

Supplementary Results

Removing Shadows from Images of Documents

**Steve Bakō¹, Soheil Darabi², Eli Shechtman²,
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**University of California, Santa Barbara¹
Adobe Research²**

Synthetic Dataset Results (11 Documents)

Comparisons:

- Input image
- Ours
- Ground truth

Document A

arXiv:0704.1622v1 [physics.ed-ph] 12 Apr 2007

MATLAB codes for teaching quantum physics: Part 1

R. Garcia,* A. Zozulya, and J. Stickney

Department of Physics, Worcester Polytechnic Institute, Worcester, MA 01609

(Dated: February 1, 2008)

Among the ideas to be conveyed to students in an introductory quantum course, we have the pivotal idea championed by Dirac that functions correspond to column vectors (kets) and that differential operators correspond to matrices (ket-bras) acting on those vectors. The MATLAB (matrix-laboratory) programming environment is especially useful in conveying these concepts to students because it is geared towards the type of matrix manipulations useful in solving introductory quantum physics problems. In this article, we share MATLAB codes which have been developed at WPI, focusing on 1D problems, to be used in conjunction with Griffiths' introductory text.

Two key concepts underpinning quantum physics are the Schrodinger equation and the Born probability equation. In 1930 Dirac introduced bra-ket notation for state vectors and operators.¹ This notation emphasized and clarified the role of inner products and linear function spaces in these two equations and is fundamental to our modern understanding of quantum mechanics. The Schrodinger equation tells us how the state Ψ of a particle evolves in time. In bra-ket notation, it reads

$$i\hbar \frac{d}{dt} |\Psi\rangle = H|\Psi\rangle \quad (1)$$

where H is the Hamiltonian operator and $|\Psi\rangle$ is a ket or column vector representing the quantum state of the particle. When a measurement of a physical quantity A is made on a particle initially in the state Ψ , the Born equation provides a way to calculate the probability $P(A_o)$ that a particular result A_o is obtained from the measurement. In bra-ket notation, it reads²

$$P(A_o) \sim |\langle A_o | \Psi \rangle|^2 \quad (2)$$

where if $|A_o\rangle$ is the state vector corresponding to the particular result A_o having been measured, $\langle A_o | = |A_o\rangle^\dagger$ is the corresponding bra or row vector and $\langle A_o | \Psi \rangle$ is thus the inner product between $|A_o\rangle$ and $|\Psi\rangle$. In the Dirac formalism, the correspondence between the wavefunction $\Psi(\vec{x})$ and the ket $|\Psi\rangle$ is set by the relation $\Psi(\vec{x}) = \langle \vec{x} | \Psi \rangle$, where $|\vec{x}\rangle$ is the state vector corresponding to the particle being located at \vec{x} . Thus we regard $\Psi(\vec{x})$ as a component of a state vector $|\Psi\rangle$, just as we usually³ regard $a_i = i \cdot \vec{a}$ as a component of \vec{a} along the direction i . Similarly, we think of the Hamiltonian operator as a matrix

$$H = \int d^3\vec{x} \; |\vec{x}\rangle \left\{ \frac{1}{2m} \left(\frac{\hbar}{i} \frac{\partial}{\partial \vec{x}} \right)^2 \Psi(\vec{x}, t) + U(\vec{x}) \right\} \langle \vec{x}| \quad (3)$$

acting on the space of kets.

While an expert will necessarily regard Eqs.(1-3) as a great simplification when thinking of the content of quantum physics, the novice often understandably reels under the weight of the immense abstraction. We learn much about student thinking from the answers given by our best students. For example, we find a common error

when studying 1D quantum mechanics is a student treating $\Psi(x)$ and $|\Psi\rangle$ interchangeably, ignoring the fact that the first is a scalar but the ket corresponds to a column vector. For example, they may write incorrectly

$$\langle p | |\Psi\rangle |x\rangle = |\Psi\rangle \langle p | x \rangle \quad (\text{incorrect!}) \quad (4)$$

or some similar aberration. To avoid these types of misconceptions, a number of educators and textbook authors have stressed incorporating a numerical calculation aspect to quantum courses.^{4,5,6,7,8,9} The motive is simple. Anyone who has done numerical calculations can't help but regard a ket $|\Psi\rangle$ as a column vector, a bra $\langle \Psi |$ as a row vector and an operator H as a matrix because that is how they concretely represented in the computer. Introducing a computational aspect to the course provides one further benefit: it gives the beginning quantum student the sense that he or she is being empowered to solve real problems that may not have simple, analytic solutions.

With these motivations in mind, we have developed MATLAB codes¹⁰ for solving typical 1D problems found in the first part of a junior level quantum course based on Griffith's book.¹¹ We chose MATLAB for our programming environment because the MATLAB syntax is especially simple for the typical matrix operations used in 1D quantum mechanics problems and because of the ease of plotting functions. While some MATLAB numerical recipes have previously been published by others,^{12,13} the exercises we share here are special because they emphasize simplicity and quantum pedagogy, not numerical efficiency. Our point has been to provide exercises which show students how to numerically solve 1D problems in such a way that emphasizes the column vector aspect of kets, the row vector aspect of bras and the matrix aspect of operators. Exercises using more efficient MATLAB ODE solvers or finite-element techniques are omitted because they do not serve this immediate purpose. In part II of this article, we hope to share MATLAB codes which can be used in conjunction with teaching topics pertaining to angular momentum and non-commuting observables.

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While an expert will necessarily regard Eqs.(1-3) as a great simplification when thinking of the content of quantum physics, the novice often understandably reels under the weight of the immense abstraction. We learn much about student thinking from the answers given by our best students. For example, we find a common error when studying 1D quantum mechanics is a student treating $\Psi(x)$ and $|\Psi\rangle$ interchangeably, ignoring the fact that the first is a scalar but the ket corresponds to a column vector. For example, they may write incorrectly

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Document B



CARTE POSTALE

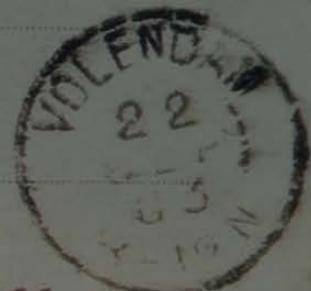
Ce côté est exclusivement réservé à l'adresse

Monsieur et Madame J. Benoit. leoy

Hôtel Volendam

a Volendam

près Amsterdam
Hollande



Input

Document B



CARTE POSTALE

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Ours



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Ground Truth

Irlich.
Restauration Fischer,
mit schönem schattigem Garten,
empfiehlt
hochfeines Bier
und frische Backfische.

Kirchweihfest Irlich.
Samstag den 29.
und Sonntag den 30. Juni:
Tanz-Musik
bei Jos. Driesch.

Erlaube mir meine
Flaschen-Biere
aus der Brauerei der Brüderge-
meine, Niedermendiger Bräu,
15 ganze oder 28 halbe Flaschen
zu Mark 3.—, **Culmbacher**,
allezeit ärztlich empfohlen, 12
ganze oder 23 halbe Flaschen
zu Mark 3,50,
Flaschenweine, per Flasche
von 60 Pfz. an, frei ins Haus,
höflichst zu empfehlen.

Aug. Stelting.

NB. Mein Wagen geht jeden
Freitag nach Irlich und
Heddesdorf, jeden Samstags
nach Niederbieber,
Oberbieber u. Zegeudorf.

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Oberbieber u. Zegeudorf.

Document D

In y^r Letter, when I
conveyed to you, to enquire the
Reason of your Silence, go which has
surprised me y^r more, as you^r afraid
me, before the time that y^r Paym^t
became due, of your Penitentiaty.
These gent^s inform me, that they
did not find you, but your Books
who assumed me! that ther were
certain differences in our Family, who
plead to have a claim to y^r some
capital, which had presented you
own fulfilling your obligations
towards us. I expected that you
would have communicated to us
immediately his obstacle, that we
might have been enabled to rem^d
it & have condon^d y^r expenses
to y^r disbursements, & expenses, ther
is y^r charges of law, & y^r attorney
of y^r capitals & soe. Sir, that
is an y^r Body has placed in your
hands a regular ^{former} obstacle, upon
which will acquaint us with it that
we may regulate it (which will

Input

Document D

In y^r Letter, when I
conveyed to you, to enquire the
Reason of your Silence, go which has
surprised us y^r more, as you^r afraid
us, before the time that y^r Paym^t
became due, of your Constitutionality.
Their facts inform us, that they
did not find you, but your Children
who answered us! that there were
certain differences in our Family, who
failed to have a claim to y^r some
Capt^y, which had precluded you
from fulfilling your obligations
towards us. I expected that you
would have communicated to us y^r
immediately this obstacle, that we
might have been enabled to remon-
str^t & have condemned y^r expenses
by y^r disbursements, & expenses, that
is to y^r charges of law, & y^r attorney
of y^r Capital - I hope Sir, that
if any Body has placed in your
hands a regular ^{former} obstacle, you
will acquaint us with it, that
we may negotiate it (which will

Ours

Document D

In yr. Letter, where you
so convey to you, to enquire the
Reason of your Silence, which has
surprised us y. more, as you afford
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certain differences in our Family, who
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str^t & have condemned y^r opposition
to y^r disbursements, & expenses, that
est to y^r charges of law, & retrench
of y^r Capital - I hope Sir, that
is an y^r Body has placed in your
hands a ^{former} obstacle, upon
which will acquaint us with it that
we may regulate it (which will

Ground Truth

Document E

Thirty members of the Los Angeles Motorcycle Club are preparing to go to Riverside to witness the hill-climbing contests on the Box Springs grade, Thanksgiving Day. About fifteen members of the club expect to take part in the motorcycle race which is the first number on the programme. A number of fine machines and good riders are in Los Angeles and one of the entries from here is expected to bring home the honors.

Friends of W. S. Collins are tipping him off to win. He rides a special Reading racer and is light in build, which counts when going up a grade. His machine generates two and one-fourth horse power. William Hoag also rides a Reading and has a light seat.

W. C. Risden, riding an Indian machine, is "laying" for the "mile-a-minute Mitchell" machine from San Bernardino which was a winner last year. Risden was making the best time of any in the race in that event when his tire burst, throwing him out of the running. He desired to ride the event over again against the San Bernardino machine, but the judges would not permit him. He then went over the course alone with especially appointed timers and claims to have beaten the time set by the winner. This year he wants to prove his contention, not only by beating the Berdoo outfit, but by winning the race.

Rene Le Goube, with his imported French Peugot, expects to show up the American machines. His motor is double cylinder and generates five horse power. Young Lord, in his three-horse-power Harley Davidson machine, is going to be a contender, it is believed.

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Document F

This image shows a full page from a Danish newspaper from 1852. The layout includes several columns of text, some headings, and a small illustration at the bottom right. The text is in Danish, and the overall appearance is that of a 19th-century printed document.

Input

Document F

This image shows a single page from a historical Danish newspaper, likely from the year 1852. The page is filled with dense text in Danish, organized into several columns. At the top left, there's a large title 'Svenske Mønster' (Swedish Models). Below it, a section titled 'Berättelser och Artiklar' (Stories and Articles) contains several short articles. The central part of the page features a large, bold title 'Hundene' (The Dogs), which is also the name of a column. To the right of this, another large title reads 'Følg med!' (Follow me!). There are several other titles and subtitles throughout the page, such as 'Berättelser om hundar' (Stories about dogs), 'Dansk Hunde-Skole' (Danish Dog School), and 'Den store Reaktion' (The Great Reaction). At the bottom of the page, there are several advertisements, including one for 'Ahlmanns Apotek' (Ahlmann's Pharmacy) and another for 'David Andersen, Møbelsnedker' (David Andersen, Furniture Maker). The text is in a classic 19th-century font, and the layout follows the traditional newspaper format of the era.

Ours

Document F

This image shows a page from a Danish newspaper from 1852. The page is filled with dense text in Danish, organized into several columns. At the top left, there's a large title 'Svenske Meninger.' Below it, a section titled 'Berättelser från Stockholm!' contains an article about a shipwreck. The central part of the page features a large title 'Den store Reaktion.' To the right, there's a prominent advertisement for 'El-Bonden' (Electricity). The bottom half of the page includes a section titled 'Folge med!' (Follow us!) and a small advertisement for 'Aldrigske' (Aldrigske).

Ground Truth

Document G

Pamphlet auf fol. 262 und zwar mit der Überschrift: Wie der römisch kaiser mit einer geschrift zu Wien öffentlich angeslagen, gestrafft ist etc. Ein Datum fehlt, dagegen steht unter den Schlusssworten der Name „Fridreich Handtmaister“. Da die Sammlung, wie gesagt, chronologisch fortläuft, so ergibt sich aus der Stellung des Pamphlets im Kodek das Jahr der Abfassung — 1470.¹⁾ Wir werden bei Betrachtung des Inhalts sogleich sehen, daß dies wahrscheinlich richtig ist.

Der Text des cod. Hungar. ist wesentlich besser, als der des Monacensis; fast alle jene Stellen, welche der Abdruck im „Jahresbericht“ durch ? oder ! beanstandet, lassen sich aus dem Hungaricus bessern, vieles zeigt, daß der Schreiber des Monacensis seine Vorlage nicht verstanden hat.²⁾ Doch ist derselbe keine einfache Abschrift des Hungaricus, er bietet vielmehr an einigen Stellen eine vollständige Umstilisierung. Wie dies und die abweichende Jahreszahl zu erklären ist, werden wir sehen. Zunächst gebe ich eine Inhaltsangabe des Pamphlets.³⁾

„Allerdurchleuchtigister, vnüberwintleichister, gnadigister vnd der hailigen cristenheit obrister, in weltlichen dingen haubt, Fridreich, des romischen gewalts ain kayser, stannd auff von dem slaff, darinn du lanng nach leibs lust gelegen bist,nym fur dich des reichs angen vnd deiner verlehenter getrewen vnderthan quel, jamer vnd nott.“ Merf' auf, was diese Titel bedeuten. Deine Unterthanen vom Adel und Gemeinden zu Krain und Mödling, Kärnter und Steyrer flehen dich um Hilfe gegen den Türken an, um Frieden im Lande. „Ey wie gar wunderleich vnd verporgten schickt die ewig weisshait! Alle ding, die da dein fursten vnd räte in disen kläglichen leuffen mit getrewer sorgfeltikait sollen das zu hertzen nemen vnd mit ganntzer emsikait umbsehen vnd aussrichten, sein weder durch dich, dein fursten, räte, prelaten, grauen, freyen, herren, ritter vnd knechte furgenomen, sunder vergessen, zu ruck gelegt.“ Deshalb hat sich „die gemanaw paurschafft vnd armleute der obern Steyrmarck“ im Jahre 1469 zu Knüttelfeld versammelt und haben Adel und Herren zu vereinigtem Widerstand „in vndertanikeit angerufft.“ „Geschehe aber des nicht, sie sich selbs bis in den tote des

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Document G

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Document H

Thanksgiving--1943

TOMATO JUICE COCKTAIL

PUREE OF TURKEY SOUP STUFFED CELERY RIPE OLIVES

MIXED VEGETABLE SALAD WITH THOUSAND ISLAND DRESSING

ROAST TOM TURKEY

VIRGINIA BAKED HAM

GIBLET GRAVY CREAM MASHED IRISH POTATOES

CANDIED SWEET POTATOES

CREAMED CARROTS AND PEAS GOLDEN BANTUM CORN

HOT PARKERHOUSE ROLLS

PUMPKIN PIE CRANBERRY SAUCE

BREAD BUTTER COFFEE

MIXED HARD CANDY MIXED NUTS

CIGARS CIGARETTES

Input

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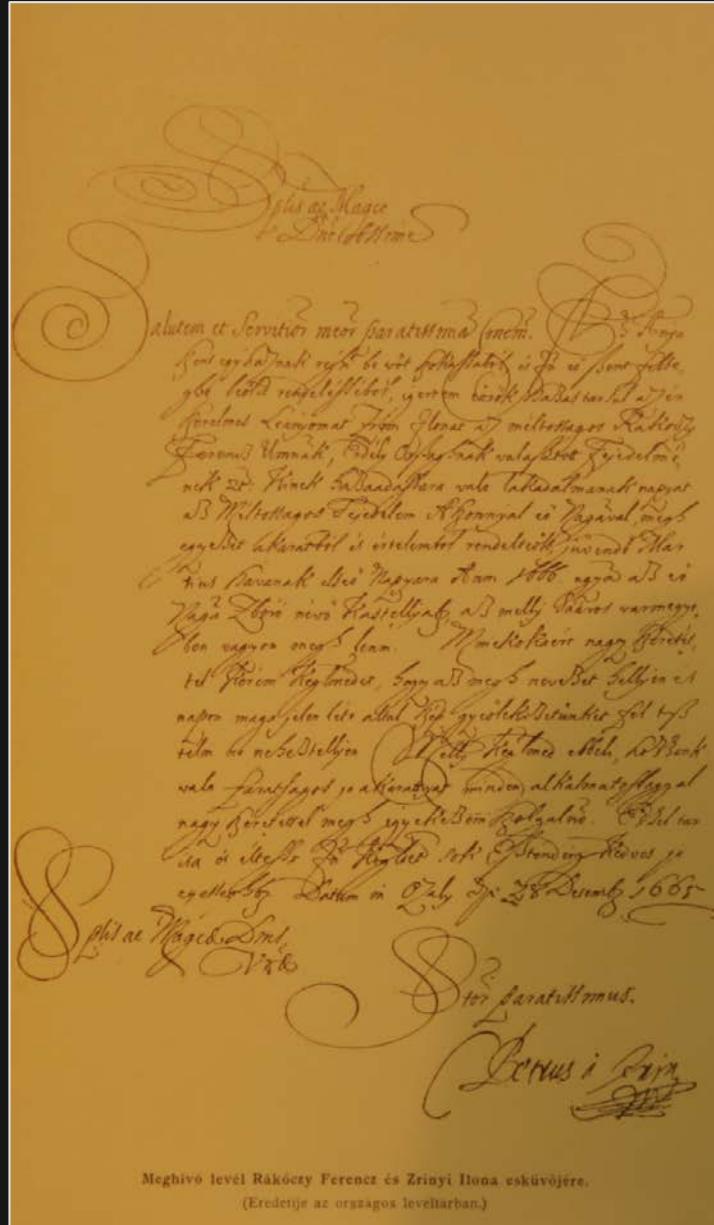
BREAD BUTTER COFFEE

MIXED HARD CANDY MIXED NUTS

CIGARS CIGARETTES

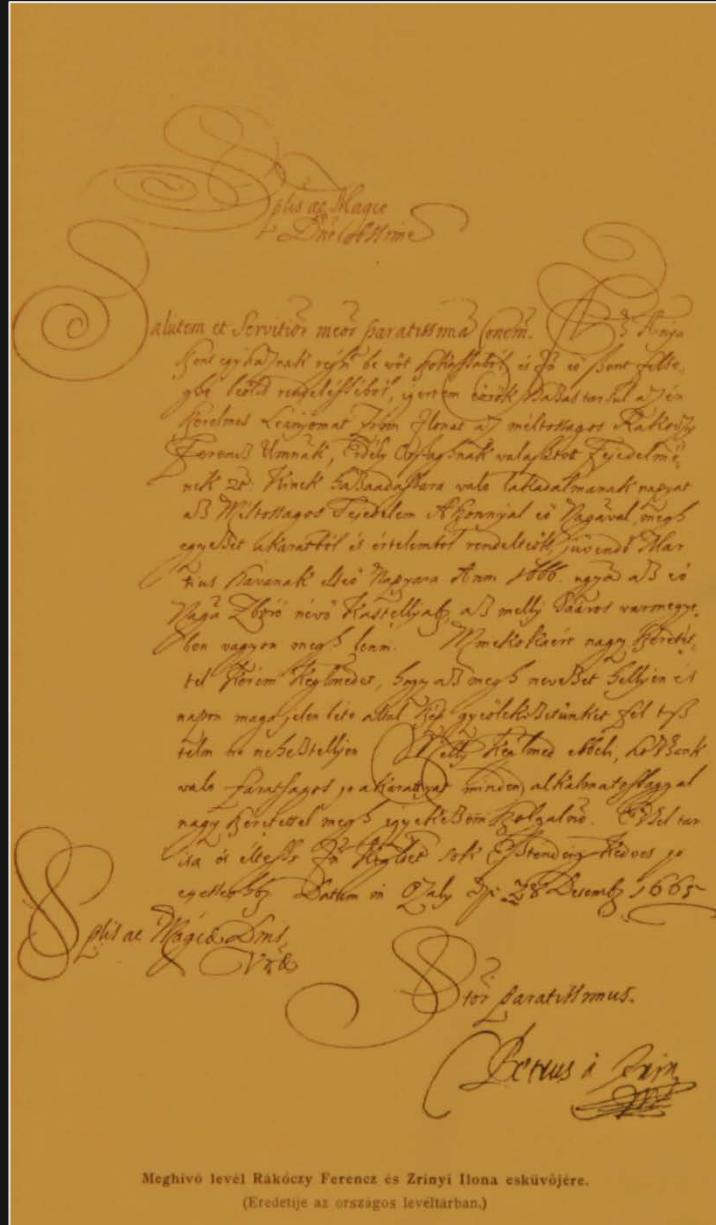
Ground Truth

Document I



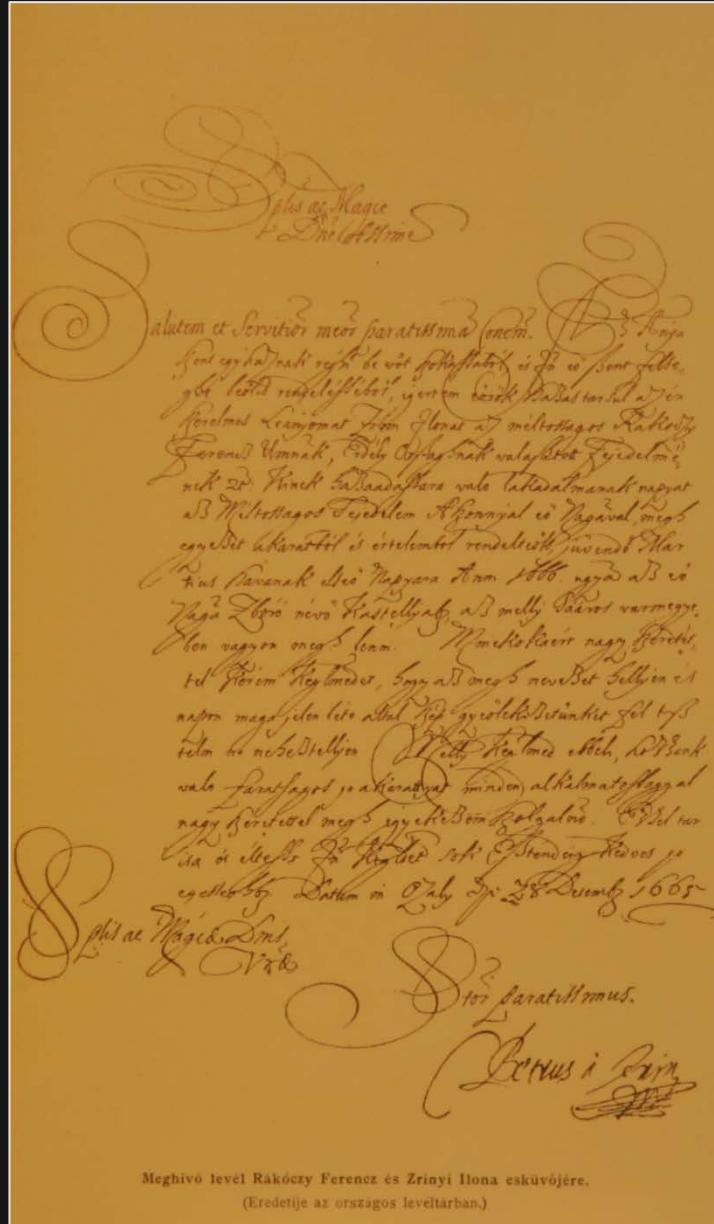
Input

Document I



Ours

Document I



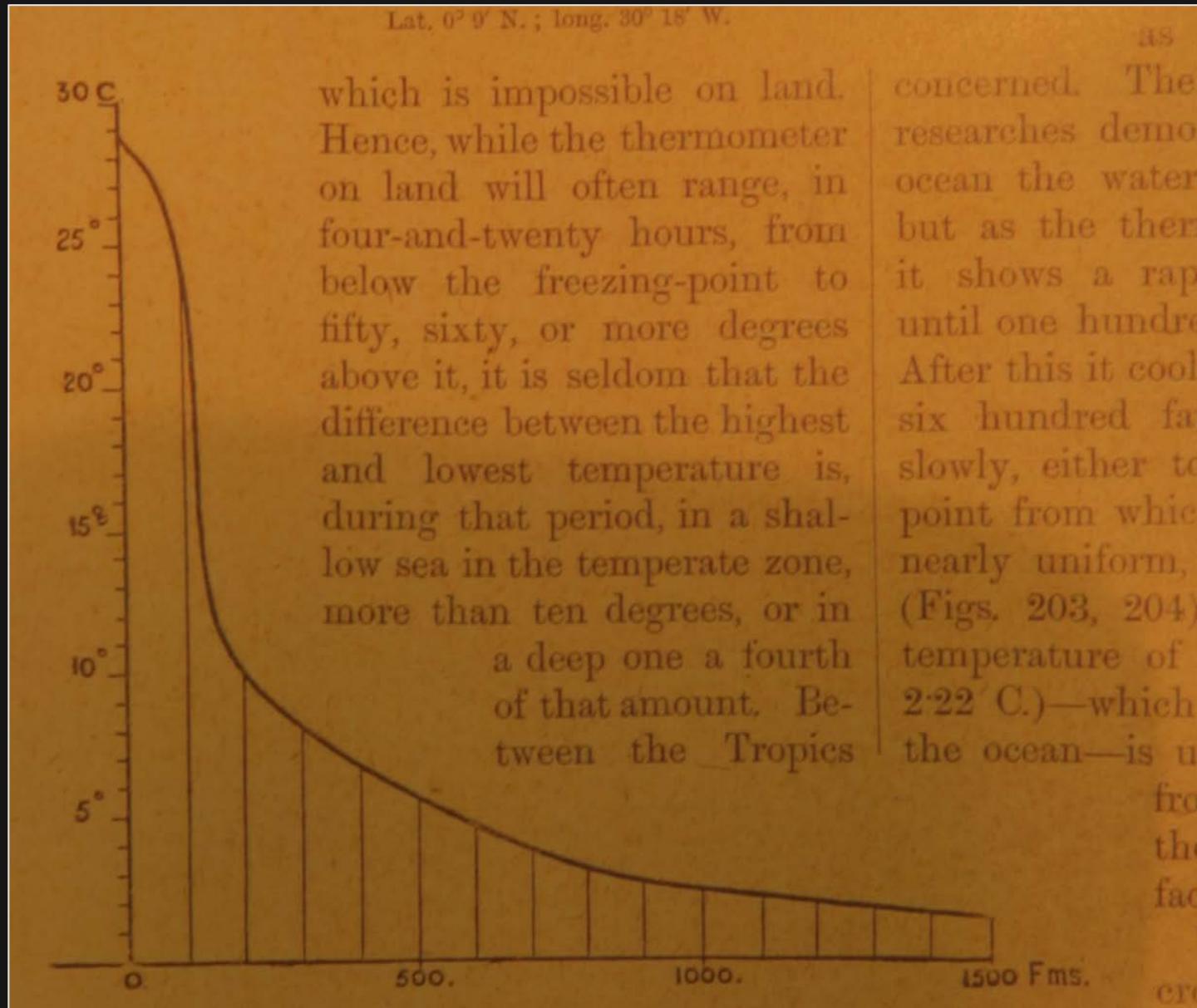
ivó levél Rákóczi Ferencz és Zrinyi Ilona esküvőjére.
(Eredetije az országos levéltárban.)

Ground Truth

Document J

Lat. $0^{\circ} 9' N.$; long. $30^{\circ} 18' W.$

as



which is impossible on land. Hence, while the thermometer on land will often range, in four-and-twenty hours, from below the freezing-point to fifty, sixty, or more degrees above it, it is seldom that the difference between the highest and lowest temperature is, during that period, in a shallow sea in the temperate zone, more than ten degrees, or in

a deep one a fourth of that amount. Between the Tropics

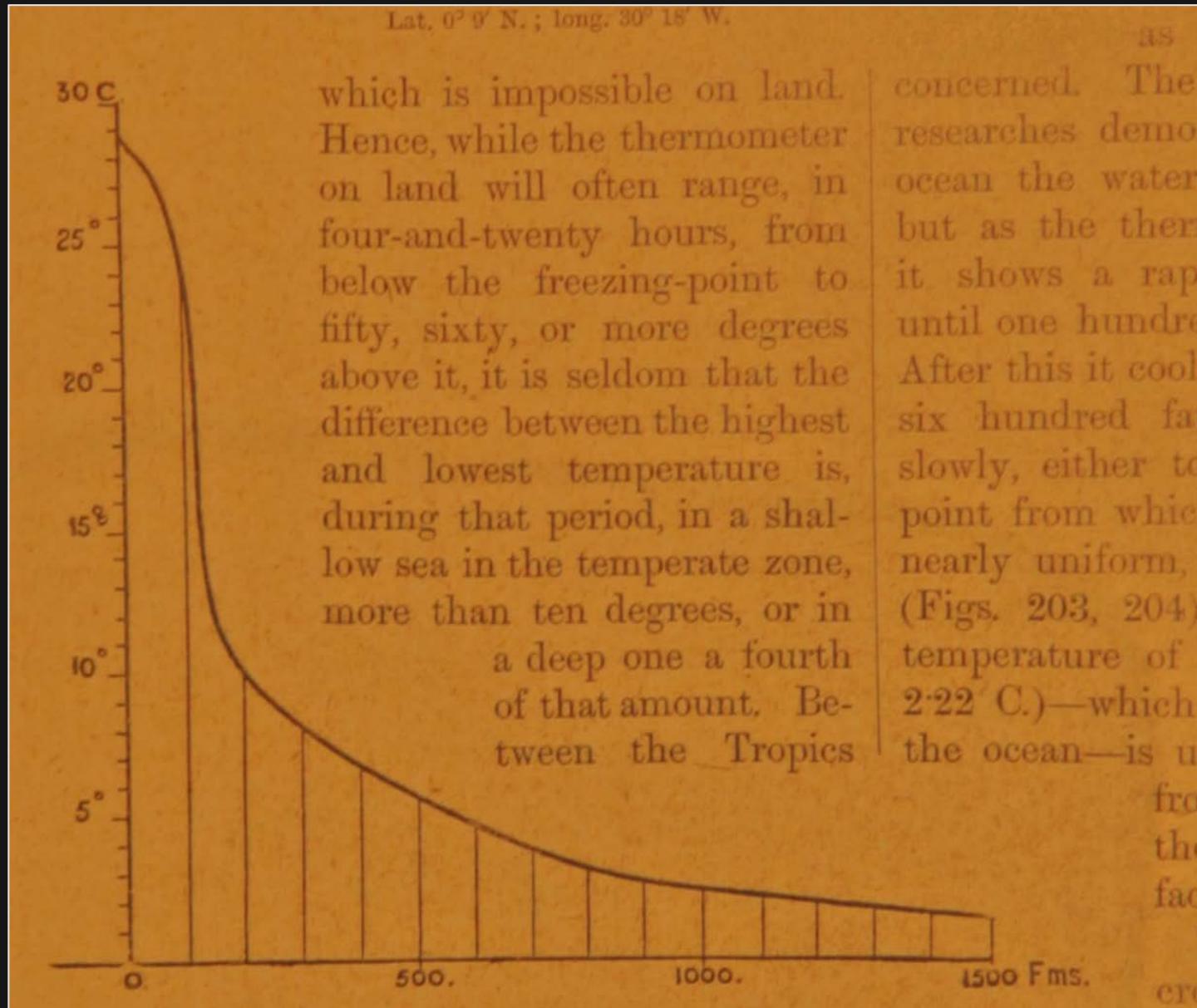
concerned. The researches demo ocean the water but as the ther it shows a rap until one hundred After this it cool six hundred fat slowly, either to point from whic nearly uniform, (Figs. 203, 204) temperature of 2.22 C.)—which the ocean—is u fro the fac cre

Input

Document J

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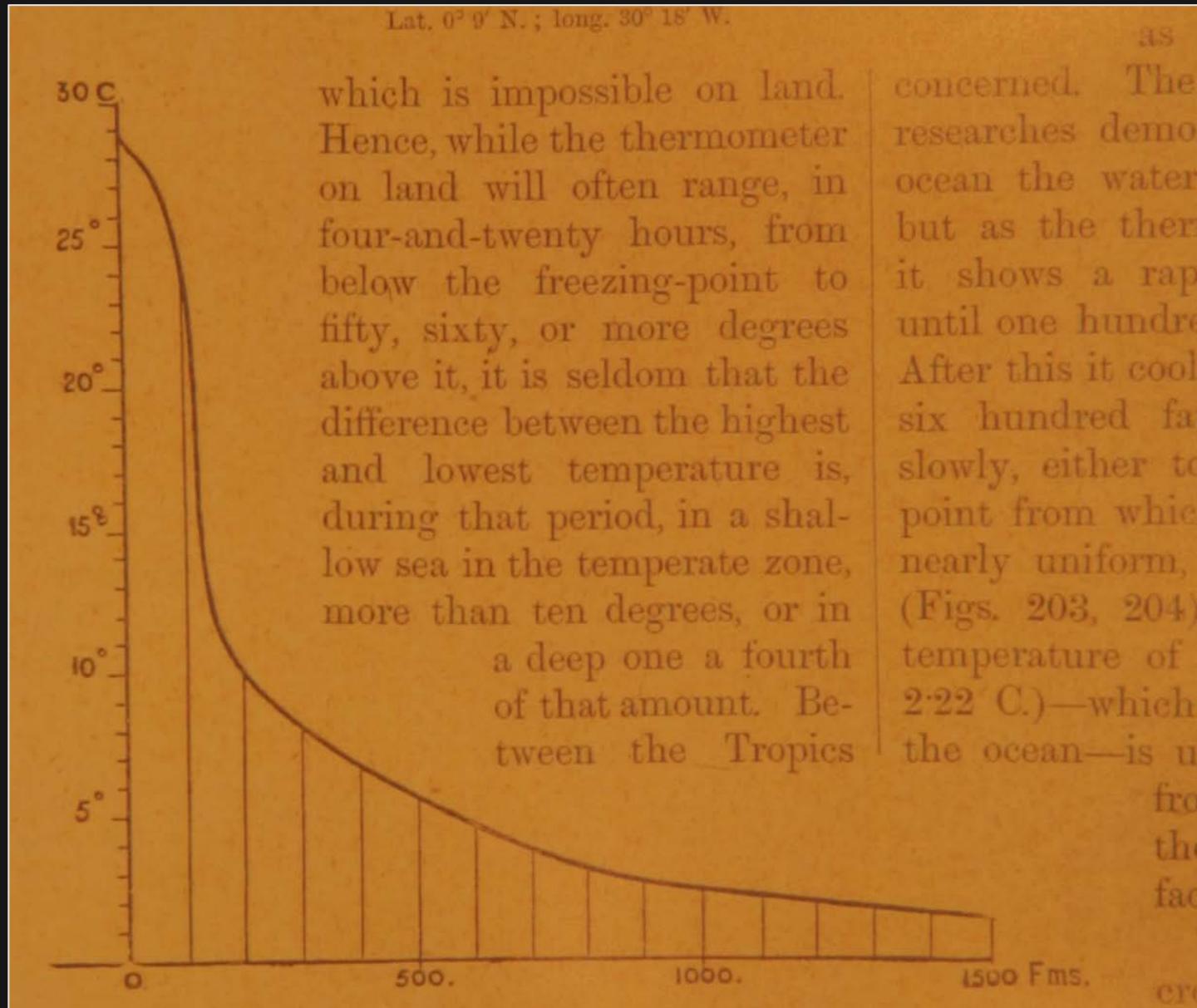
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Document K

Input

Document K

non incendio, e non un Christus, che haueva la Regnare in
Sabbatj carnali, ma in spirituali. Che furon, et habueruntur
Dei, et Homo. Et habebat cum illis, sed sta 3^o ale in Dio - per
mille, mag uerum nostre Dolore, ma confundit felicitate. Se-
endo, offerebat Deum con lauagio ad occidere cog. et non
erit negli morti, nel 2^o ale.

Non erano che dolce reali le uerder Christo in terra in
fatto 7 mo millenario, con quel paese. Peri galilee quod stat
di appartenere cum excede in Galilei, que madonna uidebat
cum Ascensionem, et veniet.

Dico poi che fatto diciam nell' amore Simeone, Abenact
Regnus tuus. I' uende il Regno di Christo, nel 7^{mo} mille:
nario. Dicte come dicens d' ogni felicitate - e fiducia, il
Uerba nostra male, he vincenda da molti, non che l'esse fer:
metta. e transpondere esse in malo ne sei millenario, pertanto
per la Chiesa pietra felsaria nel 7^{mo} millenario.

Dicteo. Recuperato il 7^{mo} mille, et ambedue di nuovo il
Demone, e uerba di sedur le Gentili, che li porti pote, e maneg
gelle gran scissio, fatto numerose heretici, uerano a inuader
la Grecia, ma ne capi demandet de Cielo, et domandet eos, et
in breve tempo succedeva poi il Giudicio universale, e dice Ave
ant Resurrezione secundo, non fieri per le Gentili ne ga evane
renunciati, nis per le altrui.

Ti finire che il merito di Gesu Christo, ea incepit, hunc sedit facto
alle de Cielo, et hoc vix intercali del nostro, et atque per i
centi temporali del Corpo, ma che que non si godessero le non nel 7^{mo}
millenario nel quale si consumava, che ea incepit Peli Co:
mune per l' Alba, e per il Corpo, menere al puro siamo nelle
penitenti. Scende ut sara recuperato l' effetto della Indulgencie
per integrum per L' Hc. 7^{mo} millenario, resuscitare al Corpo.

Quo è q: mi insegn dal Hc. Candidi, nel suo loco, nel tempo che non
con trattamento a sentito, sino al 1^o et 2^o Lettione, essendo stato
sentito con curiosità de molti, non obsoletus d' alcuna thi:
crosis de molti presenti a ogni sorte. Che se mi uocare figura
nro di una consulente.

Int: de fama sueta Candidi tam agit a quam alio. Hc non so
Hoc di q: no detto, non havendone altra notizia.

Int: en oddi, nel amore, et alq: q: q: Celi, nec.

Cui habet et dimicat frustis, et flagellis in fiducia habet.

Sedecim. Tu sufficiens. Hc. 7^{mo} mille aff.

Int: de Episcopio (Anno 5) mer. Inq. 1.

Die 10. Aug. 6^o a. Christi. Et anno 88.

Int: marcelli Porci et Angelus Guido Porci et Petrus Porci.

Voc: genitale Christi, corde et uultus, in meo. R. Petri Gabriel Ghisi, in
cordis suorum. Hc. 7^{mo} a. 7^{mo} mille. 1^o d. Incarnationis secund
d. Crucifixi, ut delecto diversis uerbi decretis, q: preceptib[us] carceris
de. Euangeliis, faciliq[ue] dico.

Int: an uiat, uel in agere cum ual. locat nos, et fructuosis.

Hc. Non es in mea gaudi q: che l' i. Trinitate regnante formata, per Regnos
tertii Alipi, alla uita dei Teodori, nella fine del messe di Augo

Ours

Document K

non intendeva gridare con Chiarino, che lauore ha degnare in
Sabbia camminarne in quiescenza. Che furto, dell'incamminamento
dei, ad hoc. Et habebat cum illis, ed era il 24 aprile 1807 - ma
molti mag. in anni nostri domini, ma continuo felicità. Si-
endo, obbligato, Deum, per la regna, ad oculi cog. et non
erit ne p. morte, nec post mortem.

Non avrei che dolce reahn di vedere Christo in terra in
1807 e 1808 millesimo, con quel paese. Però qualche qualcosa
di apprezzabile esser avrebbe in ciò, per me non solo libidici
eudallendimenti, con verità?

Dunque ha fatto di l'anno nell'Avvenire Simeone, libeniat
degli tuoi. I credo il Regno di Cristo, nel 7^{mo} millesimo:
anno, pare come questa d'ogni felicità - e rigonfia, il
lavoro non è male, se vincenda da male, cioè che l'offre
mette. e corrispondere essi malì na sei millesimo, parla
per la Chiesa, piena felicità nel 7^{mo} millesimo.

Diego. Ricordando il 7^{mo} millesimo, e considerare di nuovo il
mondo, e vorrei di adorare la Gentilezza, e Loggia, e Massone
delle Gran Santez, fatto numeroso servito, veniamo a inuader
la Greca, ma ne capi, desiderio de Cielo, et Desiderio così, et
in breve tempo succedeva poi il Giudizio universale, e diceva esse
esset Resurrezione resorta, non però per L'Greca, se ga avuto
renosciati, ma per le altri.

In fin fine, che il merito di Gesù Cristo, ga insegnato, hanno codi fatto
che de' Cielo, e già ora sanguinale dell'unione, et anche per i
veri temporali del Cielo, ma che già non si godessero le non nel 7^{mo}
Millesimo, nel quale si ragionava, che ea insegnava Dio: Co-
messo per l'Alma, e per il Corpo, mentre al resto siamo nelle
peribili. Secondo che sara raggiunto l'effetto della redenzione
per intero per L'Ho. 7^{mo} millesimo, necessariamente al Corpo.

Così è q. mi insegnò dal Ho. Andidi, nel suo loco, nel tempo che mi
con trattamento è sentito, sino al'ult. lezione, essendo stato
sentito con curiosità de molte, erano opposte e' alcuna si-
crova de molti presenti e ogni sorte. Che già mi avesse figura
non di mala conoscenza.

Int. De fana augt. Candidi tam agit a quam alios. E' non so
dove di q. no detto, non avendone altra notizia.

Int. En oddi, nel amore, et alpi q. Ho. necè.
Cuius habet et dimicat fructus imp. et legat in fiducia habet.

Sopras. Tu sufficiens. P. S. H. M. aff.

And. de Episcopio (Anno 5) merito.

Sic ist. Aug. 6. 1807. a. Brisson. C. n. 28.

Ted. marcelli Bon. et Angelo Giedro Bon. C. 2. Bressana.

Voc. generali (graft), com. erubuit, in meo. R. Star Gabriel Ghisi, sa-
cedote Bressana. Gil. q. 10. 2. an. 2. 1807. Incoronata sec. 2.
V. Cacciani, cui date lo scritto, e' veritatis Deum, q. presenti occisi
de. quando q. faciliq. Danno.

Int. an. 1807, nel maggio q. cum mea loca nra, et fratres omnis.

ff. Non es. t. maggio q. q. che l. T. Trivello, uscito romanesco, per Reggio
ff. In alpi, alla Scola d'is. Teodoro, nella fine del messe di Aug.

Real World Dataset Results (17 Images)

Comparisons (From top left to bottom right):

- Input image
- Bell et al. [2014]
- Gong et al. [2014]
- Acrobat “Enhance”
- Pilu et al. [2002]
- Wagdy et al. [2013]
- Oliveira et al. [2013]
- Ours

Document A

Date: Oct 19, 2008 Time: 12:27PM
Server: Colleen Table : 7N
Bill: 98484

1 Coffee 2.25
Tea 2.50
french toast 11.00
back bacon 3.00
chorizo omlette 10.00
SIDE SALSA 1.00
Tomato Benny 10.00
THAT PLEASE 3.00

Subtotal 42.00

Input image

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Gong et al. [2014]

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Acrobat “Enhance”

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Subtotal 42.00

Pilu et al. [2002]

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Wagdy et al. [2013]

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Bill: 98484

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Oliveira et al. [2013]

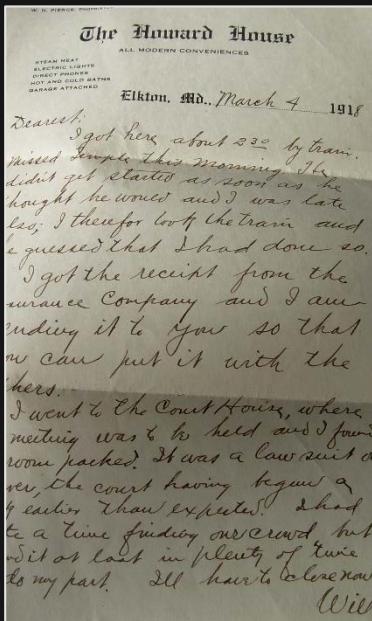
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Tomato Benny 10.00
THAT PLEASE 3.00

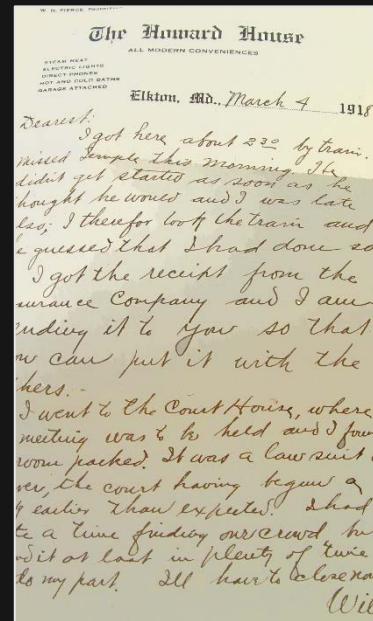
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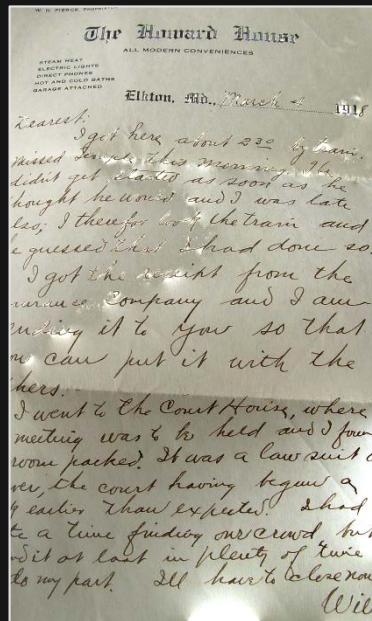
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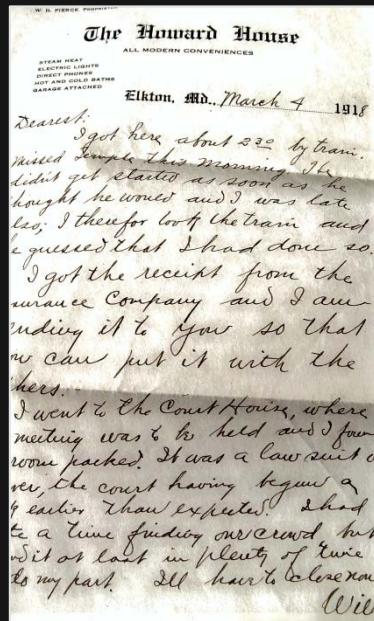
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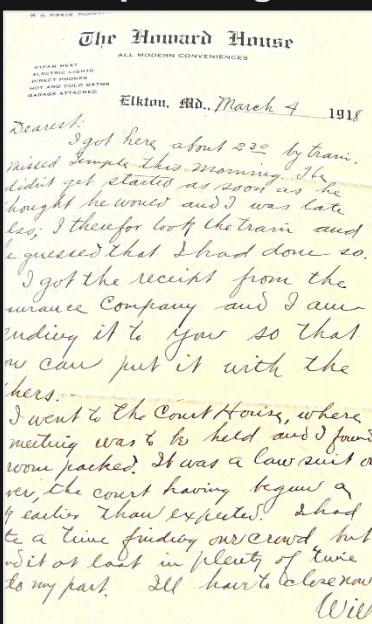
Bell et al. [2014]



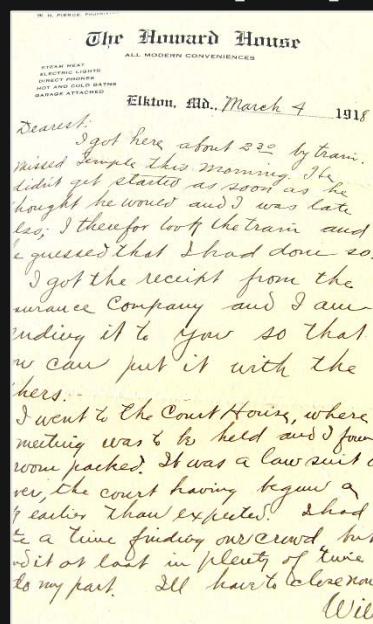
Gong et al. [2014]



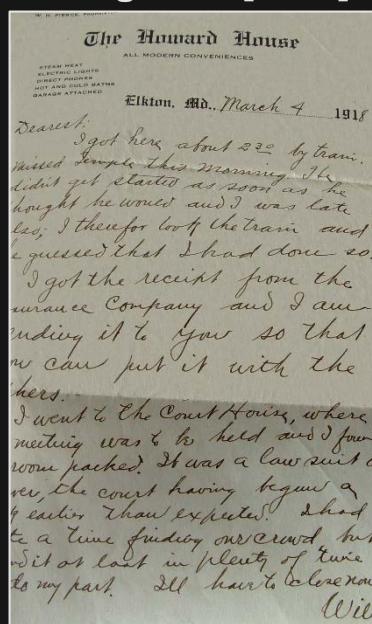
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Pilu et al. [2002]



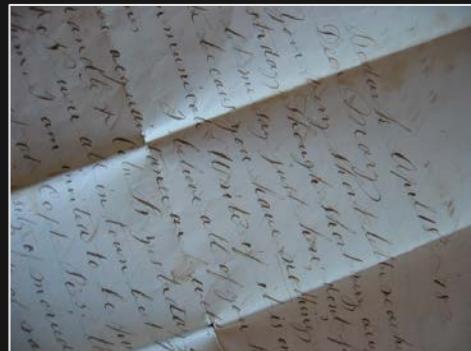
Wagdy et al. [2013]



Oliveira et al. [2013]

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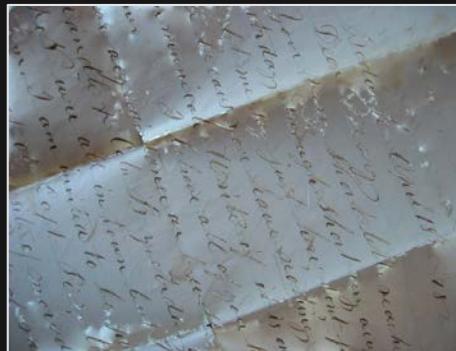
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Bell et al. [2014]



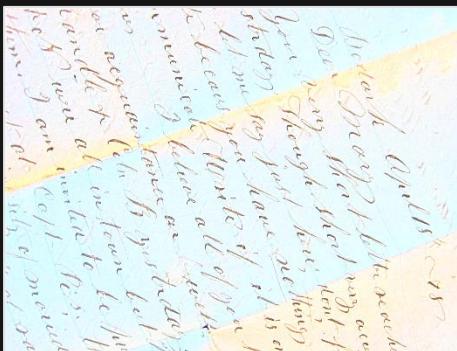
Gong et al. [2014]



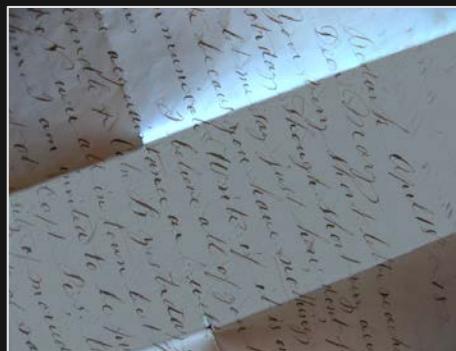
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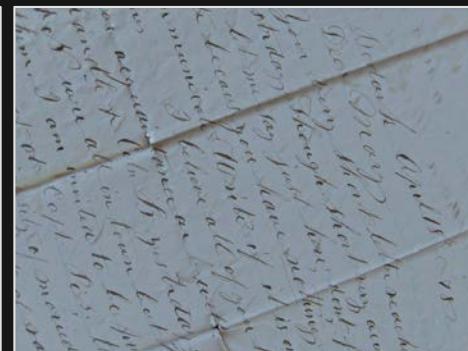
Pilu et al. [2002]



Wagdy et al. [2013]



Oliveira et al. [2013]



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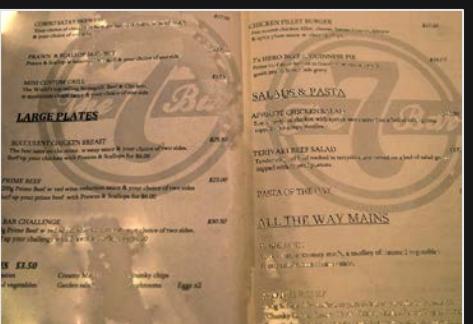
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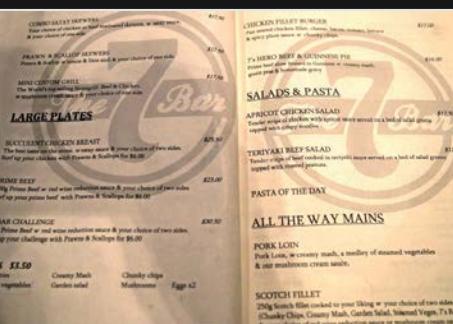
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Bell et al. [2014]



Gong et al. [2014]



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Pilu et al. [2002]



Wagdy et al. [2013]



Oliveira et al. [2013]



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Document E

Cambridge Evening House

RULES AND REGULATIONS FOR THE INMATES.

4. Young people over 16 years old shall be required to be in bed and go to sleep by 9 p.m.

5. Any child staying away from school during the period of the curfew shall be subject to a fine of \$100.00.

6. Any child who continues to violate the curfew after being warned shall be subject to the individual suspension of the child, and in such case the parents or guardians shall be required to provide the specific facilities available to require the child to stay home.

7. Every licensee in any establishment shall be provided with a copy of the "Curfew Law" and the "Penalty of the Violation of Curfew".

8. Any such licensee shall also be provided with enforcement cards which shall be used to make known to the police officer the name of the place, address, telephone number, and other relevant information concerning the establishment so that the police officer may readily identify the place where the violation of the curfew should be found.

9. The licensee shall take every care, and the policeman, and any other person, shall take every care to prevent any person from entering his premises with their light fixture, shade, lamp, torch, flashlight, or any other device which may be used to illuminate the outside of such place. They shall observe these laws and regulations.

10. The police shall be called upon every night at half past 11 o'clock and shall be required to inspect every place of amusement, hotel, restaurant, and other places of public assembly, and to determine if the hours of curfew have been observed during the remainder of the year or not. If it is violated, the police shall be called upon again.

11. The police shall be called upon at such times as the Government shall direct.

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Bell et al. [2014]

Gong et al. [2014]

Acrobat “Enhance”

Cambridge Spinning House

RULES AND REGULATIONS FOR THE INMATES.

3. Eddy porous annuli or expandable shell to replace a bullet and put in the dose position for fire.

3. The shell contains a separate shell during fire period of separation enough under proper circumstances, or when the fuse is too slow to allow individual separation of all the Initiators, and it will cause the Von Graffeller or the Volking Gunner shell specify the porous membrane to be enclosed in separate cells.

- 4. No decision time nor regular therapy shall be made except by authority of the Medical Officer.
 - 5. The treatment shall not be altered in any field, hospital during the course of 30 days continuous without or after consulting directly by the Geo-Chemist or some other Geologist. This authority is given only to the Geologist and no other Geologists shall be held liable in case of appeal of the people, nor will the presence of the Surveyor or other officer of the State and any other for a purpose of review only, except in special cases.

Cambridge Spinning House

Cambridge Spinning

RULES AND REGULATIONS FOR THE INMATES.

Cambridge Evening House.

Cambridge Evening House.

CODES AND REGULATIONS FOR THE INMATE

will keep their cars, and the furniture and fixtures in good order. They shall be clean and neat and their beds and clothes dry, and shall have their meals at regular hours, and shall not be absent from a week, or more, in the State of New Mexico.

They shall be allowed three times, and then removed.

All shall be looked up every night and at other intervals every morning during the months of November, December and January, and again, and during all of the year six little children.

- in accordance with the law. If owing it would, if given to those through whom it could be recovered, be recovered; but if given to persons whom it could not be recovered, it would be irrecoverable. The same applies to debts, rents, charges, &c., paid down my prior or public holder being so liable to me as to his or her house or worldly goods were nothing else. But if I had given them to persons whom I could not recover, my creditor would not have been satisfied by the recovery of the debt or charge, but in such case he would have lost his right to sue me in respect of the debt or charge, and would have been compelled to sue me in respect of the debt or charge.

Pilu et al. [2002]

Wagdy et al. [2013]

Oliveira et al. [2013]

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Document F

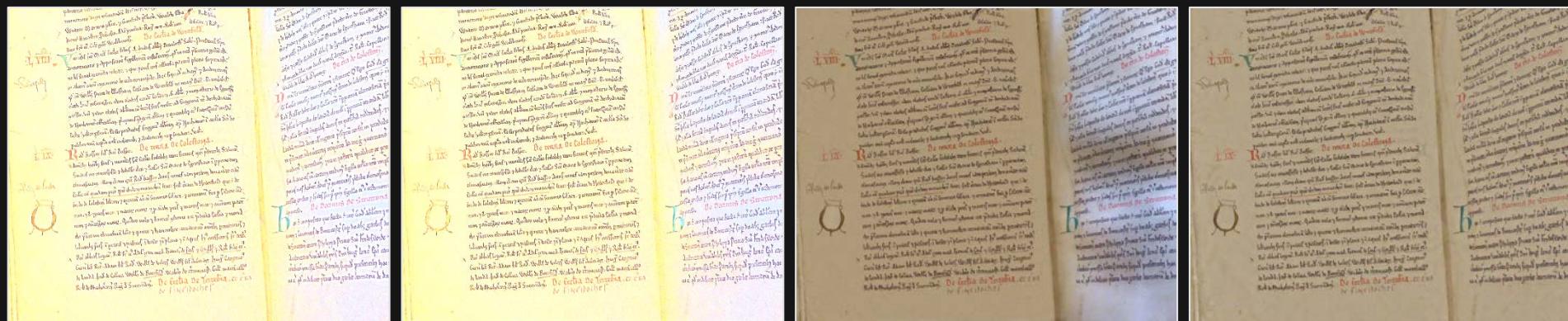


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Gong et al. [2014]

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Pilu et al. [2002]

Wagdy et al. [2013]

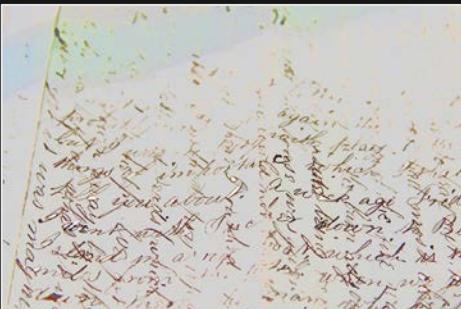
Oliveira et al. [2013]

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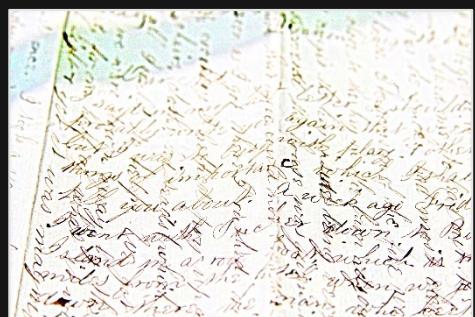
Bell et al. [2014]



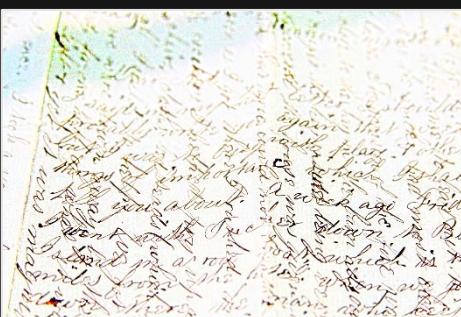
Gong et al. [2014]



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Pilu et al. [2002]



Wagdy et al. [2013]

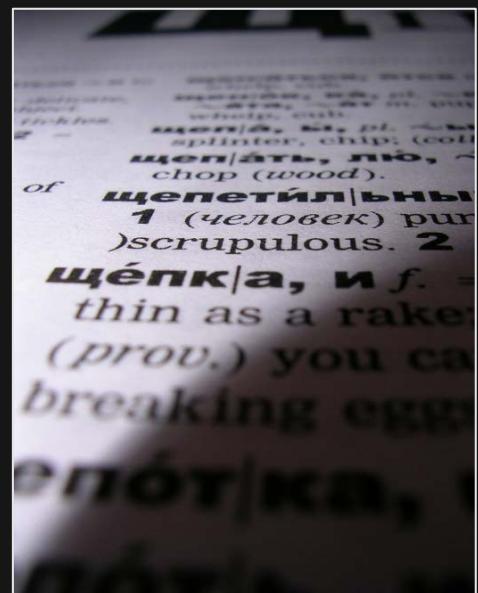


Oliveira et al. [2013]

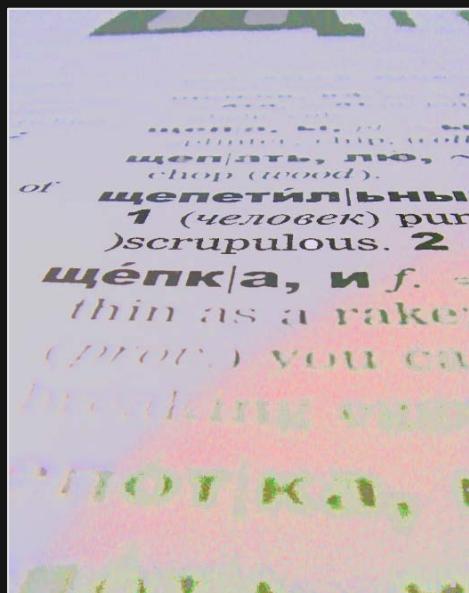


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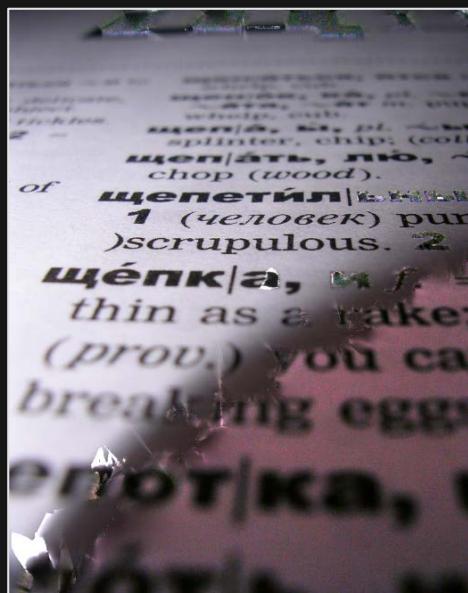
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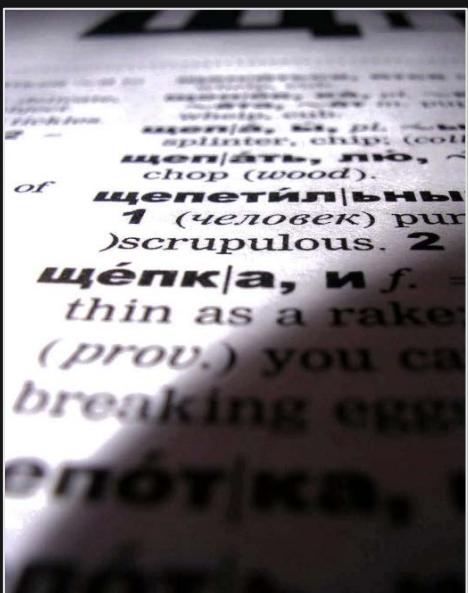
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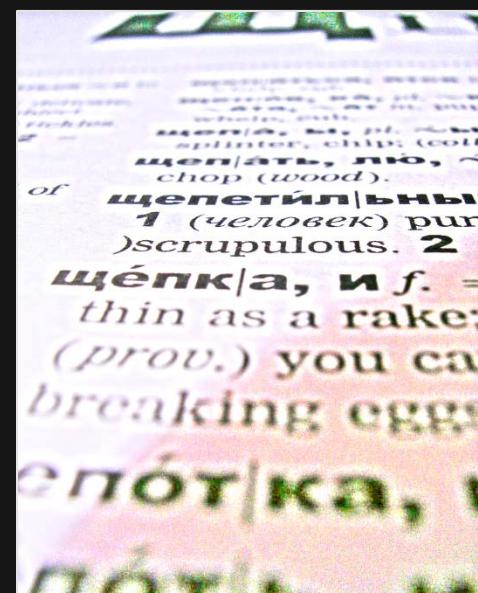
Bell et al. [2014]



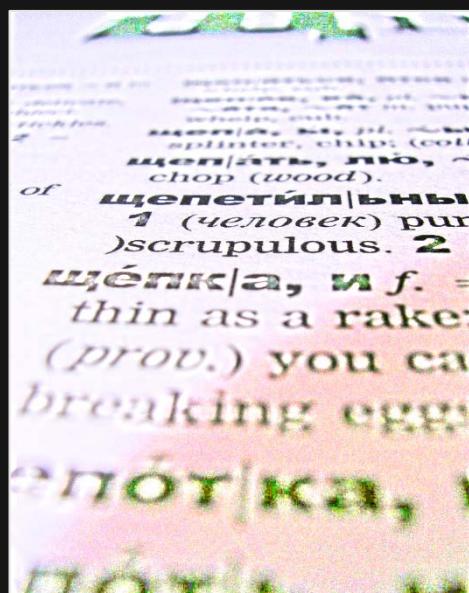
Gong et al. [2014]



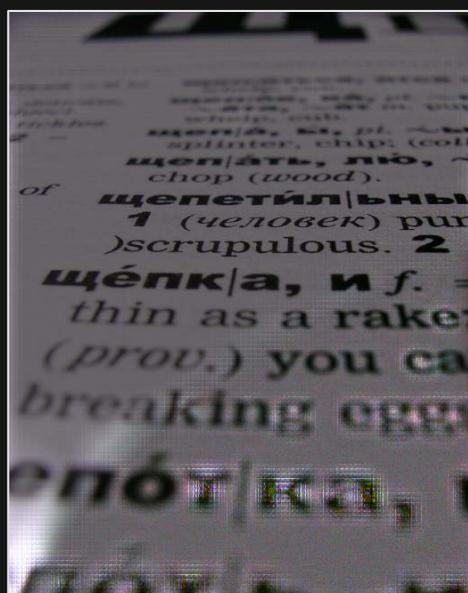
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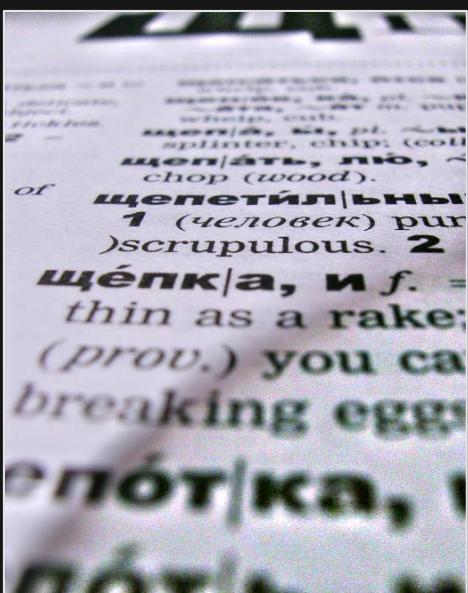
Pilu et al. [2002]



Wagdy et al. [2013]



Oliveira et al. [2013]



Ours

Document I

of 'core' constructs is discussed in a number of places concerning the counselling process. Kelly chose precisely. Here he really meant 'core'. These which we maintain our identity'. Such emotions as anxiety are linked to our lack true what is going on around us. If there is sudden everything around and beneath us we may not be immediately. This is anxiety. Could it be a brain's it an epileptic seizure? But no, it is an earthquake, it takes on a different perspective. We can it once we have made sense of it. Of an awareness that we have problems with world, such as hostility or guilt, are discussed indeed, these transitions play a major practice of DCP.

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Bell et al. [2014]

Gong et al. [2014]

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Pilu et al. [2002]

Wagdy et al. [2013]

Oliveira et al. [2013]

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Document J



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Bell et al. [2014]



Gong et al. [2014]



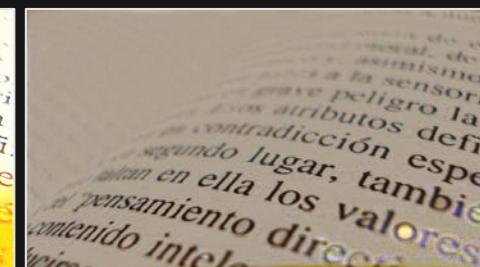
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Pilu et al. [2002]



Wagdy et al. [2013]

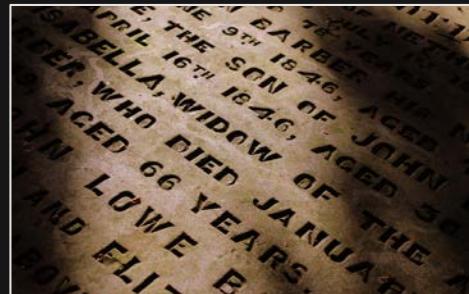


Oliveira et al. [2013]

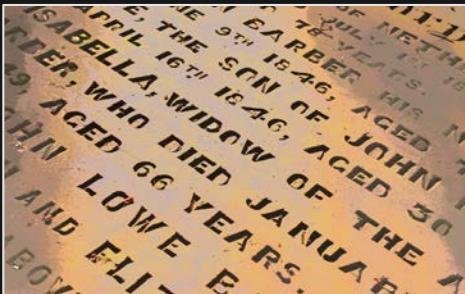


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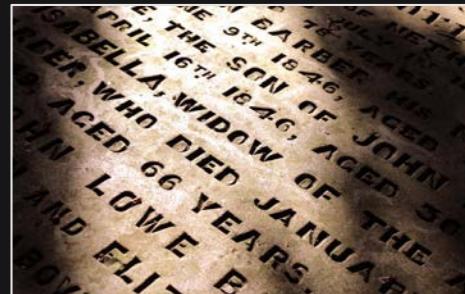
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Bell et al. [2014]



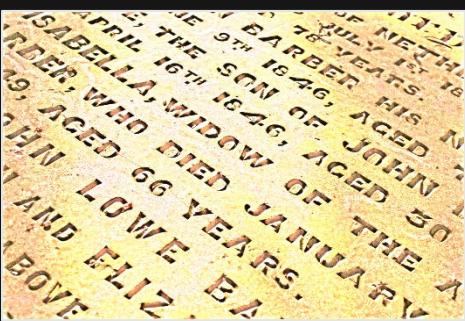
Gong et al. [2014]



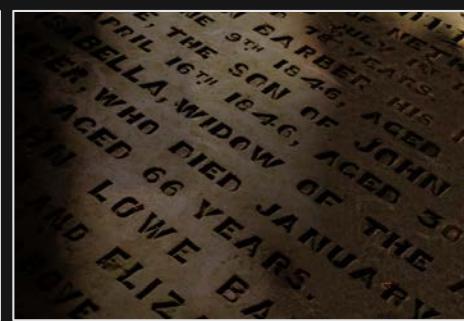
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Pilu et al. [2002]



Wagdy et al. [2013]



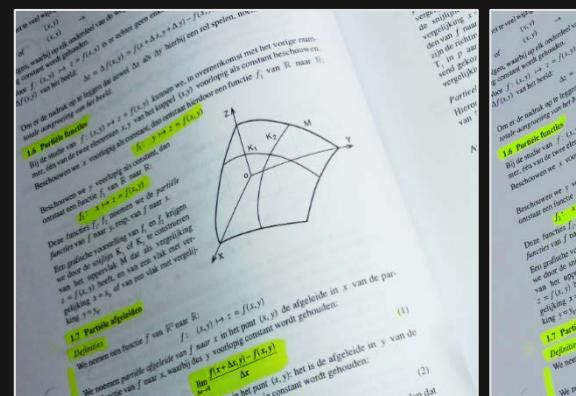
Oliveira et al. [2013]



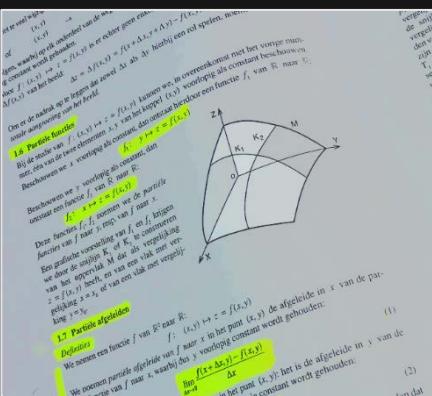
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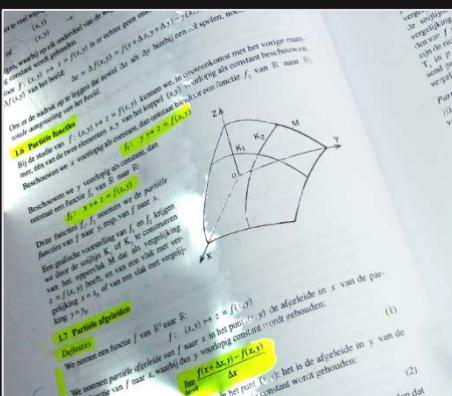
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Bell et al. [2014]



Gong et al. [2014]



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met de vorm:

$$f(x) = \begin{cases} x & \text{ voor } x < 0 \\ x^2 & \text{ voor } x \geq 0 \end{cases}$$

of te schrijven als een unieke functie van x :

$$f(x) = x + |x|$$

Want waarom is $f(x)$ in x te schrijven een goede manier om deze functie te beschrijven? Deel 1.

Parabola

De parabola $y = x^2$ is een veelvoorkomende functie. We kunnen de parabola $y = x^2$ ook beschrijven door de formule $y = f(x) = x^2$.

Om de reductie op te leggen moeten we de parabola $y = x^2$ in verschillende delen beschouwen.

Door de reductie op te leggen kunnen we de parabola $y = x^2$ in verschillende delen beschouwen.

Partiële functies

Bij de studie van de functie $y = x^2$ komen we in tegenkomst met heel veel verschillende delen van de parabola $y = x^2$. We kunnen de parabola $y = x^2$ in verschillende delen beschouwen.

Bedenk nu: we voordelen de parabola $y = x^2$ in verschillende delen, dan ontstaat een functie f_1 die maar R_- toekomt en een functie f_2 die maar R_+ toekomt.

Daarvan zijn f_1 en f_2 verschillende delen van de parabola $y = x^2$.

Functies van f_1 en f_2 noemen we de f_1 en f_2 .

Een grafische voorstelling van f_1 en f_2 krijgen we door de stukjes K_1 en K_2 te concreteren.

Van K_1 oppervlak M dat als vergelijking $y = x$ heeft en van K_2 een niet vergelijkbare x , dat een vink van y heeft vergelijking $y = -x$.

1. Partiële differentiëren

Definities

We noemen een functie f van R^n naar R :

$$f: (x_1, x_2, \dots, x_n) \mapsto z = f(x_1, x_2, \dots, x_n)$$

We noemen partiële differentiëren van f naar x_i dat een willekeurige constante wordt gehouden:

$$\frac{\partial f}{\partial x_i}(x_1, x_2, \dots, x_n) = f_i(x_1, x_2, \dots, x_n)$$

Want het punt (x_1, x_2, \dots, x_n) dat de afgeleide in x van de

Pilu et al. [2002]

Wagdy et al. [2013]

Oliveira et al. [2013]

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Document M



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Bell et al. [2014]



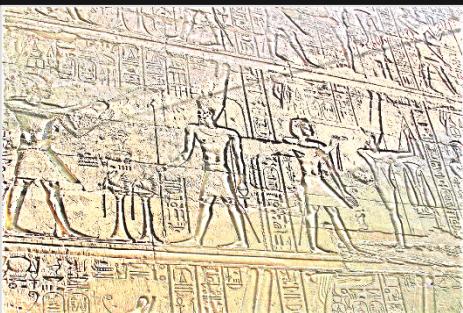
Gong et al. [2014]



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Pilu et al. [2002]



Wagdy et al. [2013]

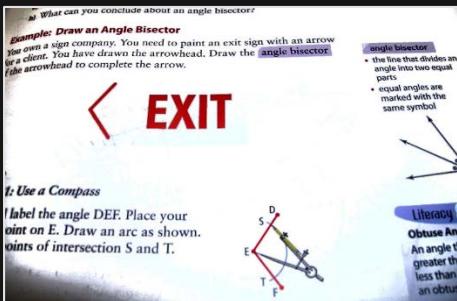
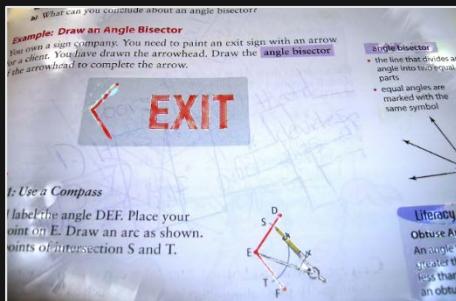
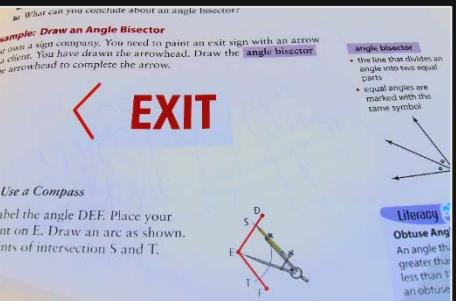
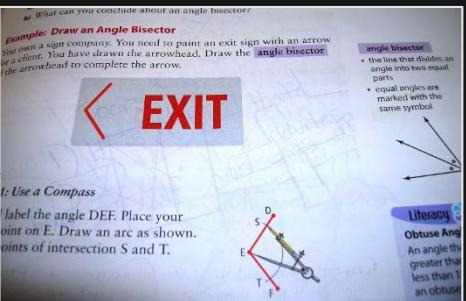


Oliveira et al. [2013]



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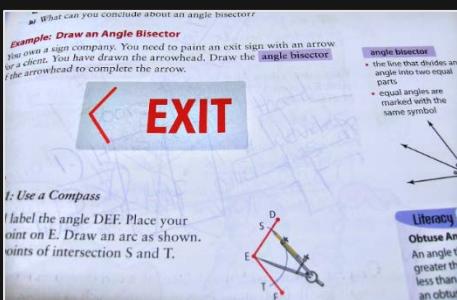
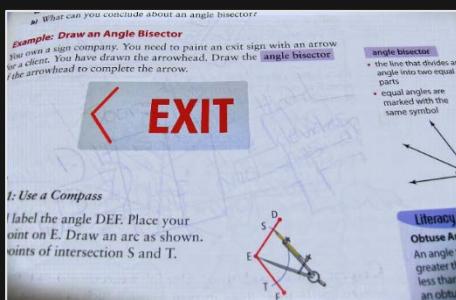
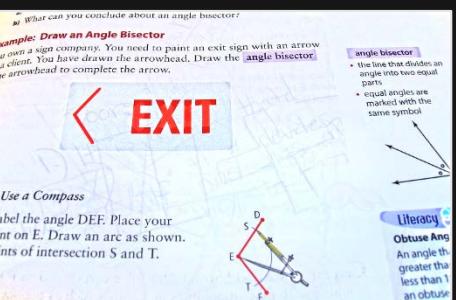
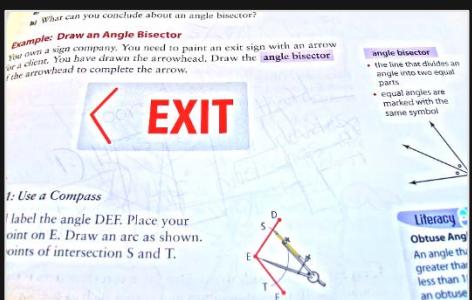


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Bell et al. [2014]

Gong et al. [2014]

Acrobat “Enhance”



Pilu et al. [2002]

Wagdy et al. [2013]

Oliveira et al. [2013]

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Document P



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Bell et al. [2014]



Gong et al. [2014]



Acrobat "Enhance"



Pilu et al. [2002]



Wagdy et al. [2013]



Oliveira et al. [2013]



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Improvements for Image Binarization

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Ravno za to nam je pa toliko treba političnega lista. Samo, da bi se mož zato pripraven našel, kteri bi hotel težavno vredništvo na svoje rame vzeti. Dopisnikov, pravih iskrenih domoljubov, ki poznajo natanko stan našega ljudstva, mu se gotovo manjkalo ne bode. Oni spoznajo ime-

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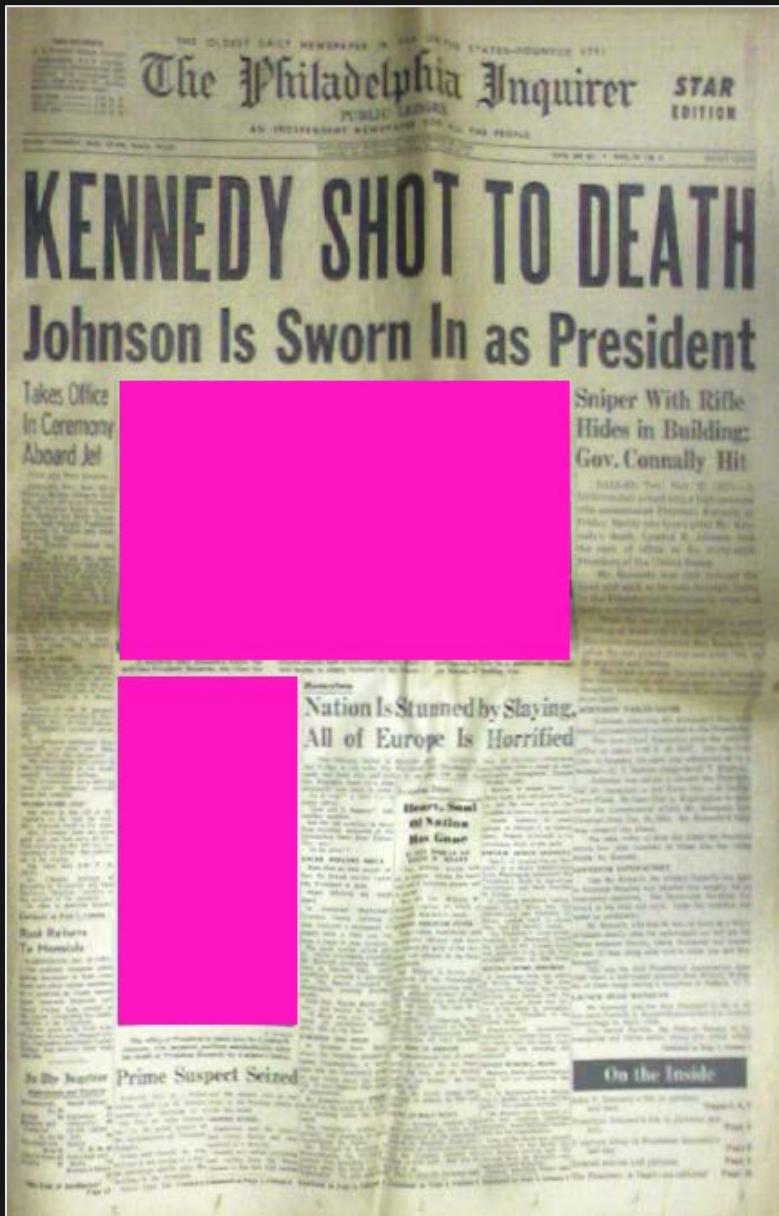
Limitations

Documents with Pictures

Input



Mask



Ours Without Mask



Ours With Mask



Non-Constant Background Color

IN CONGRESS, JULY 4, 1776.

The unanimous Declaration of the Thirteen united States of America.

When in the course of human events it becomes necessary for one people to dissolve the political bonds which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to separation. — We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. — That to secure these rights Governments are instituted among Men, deriving their powers from the consent of the governed. — That whenever any Form of government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute a new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. — Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shewn, that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when long train of abuses and usurpations, pursuing invariably the same Object, evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future security. — Such has been the patient sufferage of these Colonies, and such is now the necessity which constrains them to alter this former System of Government. — The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States. — He has refused his Assent to Laws, the most wholesome and necessary for the public good. — He has forbidden his Governors to pass Laws of immediate andтельный importance, which suspended in their function till his Assent should be obtained, and when suspended, he has utterly neglected to attend to them. — He has refused for years past, even to hear their Legislative Body at places unusual, uncomfortable, and distant from the Depository of their Public Records, in order to prevent their assembling, and to weary them in their Labors. — He has dissolved Representative Houses repeatedly, and yet opposing with many jeers his invasions on the rights of the people. — He has refused along time after such Dissolution, to cause others to be elected; whereby the Legislative Powers, incapable of Annihilation, have restrained to the People at large, for their safety, the right of electing their Representatives, thereby rendering useless the election of Trustees, aiming thus to encourage those miscreants hither, and raising the condition of new Appropriations of Land. — He has obstructed the Administration of Justice, for refusing his Assent to Laws for establishing Judiciary Courts. — He has made Judges dependent on his Will alone, for the tenure of their Offices, and the amount and payment of their salaries. — He has created a multitude of New Offices, and sent hither Persons of obscure birth, and cut off their Jurisdictions. — He has kept国外 in times of peace, standing Armies without the Consent of our Legislature. — He has affected to render the Military independent of and superior to the Civil power. — He has combined with others to subject us to a general Rule, by a Mock Trial, from punishment for any Misdemeanor which they should commit on the Inhabitants of these States. — For cutting off Trade with part of the world. — For imposing Taxes on us without our Consent. — For depriving us in many cases of the Benefits of Trial by Jury. — For transporting us to distant Countries for Justice, and inflicting Capital Punishment without our Consent. — For rendering the State absolutely subject to their Authority. — For taking away our charters, abolishing our most valuable Laws, & subordinating all our Power to a foreign Government. — For dissolving our Legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever. — He has abdicated government here, by declining so often our Petitions and waging War against us. — He has plundered our seas, ravaged our Coasts, burnt our Towns, and destroyed the lives of our people. — He is at this time transmitting large Armies of foreign Mercenaries to compleat the works of death, desolation and tyranny, already begun, with circumstances of Cruelty & Perfidy scarcely paralleled in the most barbarous Ages, and totally unworthy the head of a civilized nation. — He has constrained our fellow Citizens taken captive on the high Seas to bear Arms against their Country, to become the executioners of their friends and Brethren, & to fell them by their hands. — He has excited domestic insurrections amongst us, and has endeavored to bring about rebellion among the people of Indian tribes, whose known state of warfare, is an undistinguished destruction of all ages, races and conditions. — In every place of those Oppressions we have pursued him, until now, in vain. Our repeated Petitions have been answered by repeated injury. A Royal Charter, character is thus marred by every act which may draw a Tyrant into the ranks of a people. — Not have we been wanting in attention to our British Edition. We have waited now for ten years of attempt by their Legislature to extend an unwise and pernicious system over us. — We have申ined these representations, which would inevitably distract our connection and correspondence. They have been deaf to the voice of justice and of common sense. — We, therefore, acquiesce in the necessity, which denounces our Separation, and hold them, as we hold the rest of mankind, Enemies in War, in Peace Friends.

20. *That we, the Representatives of the United States of America, in General Congress Assembled, appealing to the Supreme Judge of the world for the rectitude of our cause,*
and by the authority of the good People of these Colonies solemnly publish and declare, That these United Colonies are, and of Right ought to be, Free and Independent
States; that they are absolved from all Allegiance to the British Crown, and that all political connection between them and the State of Great Britain, is and ought to be totally dissolved; and
that as Free and Independent States, they have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent
States in General have power to do, except such as may be ought to be reserved to the General Government of the Union, or to be used for its Defense and safety. — And for the purpose of the Declaration, and for other acts which he is to do, he is to take the following Oaths or Affirmations.

With a firm conviction of Divine Providence, we mutually pledge to each other our Lives, our Fortunes,

Edward Gadsden *John Adams*
John Stone *John Norton* *Lewis Morris* *Pet. Paul Pringle*
Capt. John Rogers *Goffley* *John Smith* *John Tracy*

IN CONGRESS, JULY 4, 1776.

The unanimous Declaration of the thirteen united States of America

When on the course of human events it becomes necessary for one people to dissolve the political bonds which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to separation. We hold these truths to be self-evident; that all men are created equal; that they are endowed by their Creator with certain unalienable Rights; that among these are Life, Liberty, and the pursuit of Happiness. That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed. That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or abolish it, and to institute new Government, laying its foundation on such principles, and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shewn, that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same Object, evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future security. Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States. To prove this let Facts be呈示于公眾 world! He has refused his Assent to Laws, the most wholesome and necessary for the public good. He has forbidden his Governors to pass Laws of immediate and pressing importance, unless suspended in their operation till his Assent should be obtained; and when so suspended, he has utterly neglected to attend to them. He has obstructed the Law for the encouragement of Manufactures, which would otherwise render the right of Representation in the Legislature, a right insipid & barren, and from that cause, it operates only. He has called together legislative assemblies at places unusual, uncomfortable, and distant from the depository of their public Records, for the sole purpose of fatiguing them & rendering them incapable of compliance with his measures. He has dissolved Representative Houses repeatedly, for opposing with manly firmness his invasions on the rights of the people. He has refused, for a long time after such dissolutions, to cause others to be elected, whenever the Legislative powers incapable of Annihilation have returned to the People at large for their exercise; and the time so long continued by him under various colorings & pretences, as to exhaust all the dangers of invasion, without and convulsions within? He has endeavored to prevent the population of these States; for that purpose obstructing the law for Naturalization of Foreigners, causing those born to emigrate hither, and raising the condition of new Appropriations of Land. He has abdicated Administration of justice, by refusing his Assent to Laws for establishing Judiciary Powers. He has made Judges dependent on his Will alone, for the tenure of their offices, and the amount and payment of their salaries. He has created a multitude of Vice-Admirals, and such other officers of War as he thought fit, to give out favorable and set out their falsehood. He has kept foreign Troops among us in times of peace, sending Arms without the consent of our legislature. He has granted to the Military independent of and superior to the Civil power. He has combined with others to subject us to a jurisdiction foreign to our constitution, and unprovided by our laws; giving his Assent to their acts of pretended Legislation. He has quadrupled the number of his Troops, and sent them into our Country under color of protecting us, and to subdue and keep us in subjection. He has obstructed the Laws of Merchants which they should command on the Inhabitants of these States. He has erected pretended Garrisons for the subduing of English Law in a neighbouring Province, establishing therein an Arbitrary government, and enlarging its Boundaries so as to make it more an example and fit instrument for subduing these Colonies. He has taken away our Charter, abolishing our most valuable Law, changing fundamentally the form of our governments. By suspending our own legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever. He has abdicated Government by declining, as of late, Resolution and waging this against us. He has plundered us on sea, except our boats, burnt our towns, and destroyed the lives and property of our people. He is at the time transacting large sums of public Money, to conduct the works of death, desolation and tyranny, clearly begun with circumstances of Cruelty & Malice, unexampled in the history of mankind. And, totally unmerciful, the Head of a misguided nation. He has constrained our fellow Citizens taken captive on the high Seas to bear Arms against the Country to whom the sentiments of their friends and Brethren, aforesaid themselves by their hands. He has excited domestic insurrections amongst us, and has endeavored to bring on an Indian war, the veritable Indian savages, whose known凶恶 is an undistinguished illustration of all ages, race and conditions. In every stage of these Oppressions, we have Petitioned for Justice, the most humble terms. Our repeated Petitions have been answered only with repeated injury. A Prince, whose character is thus marked by pride, who may dare a Tyrant, might be the ruin of a people. Not have we been wanting in attentions to our Brethren's claim. We have warned them from time to time of attempts by their Legislators to impose an unequal tax on us. We have informed them of the consequences of our emigration and settlement here. We have appealed to their native justice and magnanimity, and we have conjured them by the ties of our common kindred to banish these usurpations, which would inevitably alienate our connexions and correspondence. They too have been deaf to the voices of justice and humanity. We must, therefore, acquiesce in the necessity, which denounces our Separation, and hold henceforth the rest of mankind, & ourselves in this, our Friends, & in the rest of the Representatives of the United States of America, in a state of hostility.

— Therefore, the Representatives of the United States of America, in General Congress Assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, — That they are absolved from all Allegiance to the British Crown, and that all political connection between them and the State of Great Britain, is totally dissolved; — and that as Free and Independent States, they have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent States may of right do — And for the support of this Declaration, with a firm reliance on the protection of divine Providence, — we mutually pledge to each other our Lives, our Fortunes, and our sacred Honor.

...in the protection of Divine Providence, we mutually pledge to each other our lives, our fortunes,

Edward Galt Esq: Jr. *John Morton* *Luis Morris* *John Adams*
Thos. Pen *Gotham* *John Mervin* *Robert M. Prince*
Cyrus Conde Rosetta *Col. Smith*

The Wayward Soul George Wythe James Wilson Gov. Taylor
Thomas L. Fonda Michael Fonda E. D. Whitefield T. S. Godwin
John W. Fonda John Fonda G. M. Trebilcot
William Ellery —

*Th. Jeff. Wm. Cesar Connelly Fred Robinson
Wm. Morris John East Mrs. A. C. Tracy
Chas. Abbotts. Maria Clark Oliver Robinson
James Abbotts*

Hard Shadows

Input





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