

BVCC General Meeting

August 14, 2023

"Scanners"

Joel Ewing, President BVCC

Will Look At A Variety of Scanners

- **All-In-One printers**
- **Flat-bed scanner**
- **Portable auto-feed scanner**
- **portable camera-based scanner**
- **Other Devices**

- **A PDF of the presentation slides for this program will be posted under Information → Presentations on the BVCC website (bvcomputerclub.org)**



Some Generalities

- **Controlling all scanning options and supporting various file formats typically requires software from the vendor**
 - Vendor software packages for most retail scanners are Windows only
 - Some more expensive scanners do advertise Mac support
 - Some scanners have driver support available for Linux, but application support tends to be "basic", not full featured support
- **There are specialty scanners available, like hi-res auto-feed 35mm slide scanners, but these are hard to cost-justify for casual use**
- **Vendor software OCR support (for searchable PDF or DOCX formats) has improved in the last decade, but don't expect perfection**
- **There may be problems with out-of-support scanner software if support for a newer scanner from the same vendor is installed on the same Windows system.**
- **Best scanning parameters depends on objective and quality of original**
 - 8x11 document readable at 150 ppi, if want to print reasonable-quality copies, go to 300 ppi minimum
 - standard photo prints: generally 300 ppi adequate
 - Items that are clearly not intended to be in color may scan better as grayscale to avoid color artifacts in image
 - Photo versus document optimization
 - 35mm slides - experiment with 1200 - 4800 ppi. Higher res with marginal slides may just reveal more imperfections (poor focus, camera movement, improper exposure, surface damage) rather than useful details. Stop at point of diminishing returns.

All-In-One Printers (HP6978, \$95 in 2018)



All-In-One Printers

- **Many ink-jet printers are print/copy/scan/fax combo**
 - Scanner typically used to "align" the print heads
- **Advantages**
 - No extra desk space, bundled with other printer features
- **Disadvantages**
 - Slower
 - Scanner Hardware & Software may have fewer features; usually a smaller scanning surface

HP 6978 Office Jet Pro

- ADF (max 8.5"x14") and Scanner Glass (max 8.5"x 11"+) – no auto-duplex scan
- Slow - ADF of one 8.5x11 page: 28 secs
- Resolution dpi: 75, 150, 200, 600, 1200
- Color vs Grayscale
- Scan area: entire, Letter (8.5x11), A4(210x297mm), 4x6, 5x7. Use of ADF adds Legal (8.5x14) – Can adjust guides on ADF, so perhaps can autofeed 4x6 and 5x7 cards, provided stock will bend 180°
- Type: Document, Photo, Multi-Item, Book, ID Card
- Detect Edges option
- Save as: Basic PDF, JPG, Searchable PDF, DOCX, TXT
- Compression: none, low, medium, high
- High compression on PDF (300 dpi) vs none: size / 4
- Searchable PDF did fairly decent job but not 100%
- DOCX also seemed fairly close, some visual differences
- TXT format seemed to include significant garbage chars
- HP Smart software drawbacks
 - Requires an HP login to fire up software
 - Requires printer/scanner to be on the same sub net, not just reachable. Windows can actually print on the printer from a different sub net if IP address reachable and known, but full function scanning requires HP software.

Epson Perfection V500 Photo Flat-Bed Scanner (\$218 in 2009)



Epson Perfection V500 Photo Flat-Bed Scanner (\$218 in 2009)



Epson Perfection V500 Photo Flat-Bed Scanner (\$218 in 2009)

- **Older model, but still works. ADF alternate lid attachment wore out and replacement parts no longer available.**
- **Scanning area 8.5"x 12" (legal paper required ADF)**
- **Switches from bottom lighting to back lighting in lid in order to scan slides and film of multiple sizes. Software converts color and b&w negatives to positive images**
- **Lid can stay open on its own, so flat sides of a 3-dimensional object can easily be scanned**

Epson Perfection V500 Photo Flat-Bed Scanner

- **Scanning requires multiple steps**
 - **Setting scanning parameters and saving format, Preview scan, selecting the rectangular area for the image, actual scan**
 - **Selection of scan area via mouse or manual specification of WxH (inches or mm) and moving scan area with mouse**
 - **When scanning many similar, identical sized, identically positioned items, only the physical placement and "actual scan" needs to be repeated – auto-increment of name of saved file**
 - **Does auto-adjust for exposure on area selected for scan**
 - **Time for actual scan depends on size of scan area and resolution**
 - **Processing options may add time – dust removal, Digital ICE (Image Correction and Enhancement) for film/slides (hardware+software)**

Scanning Documents

- **Use "Document" setting to optimize for text**
- **Unless extremely fine print, 150dpi is sufficient for a readable document, perhaps go to 300 dpi if object is to be able to print a copy of the original, or if is an important legal document**
- **If document does not use color, scan as greyscale rather than color – saves as a smaller image and no color artifacts from imperfections in document surface**
- **Best saving format is PDF (retains size info, and supports multiple pages). PDF with OCR text also supported, but not that great with this older software and requires minimum of 400 dpi scan.**

Scanning Images From Prints

- **Specify auto-exposure "Photo"**
- **Suggest trying 300 dpi – higher res may just reveal defects or texture of print surface**
- **If non-colored image, scan as greyscale, unless there is unusual coloring from age that you want to preserve.**
- **Saving format: most likely, jpg (has lossy compression). Sometimes when there is important descriptive info on back of print, I will save a front & back image of the print as a 2-page PDF; but one could just save the back as a separate image.**

Scanning Images From Film/Slides

- For consistency may want to specify scan size in mm as film has standard sizes (e.g, 35 mm slides have typical image of 23mm x 34mm or 34mm x 23mm, depending on camera orientation)
- Use an anti-static brush to clean dust from film before scanning
- Film/slides needs to be scanned with emulsion (duller) side up. On slides the side may be marked "this slide toward screen". If you get this wrong, image will be flipped horizontally left-to-right and any text in image will be backward. GIMP can be used to do a horizontal flip to correct, but less work to scan it right in the first place.
- Film potentially has much higher resolution than typical prints, but effective resolution depends on the quality of the camera, skill of its user (accuracy of focus, lack of camera movement), and film speed. Experiment depending on intended use – max resolution supported by scanner probably not the best choice and will result in excessively large image files with no improvement in quality.
- Typical saving format: JPG. If want to preserve image with no compression loss, saving in a lossless-WebP or PNG format would be better, but my older software only supports TIFF for that purpose, which produces much larger files than either PNG or WebP – can use GIMP or other image utilities to convert to other image formats.
- Digital ICE enhancement makes sense for slides to "fix" scratches, but adds significant time. I averaged almost 2 mins per slide scanning 35mm slides at 3200 dpi (over 33 hours for 1000 slides) . Part of that time was overlapped with renaming slide images based on content or description written on slide. Each slide was 37 MB as TIFF. Would be 15MB-20MB as PNG, slightly less as a lossless WebP, maybe 5MB as JPG.

Example: Part of A Scanned Slide



Correct



Reversed Left-to-Right

This is from a slide that was scanned at 3200 dpi and illustrates two points:

How the presence of text can clearly show whether the slide was scanned with the correct side up. Of course any asymmetric object in the picture will serve, provided you know the true left-right appearance of the object.

How lack of sharpness in the image when individual pixels are not yet obvious can be a clear indication that there's no point in scanning at a higher resolution.

After Thoughts on Flat Bed Scanner

- **If I had known in advance how many slides I would inherit in addition to my own, I might have seriously considered spending \$500-\$1,000 for a specialized automated slide scanner.**
- **Flat bed Scanner is good for scanning small pamphlets or booklets, but scanning large multi-page documents, especially if duplexed, is a pain.**
- **Items larger than the scanner surface can be scanned as multiple images, even sometimes stitched together successfully into one image with specialized software (like Hugin), but that doesn't always work and can be time-consuming.**

Epson ES-200 (~\$200)

- **Needed a better, faster way to scan: legal-sized documents, duplexed-documents, unusual-sized receipts.**
- **Found Epson-200**
 - **Small, easily portable**
 - **Auto-feeds documents from 2" to 8.5" wide up to 36" long and automatically sizes the image or PDF appropriately, including postcards and envelopes**
 - **Scans both sides of each sheet at the same time, auto-detecting blank sides – cuts scanning time for duplexed documents in half (5-6 sec/page).**
 - **Special feed for scanning business cards**
 - **Can save as JPEG, PNG, TIFF, multi-TIFF, PDF, Searchable PDF (does a better job on OCR than older software)**

Epson ES-200



Epson ES-200 Scanning Multi-Page Document



Statement for Account # 432-86648
07/01/03 - 07/01/03

Income Statement Detail

Current
\$ 0.79
0.00
3.33

NOTE: This report includes items which incorrectly reflect your transactions issued for the year. You may be applying income amounts for the year.

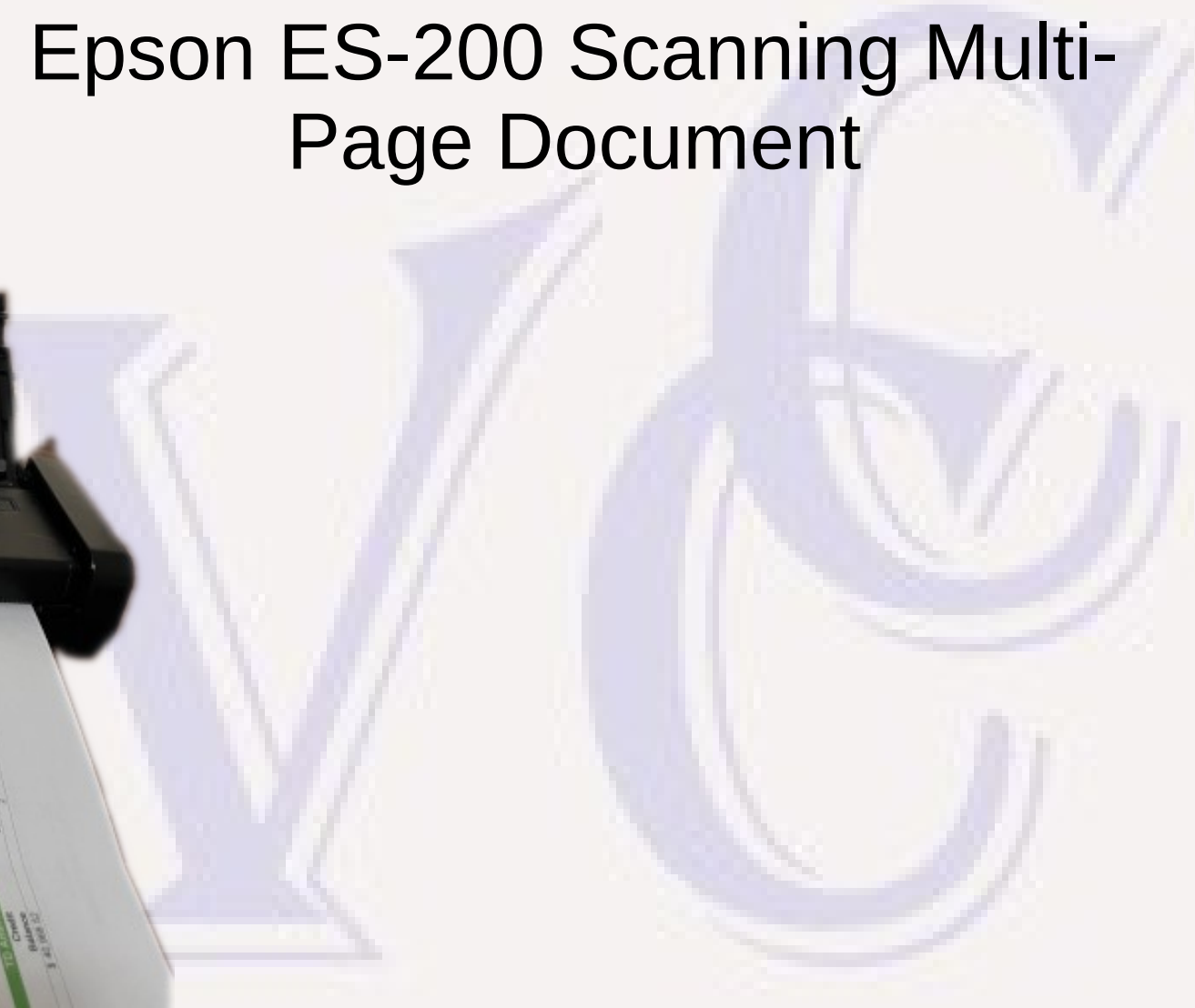
Account Activity

Description	Symbol/ CLUB#	Quantity	Price	Amount
FISC INSURED DEPOSIT ACCOUNT	MBCA1		\$ 1.10	1.10
CONF. NOT COVERED BY SFPC Interest - Insured				
Deposit Account Bank USA				
Payable 07/01/03				
Insured Deposit Account Interest				
3.33			0.00	3.33
REDEMPTION FISC INSURED DEPOSIT ACCOUNT	AFL	3.33	1.00	3.33
AMEREN CORP				
TDA TO PERSON				
DONATION				
SD 07/01/03 343				
TDA CARP BALANCE OUT				
INTEREST CREDIT				
Payable 07/01/03				

To Balance Credit Estimate

Balance of Day 3.33
Rate and Fee 1.10
Total 4.43

Credit Balance
\$ 42,868.50



A Scan Problem

- **How to scan a delicate oversized book**
 - **Battle of Waterloo, pub 1817**
 - **Large (2.5" x 11.5" x 13")**
 - **Not in pristine condition, brittle pages, smoke damage on some page edges (better copies online at French museum)**
 - **Of family historical interest. Handwritten comments by ancestors in 1880's**



A Solution

- **An practical solution was finally found in 2022: IRIS ScanDesk 5 Pro (\$165)**
 - **Designed to "scan" two pages at a time from smaller books using a camera embedded in a pedestal, but also meant it could handle the size of a single 11.5"x13" page**
 - **Not a perfect solution but could produce a readable copy with much less effort and minimal risk of book damage.**
 - **Most useful output formats: PDF, searchable-PDF, JPG, also supports EPUB OCR text, but quality depends on original font quality.**
 - **Can take of picture of two pages in two seconds, but scan speed limited by how fast you can turn pages**

IRIS ScanDesk 5 Pro



- Hi-res camera & LED light on metal arm & base
- Black pad with position markings for scanner base and books
- USB connection to PC for data and power
- Push switch connected to scanner to initiate scan - about 2 secs for both pages
- Software partially compensates for camera parallax, senses division between pages
- Can save as PDF with each page a separate page or with two pages per PDF page
- Searchable PDF or EPUB formats require significant processing time for OCR, but makes use of multiple CPUs if available. Can also save as one JPG per page
- Was able to successfully scan one single large page at a time, but a lot of extra work because software not really designed for that

IRIS ScanDesk Results

- Two pages from 50 page booklet – scanned in under 2 mins, + 2 mins post processing for OCR scannable PDF
- Some minor differences in page rotation, but pages fairly well cropped with minimal parallax distortion

FIFTY KEY IDEAS IN COMPUTERS AND DATA PROCESSING

The following selection of special terms in the field of computers and data processing are essential for understanding the subject. They might reasonably be called "fifty key ideas" in this field.

1. General Concepts

Computer — 1. A machine which is able to calculate or compute, that is, which will perform sequences of measurable operations with information, mainly arithmetical and logical operations. 2. More generally, any device which can accept information, apply definite measurable processes to the information, and supply the results of these processes. 3. A human being who can perform these operations and processes.

analog computer — A computer which calculates by using physical analogs of the variables. — Most usually a one-to-one correspondence exists between CD each numerical variable occurring in the problem and its relative and CD a varying physical measurement such as electrical voltage or rotation of a shaft in the analog computer. In other words, an analog computer is a physical system in which the analysis or solution of the problem is mirrored by the varying behavior of the physical system.

digital computer — A computer in which information is represented in discrete form and which calculates using numbers expressed in digit and zero and ones expressed usually in 1's and 0's, to represent all the variables that occur in a problem.

data processor — A machine for handling information in a sequence of reasonable operations.

control — 1. The comparative level of the control and the internal completion of information-handling machines and the central nervous systems of animals and men, in order to understand better the functioning of brains and communication. 2. The study of the art of the pilot or steersman.

feedback — The returning of a fraction of the output of a machine, system, or process to the input, to which the fraction is added or subtracted. If increase of input is associated with increase of output, subtracting the returned fraction (negative feedback) results in self-correction or control of the process, while adding it (positive feedback) results in a runaway or out-of-control process.

negative feedback — The returning of a fraction of the output of a machine, system, or process to the input from which the fraction is subtracted. If an increase of input is associated with an increase of output, but the increase of output produces a decrease of input, this results in self-correction or control of the machine, system, or process. For example, if an increase of temperature is associated with an increase of heat being dissipated then, the temperature stabilizes.

positive feedback — The returning of a fraction of the output of a machine, system, or process to the input, to which the fraction is added. If an increase of input is associated with an increase of output, and the increase of output produces a still further increase of input, this results in a runaway or out-of-control process. For example, if an increase of rabbits results in a still further increase of rabbits, the population of rabbits displays a runaway or out-of-control process.

automatic data processing (ADP) — The processing of information by: (1) selecting input information in machine language as close to the point of origin as economically possible; (2) operating on the information by electronic computer and other means, without human intervention, as far as economically justified; and (3) producing just the output information needed. For example, a government store would have attained automatic data processing if: (1) at the time of each sale the details were entered mechanically into the system by a salesperson's price, a customer's debit, and a merchandise punched ticket; and (2) reports of the merchandise, bills to the retailer, and orders for new inventory, produced by the system were all computed and processed by the system without human intervention.

integrated data processing (IDP) — Data processing organized and carried out in a completely planned and systematic way, without bottlenecks. 2. A group of data-processing procedures built around a common machine language, such as punched paper tape, in which there is a rotation of operations by humans clerks, such as typing data to go into the system, and other clerical work.

language — 1. A set or system of symbols used in a more or less uniform way by a number of

people so that they may communicate with and understand one another. 2. Electronic Computers. A system consisting of a carefully defined set of characters, rules for combining them into larger units (words or expressions), and specifically assigned meanings, used for representing and communicating information or data among a group of people, machines, etc.

11. Digital Computers

input — Computers. 1. Information transferred from outside the computer, including secondary or external storage, into the internal storage of the computer. 2. The sections of the computer which accept information from outside the computer, for example, magnetic readers or punch-card readers.

output — Computers. 1. Information transferred from the internal storage of a computer to secondary or external storage, or to any device outside of the computer. 2. The device or device which bring information out of the computer.

memory — Computers. 1. The units which store information in the form of the arrangement of hardware or equipment in one way or another. Same as "storage". 2. Any device into which information can be introduced and then extracted at a later time.

arithmetical unit — Digital Computers. The section of the hardware of a computer where arithmetical and logical operations are performed on information.

control unit — Digital Computers. That portion of the hardware of an automatic digital computer which directs the sequence of operations, interprets the coded instructions, and initiates the proper signals to the computer circuits to execute the instructions.

address — Digital Computers. A label, name, number, or symbol identifying a register, a location, or a device where information is stored.

access time — Digital Computers. 1. The time interval between the instant at which the arithmetic unit requires information from the storage or memory unit and the instant at which the information is delivered from storage to the arithmetic unit. 2. The time interval between the instant at which the arithmetic unit starts a new information to the memory unit and the instant at which the information is delivered to the memory unit. — In analog computers, the value at time of such dependent variable represented in the problem is usually immediately accessible when the value of the independent variable is at time t , and otherwise not accessible.

random access — Computers. Access to the memory or storage under conditions where the register from which information is to be retrieved changes at random. Random access does not depend on the location of the previous register. For example, access to the name in the telephone book is "random access". The next name that system is going

to look up in the book may be almost anywhere in the book with roughly equal probability. — Circuits. In general, a sharp difference, usually over a relatively short period of time, between the normal level of some physical variable corresponding to the average level of a wave or wave and a high or low level of that physical variable corresponding to the crest or trough of the wave. For example, a sharp voltage change. For example, if the voltage at a terminal changes from 10 to 200 volts and remains there for a period of 2 microseconds, one says that the terminal received a 20 volt 2 microsecond pulse. A positive pulse is characterized by a rise or increase from one value of the variable to a greater value, a finite duration of the greater value, and a decay or decrease from the greater value back to the original value. A negative pulse is the same except that the change is to a smaller value.

channel — 1. Digital Computers. A path along which information, particularly a series of digits or characters or units of information, may flow or be stored. For example, in the machine known as a punch-card mechanism, information (in the form of punch cards) may flow in either one of two card channels which do not physically connect. 2. Magnetic Tape or Magnetic Drum. A path parallel to the edge of the tape or drum along which information may be stored by means of the presence or absence of polarized spots, rings, or inserts. 3. Delay-Line Memory such as a Quartz Rod. A circular path formed through the delay-line memory and back through electrical circuits along which a picture of pulses representing information may be stored.

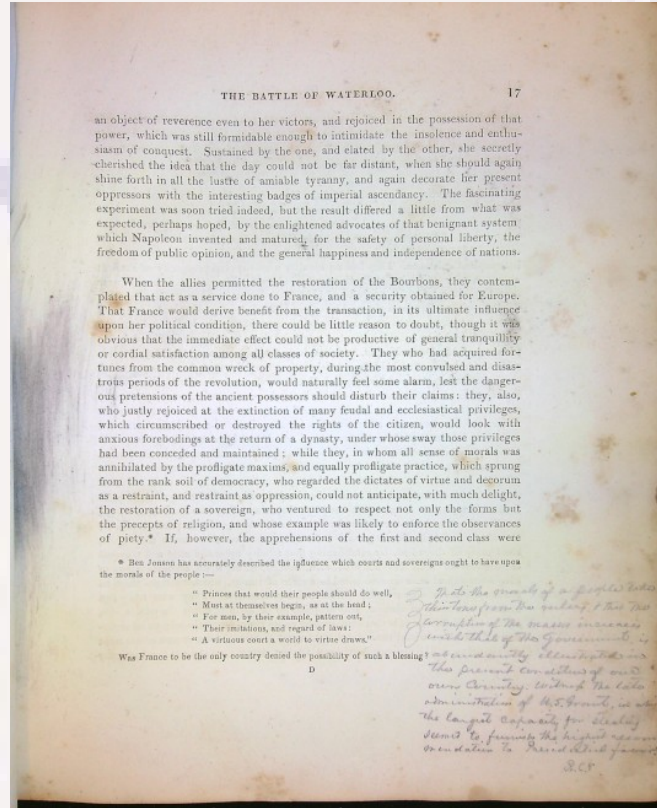
clock — Digital Computers. 1. In a synchronous computer, the master circuit which provides pulses at equal time intervals to coordinate the operations of the computer. — In an asynchronous computer, there is no need for such a clock, since the closing or completion of one circuit initiates the operation of a subsequent circuit.

integrated — 1. A device which converts energy from one form to another. For example, a slab of quartz crystal embedded in silicon can change electrical energy to sound energy and vice versa, as is done in sonic delay lines in digital computer memory systems. Any device which enables the conversion of any physical, chemical, or biological phenomenon into an electrical, hydraulic, pneumatic, mechanical, or other form of energy. — Transducers have been referred to as pick-up, sensing elements, primary elements, control elements, sensors, detectors, and probes. As examples, transducers which will convert pressure, temperature, acceleration, force, mass, time, distance, radiation and a multiplicity of other phenomena into electrical form. They input to the then result fed to amplifiers, data processing systems, or output controllers. Any instrumentation problem may be resolved into the choice of input and output transducers with an interconnecting information-processing means, in the telephone book is "random access". The next name that system is going

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IRIS ScanDesk 5 Pro on Large Book



- Two pages from 1817 book Battle of Waterloo
- Many hand-colored pics
- Hand-written note from abt 1880 by gggf Vaughan
- I have read Victor Hugo's long description of the Battle of Waterloo in *Les Misérables*, Volume II, Book I.
- In my grade school days I remember riding West from Lexington, MO on old US 24 through little towns Wellington, Waterloo, and Napoleon

Why not Use Smartphone Camera as Scanner?

- **Pros**

- widely available, portable, hi-resolution on newer models

- **Cons**

- Usability optimized for pictures
- cropping is a manual operation
- Parallax distortion - rectangular pages no longer rectangles. Parallax distortion can be significantly fixed with GIMP perspective transformation, but is labor intensive.
- Document image lacks meta data of actual document size
- Quality variation: resolution of actual document, focus, rotation, lighting, shadows all depend on skill of user, which means not consistent. Difficult to judge quality on a small smartphone screen.
- Transfer to PC platforms for organization and archival adds additional steps

A Typical Smartphone Camera "Scan"

THE REFERENCE DIARY OF THE LIBRARY OF COMPUTER AND INFORMATION SCIENCES

Edmund C. Berkeley

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We gratefully acknowledge the permission of "Computers and Automation" magazine to reprint here "Over 1000 Areas of Application of Computers", the "Computer Census", and "Descriptions of General Purpose Digital Computers".

All suggestions, comments, corrections, and criticisms will be most welcome, and will help to make the next edition of this reference diary more serviceable.

Newtonville, Mass. 02160
August, 1966

Edmund C. Berkeley

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Readable, but with perspective (parallax) distortion

But, Current iPhone Magic

- **Create a Note**
- **Select the camera icon**
- **Select "Scan Documents"**
- **Position camera to get entire document in view – will take picture when it sees entire document**
- **Repeat for any additional pages, then press save to save all pages**
- **All scanned pages are automatically cropped, corrected for perspective distortion and saved as multi-page PDF. There are even some editing options for manual rotation or manual cropping. Even does some OCR to attempt to come up with meaningful name for PDF.**
- **Use the send icon (rectangle w up arrow) to email or to save PDF in cloud storage that is accessible to your computer.**
- **Results are at least as good as a cheap scanner!**

Example of Note "Scanned Document" Page

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Hand-Held Scanner

- **In search for ways to scan problem books, tried out a rechargeable, hand-held bar scanner**
 - **Bar must be held horizontal to page while moving vertically down the page. Multiple pages could be scanned, and then bar connected to computer via USB to transfer images and recharge.**
 - **Nice concept, very light, but didn't function reliably for me:**
 - **Difficult to move bar at an even speed while keeping it parallel with top&bottom of page and keeping movement precisely parallel with sides of page. Failure to maintain the required alignment produced "waves" in scanned pages.**
 - **Difficult to keep correct consistent pressure of bar against page, needed for tracking wheel to accurately measure speed of vertical movement – failure resulted in parts of scanned image being compressed or stretched vertically.**
 - **As a result, I found after downloading images from scanner to computer that many pages needed to be re-scanned before an acceptable scan of all pages was obtained. Even with utilities to make it easy to merge together PDF pages from multiple attempts, generating a "good" PDF for a document with even a modest number of pages was a very frustrating process.**