

Resemblance Notebooks

Publication/Creation

1906

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F. 38



14 men
with 20 small men in 100 men. 140

3 men

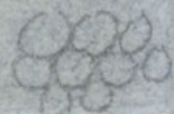


2 half $A_1 = 3$ while A_1 are washed in rather like a B although

..... or L B altogether

entire
son or 6 that of the square, both circumstances about same circle
6 to 3.0 or at 100 to 115.4

1 which the trees are in squares the other in polygons the latter are
more trees than the other



[illegible]

00 01 02 03 04 05	00 01 02 03 04 05	00 01 02 03 04 05
10 11 12 13 14 15	10 11 12 13 14 15	10 11 12 13 14 15
20 21 22 23 24 25	20 21 22 23 24 25	20 21 22 23 24 25
30 31 32 33 34 35	30 31 32 33 34 35	30 31 32 33 34 35
40 41 42 43 44 45	40 41 42 43 44 45	40 41 42 43 44 45
50 51 52 53 54 55	50 51 52 53 54 55	50 51 52 53 54 55
00 01 02 03 04 05	00 01 02 03 04 05	00 01 02 03 04 05
10 11 12 13 14 15	10 11 12 13 14 15	10 11 12 13 14 15
20 21 22 23 24 25	20 21 22 23 24 25	20 21 22 23 24 25
30 31 32 33 34 35	30 31 32 33 34 35	30 31 32 33 34 35
40 41 42 43 44 45	40 41 42 43 44 45	40 41 42 43 44 45
50 51 52 53 54 55	50 51 52 53 54 55	50 51 52 53 54 55
00 01 02 03 04 05	00 01 02 03 04 05	00 01 02 03 04 05
10 11 12 13 14 15	10 11 12 13 14 15	10 11 12 13 14 15
20 21 22 23 24 25	20 21 22 23 24 25	20 21 22 23 24 25
30 31 32 33 34 35	30 31 32 33 34 35	30 31 32 33 34 35
40 41 42 43 44 45	40 41 42 43 44 45	40 41 42 43 44 45
50 51 52 53 54 55	50 51 52 53 54 55	50 51 52 53 54 55

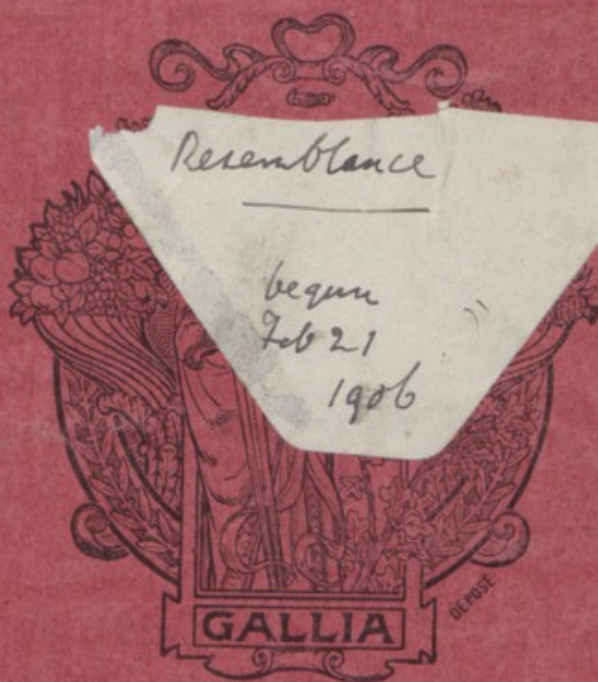
1974

Resemblance

begun

Feb 21

1906



1905

F. 21

Feb 21 The converging lines that Eves painted for me
at 11-12 yards looked at through microscope the wider lot are
discovered the narrower not
at an additional 19 yards (total 30 or 31 yards) the same occurs to
my naked eye

Obvial glass of microscope wider; eye glass - wider

The checkered pattern must have checkers on the white border that
is just within the black border

Objects are projected on a hollow sphere of which the eye is the center
the sphere may be supposed to be of triangular mosaics each so small that
its Circumscribing circle is 1 minute of arc in radius, or therefore indistinguishable
by the naked eye from its neighbours. The limit of each mosaic is the mean of all its
more elementary contents.

Identity exists (visual identity) between two objects when the mosaics used in their
retinal projections are the same, each with its corresponding one

Length of arc = 1 centirad; to find the corresponding angle θ

$$\theta : 360^\circ :: 1 : 2\pi \times 100 \quad \therefore 1 : 314.16 \times 2$$

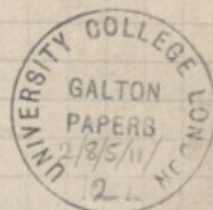
$$\theta : 18^\circ :: 1 : 31.416$$

$$\theta = \frac{18 \times 60}{31.416}$$

$$\theta = 34.41 \text{ minutes of a degree}$$

$\log 18$	1. 2553
$\log 60$	1. 7782
	<hr/> 3. 0335
$\log 31.416$	1. 4969
34.41	<hr/> 1. 5366

$$31.416 \div 18000 \times 60 = 34.36$$



Feb 22

p. 30

Figure 3 in faint medium, & black
on a faint and on a medium background.

on door

Lettering on blue cover & on white title page of a Blue book
the words Report - Departmental Committee

The blue cover read at $4\frac{1}{2}$ feet

white page " " 9 feet.

(Feb 22)

out of door

Lettering on blue cover Report Departe Ctte legible out of door 9 ft
white title page 14 ft

Converged lines a b c and

a were merged at 40-50 feet

b

c

d

all a uniform shade 70 or 80 feet

Feb 24 For blurring, dots are better than lines



last?
best
of these

(Copied from old books "Equivalent Square" "Discrepancy")

My little telescope magnifies about $2\frac{1}{4}$ times - (I have lost the focus of the 2 lenses)

For publication of two resembling photographs. Each set a same plate (photogr.).

1. Same uniform size of 0.4, height to width - 60%

2. " " " " 0.1' with test dots below, sharp focus

3. As above, blurred until indistinguishable at 20' distance

Then by darkening 3 by hand a book it can be made indistinguishable at 10'.
(Use a telescope or an isoscope for determining the 20' distance blurring.) and write down all data.

Feb 25 After careful study of the boat group pictures, decided that \bigcirc 0.2 height from chin to head was the smallest quite satisfactory reduction attainable - An out-of-focus blur is then adequate to muddle the main distinctive marks.

Punchi frontispiece might be reduced $\frac{1}{2}$ & then blurred as an example

Five pairs to test severity of blur are mechanically much easier to produce & scale than all
and they really seem to do as well - These 2 printed figures. Start making the latter by the former

10 with total height of head and face

its features are distinguishable at from 25 to 30 yards = 900 to 1080 inches
 say at 1000 inches

\therefore the face is then 1 centimetre in height = $\frac{1}{10}$ inch viewed at 10 inches. (3)

Faces begin to be distinguishable even though generally similar at about 25-30 feet
 their actual width are about 6 inches in the reduction is 1 to 150 to 180. 75 90 feet
~~old faces (black & white)~~
 their actual length is about 10 inches in the reduction is $\frac{10}{90 \times 12} = \frac{1}{108}$ say $\frac{1}{100}$
 at 10 inches from eye = a length of 0.1 inch = 1 centim

In meters say a length of 25 centimeters at distance of 25 meters = 1 to 100 or 2.5 m at 250 mm

March 1. To blur the line to any desired width & move the picture through that width with uniform motion in front of camera, (or move the camera) (or merely the slide)
 If the line be replaced by a point, move the negative or above, crossways, then the resulting position will turn the point into a square.
 In this way a large picture can be uniformly blurred to any desired degree, each point becoming a square of equal confusion. Each square becomes a bigger square with prominence

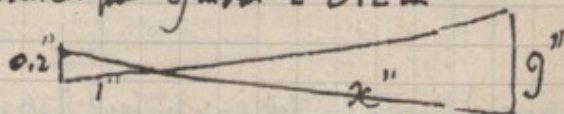
13. Letters without heads or tails a c e m n o r s u v w x z — 13
 (a c e m n o r s u v w x z are all equal broad)
 with heads only b d h k l t — 7
 " tails only g j q y — 3
 both f i p — 3
 ————— 26

? experiment with type-written letters, keep all of equal breadth

with lens 1 inch from at distance x , the object is reduced from 9 inches to 0.2 in

$$x : 1 :: 9 : 0.2 :: 90 : 2 \quad (x = 90)$$

$$x = 45^\circ \quad (\text{under 4 feet})$$



with lens 2 inch from, $x = 90 = 7' 6''$ ○

3 inch from, $x = 3x = 12' 3''$ ○

from 9 inch to 0.3 inch ○

3 inch from 9 inches reduced to 0.3 inch at 90 inches = $7' 6''$
 " " " 0.2 " " 135 " = $11' 5''$
 " " " 0.1 " " 270 " = $23' -$

Chord of 1 decrad

$$\sin 2^\circ 48' = 0.488$$

$$4 = \frac{0.012}{0.0006}$$

$$2^\circ 52' = 0.500$$

$$2 \sin 2^\circ 52' = \text{chord of } 344' = \text{chord of 1 decrad}$$

$$\sin 5^\circ 42' = 0.993$$

$$2 = \frac{0.006}{0.0006}$$

$$\sin 5^\circ 44' = 0.999 = .1000 \text{ sag}$$

$$2 \sin 5^\circ 44' = \text{chord of } 688' = \text{chord of } \frac{1}{2} \text{ decrad (length)} \quad \begin{array}{r} 300 \\ 40 \\ \hline 340 \end{array}$$

$$2 \sin 8^\circ 6' = \text{chord of } 1032' = \text{chord of } \frac{1}{3} \text{ decrad (length)} \quad \begin{array}{r} 300 \\ 40 \\ \hline 340 \end{array} \quad \times 2 = 688$$

$$\text{Arc of 1 centered} : 180^\circ :: \frac{1}{100} : \pi :: 1 : 100\pi = 1 : 314$$

$$314 / 180.0 (.573 \times 60') = 34.380$$

$$1570$$

$$2300$$

$$2198$$

$$1020$$

$$1042$$

$$\times 20 = 687.6$$

Hence the chord of 2 decrad $\overset{\text{arc}}{\underset{\text{length}}{=}} 20 \times \text{arc of 1 centered}$ with the nearest integer
 $= 687.6$ instead of 688.

$$\sin 3^\circ = .0523; \text{ chord } 6^\circ = 2 \sin 3^\circ = 0.1046$$

$$\text{arc } 6^\circ = \frac{1}{30} \pi \times 60 = 100 \text{ arc } 6^\circ = \frac{100}{3} \pi = 3/314 \cdot 180 = 104.72$$

Smallest visible interval = $1'$
 its chord = $\frac{1}{3.44}$ centered = $\frac{1}{3.44}$ millirad = a little less than $\frac{1}{3}$ of a millirad

The height of just legible letter (see opposite page) = 2 millirads

$$2 : \frac{1}{3.44} = 6.88 \pm 1 \text{ say } 7 \pm 1$$

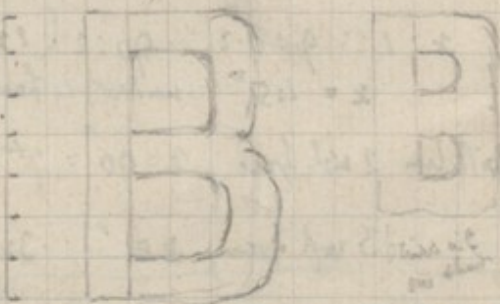
The summed breadth of a black & a white band, that merge into gray = $2'$

Such a pair of bands: a just legible letter

$$= \frac{2}{3.44} : 2 = 1 : 3.44 \text{ legible letter}$$

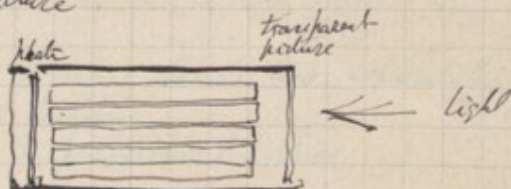
$$\text{or a single band: a just legible letter} :: \frac{1}{2} : 3.44 = 1 : 6.88$$

The just legible letter has the height of 3.44 complete (black & a white band)
 $= 6.88$ (or say 7) times that of a single band



To diminish contrast by a tinted glass over the picture

To make a correct mosaic - use a transparent position and reproduce a battery of empty cigarette labels



To make oak, outline with artists' charcoal, which dusts off quite easily & thoroughly.

hesitating - blurring - dulling discrimination, impair distinctness

Confuser - blunter - softer & blurrier

The eye never sees a line finer than 1' in angular width. Distances which diminish the angular width of the portrait proportionately increased the width of blur in relation to width of portrait.

Within the limits of 2 decipeds the chord & the arcs of angles are sensibly the same. The ~~extreme~~ difference being as 688.0 to 687.6. For a 60° the arc = $100 \frac{1}{3} \pi = 1.047$
 $\pi = 3.1416$ as against 3.14159
 diff. about 5% diff.

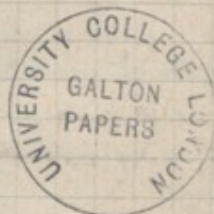
The amount of indistinctness that just produces mutual intelligibility may be measured directly or by its effects on a scale of test letters, determining legibility up to a certain scale value.

Soften & partly efface the minor distinguishing marks - when the sufficient scale is reached what are major & what minor distance test.

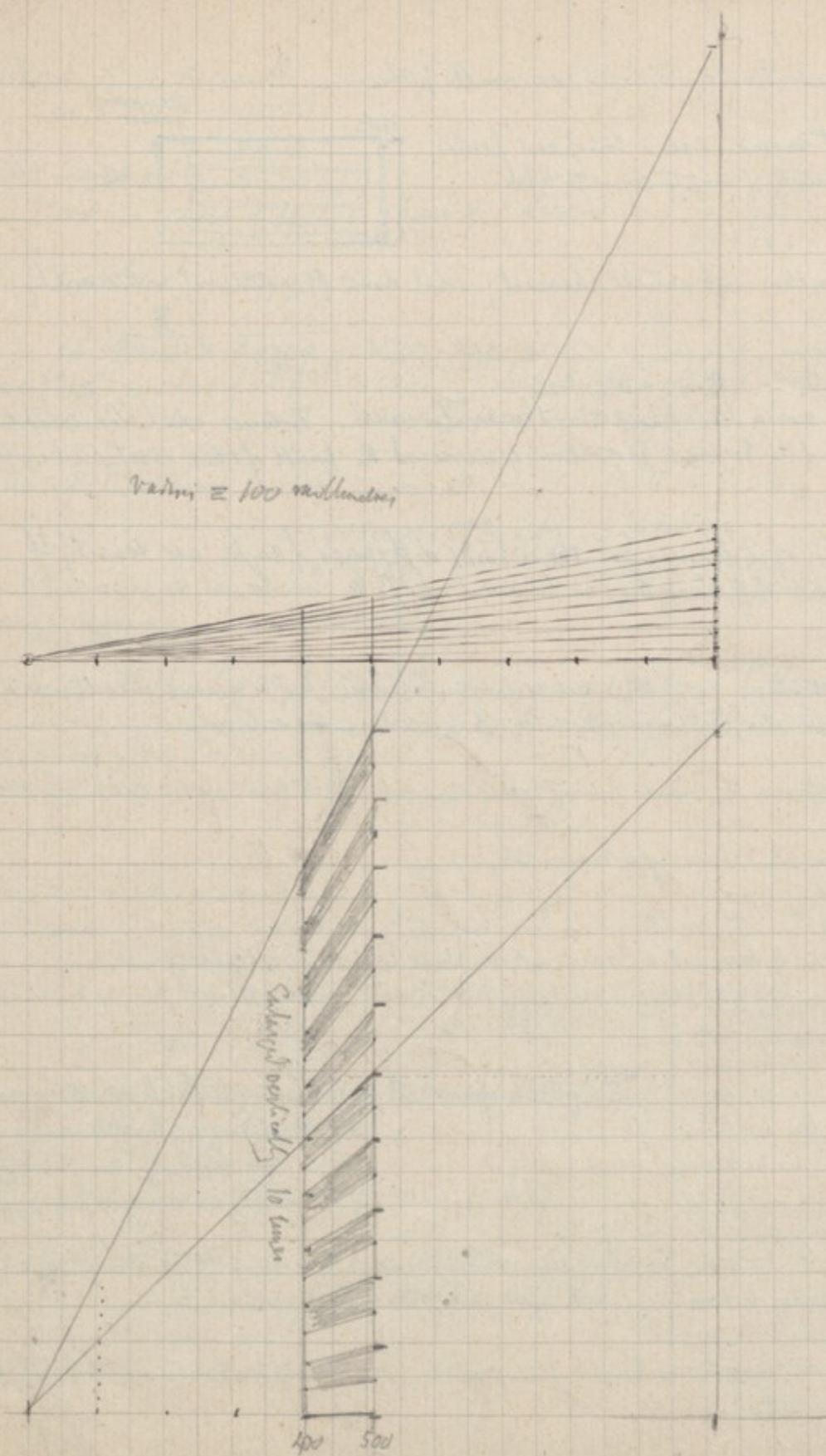
March 13 Result of several experiments on well proportioned capital letters

Height of letter	width	proportion height dist	legibility
0.24	200	1 to 500	0.20
0.22	175	1 to 523	0.19
0.16	90	1 to 562	0.18
0.12	48	1 to 600	0.17
0.065	40	1 to 615	0.16
		5) 2600	0.15
		1 to 520	0.14
		= 0.19 to 100	
		say 0.2 to 100	

= 2:1000 = 2 millipeds = height of a just legible & well proportioned capital letter
 = $\frac{1}{500}$ cent



f. 5v



March 11. Experiments with the isoscope, on the types used in Nature

leading article just readable at $21\frac{1}{2}$ inches	at $\frac{1}{2}$ inches the lines & intervals that separate the letters disappear at 12 or 13 the paragraphs disappear
"Notes" at $19\frac{1}{2}$	
Diary of Socials at $14\frac{1}{2}$	

Objects at a few paces seem greatly diminished when seen through the isoscope. This is a pure illusion, as shown by viewing them simultaneously & directly with the other eye.

Chord of $34' \cdot 22'' \cdot 6 = 1$ contained (done by Greenport's Table & method)

April 5 Paris. "Measurement of Resemblance, as defined by the facility with which compared objects can be rendered indistinguishable".

Scale of distinguishability, radius of vision (or rad) = distance from eye.

April 16. London. M A R by interposing optical hindrances to distinct vision, until the compared objects cease to be distinguishable.

Measurement of Resemblance between two objects, by the degree of indistinctness that (suffices to conceal their differences) is required under inappreciable

Measurement of Resemblance between two objects, by the degree of indistinctness that is required to make their difference inappreciable.

April 18.

Measurement of Resemblance between two objects, in terms of the indistinctness required to obliterate all visible difference between them.

M of R
by the degree of indistinctness that suffices to conceal differences
that renders them apparently identical
by the amount of indistinctness that prevents discrimination
by interposing hindrances to clear vision, until their difference disappears
(known amount of)

by the amount, differences through optical influences conditions

M

of R

~~by viewing them under conditions which~~ ^{just} ~~highlight~~ ^{highlight} ~~the~~ ^{small} ~~differences~~

M

of R

by viewing objects under conditions that just highlight their differences,
 to ~~be~~ ^{be} ~~combined~~ ^{combined} with standardised test cards
 (to nullify colour)

From Carri Synoptici: Sani
 Sani smallest Sani diameter July 15.45.5
 largest Jan 1 16.17.8
 Mean diameter of Sani 32'. 3.3

Table at end of the Synopticon
 Length of arc 1' = sin 1' = .000290888

Length of arc 10' = .017453293
 sin 10' = .017452406

Sagitta first 5 decimal places

log tan 1/2 15° = log sin 7.5° = 9.1156977
 log 2 = 0.3010300
 log chord 15° = 9.4167277
 .26104 .4167071

Chord 15° = 0.261047

Chord 15° = 1/12 arc 180° = 1/6 π
 = 1/12 x 3.14159265 =

12/3.14159265 = .26179939
 12 3.14159265
 24 6.2831853
 74 2.44148268
 21 1.0210354
 12 9.0984608
 95 1.0440150
 119 1.0440150
 106 1.0440150
 112 1.0440150
 102 1.0440150
 46 1.0440150
 36 1.0440150
 105

log π 0.4971499
 log 12 1.0791812
 log arc 15° = 9.4179687
 0.26179 9.4179531
 9 156

✓ 0.261799 = arc 15°
 ✓ 0.261047 = chord 15°

chord 15° : arc 15° :: 1 : k
 k = chord 15° / arc 15°

log chord 15° = 9.4167277
 log arc 15° = 9.4179687

9.4179687
 9.4167277
 9.4179687
 7590
 0.0012410
 .0012143
 277

10028
 6
 100286

or under 3 per mille.

Chord, Sin, & arc being practically identical in angles less than 10

1 centrad of chord = 0.01 of sine log .01 = 8.000

log sin 34'.23" = 8.0000886

23/40(26
 46
 140
 132

1 centrad chord = { 34'.23" = 34.26
 or say 34 1/4

1/2 a degree = 30'
 Sani mean diameter = 32.3
 Chord of 1 centrad = 34.3

$$3.41 / 26.60 (25.4 \text{ kg}) \quad \log 1.4038$$

$$\frac{682}{1840} \quad \frac{1}{2} \quad 0.7019 \quad 5034$$

$$\frac{1705}{1350}$$

$$\log 1364$$

$$\log 2.9275$$

$$\log 2.750$$

$$\log 0.4970314 \quad 1500 (47.8) \quad (= 6.92 \text{ for } 6.9)$$

$$\log 1.3720$$

$$\log 1.3720 = 0.1372$$

$$\frac{1586}{2440}$$

$$\frac{2198}{2420}$$

$$2572$$

$$\cos 30^\circ = .866 \quad 2 \cos 30^\circ = 1.772$$

$$a = 10 \quad 2a \cos 30^\circ = 17.72$$

$$a \sin 30^\circ = 5.00 \quad \log 9.9556$$

$$\log 2.750$$

$$\log 2$$

$$\log 2 \cos 30^\circ = 0.2750 = \log 1.772$$

$$\log 2 = 0.3010$$

$$0.3780 = 2.378$$

$$\text{Area of } a-b-c = 2r \times r = 2r^2$$

$$= 2a^2 \times \cos^2 30^\circ$$

$$a = 10$$

$$\text{Area in square units} = 200 \times (.866)^2 = 2 \times 74.9956$$

$$= 150 \text{ sq. u.}$$

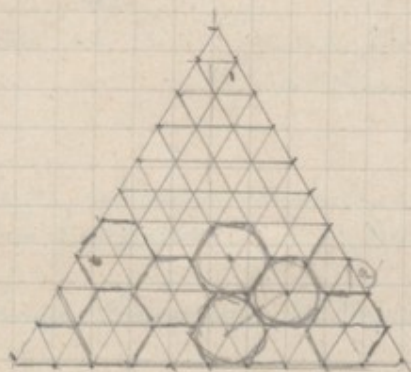
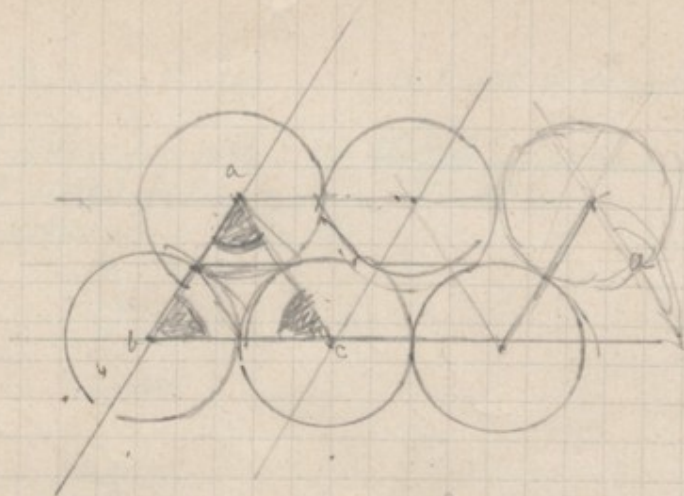
Sum of Areas of 3 black sectors = that of one semicircle whose radius is S

$$\text{So that } \pi S^2 = 150$$

$$S^2 = \frac{150}{\pi} = 47.8; S = 6.9 \text{ about} \quad \leftarrow$$

Interval between diameters or sides of the equilateral triangle	a	$= 10$
Radius of circles	$a \cos 30^\circ$	$= 8.66$
Distance between their centers	$2a \cos 30^\circ$	$= 17.72$
Radius of black spot	S	$= 6.9$

$$\pi S^2 = \frac{1}{2} \{ 2a^2 \times \cos^2 30^\circ \}$$



distance between marks on sides of the triangle = a
 r radius of circle inscribed in hexagon

$$r = a \cos 30^\circ$$

Interval between centres of circles = $2a \cos 30^\circ$

Black spots & have same area as white intervals

$\therefore \triangle abc$ radius of spot = S must be such that $\pi S^2 = \frac{1}{2} (2r)^2$

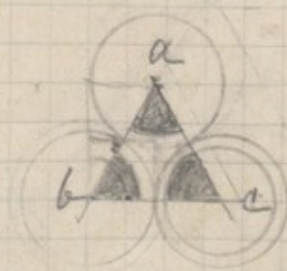
$$S = \frac{r}{\sqrt{\pi}}$$

$$S = \frac{a \cos 30^\circ}{\sqrt{\pi}} = a \times 0.2388$$

$$a = 10 \text{ mm}$$

$$a \cos 30^\circ = 8.66$$

$$2a \cos 30^\circ = 17.32$$



$$\text{area of } abc = r + 2r = 2r^2 = 2 \times a^2 \cos^2 30^\circ$$

$$= 2 \times 100 \times \cos^2 30^\circ$$

$$200 \times 0.8660 = 86.6 \text{ sq. mm}$$

area of the 3 thirds of a spot radius S = half area of $\triangle abc$
 $= \frac{1}{2} \pi S^2$

that white intervals st^l equal black spots
 $\frac{1}{2} \pi S^2 = \frac{1}{2} \text{ area of } abc \approx 43.3 \text{ sq. mm}$

$$S^2 = \frac{2}{\pi} \times 43.3 = \frac{1}{\pi} 86.6$$

$$S = 5.034 \text{ mm}$$

θ = angle whose chord is 1 centian

$$2 \sin \frac{1}{2} \theta = 0.01 \quad \sin \frac{1}{2} \theta = 0.005; \quad \log \sin \frac{1}{2} \theta = 7.698970$$

By Napier's table

$$\begin{aligned} 9 - L &= 4.685573 \\ 9 &= 7.698970 \\ \log x &= 3.013397 \\ \log 1031'' &= 3.013259 \\ &\quad \quad \quad 138 \end{aligned}$$

$$\frac{1}{2} \theta = 1031''.3 = 17'.11''.3; \quad \theta = 34'.22''.6$$

$$\text{Chord } 46^\circ = 2 \sin 23^\circ$$

$$\log 2 \sin 23^\circ = 9.019830$$

$$\log 1045 = 9.019532$$

$$\text{diff} = .000298$$

$$1046.7 \times 100 = \underline{\underline{10.467}}$$

$$\pi = 3.1415927$$

$$\text{Arc } 46^\circ = \frac{100}{30} \cdot \pi = \underline{\underline{10.471}}$$

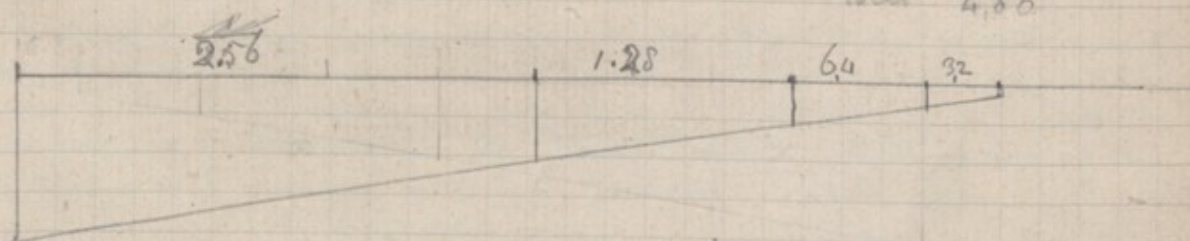
$$\text{Arc} : \text{chord} = 10.471 : 10.467$$

Describe a circular whether to chord semi or a to arcs
 ratio between chords and arcs; - for 60° as 1000 to 1047 less than 5%
 for 6° as 1000 to 104.71 more with magnifying glass

In a face whose height = 1 contour is 9 inches at 900" or at $\frac{900}{30} = 23$ to 24 yards features are not clear
 at height = 10 contours is at $2\frac{1}{2}$ yards = 7 feet quite clear
 Some things require close scrutiny color of eye - finger edges, need a lens.
 Recollection for therefore many grades - must specify which

Print - proportion of page & margin - paragraph & columns - type & length of lines

Evan's 2 conditions		from total height of 5 inches $\pm 2\frac{1}{2}$		reduced length	
		total length 15 inches			
reduce	A'	$\frac{1}{50}$	0.1 at lower 0.05	0.32	= 1.2
	A	$\frac{1}{25}$	0.2	0.64	= 0.6
	B	$\frac{1}{12\frac{1}{2}}$	0.4	1.28	
	C	$\frac{1}{6\frac{1}{4}}$	0.8	2.56	
				total	4.80



$$\frac{1}{50} \times 16 = \frac{1}{5} \times 16.0 = 3.2$$

$$\frac{1}{25} \times 16 = \frac{1}{2.5} = 6.4$$

$$\frac{1}{12\frac{1}{2}} \times 16 = \frac{1}{12.5} = 1.28$$

$$\frac{1}{6\frac{1}{4}} \times 16 = \frac{1}{6.25} = 2.56$$

$$4.80$$



$$\begin{array}{l} \sin 2^{\circ} 48' = 0.488 \\ \text{add } 4' = 12 \\ \sin 2.52' = 0.500 \\ \text{chord } 5.44' = 0.500 = 5 \text{ millim.} \end{array} \quad \begin{array}{l} \sin 12' = 0.035 \\ \text{add } 8' = 15 \\ \sin 17' = 0.040 \text{ A} \\ \text{chord } 32' = 4 \text{ millim.} \end{array}$$

$$\sin \log 1 = 0.1745 \times 20 = 3490$$

$$\begin{array}{l} \text{then } \log 5^{\circ} = 0.871 \times 21 = 3484 \text{ near } 16 \\ 10^{\circ} = 1736 \times 2 = 3472 \\ 15^{\circ} = 2588 \\ 20^{\circ} = 3420 \times 1 = 3420 \end{array}$$

$$3420 : 3484 = 9965 : 10000$$

$$\log \sin 1^{\circ} = 8.241855$$

$$.241795 = \log 1745$$

$$8.24 = \log .01745$$

$$342 : 349 = 1 : k$$

$$k = \frac{342}{349} \times 1.02$$

$$\begin{array}{r} 342 \times 349 = 2 : 100 \text{ or } 105 : 100 \\ 344 / 360 \times 105 \\ 344 \\ 1600 \\ 1620 \end{array}$$

It is seen that the angle when chord is a decimal is 4.16 for
as $\frac{1}{10}$ of the radius, 10 times that subtended by a circular arc there is
much more nearly 4.16 times that subtended by an arc of the same
radius. For a 2nd place and 1000, the angle is 10 degrees. The
ratio here is 360 : 344 or as 105 : 100.
Therefore though the scale is not strictly one of equal parts
it is practically equal with the terms that are used advent
then strictly defined.

Chord can be measured with as much accuracy as is desired
or can be measured roughly with good case. As an example of this
the handle of my walking stick happens to be a curve, enclosing a width
of 3 1/2 inches at ~~about~~ 35 inches from the end of the stick.

bepröbte-Weine

[illegible]

1 rad = chord of 60° that is of	3600' minute.	Express it as briefly as you can
1 deci rad = $5^\circ 44'$	344' "	is practically the same as $\frac{1}{10}$
1 centi rad = $54.4''$	34.4' "	even const. nearly $\frac{1}{100}$ of the radius, the
1 milli rad = $5.44''$	3.4' "	sin $20^\circ : 20 \text{ sin } 1^\circ :: 34/20 : 3600$

The number of minutes in the last three lines, proceed by tenths, because the difference between the lengths of the ^{the angles} chords is small angles as there, requires more decimal places, ^{than on any other} ¹⁰⁰ ¹⁰² ¹⁰⁴ ¹⁰⁶ ¹⁰⁸ ¹¹⁰ ¹¹² ¹¹⁴ ¹¹⁶ ¹¹⁸ ¹²⁰ ¹²² ¹²⁴ ¹²⁶ ¹²⁸ ¹³⁰ ¹³² ¹³⁴ ¹³⁶ ¹³⁸ ¹⁴⁰ ¹⁴² ¹⁴⁴ ¹⁴⁶ ¹⁴⁸ ¹⁵⁰ ¹⁵² ¹⁵⁴ ¹⁵⁶ ¹⁵⁸ ¹⁶⁰ ¹⁶² ¹⁶⁴ ¹⁶⁶ ¹⁶⁸ ¹⁷⁰ ¹⁷² ¹⁷⁴ ¹⁷⁶ ¹⁷⁸ ¹⁸⁰ ¹⁸² ¹⁸⁴ ¹⁸⁶ ¹⁸⁸ ¹⁹⁰ ¹⁹² ¹⁹⁴ ¹⁹⁶ ¹⁹⁸ ²⁰⁰ ²⁰² ²⁰⁴ ²⁰⁶ ²⁰⁸ ²¹⁰ ²¹² ²¹⁴ ²¹⁶ ²¹⁸ ²²⁰ ²²² ²²⁴ ²²⁶ ²²⁸ ²³⁰ ²³² ²³⁴ ²³⁶ ²³⁸ ²⁴⁰ ²⁴² ²⁴⁴ ²⁴⁶ ²⁴⁸ ²⁵⁰ ²⁵² ²⁵⁴ ²⁵⁶ ²⁵⁸ ²⁶⁰ ²⁶² ²⁶⁴ ²⁶⁶ ²⁶⁸ ²⁷⁰ ²⁷² ²⁷⁴ ²⁷⁶ ²⁷⁸ ²⁸⁰ ²⁸² ²⁸⁴ ²⁸⁶ ²⁸⁸ ²⁹⁰ ²⁹² ²⁹⁴ ²⁹⁶ ²⁹⁸ ³⁰⁰ ³⁰² ³⁰⁴ ³⁰⁶ ³⁰⁸ ³¹⁰ ³¹² ³¹⁴ ³¹⁶ ³¹⁸ ³²⁰ ³²² ³²⁴ ³²⁶ ³²⁸ ³³⁰ ³³² ³³⁴ ³³⁶ ³³⁸ ³⁴⁰ ³⁴² ³⁴⁴ ³⁴⁶ ³⁴⁸ ³⁵⁰ ³⁵² ³⁵⁴ ³⁵⁶ ³⁵⁸ ³⁶⁰ ³⁶² ³⁶⁴ ³⁶⁶ ³⁶⁸ ³⁷⁰ ³⁷² ³⁷⁴ ³⁷⁶ ³⁷⁸ ³⁸⁰ ³⁸² ³⁸⁴ ³⁸⁶ ³⁸⁸ ³⁹⁰ ³⁹² ³⁹⁴ ³⁹⁶ ³⁹⁸ ⁴⁰⁰ ⁴⁰² ⁴⁰⁴ ⁴⁰⁶ ⁴⁰⁸ ⁴¹⁰ ⁴¹² ⁴¹⁴ ⁴¹⁶ ⁴¹⁸ ⁴²⁰ ⁴²² ⁴²⁴ ⁴²⁶ ⁴²⁸ ⁴³⁰ ⁴³² ⁴³⁴ ⁴³⁶ ⁴³⁸ ⁴⁴⁰ ⁴⁴² ⁴⁴⁴ ⁴⁴⁶ ⁴⁴⁸ ⁴⁵⁰ ⁴⁵² ⁴⁵⁴ ⁴⁵⁶ ⁴⁵⁸ ⁴⁶⁰ ⁴⁶² ⁴⁶⁴ ⁴⁶⁶ ⁴⁶⁸ ⁴⁷⁰ ⁴⁷² ⁴⁷⁴ ⁴⁷⁶ ⁴⁷⁸ ⁴⁸⁰ ⁴⁸² ⁴⁸⁴ ⁴⁸⁶ ⁴⁸⁸ ⁴⁹⁰ ⁴⁹² ⁴⁹⁴ ⁴⁹⁶ ⁴⁹⁸ ⁵⁰⁰ ⁵⁰² ⁵⁰⁴ ⁵⁰⁶ ⁵⁰⁸ ⁵¹⁰ ⁵¹² ⁵¹⁴ ⁵¹⁶ ⁵¹⁸ ⁵²⁰ ⁵²² ⁵²⁴ ⁵²⁶ ⁵²⁸ ⁵³⁰ ⁵³² ⁵³⁴ ⁵³⁶ ⁵³⁸ ⁵⁴⁰ ⁵⁴² ⁵⁴⁴ ⁵⁴⁶ ⁵⁴⁸ ⁵⁵⁰ ⁵⁵² ⁵⁵⁴ ⁵⁵⁶ ⁵⁵⁸ ⁵⁶⁰ ⁵⁶² ⁵⁶⁴ ⁵⁶⁶ ⁵⁶⁸ ⁵⁷⁰ ⁵⁷² ⁵⁷⁴ ⁵⁷⁶ ⁵⁷⁸ ⁵⁸⁰ ⁵⁸² ⁵⁸⁴ ⁵⁸⁶ ⁵⁸⁸ ⁵⁹⁰ ⁵⁹² ⁵⁹⁴ ⁵⁹⁶ ⁵⁹⁸ ⁶⁰⁰ ⁶⁰² ⁶⁰⁴ ⁶⁰⁶ ⁶⁰⁸ ⁶¹⁰ ⁶¹² ⁶¹⁴ ⁶¹⁶ ⁶¹⁸ ⁶²⁰ ⁶²² ⁶²⁴ ⁶²⁶ ⁶²⁸ ⁶³⁰ ⁶³² ⁶³⁴ ⁶³⁶ ⁶³⁸ ⁶⁴⁰ ⁶⁴² ⁶⁴⁴ ⁶⁴⁶ ⁶⁴⁸ ⁶⁵⁰ ⁶⁵² ⁶⁵⁴ ⁶⁵⁶ ⁶⁵⁸ ⁶⁶⁰ ⁶⁶² ⁶⁶⁴ ⁶⁶⁶ ⁶⁶⁸ ⁶⁷⁰ ⁶⁷² ⁶⁷⁴ ⁶⁷⁶ ⁶⁷⁸ ⁶⁸⁰ ⁶⁸² ⁶⁸⁴ ⁶⁸⁶ ⁶⁸⁸ ⁶⁹⁰ ⁶⁹² ⁶⁹⁴ ⁶⁹⁶ ⁶⁹⁸ ⁷⁰⁰ ⁷⁰² ⁷⁰⁴ ⁷⁰⁶ ⁷⁰⁸ ⁷¹⁰ ⁷¹² ⁷¹⁴ ⁷¹⁶ ⁷¹⁸ ⁷²⁰ ⁷²² ⁷²⁴ ⁷²⁶ ⁷²⁸ ⁷³⁰ ⁷³² ⁷³⁴ ⁷³⁶ ⁷³⁸ ⁷⁴⁰ ⁷⁴² ⁷⁴⁴ ⁷⁴⁶ ⁷⁴⁸ ⁷⁵⁰ ⁷⁵² ⁷⁵⁴ ⁷⁵⁶ ⁷⁵⁸ ⁷⁶⁰ ⁷⁶² ⁷⁶⁴ ⁷⁶⁶ ⁷⁶⁸ ⁷⁷⁰ ⁷⁷² ⁷⁷⁴ ⁷⁷⁶ ⁷⁷⁸ ⁷⁸⁰ ⁷⁸² ⁷⁸⁴ ⁷⁸⁶ ⁷⁸⁸ ⁷⁹⁰ ⁷⁹² ⁷⁹⁴ ⁷⁹⁶ ⁷⁹⁸ ⁸⁰⁰ ⁸⁰² ⁸⁰⁴ ⁸⁰⁶ ⁸⁰⁸ ⁸¹⁰ ⁸¹² ⁸¹⁴ ⁸¹⁶ ⁸¹⁸ ⁸²⁰ ⁸²² ⁸²⁴ ⁸²⁶ ⁸²⁸ ⁸³⁰ ⁸³² ⁸³⁴ ⁸³⁶ ⁸³⁸ ⁸⁴⁰ ⁸⁴² ⁸⁴⁴ ⁸⁴⁶ ⁸⁴⁸ ⁸⁵⁰ ⁸⁵² ⁸⁵⁴ ⁸⁵⁶ ⁸⁵⁸ ⁸⁶⁰ ⁸⁶² ⁸⁶⁴ ⁸⁶⁶ ⁸⁶⁸ ⁸⁷⁰ ⁸⁷² ⁸⁷⁴ ⁸⁷⁶ ⁸⁷⁸ ⁸⁸⁰ ⁸⁸² ⁸⁸⁴ ⁸⁸⁶ ⁸⁸⁸ ⁸⁹⁰ ⁸⁹² ⁸⁹⁴ ⁸⁹⁶ ⁸⁹⁸ ⁹⁰⁰ ⁹⁰² ⁹⁰⁴ ⁹⁰⁶ ⁹⁰⁸ ⁹¹⁰ ⁹¹² ⁹¹⁴ ⁹¹⁶ ⁹¹⁸ ⁹²⁰ ⁹²² ⁹²⁴ ⁹²⁶ ⁹²⁸ ⁹³⁰ ⁹³² ⁹³⁴ ⁹³⁶ ⁹³⁸ ⁹⁴⁰ ⁹⁴² ⁹⁴⁴ ⁹⁴⁶ ⁹⁴⁸ ⁹⁵⁰ ⁹⁵² ⁹⁵⁴ ⁹⁵⁶ ⁹⁵⁸ ⁹⁶⁰ ⁹⁶² ⁹⁶⁴ ⁹⁶⁶ ⁹⁶⁸ ⁹⁷⁰ ⁹⁷² ⁹⁷⁴ ⁹⁷⁶ ⁹⁷⁸ ⁹⁸⁰ ⁹⁸² ⁹⁸⁴ ⁹⁸⁶ ⁹⁸⁸ ⁹⁹⁰ ⁹⁹² ⁹⁹⁴ ⁹⁹⁶ <

h = pupil to mouth distance, in a living man it is about 3 inches

which is a face at 8 feet yards is below about 1 to 100 etc. I take as the standard
 k = measured pupil to mouth of the smaller profile in inches
 d = distance of view when portraits are taken at distance d in inches
 $d = \frac{100 k}{h}$

h = height of head (in) in portrait

A portrait is assimilated to another when they are viewed at a distance d in dim light, or at δ in clear light (in inches)

r = ratio of just discernible interval in dim light to that in clear. It always exceeds 1. The greater that r is, the greater must be the ratio of δ to d . $\delta = rd$

The unit (linear) of scale of portraits $\times \frac{10}{\delta}$ is that which viewed at 10 inch w^d produces like effect.
Corrected scale = $\frac{10}{rd}$

Ex: $r = 2$ $d = 16$ corrected height of face $h_c =$
Corrected value of $h = \frac{10}{32} = 0.3125 \approx H$

Assume height of head-chin in living person to be ~~the same as~~ 9 inches.
and ordinary distance of recognition to be 900 inches (= 25 yards)

Then ~~the~~ a portrait 0.1 inch high viewed at 10 inches subtend
less angle as 9 at 900 inches when viewed at 10 inches

hence with example, the portrait must be of that size \times or be seen at $\frac{900}{10} = 90$ times the distance of ordinary recognition in order to appear alike.

Experiments during first week of May 1906 on test lines

The figures 7, 4, 2 on the height of 10 completely \equiv of black & white sectors in inches

So interval height of each couple is 0.07, 0.06, etc.

The distance at which they cease to be streaky is greater.
The first two experiments were not discarded

Experiment	Height of couple	Distance observed, inches	Height of couple	Distance observed, inches
	0.07	0.08	0.030	0.035
3 rd	30	43	51	54
4 th	30	38	48	58
5 th	27	31	36	50
6 th	34	45	47	57
4)	121	157	182	209
	30	40	45	52

distance	.020	.025	.030	.035	.040
30-					
40-					
50-					
60-					

Result .030 interval is just discernible at 45 inches

or 3 inches at 4500, or 1 at 1500

or 0.666 at 1000; 1.0 at 1000 (million) 3.4

0.666 at 1000 (million) 0.57 (million)

say, half a million is the smallest worth considering
= $\frac{1}{2000}$ at 10 inches.

May 15th Magnification of Pinner's opera glass
 " at 2.6 \times 1.0 = 2.6
 magnification with same = 0.385

Opera glass lenses	lenses	Objed at	Objed glass	x 0.385	x 2.6
Eye piece at	Objed glass at	Objed at	Objed glass		
Zero	6	11 $\frac{1}{2}$	5 $\frac{1}{2}$	2.1	13
	5	11 $\frac{1}{2}$	6 $\frac{1}{2}$	2.5	16
	4	12 $\frac{1}{2}$	8 $\frac{1}{2}$	3.4	22
	3	14 $\frac{1}{4}$	16 $\frac{1}{4}$	6.2	42
	2 $\frac{1}{2}$	out of room	in 36 feet that distant	13.8	
	2 $\frac{1}{8}$ about				

Board 36 inches by
 draw from 2nd \times 5 which will take to 6 feet distant at least
 sagittable at further
 noted by
 about 2 $\frac{1}{2}$
 13 $\frac{1}{8}$

Magnification at 6 about 2
 36 14

May 7

p. 17

Group portrait No. 25 same as above

Name	Vertex to chin mm	distance of marking brow & eyes	
		inches	mm
No 25	10	33 =	835
Small	8	32 =	800
No 25	8	35 =	815
Small	9	32 =	850

Probably, when chin to vertex = 1 centimetre, eyes & brow nearly
The result is fairly seen. In full front light
the nose hardly visible at all
Blue of face retains character in shape.

$$8:800 = 1:100 = 1 \text{ centimetre}$$

$$\Delta = d \times 2.6$$

$$d = \text{distance in mm}$$

$$\delta = d \frac{1}{2.6} = d \times 38.5$$

$$\delta = \frac{d}{2.5} = d \times 38.5$$

$$\Delta = d \times 2.6$$

$$2.5 \quad 2.6$$

$$5.2$$

$$7.8$$

$$10.4$$

$$13.0$$

$$15.6$$

$$18.2$$

$$20.8$$

$$23.4$$

$$26.0$$

$$28.6$$

$$31.2$$

$$33.8$$

$$36.4$$

$$39.0$$

$$1$$

$$2$$

$$3$$

$$4$$

$$5$$

$$6$$

$$7$$

$$8$$

$$9$$

$$10$$

$$11$$

$$12$$

$$13$$

$$14$$

$$15$$

$$16$$

$$17$$

$$18$$

$$19$$

$$20$$

$$21$$

$$22$$

$$23$$

$$24$$

$$25$$

$$26$$

$$27$$

$$28$$

$$29$$

$$30$$

$$31$$

$$32$$

$$33$$

$$34$$

$$35$$

$$36$$

$$37$$

$$38$$

$$39$$

$$40$$

$$1.5$$

$$3.0$$

$$4.5$$

$$6.0$$

$$7.5$$

$$9.0$$

$$10.5$$

$$12.0$$

$$13.5$$

$$15.0$$

$$16.5$$

$$18.0$$

$$19.5$$

$$21.0$$

$$22.5$$

$$24.0$$

$$25.5$$

$$27.0$$

$$28.5$$

$$30.0$$

$$31.5$$

$$33.0$$

$$34.5$$

$$36.0$$

$$37.5$$

$$39.0$$

$$40.5$$

$$42.0$$

$$43.5$$

$$45.0$$

$$46.5$$

$$48.0$$

$$49.5$$

$$51.0$$

$$52.5$$

$$54.0$$

distance to the nearest
point of glasses nearest to object

draw of glasses $\frac{1}{2} \times 2.5$
or 50.0

19.25

Range from 5 to 40

9 years 2 - 15.4

13.0 - 10.0

10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

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10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

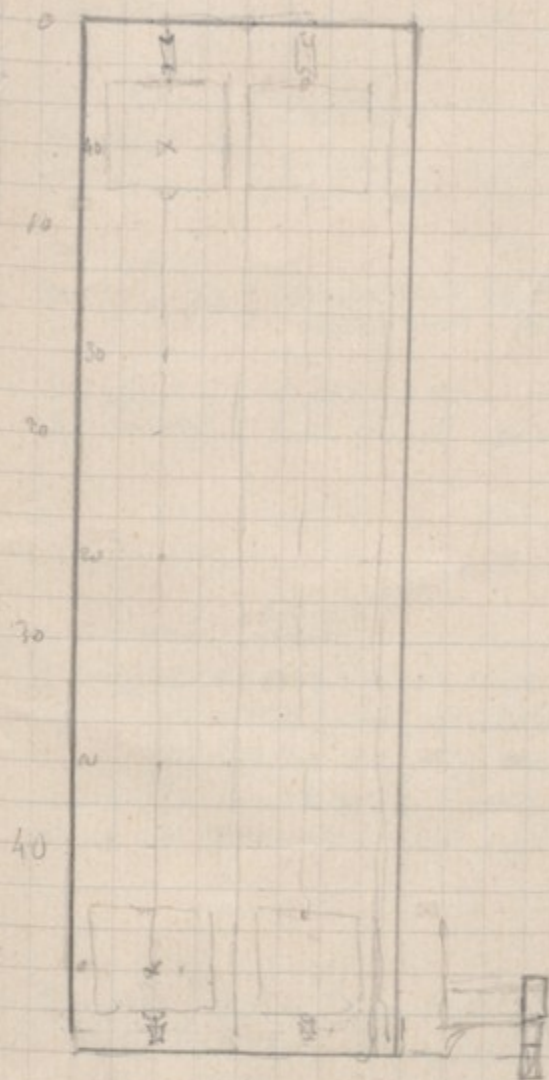
10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

10.0 - 10.0

1 square = 2 m.
Base board 50 x 16
clear run of 40 m.



Schuster family

1. E.H. Schuster } are mistakable for the same person in different aspects of
 2. his brother G.E. Schuster } $\frac{1}{2.6} \times \frac{.66}{78} \text{ inches} = 3.25 \text{ millirads}$ Pupil to mouth
in millirads
3.25 millirads
 the brothers are a characteristic.
 The others are not mistakable.

Norman Campbell family

3. Eldest sister } mistakable at $39 \times 2.6 \text{ inches} = 101 \text{ inches} = \frac{300}{101} = 2.98 \text{ millirads}$
 5. Youngest } Pupil to mouth .32 x .28, day .30
 1. Father } head alone at $39 \times 2.6 \text{ inches} = 101 \text{ inches} = \frac{330}{101} = 3.27 \text{ millirads}$
 5. Youngest son } Pupil to mouth .38 x .28, day .33
 2. } almost } at $39 \times 2.6 \text{ inches} = 101 \text{ inches} = \frac{300}{101} = 2.98 \text{ millirads}$
 4. } mistakable } Pupil to mouth .30 and .29, day .30

Ward family

- Wd-a } have some resemblance when seen closely, which does not
 Wd-b } increase but it is obvious, at a distance; they are hardly
 mistakable even at $44 \times 2.6 \text{ inches}$ - Pupil to mouth .29 in $\frac{290}{114.4} = 2.54 \text{ millirads}$
 Wd-e (48) } seem to be same person at different ages when seen
 Wd-f (.32) } but are not mistakable until $46 \times 2.6 = 119.6$ $\frac{480}{120} = 4.00 \text{ millirads}$

Symonds & A. Jones (in my collection of friends)

- Mudge Pupil to Mouth .33 } mistakable at $48 \text{ inch} \times 2.6 = 124.8$ $\frac{330}{125} = 2.64 \text{ millirads}$
 Catherine " " .32

Satterley family

- M. J. Sg. Son of Sg-a. P.E. .34 inch } close white face alone at $32 \times 2.6 \text{ inches}$ from first
 M. J. N. Sg. (son) " .24 " } $32 \times 2.6 = 83.2$; $\frac{340}{83.2} = 4.08 \text{ millirads}$
 as above a good picture
 M. J. Sg. Son } P.E. .13 } like you first distinguishing features
 M. J. N. Sg. (son) " .13 } $7 \times 2.6 = 18.2$; $\frac{130}{18.2} = 7.19 \text{ millirads}$

Continued next page.

Group portrait

Satterly family continued

millions
4.61

M2 S-y senior .12 } at 26 xda; $\frac{120}{26}$
 M1 S-y .11
 F. S-y (boy) .13

4.82

J. S-y senior .13 } at 27 xda; $\frac{130}{27}$
 H. S-y .10
 E. S-y .14
 J. S-y junior .12

J. S-y senior .13 } at $84 \times \frac{1}{2.6} = 32.3$; $\frac{130}{32.3} = 4.03$
 H. S-y .10
 E. S-y .14
 J. S-y .12
 C. S-y .12

J. S-y senior .13 } at $60 \times \frac{1}{2.6} = 23.1$; $\frac{130}{23.1} = 5.63$
 J. S-y junior .12

J. S-y junior .12 } at $65 \times \frac{1}{2.6} = 25.0$; $\frac{120}{25} = 4.80$
 M1 S-y .10

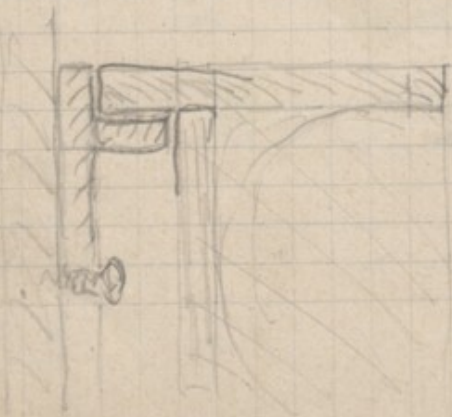
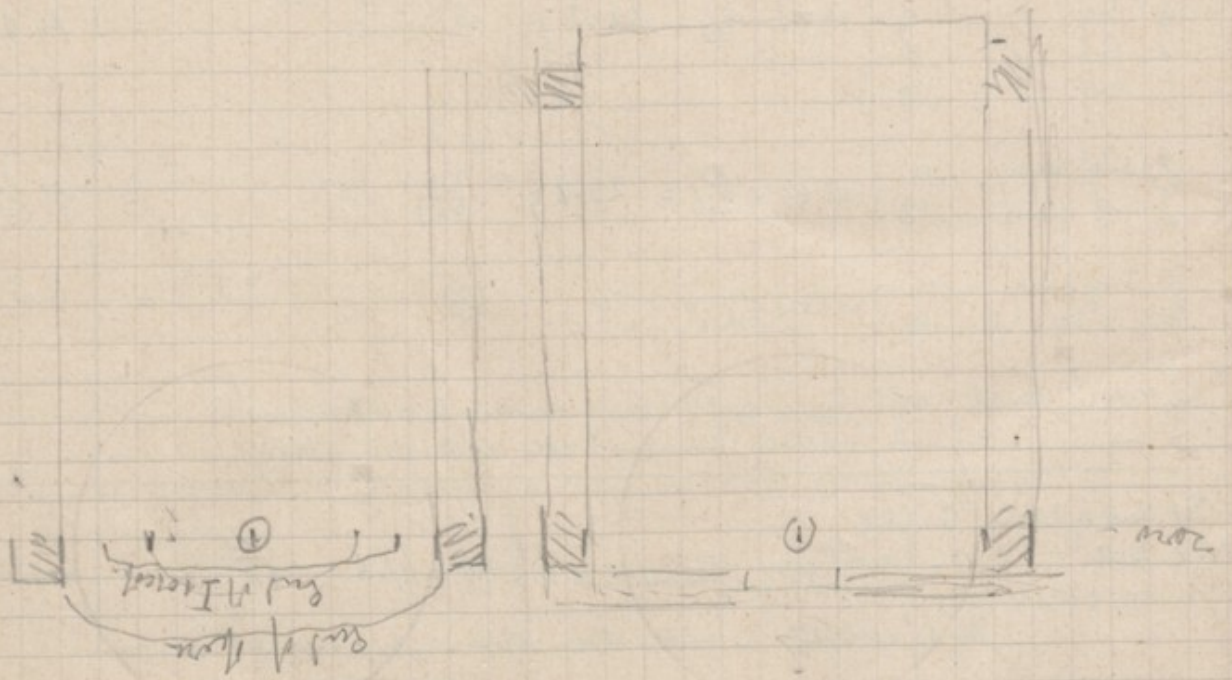
J. Satterly senior .35 } have a sort of likeness seen near, but it disappears at
 F. S-y .18 } a distance. He confirmed I nose with a partly to brown

Sets sent by Norman Campbell

N2 Mother .32 } marked eyes & nose } must be at $18 \times 2.6 = 67.6$; $\frac{320}{68} = 4.70$
 boy of 15 w. so .31 } not quite marked }
 They are much alike but scratching shows difference in eyes & somewhat in lower face

N2 Son a1 .32 } marked lower lips } pair surely distinctive
 Son b1 .30 } red chin } at $32 \times 2.6 = 83$; $\frac{320}{83} = 3.9$

Set T mother .18 } marked eyes & nose } pair surely distinctive
 son .20 } lower lip & below } at $94 \times 2.6 = 35$; $\frac{190}{35} = 5.4$



Norman Campbell

Set F

miVues

son 1	Fu .30	are mistakable at $32 \times 2.6 = 83.2$ inches	$\frac{300}{83}$	=	3.6
son 2	Fu .31	they are less like further off or nearer to			
Quint n? Mother?	Fu .26	mistakable at $34 \times 2.6 = 88.4$ inches	$\frac{230}{80}$	=	2.9
son 5	Fu .23	marked eye but from mistaking it 69 (mean = 80)			
Quint n? Mother?	Fu .26	Stronger wild eyes not well distinguished before $16 \times 2.6 = 42$	$\frac{260}{37}$	=	7.0
son 2	Fu .31	ditto by marked eye 32 (mean = 37)			
son 2	Fu .25	not nearly distinguished with anti- or near as	$\frac{250}{104}$	=	2.4
son 3	Fu .28	$40 \times 2.6 = 104$ from son 2			

Second attempt June 17 the above being hidden at various suit for the

Set F	PT Left hand	width	(x 2.6)		
son 1	PT Left hand	.30	33 inches, might be the same person differently set up = 85.8	$\frac{300}{85.8}$	= 3.5
son 2	PT Left hand	.31	the eyes are brown merge		
Quint n? Mother?	PT Left hand	.26	with 23×2.6 inches = 59.8	$\frac{2600}{59.8}$	= 4.3
son 5	" "	.23			
Quint n? Mother?	" "	.26		$\frac{3400}{702}$	= 4.8
son 2	" "	.31	at 27×2.6 inches = 70.2		
son 2	" "	.25		$\frac{2800}{83.2}$	= 3.4
son 3	" "	.28	$32 \times 2.6 = 83.2$	$\frac{2600}{80.6}$	= 3.2
			$31 \times 2.6 = 80.6$		

This attempt Set F

	depths to left hand	depths		
son 1	.30	omit. the letters in notation and not to really readable		
son 2	.31			
And a better?	.26			
dan 5	.23	$31 \times 2.6 = 80.6$	$\frac{2300}{80.6}$	2.9
And a better?	.26			
dan 2	.31	$42 \times 2.6 = 109$	$\frac{3100}{109}$	2.8
dan 2	.25			
dan 3	.28	$31 \times 2.6 = 80.6$	$\frac{2800}{80.6}$	3.5

June 29 1906 New instruments by Baker

Carotids killed. The Galilean magnifies 27 mm to 100 mm = 1 :
reversing it, it minifies 100 mm to

This won't do because magnification depends on distance from

20 black & white in an inch = 2 black & white : 100 mm $\% = \frac{2000}{m}$

value of m

value of x

19	95	9	222
18	111	8	250
17	118	7	286
16	125	6	334
15	134	5	399
14	143		
13	154		
12	167		
11	182		
10	200		

over

14.000 ft
25.000 ft
in air

dist

10	12.12
20	16.10x
30	19
40	22
50	23

20x
4.5 : 25.0 : 1 : x

$$x = \frac{25.0}{4.5} = 5.10$$

$$\frac{25}{5.3} = 4.7$$

$$\frac{23}{6} = 4.2$$

30x

lenses
Baker's Galilean
25mm scale
(occurs in field of lens)

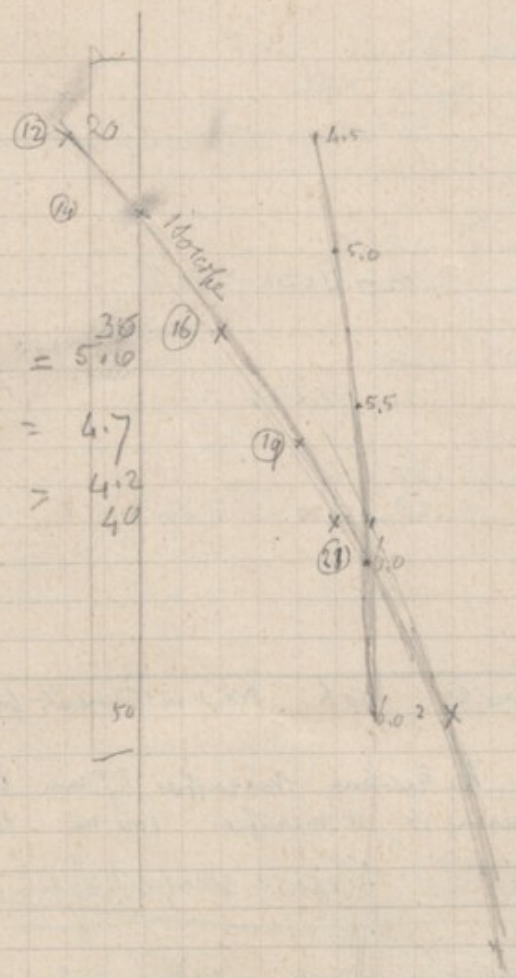
distance
in air

20	4.5	25.6
30	5.3	4.7
40	5.0x 6.0	4.2
50	6.10	4.2

magnification

for 1st

about 3.25



14.000 ft
25.000 ft
in air

10	12
20	16
30	19
40	22
50	23

Baker's Galilean
converging lens
5 mm in front of board

10	4.5
20	5.5
30	6.0
40	6.75

Baker's Galilean
Concave in front
5 mm in front of board

10	4.5
20	5.5
30	6.0
40	6.75

20 Black & white in y millimetres
= a millimetres : 100

$$20 : y :: a : 100$$

$$y = \frac{2000}{a}$$

Value of a y

100 20

150 13.3

200 10

250 8

300 6.7

350 5.7

400 5

450 4.4

500 4

550 3.6

600 3.3

650 3.1

700 2.9

750 2.7

800 2.5

850 2.4

900 2.2

1000 2

1200 1.7

1500 1.3

2000 1

2500 .8

3000 .7

3500 .6

4000 .5

4500 .4

5000 .4

5500 .4

6000 .3

6500 .3

7000 .3

7500 .3

8000 .3

8500 .3

9000 .3

9500 .3

10000 .3

10500 .3

11000 .3

11500 .3

12000 .3

12500 .3

13000 .3

13500 .3

14000 .3

100 20

150 13.3

200 10

250 8

300 6.7

350 5.7

400 5

450 4.4

500 4

550 3.6

600 3.3

650 3.1

700 2.9

750 2.7

800 2.5

850 2.4

900 2.2

1000 2

1200 1.7

1500 1.3

2000 1

2500 .8

3000 .7

3500 .6

4000 .5

4500 .4

5000 .4

5500 .4

6000 .3

6500 .3

7000 .3

7500 .3

8000 .3

8500 .3

9000 .3

9500 .3

10000 .3

10500 .3

11000 .3

11500 .3

12000 .3

12500 .3

13000 .3

13500 .3

14000 .3

a y

160 12.5

240 8.3

360 5.6

540 3.7

810 2.4

1200 1.6

1600 1.2

2400 .8

3600 .6

5400 .4

8100 .3

12000 .2

16000 .2

24000 .1

36000 .1

54000 .1

81000 .1

120000 .1

160000 .1

240000 .1

360000 .1

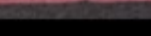
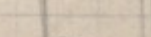
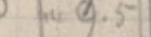
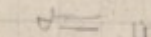
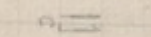
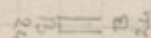
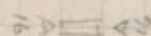
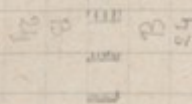
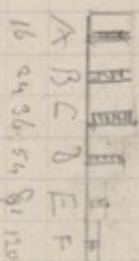
540000 .1

810000 .1

1200000 .1

1600000 .1

2400000 .1



P. 9000
Komet
Sach 2.5

$$\frac{9/25 \times 2.8}{70}$$

Nearest clear from Isosceles
of Baker's Gateless

6 1/2 inch
17 inches

Distance
in the

Magnification
Isosceles

Gabriel

10
20
30
40
50

25
16
12
10
8

4.5
5.5
6.0
6.75

Magnification
Calculation

1 20 20
3/4 30 10

Distance
in the

9
9.5
10

True distance
allowing for perspective

20 9.5
30 9.5
40 9.5

$$\frac{25}{9} = 2.7$$

meter & meter
meter & meter

39.37

.0254

= 25.4 millimeter

1 mm real length = 10 mm of apparent length

f. 23v

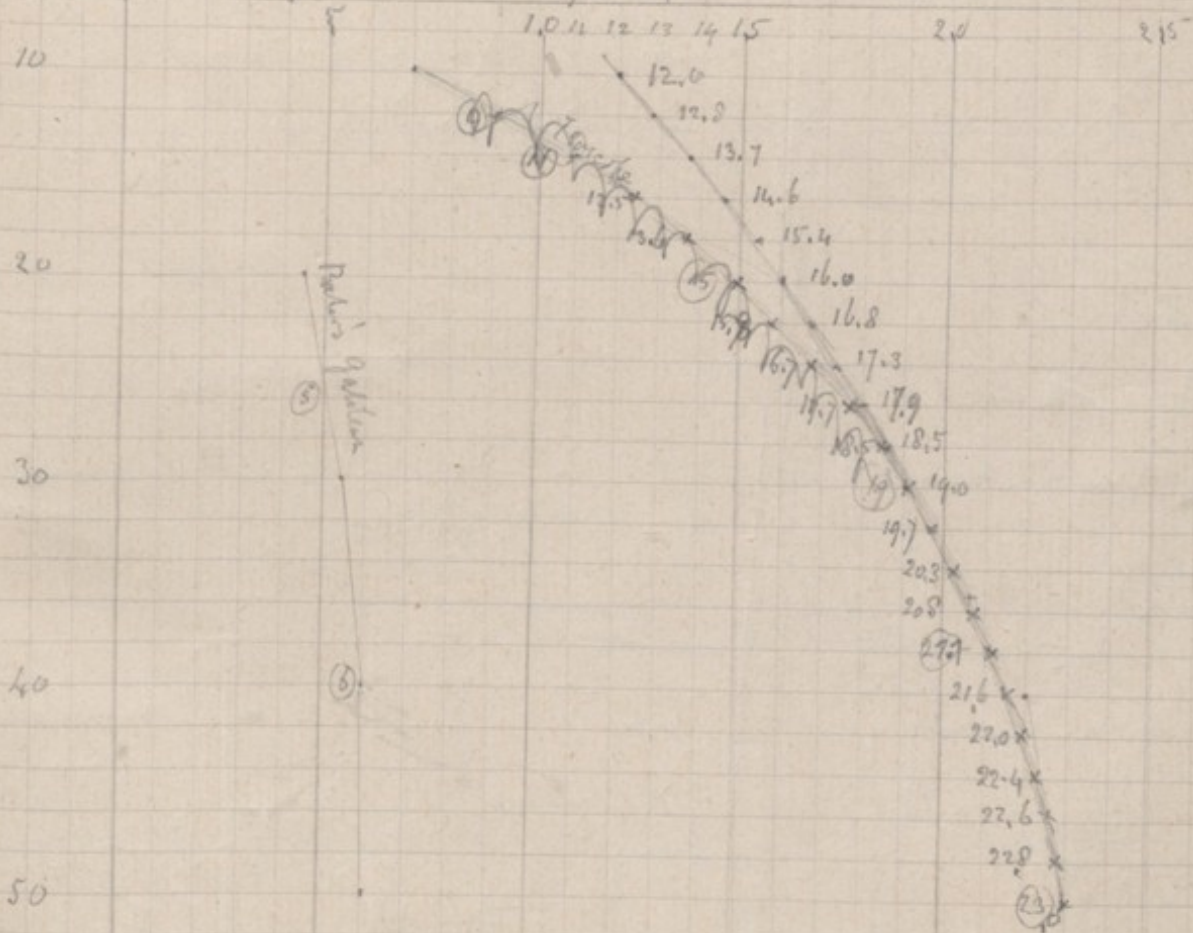
Muller
25 mm screen
distance
field of view

Isoscope

Baker's Galilean

distance from object to screen	25 mm apparent length at screen & distance	distance in millimeter	apparent length of 100 mm at screen & telescope	reciprocal screen & magnification	25 mm apparent length & telescope	100 mm apparent length	Magnification
10	12.0	25.4	48.0	2.08			
12	12.8	30.5	51.2	1.95			
14	13.7	35.6	54.8	1.82			
16	14.6	40.6	58.4	1.71			
18	15.4	45.7	61.6	1.62			
20	16.3	50.8	64.4	1.55	4.5	18.0	5.55
22	16.8	55.9	67.2	1.49			
24	17.3	61.0	69.2	1.45			
26	17.9	66.0	71.6	1.40			
28	18.5	71.1	74.0	1.35			
30	19.1	76.2	76.4	1.30	5.3	21.2	4.71
32	19.7	81.3	78.8	1.27			
34	20.3	86.4	81.2	1.23			
36	20.8	91.4	83.2	1.20			
38	21.2	96.5	84.8	1.18			
40	21.6	101.6	86.4	1.15	6.0	24.6	4.16
42	22.0	106.7	88.0	1.14			
44	22.4	111.8	89.6	1.11			
46	22.6	116.8	90.4	1.11			
48	22.8	121.9	91.2	1.11			
50	23.0	127.0	92.0	1.08	6.0	24.0	4.16

Distance on board from object glass to screen	Image of 25 on screen seen by naked eye		
	occurs at lengths as below in field of telescope		
	Horscope	Baker's Galilean direct	Baker's Galilean inverted
10	12	—	—
20	16	4.5	9.5
30	19	5.3	9.5
40	22	6.0	9.5
50	23	6.0	9.5



Left eye: 11) 18.5 mm, 12) 18.0 mm
 distance 42 mm = 1067 mm

F.24v

one card

Left portion of face Norman Campbell set 2. Two smaller faces registered on
 entire nose eyebrows upper lip down & ~~mouth~~ but not reaching the upper lip
 are indistinguishable at 42 inches with microscope, but there is a noticeable
 difference in interval between the eyebrows & eyelids.

$$\frac{42}{107} = .0393 = \text{chord } \theta \quad \frac{18.5}{107} = .0173 \quad \frac{18.0}{107} = .0168$$

They make a beautiful composite quite clear & really like to see

42 inches with microscope = 42×1.14 in reality = 47.88 in. ~~in reality~~

$$\frac{47.88}{107} = .0452 = \text{chord of } \theta \text{ where } 2 \sin \frac{\theta}{2} = .0452$$

$$\sin \frac{\theta}{2} = .0226 \quad \frac{\theta}{2} = 12.17' = 77\frac{1}{2}'$$

$$\theta = 155' (= 2.35')$$

~~18.5~~
~~18.0~~

~~18.2~~

18.2 when seen through microscope at 1070 mm = ~~18.2~~ $\times 1.14$ seen through naked eye
 = 20.6 mm

$$\frac{20.60}{1070} = .0193 = \text{chord of } \theta$$

$$\text{where } \sin \frac{1}{2}\theta = .00965 \quad \frac{1}{2}\theta = 33' \quad \theta = 66' \text{ inches}$$

in inches .32 at 42 inches

$$\frac{.32}{42} = .0076 \quad .32 \times 1.14 = .36$$

$$\frac{.36}{42} = .0086 = \text{chord of } \theta$$

$$\sin \frac{1}{2}\theta = .0043 \quad \frac{1}{2}\theta = 15' \quad \theta = 30'$$

.31 at 42 through microscope
 = really .3534 by naked eye

$$\frac{.35}{42} = .0084 = \text{chord } \theta$$

$$\sin \frac{1}{2}\theta = .0042 \quad \frac{1}{2}\theta = 14' \quad \theta = 29'$$

When 18.2 mm at 1070 through microscope
 = 20.7 through naked eye

$$\frac{20.7}{1070} = .0094 = \text{chord } \theta$$

$$\sin \frac{1}{2}\theta = .0097 \quad \frac{1}{2}\theta = 33\frac{1}{2}' \quad \theta = 67'$$

Resemblance

July 1906

(This succeeds the red book.)

and is succeeded by a light-blue book.



Distance from zero		Magnification		Minification	
inches	millimetres	by Isoscope	by Galilean (Baker's) from object glass choy	by Galilean reversed from concave glass	in cradle with the big glass & the half circle
10	254	2.08			
12	305	1.95			
14	356	1.82	6.2		1/4.2 with well focused.
16	406	1.71	5.7		
18	457	1.62	5.3		
20	508	1.55	5.0		1 1/3 2.0 so known 2.5
22	559	1.49	4.8		
24	610	1.44	4.6		
26	660	1.40	4.4		
28	711	1.35	4.3		
30	762	1.30	4.2		
32	813	1.27	4.2		
34	864	1.23	4.1		
36	914	1.20	4.0		
38	965	1.18	4.0		
40	1016	1.15	4.1		
42	1067	1.14			
44	1118	1.11			
46	1168	1.11			
48	1219	1.11			
50	1270	1.08	4.1		

Handwritten notes:
 a. 1/4.2 with well focused.
 1 1/3 2.0 so known 2.5
 10 1/4 1/2
 3.5 2.0 5.5 2.5



object

4.0

because of my apparatus.

Board length 5-feet acting length 14-inches less
width 8 1/2 inch

Isochrone focus of terminal glauc

Theran glass lenses range by kind.

length when used to distant objects 3 1/2 in.
in "near vision" point 4 in
length for distant objects 3 in
for near ones 5 1/2

So far as Resemblance depends on small details, it becomes lost at a distance

July 2 Norman Campbell set 2. two youths mounted on same card
 pupils & lip-porting (1) 8.5 mm 2(8.0) - aperture 8.2
 on scale of features.

They make a beautiful composite, equally like to either.

Making out the right & lower parts of the face, leaving the nose & down to but
 not including the upper lip, they are indistinguishable at 10.67 mm (= 42 inches)
 as seen through Isoscope

At the distance the magnification is 1.14, therefore the 8.2 is really 9.3
 $\frac{9.3}{1.07} = .0087$, the chord of θ or $2 \sin \frac{1}{2} \theta$ $\frac{1000 \text{ mm} \cdot .0087}{2} = 4.35$
 $.0043 = \sin \frac{1}{2} \theta$; $\frac{1}{2} \theta = 15'$; $\theta = 30'$ R
8.2

- 2 The measure of Resemblance is the number of minutes of a degree subtended
 by the facial unit, at the distance when the resemblance first occurs.
 1 The facial unit is the distance on a portrait between the line joining the pupils and
 the parting of the lips.

Isoscope at 28 inch & reversed Dole's Galilean at 12 shows image of about the same size
 a working length of 24 inches with 2.14 inches & 2.14 inches would do for portraits of usual size.

Measurement of Resemblance
 by ~~the~~ the hindrances to distant vision, which ~~are~~ ^{ascimate the objects.} ~~are~~ ^(are assemblage) ~~the difference between the objects.~~

Effects of distance

Brows, eyes & shadow below merge into one blur, but each blur is specially shaped
 Reunion of lips disappears
 lips & shadow below nose, which marks its termination, coalesce into a blur
 nose wrinkles disappear not deep folds & shadow

Contour of face is almost unaffected

The relative depths of shade & the shapes of the several blurs continue long to be distinguishable

Also the relations of these portions to the general contour

smile soon far

It is infrequently happens that distance increases the general effect of dissimilarity by destroying the
 smaller details of resemblance.

Grades of Resemblance (1) indistinguishable (2) cannot be ascribed with certainty to different persons
 3, strongly suggestion of another person.

July 14. Ward 2 women, $\frac{3}{4}$ faces A larger than B
face unit of A 8.5 mm of B 12.0

They resemble each other in respect to the contour of the whole face, which difference begins to appear when A is as near as 2.2 inches = 56.0 mm. Though of different type they can be compared at their slightly different distances, through the microscope, without disturbing the focus.

Magnification at (22 inch or) 56 mm is 1.5

$u = 8.5$; $mu = 1.5$; $d = 55$ $1000 mu/d = 27.3$
 $1000 mu = 1500$

$u = 8.5$; $m = 1.5$; $mu = 12.7$; $1000 mu = 12700$; $1000 mu/d = 22.7$ 13.3 $13.$

Ward 2 women one an old lady with white hair
face-unit of both 70 mm

both women - could not be seen very different persons differently dressed together at 1250 mm
 $m = 1.1$ so 70 is really 77 $1000 mu = 7700$ divided by $1250 = 6.16$ $B 16.2$
with reversed opera glass $u = 0.36$ so $mu = 2.52$; $mu = 2520$ $mu/d = \frac{2520}{500} = 5.04$ $A 5.0$

Norman Campbell set

2 girls A $u = 3.3$ breadth of face level 6.3 } section
B $u = 3.5$ } 7.0
are, if breadths be equal, $u = 3.3$ $u = 3.5$ $u = 3.3$ $u = 3.5$ $u = 3.3$ $u = 3.5$
magnification at 850 = 1.24; $u = 3.3$ $mu = 4.216$ $1000 mu = \frac{4216}{850} = 4.96$ $A 5.0$

Norman Campbell same set as before

1 girl Baraboo $u = 3.5$ } $u = 3.2$
1 boy brother $u = 3.2$ } $u = 3.2$
 $m = 1.22$ $mu = 4.48$ $1000 mu = 4480$ $1000 mu/d = 4.71$ $B 4.7$

Swanton curate & Jonathan Hibbard

2 girls sisters $u = 7.5$ They are much alike at first sight, but the differences are
obtrusive at a distance, where many details of resemblance disappear (features differ slightly)
They might be the same person differently hair-dressed & looking in rather different direction
as seen magnified by opera glass at 360 when the magnification is $1/4.8$
 $mu = 7.5 \times 4.8 = 1.56$ $mu \times 1000 = 1560$ $\frac{1560}{360} = 4.33$ $B 4.3$

Swanton as above

2 men brothers on unmounted photo - bending it reduced the breadth to the other's breadth
 $u = 3.5$ indistinguishable except by mustaches at 440 mm $m = 1.6$ $mu = 5.60$
 $\frac{1000 mu}{440} = \frac{5600}{440} = 12.7$ The photos are faint - more vigorous ones w. be better discriminated $AB 12.7$

An opera glass is directed to an object whose distance is not ~~the~~ much greater than its length —

(1) in the usual way with the large end forward

(2) ~~reversed~~ with the small end forward. ^{from the opera glass must} To find P be an ~~unknown~~ ^{known} point from which the distance ~~is~~ ^{is} measured, in order that the magnification ^{of the object} under condition (1) be m , the magnification under condition (2) shall be $\frac{1}{m}$.

Is the position of P the conjugate focus, with opera glass, of the object?

A Undistinguishable, like a perfect copy

a. ~~ditto~~ ^{except in} ~~allowing for such unessential~~ ^{and} as ~~it~~ ^{be assumed for action} as an actor will assume.

B Different in pose ^{most} but apparently the same person

b. ~~ditto~~ ^{but} ~~with~~ ^{very} different ~~non-essentials~~

Staunton (see last two) six women numbered; not a family group.

2 and 6 are alike to the near view chiefly in the eyes but less so as a distance. They can be distinguished at the extreme range of the Korschke

1 and 3 are less alike when near but indistinguishable through magnifying glass

at 3400 $u(1)u = 4.0$ $u(2)u = 4.0$
 $m = 1.08$ $mu = 24.8$ $1000 mu = 24800$ $\frac{24800}{3400} = 7.31$

July 18. Measurement of Resemblance ^{by least} distance of mutual
 unmistakability ^{by} faces. ^{see below}

Magnification at 3400 when carefully focused $8.5 \pm 2 = 4.2 \pm 1$

placed on the cradle as usual is

Revised. $\frac{1}{m} = 4.2$ $mu = 16.8$ $1000 mu = 16800$ $\frac{16800}{3400} = 4.94 AB$ 5

When 6 is sloped to same face width as 2 it is mistakable for 2 at 1250 mm with Korschke

the u of 6 = 4.0 mm; $m = 4.08$; $mu = 4.32$ $\frac{1000 mu}{1250} = \frac{4320}{1250} = 3.46$ AB 3 1/2

Barnard portrait relationship if any unknown

(1) & (2) might be the same person differently got up in hair & attitude when 1 is at 1270

u of (1) = 5.7 — (2) is smaller, & the head at quite square to line of sight.

$m = 1.08$ $mu = 6.156$ $\frac{1000 mu}{1270} = \frac{6156}{1270} = 4.85$ B 5

Two women sent to A.H. Mitchell

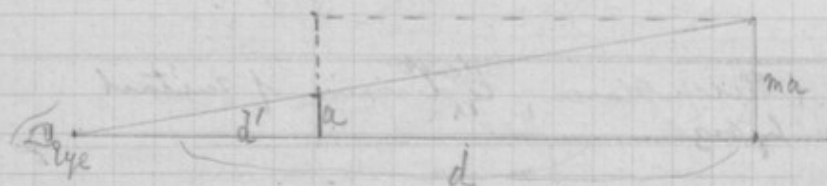
much rotated might be mistakable for same person at (8) at 1250 mm, they are faint.

u of (7) = 4.5 $m = 1.40$ $mu = 4.95$ $\frac{1000 mu}{1250} = \frac{4950}{1250} = 3.96$ B 4.

Measurement of Resemblance between two portraits, by
 the least distance at which either is unmistakable for the other
 on the scale.

unit of scale. $m = \text{magnification}$ $\frac{1}{m} =$
 indistinguishable like a perfect copy AA, ditto by all in essentials
 indistinguishable like perfect photo of the same face in different light & attitude B
 apparently the same but different, got up as for the stage and not up — C
 ditto in essentials

Complete features complete
 The larger part of them mostly major part.
 A small part of them minor part



Given m and d'

$$d : d' :: ma : a :: m : 1$$

$$d = m'd'$$

$$\text{Resemblance} = \frac{1000 \mu}{d} = \frac{1000 \mu}{m d'}$$

Perry code 2 brothers FCY & GCY on same card
 u (7th bigger) 3.0 mm, are indistinguishable with Aa complete at 900
 with 14 scope, $m = 1.2$, $mu = 3.6$, $\frac{1000 mu}{d} = \frac{3600}{900}$ mean distance

Aa 4

Perry code 3 brothers WGC¹, MO, & WGC² all like D
 white back to photo black back to photo

WGC-1) $u = 8.0$ Open recessed WGC-1, & WGC-2, wholly alike at 380 though one
 MO $u = 8.5$ is like a mirror reflection of the other & otherwise than at the ends
 WGC-2) $u = 8.0$ differ slightly $m = 4.1$, $mu = 2.0$, $\frac{1000 mu}{d} = \frac{2000}{380} = 5.27$

Aa 5

WGC-2, & MO (great resemblance except in dark part of hair) 540
 $m = 4.1$, $mu = 2.0$, $\frac{1000 mu}{d} = \frac{2000}{540} = 3.7$

Aa 4

Perry code 2 brothers S.SW & C.SW.

S.SW (the larger tail) $u = 9.5$ indistinguishable for C.SW at 800 mm
 $m = 4.5$; $mu = 2.11$; $\frac{1000 mu}{d} = \frac{2110}{800} = 2.64$ (the hair of S.SW is a little
 the darkest) AA 3
 I should have rated the resemblance closer.

All measurements henceforth to be made from the eye

Measurement of Permeance between two portraits, by the distances
 at which they become indistinguishable for one another & by their sizes.

Y an

10)

f. 5v

distia $\times 10^3$ (= constant) time scale & apparent scale in Opera reversed in 1901/2

10 +	Microscope		Opera Small finger		Microscope
	value of m 1/m	m	value of m		value of m
150	2.0	.50	.60		1.67
200	1.8	.56	.50		2.00
250	1.5	.67	.48		2.08
300	1.4	.71	.44		2.27
350	1.3	.77	.42	.40	2.38
400	1.25	.80	.40		2.50
450	1.20	.83	.39		2.56
500	1.17	.85	.385		2.59
550	1.15	.87	.38		2.63
600	1.13	.88			
650	1.125				
700	1.12	.89			
750	1.116				
800	1.114		.37		2.70
850	1.11	.90			
900	1.12				
950	1.13				
1000	1.14				
1050	1.15				
1100	1.16				
1150	1.17				
1200	1.18				
1250	1.19		.36		2.78
1300	1.20	.90			
1350	1.20				

Copies
4 ink

July 21. Schuster

(1) & (2) are brothers. one full face the other less than $\frac{3}{4}$ but comparable. They might be the same person when (1) is at 1200 distance. When nearer a distinction is clear. magnifying opera glass

$$u = 17, m = 0.36; mu = 6.12; \frac{1000 mu}{d} = \frac{6120}{1280} = 4.78 \text{ by } 5$$

(4) & (6) are father & son adults. They will be the same person at different ages, with difference in amount of hair as follows

$$N(4) \quad u = 9, d = 530, m = 0.38, mu = 2.60, \frac{1000 mu}{d} = \frac{2340}{530} = 4.43$$

$$\frac{1000 mu}{d} = \frac{3420}{530} = 6.45$$

$$\frac{23400}{530} = 4.43$$

Make pencil
drawing of face

	Mother	u	dan 2	u
	d through eye	ru	d through eye	ru
White of eyes just visible	550.37	2.59	620.37	2.40
eyebrows just ^{separately} separately at eye lid	730.37		700	2.60
eyebrows blur complete	900.37			
nose & mouth blur complete	950.37		930	
outline of face well defined	1020.37		1020	

Indices of discrimination & confusion

	Sum	Mean
White of eyes $\frac{25900}{550} = 4.71$	$\frac{24000}{620} = 3.87$	858
eyebrows just at eye lid $\frac{25900}{730} = 3.29$	$\frac{2400}{700} = 3.43$	672
eyebrows & eye lid complete blur $\frac{25900}{900} = 2.88$	$\frac{2400}{920} = 2.61$	131
nose & mouth blur complete $\frac{25900}{950} = 2.73$	$\frac{2400}{930} = 2.58$	89
outline of face well defined $\frac{25900}{1020} = 2.54$	$\frac{2400}{1020} = 2.35$	

Very Rough! then far

White of eyes about	4
eyebrows just at eye lid	3 1/2
complete blur	3 1/2
nose & mouth	2 1/2
outline of face clear	2 1/2

definite line
containing more a lot
2 is not true with accuracy

I = Indistinguishable M = Mischkalt

Aug 10, 1906

G_1 & Y	G_2 & Y	G_1 & G_2	
I 95 -	I 120 +	M 95 -	
I 1100	IM 125 +	IM 110 +	
I 85 -	IM 104 -	IM 110 +	
I 90 -	M 113 -	M 115 +	
M 80 -	I 120 +	I 120 +	
I 85 -	M 128 +	M 100 -	
M 98 -	M 127 +	M 120 +	
IM 75 -	M 140 +	M 135 +	
IM 75 -	M 140 +	M 123 +	
I 92 -	M 118 +	M 110 +	
875	1235	1138	
1135	1104	967	
2010	2339	2105	
100	1175	105.2	mean / 20

Thursday Aug 9 1906 - Brides Rd, Ockham, Surrey.
Started with new apparatus made by Baker

Test figures Eye fixed. Telescope project a small ^{relatively} as centre of turntable
No 1 just clearly visible at 43 ^{no attention to scale}

2		51
3	Experimental in room	65
4	not very clear light	73
5		82
6		92
7		98
8		100
9		119
10		137
11	class of extreme range	147

Norman Campbell set T. ^{G₁} Girl with much hair & a youth ^Y mounted on same card
also a young girl ^{unmounted}. ^{G₂}

G₁ facial unit 5.5. Y, $\alpha = 5.7$; G₂, $\alpha = 4.5$

Experiments were made as hitherto, as undistinguishable if hair and other accessories are ignored

G ₁ and Y		G ₂ and Y		G ₁ and G ₂	
85	- 20	106	- 4	90	- 4
120	+ 6	100	- 10	71	- 26
130	+ 16	109	- 1	87	- 10
110	- 4	100	- 10	100	+ 3
125	+ 11	90	- 20	100	+ 3
105	- 9	125	+ 15	78	- 19
120	+ 6	120	+ 10	108	+ 11
105	- 9	130	+ 20	130	+ 33
135 almost	21	120	+ 10	97	0
100	- 14	104	- 6	106	+ 9
113.5		110.4		96.7	
114		110		97	

^{since} I made a screen for background, and a shade for the eye; both important

Note hereafter whether resemblance amounts to M little to mistaken } appearing accessories in
out I indistinguishable } both cases

If accessories are considerable, note them

Continued on page 12 to end

Aug 10 continued from last page

3' series

f. 8r

G ₁ and Y		G ₂ and Y		G ₁ and G ₂	
I	95	I	120	M	95
I	100	IM	125	IM	110
I	85	IM	104	IM	110
I	90	M	113	M	115
M	80	I	120	IM	120
I	85	M	128	M	120
M	98	M	127	M	120
IM	75	M	140	M	135
IM	75	M	110	M	120
I	92	M	118	M	110
3' series	875		1235		1135
4' series	1135		1104		967

G₁ and Y were partially masked leaving visible the nose & the left side of the portrait visible with exception of forehead & lips. The difference between what was seen was then inappreciable at 10 inches except that the end of the eye brow of G₁ was less prolonged & straight than in Y.

Was not by help of a plate divided in squares, measure as well as describe the proportion of the face that must be masked out to secure I, IM, or M.

Aug 11. Norman Campbell sat 2. Mother & Dan 1. u of both 7.5 mm. Isoscope

Masked to show nothing above lower eyelids, nose, lips nor chin. The visible part being the full breadth of the face between. They might be indistinguishably be referred to the same person at 52 cm. Just a glimpse of one of the eyes / Dan 1. makes them distinguishably nearer; also a scrutiny of the cheeks shows slight diff. — They are less alike at 100 cm, and still less at 130 cm — By naked eye at 30 cm the diff. is disregarded.

Mother and Dan 3. treated similarly to the above & a likeness seen when seen dimly & at further off.

Sits with Opera Glasses. Family likeness in contour of face seen at 55 cm.

? 2 rolling of paper

f. 8v

R. Saphan
Sp. in made L. double
the images

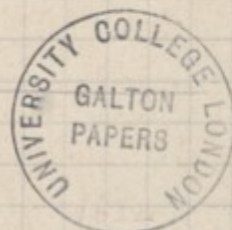


? Call it the middle-face, u = height of middle-face u
mouth

So the full head, from chin to vertex, is divided into 3 portions by the
two lines, namely that through the pupils & that through the lips which may
be briefly described as the upper middle & lower portions. It is the height of the
middle face that = u why not call it m , instead of u

Aug 13. Isoscope carefully focussed after each obs

Distance from eye	Isoscope	Concave
30	0.75	1.33
40	0.90	1.11
50	1.00 perfectly	1.00



Distance from eye	Isoscope	Concave
30	0.75	1.33
40	0.90	1.11
50	1.00 perfectly	1.00

Norman Campbell Set T. Margins and Blurs, through focussed Isoscope
all measurements in millimetres

	u	White of Eye just visible	Brow & Eyelids as blur	Nose - shadow & lips, blur.
Father	5.5	1550	1350	1550
Mother	5.5	900	1500	273
G.1.	5.5	990	1150	216
Y.1.	5.7	800	1100	193
G.2.	4.5	850	950	211
G.3.	5.0	900	1100	221

$1000 \frac{u}{d}$ = height in millimeters of facial unit at time of the blur
values of $1000 \frac{u}{d}$

	White of Eye just visible	Brow & Eyelids as blur	Lips blur with shadow of nose
Father	3.5	4.0	
Mother	6.0	3.6	
G.1.	5.5	4.8	
Y.1.	7.1	5.2	
G.2.	5.3	4.7	
G.3.	5.4	4.5	2.9

2 -	1 -	1 +
3 -	1 -	2
4 -	1 -	4
5 -	1 -	4
6 -	1 -	1
7 -	1 -	1

T. ...
 ...
 ...

1350	1350	1350
1200	1200	1200
1150	1150	1150
1100	1100	1100
1050	1050	1050
1000	1000	1000
950	950	950
900	900	900
850	850	850
800	800	800
750	750	750
700	700	700
650	650	650
600	600	600
550	550	550
500	500	500
450	450	450
400	400	400
350	350	350
300	300	300
250	250	250
200	200	200
150	150	150
100	100	100
50	50	50
0	0	0

...
 ...
 ...

1000	1000	1000
900	900	900
800	800	800
700	700	700
600	600	600
500	500	500
400	400	400
300	300	300
200	200	200
100	100	100
50	50	50
0	0	0

Aug 14.

f. 10r

Using screen & carefully focusing

Convergency

Distance meters	Ipsilateral	nasal eye	Ipsilateral	nasal eye
300	0.6	1	1	1.67
500	0.7	1	1	1.43
750	0.95	1	1	1.05
1000	practically 1.00	1	1	1.10

	Open eye	nasal eye	Open eye	nasal eye
300	3.5	10	1	0.4
300	3.1	10	1	0.32
500	3.0 ^{n3.1}	10	1	0.33
750	3.5	10	1	0.29
1000	3.4	10	1	0.29

Proportions of face in males				
See note back No 9	Vertex to chin	Vertex to lips	Lips to mouth	Mouth to chin
1	14.5	7.5	3.5	3.0
2	13.0	6.0	4.0	3.0
3	14.5	7.0	4.5	3.0
4	15.0	8.0	4.0	3.0
5	15.0	6.0	5.0	4.0
	72.0	34.5	21.0	16.0
	100.0	48	29	23
21	17.0	9.0	4.0	4.0
22	18.5	10.0	5.0	3.5
23	16.0	8.0	5.0	3.0
24	20.0	10.0	6.0	4.0
25	19.0	9.5	6.0	3.5
	90.5	46.5	26.0	18.0
	100.0	51	29	20
30	26.0	12.0	8.5	5.5
31	24.0	11.0	7.5	5.5
32	26.0	13.0	8.0	5.0
33	30.0	13.0	10.0	7.0
34	26.0	12.0	8.0	5.0
	132.0	61.0	44.0	28.0
	100.0	46.0	33.0	21.0
Sum of per cent	300.0	145	91	64
	100	48	30	22
Sample	10	5	3	2

From FRANCIS GALTON, 42, RUTLAND GATE, LONDON, S.W.

Ia

ao
fi bo i1
go co ho
do
eo

0.22
4.55

ar i2
go i ho
fi d h1
e1 e e1

Ib

ao
b1 h1
fo co io
g1 d1
eo

0.44
2.27

5 4 0
4 1 1 = 4

9/4 = 2.25

P. 11c

9/80 = 0.11

1/12 = 0.08

6 (Standard)

I 1.12

II 0.75

III 0.69

IV 0.75

ao
bo
fo go co ho io
do
eo

f2 ao i2
bo
co
do
g2 eo h2

g2 i2
b1 h1
co
g1 d1
f2 e2

a1 f2 g2
b1 h1
c1 co h1 io
d1 e1
e1 h2 i2

ao f4 g4
bo
co
do
eo h3 i3

Note: 1. The O are in all cases numerals, not letters.
2. The letters are in all cases Italics.

8/9 = .88

12/9 = 1.33

14/9 = 1.55

14/9 = 1.55

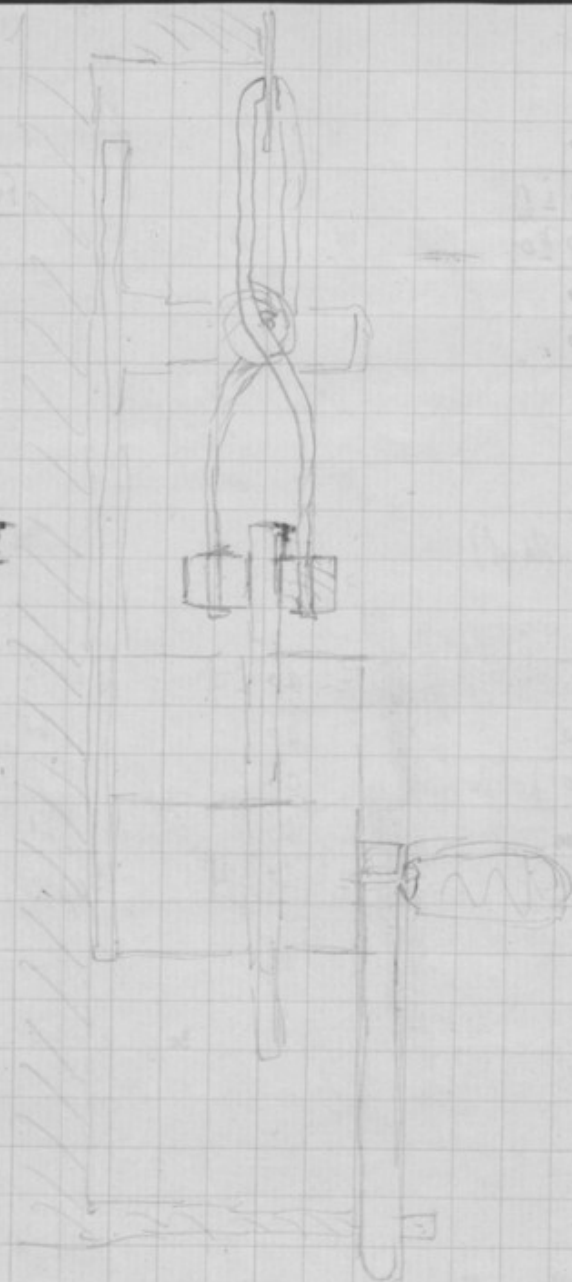
Diagram	No. of Block Squares	Displacements	Total	Unlikeliness (Total ÷ by 9)	Likelihood (reciprocal of unlikeliness)
6 (Standard)	9	in every case 0	0	0.00	absolute
1	9	5 cases of 0; 4 of 2	8	0.89	1.12
2	9	4 cases of 1; 4 of 2	12	1.33	0.75
3 2	9	5 cases of 1; 4 of 2	13	1.44	0.69
3 6	9	4 cases of 3, 2 of 4	14	1.56	0.64

III

III

II

C



Aug 20 1906

Descriptive letters, ^{used in} ~~for~~ the comparison of two portraits.

The portrait A is supposed to be compared with the portrait B, when B has been removed to such a distance from the observer as to equalise its apparent size with that of A.

The critical distance, d , of A from the observer, is that, ^{at which} it fulfils one or other of the following specified conditions

α . Discrimination between A and B becomes impossible

α Distinction between the persons represented by A & B becomes impossible if the pose of A be supposed changed to that of B, and if the light ^{falls} in the same way and the hair ^{be} similarly arranged.

β As above, with the further supposition that hair has been ^{added to} ~~removed~~ from the head, lips, or chin ^{of A or B}, and that ^{the} ~~the~~ ^{hair} depicts ^{the} ~~the~~ ^{color} of hair be altered ^{or wrinkles effaced}.

γ As above, with the further supposition that paint ^{has} ~~is~~ employed to alter the color the hair of A or B, to pencil the eyebrows of one of them, to efface wrinkles, or other marks.

This nomenclature may be limited to specified features as " α , but only for forehead, brows, and eyes" or " β , ignoring contour of cheeks & chin".

Compound letters may be used, as $\alpha-\beta$, $\alpha-\gamma$, $\beta-\gamma$. when needed.

The unit of scale, u , by which the picture ^A is measured, is the vertical distance between the middle of the line that joins the pupils, and the parting of the lips.

~~mouth. It is the measurement of the distance in terms of a~~
 $\frac{d}{u}$ is ^{the} measure of unlikeness, consequently $\frac{u}{d}$ is ^{the} measure of Resemblance, or of R.

Therefore Resemblance is expressed by some such formula as " R, α "; R, α for forehead brows & eyes; " R, β , ignoring contour of cheeks & chin".

Aug 21st Septum down to Instr^c

Sight 88 m. to the ground level	Natural Reading on scale	Noted by	Isoscope
400	320 ind.		0.62
500	420	0.58	0.60
600	520	0.60	0.66
700	620	0.70	0.70
800	720	0.70	0.75
900	820	largest last scale	0.78
1000	920		0.80
1100	1020		0.83
1200	1120		0.83
1300	1228		0.86
1400	1320		0.85
1500	1420		0.83

I found this
in bottle

* The eye hole is 80 mm to the back of zero
to the graduation and colored with D. 2. 1. 1. 1.

Corrected in zero	Open observed reading on the bottle	reversed Noted by	Plus reverse	scale
400	320	1.00	2.2	.45
500	420		2.5	.40
600	520		2.8	.36
800	720		3.0	.33
1000	920		3.1	.32
1200	1120		3.2	.32
1400	1328		3.2	.32

$\begin{array}{c|c|c|c|c|c} \text{N}_{\text{on}} & \text{N}_{\text{ed}} & & \text{R} & \text{d}_2 & \text{otherwise} \\ \hline \text{Satz 2} & 8 & 8.0 & \text{dus} & 1 & \\ \hline \text{Satz 2} & & & & & \\ \hline & \text{R} & \text{d}_2 & \text{qualit} & & \end{array}$

$\left\{ \begin{array}{l} \text{Satz 1} \\ \text{Satz 2} \end{array} \right. \begin{array}{l} 7.5 \\ 6.5 \end{array} \left| \begin{array}{l} 1/2 \\ 1 \end{array} \right. \begin{array}{l} 130 \\ 65 \end{array} \begin{array}{l} \text{A possibly bad} \\ \text{No - too many, small diff.} \\ 100 \text{ No} \\ 150 \text{ A accept} \end{array}$

$\begin{array}{l} \text{Satz 2}^* 6.5 \left| 1/2 \right. 130 \text{ A possibly} \\ \text{~ 1 } 7.5 \left| 1 \right. 65 \text{ no} \\ \phantom{\text{~ 1 } 7.5 \left| 1 \right.} 100 \text{ no} \\ \phantom{\text{~ 1 } 7.5 \left| 1 \right.} 150 \text{ A, accept} \end{array}$

Satz 2 6.5* Satz 1.75

1/2 130 A possibly

$$r=1$$

f. 15

47.5

45

40

35

$$\cos \theta =$$

0.95

0.9

0.8

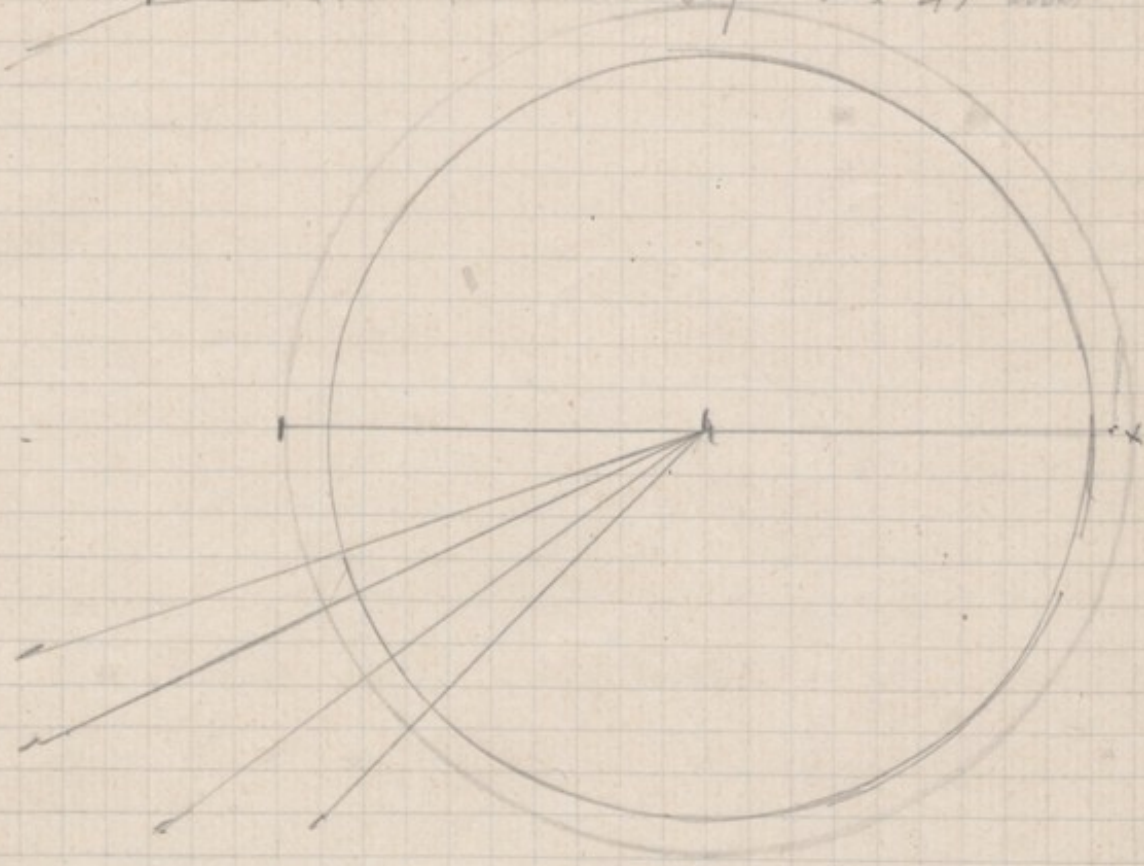
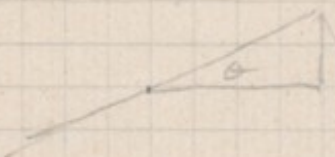
0.7

$$\theta = 18^\circ \text{ above}$$

$$\theta = 25^\circ \text{ above}$$

$$\theta = 36^\circ \text{ above}$$

$$\theta = 45^\circ \text{ above}$$





Light blue book
Aug 26 1906
This succeeds the Yellow Book.



$$I = \frac{100 \mu m}{d_c} \quad \left(= \frac{1000 \mu}{d} \right)$$

aa apparently the same portrait
copied or reduced.

-
- a to all appearance refers to same person
 - b mistakeable for same person, if hair
and dress were slightly altered.
 - c " if much altered, as for theatre.

intermediates a-b b-c can be used

$$\frac{1}{12} = 0.0833$$

f. 1b

for better & clear data as in f. 1a

Take the height of the human head, as 9 inch

Then the distance between x^2 & 10 gives the distance of the subject in inches

R inches feet inches to the nearest value of W

0.50	1800	150	16.0
0.75	1350	112	12.0
1.00	900	75	8.0
1.50	670	56	6.0
2.00	450	37	4.0
2.50	360	30	3.2
3.00	300	25	2.7
4.00	220	18	2.0
5.00	180	15	1.6

u = height of head, taken

between g inches = 22.5 inch

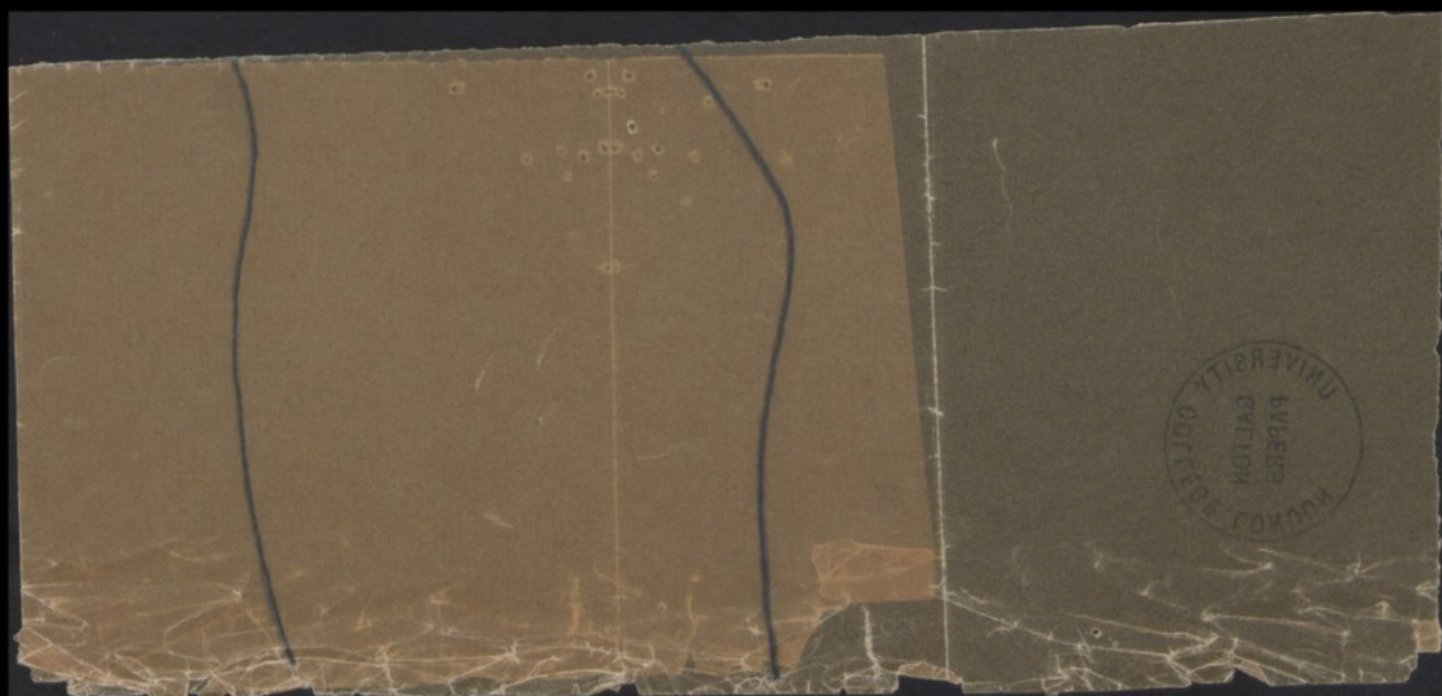
Distance

R nearest feet

If the height of the head be taken as the unit of scale and taken at the ordinary value of 9 inches = 22.5 inch, the distance of the subject from the observer will be as below

Distance from g in inches

R feet inches



wood at
20 yards
= 720 u
= 1440

Each hexagon must be
at $\frac{1}{1440}$ d

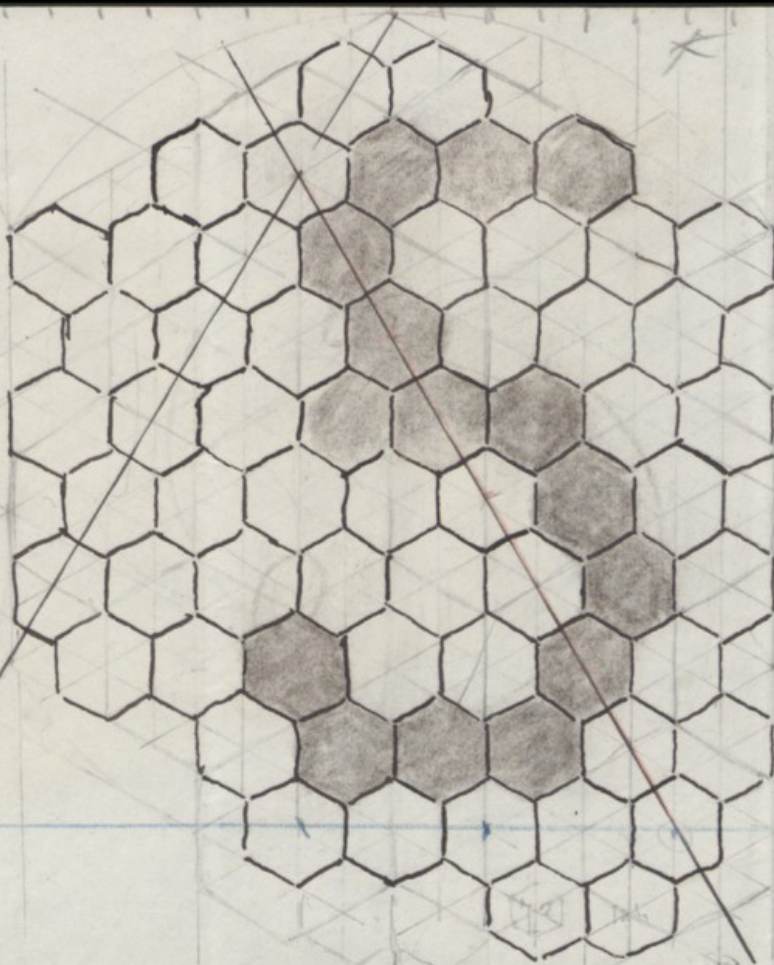
reducing at 10 m d = d

$\frac{1}{1440}$ day $\frac{1}{150}$

If hexagons are $\frac{5}{8}$ in

30 inches would

make 1 in of result





d = distance from Observer

u = vertical distance between the pupils in the portrait and the parting of the lips. d being large compared with u , the chord of the angle subtended by u , and indeed its sine and tangent also, are all practically identical with $\frac{u}{d}$, which is supposed to be proportional to the clearness of Resemblance.

The Index of Resemblance is taken as $1000 \frac{u}{d}$, in order to avoid many decimals.

It is convenient to measure u and d in different units, u in millimetres, d in centimetres; calling these respectively u_m and d_c , R becomes $100 \frac{u_m}{d_c}$.

Conversely, when R is given and d_c is required, $d_c = 100 \frac{u_m}{R}$.

Whenever d and u are measured by the same units, the tabular values must be multiplied by 10.

Corresponding distances from Observer of a man whose average sized face.

I	metres	feet
5.0	45	152
7.5	40	132
10.0	33	108
15.0	17	56
20.0	11	37
25.0	9	30
30.0	8	25
40.0	6	19
50.0	3.5	15

Distances from Observer, measured in centimetres, corresponding to various values of u , measured in millimetres, and to various values of I

I	values of u_m in millimetres									
Index of Resemblance	1	2	3	4	5	6	7	8	9	10
5.0	20	40	60	80	100	120	140	160	180	200
7.5	15	30	45	60	75	90	105	120	135	150
10.0	10	20	30	40	50	60	70	80	90	100
15.0	7	15	22	30	37	45	52	60	67	75
20.0	5	10	15	20	25	30	35	40	45	50
25.0	4	8	12	16	20	24	28	32	36	40
30.0	3	7	10	13	17	20	23	27	30	33
40.0	2	5	7	10	12	15	17	20	22	25
50.0	2	4	6	8	10	12	14	16	18	20

Aug 26 1906

f. 21 1

This begins with the latest revised method

Norman Campbell Set F. Farmer & his family

dan 1, $u = 7.0$; dan 2, $u = 6.5^*$

$$I = \frac{650}{140} = 4.64$$

1/2 130 disc A apparently
100 no defects too different
150 A certainly
accept 140 for R.A. if dan 1 and



dan 1, $u = 7.0^*$; dan 3, $u = 8.0$

$$I = \frac{700}{170} = 4.12$$

1/2 140 disc dan 1 showed t. 2 head A not quite
170 accept A
100 with not do even for C
accept 170 for $u = 7.0$ for R.A. for dan 1 & 3

mother $u = 7.0^*$; dan 2 $u =$

$$I = \frac{700}{140} = 5.0$$

1/2 140 disc Mother hair t. 2 darkened C (light not very good)
100 no too much facial w. be wadded - contour not the same
170 no - showing dan 2 improves but won't suffice
accept 140 for $u = 7.0$ for mother and dan R.C.

dan 3, $u = 8.0$; dan 4, $u = 6.5^*$

$$I = \frac{650}{150} = 4.33$$

1/2 130 disc A not quite, the greater openness of eyes of dan 4 distinguishes her
accept 150 for $u = 6.5$ for R.A. is a not good light.

dan 2, $u = 6.5^*$; dan 4, $u = 6.5^*$

$$I = \frac{650}{150} = 4.33$$

1/2 130 disc dan 4 eyes too open here might suffice for a-g
150 will do for a-g
accept 150 for $u = 6.5$ for R.A. - g not very good light.

dan 4, $u = 6.5^*$ and son 2, $u = 8.0$

$$I = \frac{650}{130} = 5.0$$

1/2 130 disc g. mustering t. dan 4 & darkens about eyes
100 no details are too different
accept 130 for $u = 6.5$ for R.A. & all very good light.

This set is continued next page 3

4.1
4.3
4.3
4.6
5.0
5.0
6/27.3
4.5

Values of $\frac{1}{2}$ a in set D.

units	4.5	4.0	4.5	4.5	4.5
Regular	2	6	7	8	9
5	2	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{2}$
6	$\frac{3}{4}$	—	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{1}{2}$
7	$\frac{3}{4}$	$1\frac{1}{2}$	—	$\frac{1}{2}$	$\frac{1}{2}$
8	$\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	—	$\frac{1}{2}$
9	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	—

$\times 5$ all ≤ 4.10

of 25 combinations 2×2

5 are natural pairs a real coral
as 2, 2, 6, 6, etc

5 are $1\frac{1}{2}$ — 7.5

6 " $\frac{3}{4}$ — 4.5

9 " $\frac{1}{2}$ — 4.5

$$\begin{array}{r} 25 \\ 25 \overline{) 15.5} \quad 0.62 \\ \underline{15.0} \\ 50 \end{array}$$

Average resemblance of them 4.62

The entire group gives 11^2 — 11 combinations
= 110 valid ones

to the mean of all countable resemblances = $\frac{15.5}{110} = .129$

for 13
corrected 1.3

Norman Campbell Set F. Continues

1.3

3

dan 5, $u=5.5$; ^{*}ton 3, $u=7.5$.

55

1/2 110 disc | would do - two need fairly needs
150 | would do at all
accept nothing

0

General remarks on the family Set F.

The contour of the face is alike in many - Storage shown; eyes in focus of them notably in an (aunt?) ton 2, and dan 4.

Some pairs of likenesses have been recorded above, or rather Set

whose average $R_a = 4.5$, two of which are a.

Their intensities vary between 4.1 and 5.0

(this for some in 1st 30 m. could be called)

Norman Campbell (Orchidation team) Set D. 11 faces.

they are dimly printed and compared a full light, u is usually 4.0 or 4.5

preliminary
1/2 20 disc 2, 6, 7, 8 Ra ~~identical~~ but all are faint.
1 40 disc 7 & 8 indistinguishable Ra, 2 nearly so, also 6
2 20 disc 7 & 6 nearly Ra not 2
3 10 disc all are distinguishable

1 1/2	30	7, 8, 6, Ra	the u of 7	8	6	9	2
			is 4.5	4.5	4.0	4.5	4.5

3/4 50 the above 2 and 6 all Ra, 9 is nearly so

1/2 70 9 falls out the above set

for general results see opposite page

5 cases of $R_a = 17.5$, 6 of 7.5, 9 of 5.0

mean ^aresemblance for all possible combinations of the 11 (excluding real pairs) = 1.3 ✓

Norman Campbell test T 9 faces of whom 3 are very young
 Father, Mother, dau 1, 2 & 3, son 1, Children Son 2, dau 4 & 5 -
 5.5 5.5 5.5 4.5 5.5 5.7 5.5

For $u=5$

1/3 150 Rg Mother, father, dau 2 son 1 dau 1 dau 3 in about this order

1/2 100 Rg Mother father dau 2 son 1 also dau 1 with much change of hair

3/4 75 Rb Mother & dau 2 — Rb Father & son 1 and dau 1 with much hair

1 50 see below dau 3 is not mistakable for any of the others though not unlike

assuming all to have $u=5$

	Father	Mother	dau 1	dau 2	son 1
Father	—	1.75	less than 0.50	0.75	0.75
Mother	1.75	—	less than 0.50	0.75	0.50
dau 1	0.75	—	—	less than 0.50	3.0
dau 2	0.75	0.75	less than 0.50	—	0.50
son 1	0.50	0.50	3.0	0.50	—

x 1/10

1 50 Father and Mother — dau 1 son 1 — 5.0

1 1/2 37 as above except dau 2 ^{accepted} 15.0

2 25 as above but Father Mother is framed, dau 1 son 1 confirmed 20.0

3 17 dau 1 & son 1 mistakable with different pose of lips 30.0

Sep 3 1906

Norman Campbell Set C 10 persons

No 2 & 3 both 4.0

R	cm	
1/2	80	rb but for different in altitude & judge well
3/4	60	rc

$$I = \frac{400}{80} = 5.0 \quad \text{accept then}$$

- NOT
2. - W.R.C
3. - Oxyley
7. - Amy Knutson
9. - R.G.C
10. - Mrs W.R.C.

f.5

7

No 9 & 10 4.5 & 4.0 respectively, say 4.0

1/2	80	rb decidedly allowing for sep & hair.
3/4	60	rc decidedly good
1	40	rc hardly, is a thick one
	50	rc good. — accept

$$I = \frac{400}{50} = 8.0 \quad \checkmark$$

No 7 and 9 both 4.5

1/2	90	r(a-b) they are of different sides a looking opposite ways but otherwise indistinguishable
1	45	r b some slight diff ^o perceivable
1 1/2	34	ditto
2.0	23	rg certainly say r(b-g)
3.0	15	r(b-g) accept

$$I = \frac{450}{15} = 30.0 \quad \checkmark$$

Norman Campbell from Set 2. Two youths on same card A & B, $u = 8.5$ or 8.0 maybe

1/2	160	ra
1	80	like but distinguishable
3/4	120	distinguishable in clear light perfectly
	140	just mistakable
	150	ditto

$$I = \frac{800}{160} = 5.0 \quad \checkmark$$

accept 1/2 for ra

Norman Campbell from Set 2 Mother & boy u of both 8.0

When all is marked except a slight show of lower eyelid & the upper lip & nose & but not showing the mouth the faces visible, namely nose & upper lip & adjacent cheek (the contours being marked) are indistinguishable even close at hand.

accept Partially rA at 25% Index of Resemblance = $\frac{800}{25} = 32.0$ or least

1/2	160	rg
3/4	120	rg if well set up
1	80	yes by a tour de force

the same as above

accept 100 for rg

$$I = \frac{800}{100} = 8.0 \quad \checkmark$$

Set 4/1906

f. 6r 9

Norman Campbell set 2 contours

Mother and dau 1 $u = 8.0$ for both (the dau is nearer 7.5)

$\frac{1}{2}$ 160 rg. the contours agree eyes & brows to brassmilitar - also hair

$\frac{3}{4}$ 120 hardly, might is

1 80 no

accept rc 140 $I = \frac{800}{140} = 5.7$

Wife 8.0 and dau 3, 7.0

$u = 7.0$
 $\frac{1}{2}$ 140 rc

160 not better

$* \frac{700}{25} = 28.0$

they are older & more cheek up & lower eyelid & down to upper lip. & might be in these respects rc at 25 $I = 28$ continued material

C. Haden 8.0 Harry Brooke 5.0

$u = 8.0$
 $\frac{1}{2}$ 160 r(b-c) beard only

$\frac{3}{4}$ 120 " diff^a in brows shows slightly

1 8.0 difference in brows shows to distinct

accept 100 with $u = 8.0$

$I = 8.0$ continuous = 8.0 meter

$I = \frac{800}{100} = 8.0$

Harry Brooke 5.0 Mrs W.A. Brown (nee Green, sister lady Taitton) 7.0

Mrs B is $\frac{3}{4}$ face & apparently is itself a narrow one, so H. Brooke is known 1.0, 8.5, 1.0 natural breadth

$u = 7.0$
 $\frac{1}{2}$ 140

like, but not mistakable

I not noticeable

I = nothing

Satterly Group C' 9 persons (C is the same on a smaller scale, with names)

J. Satterly the Father 3.5, J. Satterly Jun' 3' child 3.0 mm

$u = 3.0$

$\frac{300}{18} = 16.7$

1 very much alike certainly rc if the young face be made older or vice versa

2 $\frac{25}{18}$ " rc the jaw of the younger is less firm but might "get up" & the eyebrows begin to differ

accept 18 mm more might be given with a liberal c. $I = 15.8$

Satterly same group C' Mrs Satterly 2.5

Mrs. A. Satterly 2.75 accept 2.5

$\frac{1}{2}$ 50 rb

$\frac{250}{20} = 12.5$

1 35 r(b-c)

$\frac{1}{2}$ 18 r(b-c) with offset

accept 20 for r(b-c) $I = 12.5$

Satterly Group C' continued

F.7

11

Father and 2 Satterly both 2.5

$$\frac{250}{100} = 2.5 \checkmark$$

1/2 50 might be r-b but diff^{ce} of age is perceptible through
1/4 100 r-b only beard differs & that not noticeably at the distance
accept r-b 100 or I = 2.5

Mrs. N Satterly 3.0 H Satterly 2.75

accept 3.0

$$\frac{300}{20} = 15.0$$

1/2 60 r-b only the hair

1.0 30 r-b in color

2.0 15 r-b almost, the greater length of the growth; face begins to tell
accept 20 I

Mitchell 2 sisters both 4.5 One full one 3/4. The full one to be skewed

I d₂ the^{ce}
5.0 90 a they are faint

7.5 87 hardly a

10.0 45 no

accept 80

$$\frac{450}{80} = 5.6$$

Schuster

fa x fa both 8.0 mm

I d₂ 80

7.5 135 b

10.0 80 difference in color

110 perhaps

accept 120

$$\frac{800}{120} = 6.6$$

Schuster Edgson x Brown both 3/4

I above 4.0 / with reservations

B. might be the same person known close, but they are both much broader of

Bernard 2 men 5.5 and 3.0

5.5

$$\frac{550}{65} = 8.5 \checkmark$$

I d₂

7.5 82 a

10.0 55 hardly

accept 65

over

Staunton

Two sister 7.5

I d_a

5.0 150 b the younger drum shell than her legs less, accept $\frac{750}{150}$ 5.0 ✓
 7.5 112 distinguishable no

two members of same group, ad same family X 2 a 6 both 4.5

5.0 90 b possibly the face of b is broadest
 150 accept for b but hardly good enough
 $\frac{500}{150} = 3.3 \checkmark$
 There is a slight difference some notes which don't measure for the 1st
 It lies in the quality of the contour, & in the note.

Ward old lady (b) a young one (a) daughter both 7.5

I d_a
 5.0 150 b not very good, but will do.
 7.5 112 C accept C 112 I = 7.5 ✓
 10.0 75 no

247

Perry costs

E. J. and A. J. V. D. H. S.

both 4.5

5.0 90 almost a
 7.5 90 almost a
 10.0 45 almost a } accept 7.5 as almost a
 4.5 100 quite a accept I = 4.5
 The demarcation of face causes the "almost a"

Sister K. H. 2 & Sister G. H. 2

8.5 & 9.0

Whether a 2, a 3 or 4
it is hard to determine

10.0 85 nearly b
 150 b
 100 just b accept
 $I = \frac{900 \text{ or } 850}{100} = 8.5 \text{ say } \checkmark$

Sister M. Y. O. 5.5; brother M. O. 2 7.5

7.5
 3.0 250 about b then will do, I think
 I stood about 1 metre behind the instrument
 $\frac{750}{250} = 3.0 \checkmark$

Continued

Perry Coote continued

f.9 15

S' SW 9.0 brother of C. SW 5.5

they are at first sight hardly distinguishable held in the hand

9.0

200

2.5

a apple - thick mouthed which is hardly seen at 55

I. for a 16.4

ma-b 20.0 at least ? and more

$$\frac{900}{45} = 20$$

$$\frac{900}{55} = 16.4 \checkmark$$

OS 9.0 and AS 7.0 brother - sister

$$\frac{700}{200} = 3.5 \checkmark$$

3.5

200

b practically indistinguishable - the girls have the much looser hair
face is narrower still at that distance it is b

N.S 5.5 and AS 7.0 as above, sister

7.0

10.0

70

very fair a but N.S' eyes are more open

5.0

140

difference is more conspicuous. It peculiarities of H. eyes dominating

18.0

52

would do

accept 10.0 as a partial a regarding the eyes

Indices taken out then for Sep 7 1906

Sep 19 1906

f. 10

Natural portrait. ^{2nd} face from my tracing of Mrs B. P. & daughter
The first portrait is new.

05 5	05 5	01 5	00 6	02 5
15 4	15 5	10 6	10 6	12 5
24 6	25 5	20 5	21 4	22 6
34 5	35 6	30 5	31 5	32 6
44 5	45 6	40 4	42 6	45 4
54 4	41 1	53 6	43 8	55 6
03 6	55 4	05 6	54 2	00 4
13 5	05 6	15 5	55 5	10 4
23 5	10 5	25 4	50 5	20 5
33 4	20 5	34 6	51 5	30 5
42 5	35 6	44 5	52 5	40 4
52 4	45 5	54 4	53 5	50 4
01 5	54 6	03 6	04 6	00 4
11 4	04 5	13 5	15 4	10 4
20 6	13 5	22 5	25 5	20 4
30 5	23 4	31 6	35 5	30 5
45 6	32 5	41 4	45 5	40 5
55 6	42 5	50 6	55 6	50 5
	51 5		00 4	
			10 5	
			20 5	
			30 4	
			40 5	
			51 5	
			52 8	