the manufacture of soap and candles. He was an active business man, was con with various enterprises in the early history of Troy, and was in politics one of the old Federal party. He died in Troy, in the year 1836, aged fifty-nine. His wife died 1866, aged eighty-six. Both were members of the Society of Friends.

William Barton received a good education at the Friends' School, at Nine Partners, Dutchess Co., N. Y. For many years he was connected with his father in business in Troy. In 1832 (having previously studied engineering with Amos Eaton and others) he became assistant engineer in the construction of the macadamized road from Troy to Bennington. In 1833-34 he was assistant engineer on the Rensselaer and Saratoga Railroad, and in the construction of the bridge at Troy, over the Hudson River, for that road. From 1836 to 1839 he was engaged in the surveys for the Boston and Albany Railroad, and subsequently contracted to build sections of that road, and also to build the wharves and accommodations for the depot on the cast side of the Hudson at Albany.

In May, 1839, Mr. Barton married Mary A., daughter of James and Rebecca Wells, of Springfield, Mass., and sister of David A. Wells, of Norwich, Conn. Returning

WILLIAM BARTON was born in Troy, N. Y., Feb. 7, to Troy the same year, he was appointed city surveyor, and 1805, and was next to the eldest in the family of three nearly twenty years,-during which time, in 1858, he made the first complete map of Troy, embracing the whole city, and was also the engineer for the extension of the wharves along the city front. In 1859-60 he was one of the organizers of the Arba

Reid Steam Fire-Engine Company, and was its first president. In 1860-61 he organized the Troy and La burgh Street Railroad Company, and the Troy and Cohors Street Railroad Company, and was the engineer and superin-tendent until 1867. He has been one of the directors since the organization of both roads, and is now one of the executive committee. From 1870 to 1878 he was encaused in the coal business, at the corner of Jacob and River

Mr. Barton has taken an active part in the politics of his city and county. Was formerly a member of the Whig party; is now a Republican. For two years, 1847-48, he spresented the Seventh Ward in the common council of Troy. He has ever been interested in all enterprises tending to the prosperity of the city where he has spent most of his life as an active business man.

Reared under Quaker influences, he in early life held that belief, but about 1836 he became a Unitarian, and after returning to Troy he became one of the founders of the Unitarian Church in that city. Mr. Barton is well known in Troy as an enterprising,

upright, and judicious business man. His correct habits integrity, and honesty of purpose in all his relations of life have won the confidence of all who know him.

MORTGAGES 1658-60 AND WILLS 1681-1765

#### Bond of Cornelis Vos to Johanna de Hulter

[317] Appeared before me, Johannes La Montagne, in the service of the General Chartered West India Company commissary at Fort Orange and the village of Beverwyck, in presence of Abram Staets and Adriaen Gerritsen, magistrates of said jurisdiction, Cornelis Vosch, who acknowledges that he was well and truly indebted to Madam Johanna de Hulter in the sum of one hundred and ninety Carolus guilders in good, whole beavers, which he promises to pay on the first of August Aº. 1659; as security70 and special pledge for which sum he, Cornelis Vosch, offers the last payment on his new, sold house, which payment is due on the date above named; binding furthermore his person and estate, real and personal, under submission to all courts and judges. Done in Fort Orange, the 18th of July Aº. 1658.

Cornelis Vos

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Abram Staas Adviach Gerretsen

Acknowledged before me.

LA MONTAGNE, Commissary at Fort Orange

#### Satisfaction of above bond

Appeared before me, Johannes La Montagne, commissary of Fort Orange and the village of Beverwyck, Madam Johanna Ebbinghs," who declared that the above bond was fully satisfied and paid. Done in Fort Orange, the 8th of August A\*, 1659.

IOUANNA EBBINCK

Acknowledged before me,

LA MONTAGNE, Commissary at Fort Orange

#### Bond and mortgage of Teunis Slingerlant to Johanna de Hulter

[318] Appeared before me, J. La Montagne, in the service of the General Chartered West India Company commissary at Fort Orange and the village of Beverwyck, in presence of the Honorable Jan Tomassen and Françoys Boon, magistrates of said jurisdiction, Teunis Slingerlant, who acknowledged that he was well and truly indebted to Madam Johanna de Hulter in the sum of thirteen

 $^{16}\,H_{\rm M}pole cq.$  usually translated "mortgage."  $^{17}$  Johanna Ebbingh was the daughter of Johannes de Laet. Her first husband was Johannes de Hulter, with whom she came to New Netherland in band

#### Book Scanners Overview

Document Scanners
Planetary Book Scanners
Flying Linear Arrays
Digital Photography
Robotic Page Turners

Cut the spine off of the book and scan the loose pages in a document scanner
The book is rendered almost useless for additional use
Rebinding is expensive and slow
Makes most sense when a sacrificial copy of the book exists.

Extremely Fast
Feature Rich
Relatively Inexpensive
Large range of options and price points
Some limited applications in the Family History and Genealogy domain

Major office equipment manufactures Canon Fujitsu Kodak Panasonic Ricoh













Resolution: 100-600 DPI Bit Depths: Bitonal, Grayscale, Color Simplex / Duplex 2 x 3 inch to 12 x 30 inch documents Rate: Few hundred pages per day to tens of thousands of pages per day Deskewing, cropping, dithering, dynamic thresholding, binarization, etc...

#### **Planetary Book Scanners**

 Specialized devices designed to do primarily one thing – scan bound books
 CCD Array, integrated lighting, specialized scan beds/book cradles, and book specific image processing options

7,500 Pixel Reduction type line CCD Halogen Lamp Lighting Up to A2 Size 200/300/400/600 DPI Bitonal or 8-bit Grayscale 4.5 Seconds per scan on an A4 page at 400 DPI



Image Processing Curvature Correction Text Crushing Correction Centering Finger Masking Spread/Single/Book Split Linearization



#### Articulating Book Cradle





#### Scan buttons on the scan bed

₽ 84	B3 A2	₽ 64 ₽	

# Minolta





# Bookeye









## Zeutschel



### Planetary Book Scanners

- Resolutions from 300 DPI to 600 DPI
- Bit-Depths: Bitonal, Grayscale, Full Color
- Rich feature set well suited to large production projects
  - Book cradles, glass plates to reduce page curvature, specialized image processing, human-factors, etc.
- Support for most book sizes from small books to large quarto volumes and smaller atlases
- Proven technology, few moving parts, highly reliable
- 1 page scan in 5-10 seconds
- 1,500 3,000 pages per 8 hour shift

### Flying Linear Arrays

Integrated flying linescan CCDs and lighting systems with specialized scan tables and book cradles





# i2S – DigiBook, Zeutschel



### Flying Linear Arrays

Resolutions up to 800 DPI

- Bit-Depths: Bitonal, Grayscale, Full Color
- Very high quality scans
- Feature rich systems with book specific support

Book cradles, glass plates, human-operation factors

- Support for very large volumes, atlases, and maps to a meter square
- 1 page scan in 2-6 seconds
- 2,500 4,500 pages per 8 hour shift

## **Digital Photography**

- Large Photographic Formats
- Scanbacks
- Professional Photographic Optics and Cameras
- Studio Lighting Systems
- Color Management Software
- Custom camera positioning and book holders

### Large Format Photography

Better Tonality

- Higher color depth
- Sharper
- Grain-free

More control on the final geometry and perspective of the photographed pages

### Scanbacks

Large Format Cameras Trilinear array, 1-pass scan 6000 x 7250 pixels = 43 megapixels 30+ seconds for a single scan



# Digitizing the Gutenberg Bible







## Digitizing the Gutenberg Bible

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#### Anagramm Picture Gate 8000 Scanback

Trilinear CCD Array, 1-pass scan Large Format Camera 9 x 12 cm 8000 x 9700 Pixel Optical Resolution = 77.6 megapixels 48 Bit Color Depth 444 MB File in 48 Bit Color 40 Seconds for a full scan Fiber-optic connection

### **Digital Photography**

Super high quality images
Custom lighting and positioning
Slow

Scanning page images is slow
Positing each page is slow
Skilled and experienced photographers
Few applications in the Family History and Genealogy domain

## **Robotic Page Turners**

# Kirtas APT BookScan 1200 i2S DigiBook – Digitizing Line



### Conclusion

- Analyze your project's requirements and scope
- Understand the content and determine the scanning metrics
- Match the scanning technology to the content and project goals

# Questions

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MMansfield@Myfamilyinc.com