Handwriting Assessment Battery for Adults

Training, Administration and Scoring Manual

Prepared by

Kathrine Faddy *BAppSc (Occupational Therapy) Honours*

School of Exercise & Health Sciences
The University of Western Sydney

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Purpose of this Document

The *Handwriting Assessment Battery for Adults* was developed by McCluskey and Lannin (2003), and used initially in a series of single case studies (unpublished). As no adult handwriting assessments existed, the *Handwriting Assessment Battery for Adults* addressed a practice gap. The *Handwriting Assessment Battery for Adults: Training and Administration Manual* is designed to accompany the *Handwriting Assessment Battery for Adults*, and was developed as part of an honours project completed at the University of Western Sydney in 2004.

This manual has been developed for use by novice and experienced clinicians in adult neurological rehabilitation. Although suitable for use with people after stroke, the *Handwriting Assessment Battery for Adults* was tested and developed initially for use with people affected by brain injury. This manual has been developed to increase the reliability of test administration and scoring by therapists.

The manual contains standardised administration instructions for three sections. Each section focuses on one of three functional aspects of handwriting and allows therapists to analyse a client's deficit area through the performance of handwriting tasks.

The training, administration and scoring manual for *the Handwriting Assessment Battery for Adults* provides therapists with quantifiable outcomes. The manual provides therapists with visual examples of correct and incorrect answers, to assist when scoring. Scoring tables increase the ease of marking by reducing calculation time.

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Enquiries

Dr Annie McCluskey
Senior Lecturer (Occupational Therapy)
Faculty of Health Sciences
The University of Sydney
Cumberland Campus (C42), Blg J
PO Box 170, Lidcombe NSW 1825
Australia

Email: a.mccluskey@usyd.edu.au

Ph: + 61 2 9351 9834

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Introduction

Handwriting is an occupational task involving speed and legibility. Poor handwriting can affect an individual's satisfaction, creativity and productivity in activities of daily living (Bonney, 1992; Feder, Majnemer, & Synnes, 2000). The ability to master this complex task is imperative, as handwriting is required for daily occupations, such as communicating messages and thoughts, taking notes, and filling out application forms. Slow or illegible handwriting can impact on a person's ability to fully express their knowledge and capabilities through written language (Cornhill & Case-Smith, 1996; Feder, Majnemer & Synnes, 2000).

Handwriting often needs to be retrained after an individual has sustained a stroke or brain injury. To establish the degree of difficulty a person has with their writing legibility or speed, a valid and reliable measurement tool should be employed. Until now, no reliable or valid assessment tool has been designed to specifically measure adult handwriting performance.

The Handwriting Assessment Battery for Adults

The *Handwriting Assessment Battery for Adults* has been designed to identify if an individual's handwriting difficulties are due to reduced speed, legibility or pen manipulation. The battery of tests are short and easy to administer, and focus on the motor components of handwriting. The *Handwriting Assessment Battery* is suitable for use with adults who have had a stroke or brain injury.

The *Handwriting Assessment Battery for Adults* combines subtests from the **Motor Assessment Scale** (Carr, Shepherd, Nordholm, & Lynne, 1985), **The Jebsen-Taylor Test of Hand Function** (Jebsen, Taylor, Trieschman, Trotter, & Howard, 1969), and the **Evaluation Tool of Children's Handwriting** (Amundson, 1995).

The **Motor Assessment Scale** (MAS) is relevant to everyday motor activities such as handwriting (Carr et al., 1985), and was designed for use with adults following stroke or brain injury. The test has established face, criterion-related, construct and content validity. The **MAS** also has acceptable reliability (inter-rater = .89-.99, intra-rater = .98, and test-retest = .87 – 1.00) when tested with people who have a brain impairment (Lannin, 2004; Poole & Whitney, 2001). The **MAS** consists of eight subscales, with three measuring upper limb performance.

Two subtests from the **MAS** Advanced Hand Activities subscale which test pen grasp, are used in the *Handwriting Assessment Battery for Adults*. These timed subtests, which take approximately five minutes to complete, involve (i) the participant drawing at least 10 horizontal lines on a page to stop at a vertical line in 20 seconds, and (ii) making rapid consecutive dots with a pen for 10 seconds (Carr et al., 1985). Each test

is performed three times and scored as either 'achieved' or 'not achieved', with the best performance recorded (Carr et al., 1985).

The Jebsen-Taylor Test of Hand Function assesses hand function using simulated activities of daily living (Jebsen et al., 1969). In contrast to most instruments used to measure activities of daily living, the **Jebsen-Taylor Test of Hand Function** rates the time taken by a client to accomplish tasks, rather than the amount of assistance required (Dittmar & Gresham, 1997). The test has been standardised for use with Australian and American populations with ages ranging from 16 to 90 years (Agnew & Maas, 1982; Jebsen et al., 1969) Test-retest reliability has been established (.006 - .99, $p<0.01$) when used with people with hand impairments (Jebsen et al., 1969). No published literature was found on inter-rater, intra-rater reliability or validity.

The original version of the **Jebsen-Taylor Test of Hand Function** consists of seven timed subtests (Jebsen et al., 1969) while the Australian version has eight subtests (Agnew & Maas, 1982). The Australian version contains an extra test (hand strength) which measured, with a Jamar dynamometer, and also provides six separate percentile norms for the ages 16 to 90 years (Agnew & Maas, 1982). The *Handwriting Assessment Battery for Adults with brain injury* uses the writing subtest of the **Jebsen-Taylor Test of Hand Function.** The writing subtest involves the timed copying of a sentence containing 24 letters that is of 3rd grade reading difficulty. One pre-written sentence is selected randomly from three sentences (Jebsen et al., 1969). The time taken to complete this task is used to measure functional ability (Jebsen et al., 1969).

The **Evaluation Tool of Children's Handwriting** (ETCH) (Amundson, 1995) measures the legibility and speed of a child's handwriting, in both manuscript **(ETCH-M)** and cursive **(ETCH-C)** forms of writing (Diekema, Deitz, & Amundson, 1998). The **ETCH** was designed to be used with

children aged six to nine, with mild developmental delay, learning disabilities, and mild neuromuscular impairments (Feder & Majnemer, 2003). The **ETCH-M** has acceptable reliability coefficients ranging from .77 for total letter legibility, and .63 for total numeral legibility (Diekema et al., 1998; Feder & Majnemer, 2003; Koziatek & Powell, 2002; Schneck, 1998; Sudsaward, Trombly, Henderson, & Tickle-Degnen, 2001). Content validity has been established for the **ETCH**. However other validity studies are yet to be carried out (Feder & Majnemer, 2003).

The **ETCH** contains seven cursive writing tasks, and six manuscript tasks (Amundson, 1995). The *Handwriting Assessment Battery for Adults* includes four of the 13 writing tasks of the **ETCH**. These four tasks include: (1) writing the alphabet in lower case; (2) writing the alphabet in upper case; (3) writing numbers one through to 12 from memory, and (4) sentence composition, where (a) letter and (b) word legibility are scored. Theses tasks evaluate letter, number, and sentence legibility. Each writing and number task is scored individually, with the overall aim of scoring to determine which letters and numbers the participant is able or unable to write legibly (Feder & Majnemer, 2003).

In summary, the *Handwriting Assessment Battery for Adults* incorporates two sub-tests from the **MAS**, one sub-test from the **Jebsen Taylor Test of hand Function** and five sub-tests from the **ETCH**, with some minor adaptations to the ETCH sub-tests for use with adults (Faddy, McCluskey & Lannin, 2008). **Section 1** (Pen Control and Manipulation) had perfect agreement for the line sub-test (kappa 1.0) and high agreement for the dot sub-test (kappa 0.80). **Section 2** (Writing Speed) had perfect agreement ($ICC_{2,1}$ 1.0). **Section 3** (Writing Legibility) showed high correlation for all five sub-tests ($ICC_{2,1}$ 0.71-0.83). A ceiling effect was evident in two of the legibility subtests. For more information on psychometric properties of the test, see a recent publication by Faddy and colleagues (2008).

Test Administration

Administration of the *Handwriting Assessment Battery for Adults* should occur with clients on an individual basis in a quiet environment. The *Handwriting Assessment Battery for Adults* takes approximately 15 – 20 minutes to administer. For standardisation purposes, the assessment should be administered in the booklet order. Before administering the *Handwriting Assessment Battery for Adults* the following materials are needed:

- Test Manual/Booklet
- Test Score Sheet (contained in Test Booklet)
- Writing Speed Sentence Cards
- Sharpened HB Pencil
- Pencil sharpener
- Eraser
- Stop Watch

The *Handwriting Assessment Battery for Adults* test booklet should be placed on the table in front of the client, face up, at the midline of the client's body. The client may move the booklet to a comfortable position in front of them. Administration of each of the subtests of the *Handwriting Assessment Battery for Adults* will now be described.

SECTION 1: PEN CONTROL AND MANIPULATION

Adapted from **The Motor Assessment Scale** (Carr et al., 1985)

MOTOR ASSESSMENT SCALE - HORIZONTAL LINE DRAWINGS

Task:

The client is instructed to draw at least 10 horizontal lines to stop at a vertical line. For the client to have achieved this task, they must have at least five horizontal lines touching the vertical lines on both sides of the page.

Procedure:

Give the client a sharpened HB pencil. State: **"In this task you need to draw at least 10 horizontal lines that begin and finish at the vertical lines in 20 seconds. At least five lines must touch and stop at the vertical line."**

Additional guidelines:

- Give the client a demonstration of drawing a horizontal lines. Then ask the client to perform one practice attempt.
- Give the client a cue to begin. Time from the moment they put the pencil on the paper. Stop the client from drawing once a 20 second time period has elapsed.
- The client can only score 'achieved' if they have drawn at least 10 lines, with five of those touching the vertical lines on both sides.
- If the client achieves this, do not continue any further attempts. If the client scores 'not achieved' for this task, they need to continue to the next attempt. They are given three attempts to score 'achieved'.

MOTOR ASSESSMENT SCALE - DOTS

Task:

The client is instructed to make rapid consecutive dots on a sheet of paper. A minimum of 10 dots needs to be recorded on the paper within 20 seconds for the client to have achieved this task.

Procedure:

Give the client a sharpened HB pencil. State: **"Holding a pencil, make rapid consecutive dots on a sheet of paper. You must do at least 2 dots a second for 5 seconds. You need to pick** the **pencil up and position it without assistance. You must hold the pencil for writing. You must make a dot not a stroke."**

Additional guidelines:

- Give the client a demonstration of making rapid consecutive dots on the client booklet. Explain that a dot is accepted but that a stroke is not. Then ask the client to perform one practice attempt.
- Time the client from the moment they put the pencil on the paper. Stop the client from drawing once a 5 second time period has elapsed.
- Score the best of three attempts.

SECTION 2: WRITING SPEED

Adapted from **THE JEBSEN-TAYLOR TEST OF HAND FUNCTION** (Jebsen et al., 1969)

THE JEBSEN-TAYLOR TEST OF HAND FUNCTION - WRITING SUBTEST

Task:

The writing subtest involves the timed copying of a sentence containing 24 letters, which is of third grade reading difficulty. A pre-written sentence is selected randomly from one of three sentences.

Sentences include:

- JOHN SAW THE RED TRUCK COMING
- FISH TAKE AIR OUT OF THE WATER
- THE OLD MAN SEEMED TO BE TIRED

Procedure:

Give the client a sharpened pencil. Place one of the three cards with a sentence on it face down in front of the client. Ask the client **"Take a pencil in your writing hand and arrange everything so that it is comfortable for you to write. There is a sentence on the other side of this card. When I say 'go' copy the sentence in writing not printing. Ready? Go"**

Additional Guidelines:

- The client is timed from when the card is turned over and the pencil touches the paper, until the client finishes the sentence.
- If the client prints, misses or misspells a word, the mistake should be pointed out, and the test item repeated using an alternative sentence. The first score is ignored and the score for the alternative sentence is used.

Scoring : See separate section on 'Scoring' (page 27)

Writing Speed Cards

These cards can be photocopied and cut out for assessment use.

FISH TAKE AIR OUT OF THE WATER

JOHN SAW THE RED TRUCK COMING

THE OLD MAN SEEMED TO BE TIRED

SECTION 3: WRITING LEGIBILITY

Adapted from **The Evaluation Tool Of Children's Handwriting** (Amundson, 1995)

EVALUATION TOOL OF CHILDRENS HANDWRITING (ETCH):

ADAPTED ALPHABET WRITING: LOWER-CASE AND UPPER-CASE LETTERS

Task:

In this task, the client is asked to write both lower and upper case letters in manuscript (printing) from memory.

Procedure:

Lower-Case Letters

Say: **'Starting here** (point to the beginning of the writing guidelines below the lower-case letters in the client's booklet) **write each of the alphabet letters separately in lower-case, starting with '*a*' and ending with 'z'. If you make a mistake on a letter you only get to erase it one time. If by chance you don't know how to write one of the letters, put a (.) like this in its place. Are you ready? Begin."** [If you wish to record time taken[1], start the stopwatch when the client begins writing, and stop the watch when they complete writing. Note the time in seconds].

Upper-Case Letters:

Say: **'Starting here** (point to the beginning of the writing guidelines below the upper-case letters in the clients booklet) **write each of the alphabet letters separately in upper-case, starting with *A* and ending with Z. Remember if you make a mistake on a letter you only get to erase it one time. If by chance you don't know how to write one of the letters, put a (.) like this in its place. Are you ready? You can begin**

[1] Recording the time taken to write letters is optional. For this reason there is no space on the recording form for time taken. Timing the test often causes writers to speed up their writing, as occurred in our study (Faddy et al, 2008). By focussing on speed, writing quality (legibility) may suffer. Remember that this is a test of writing legibility, not speed. Therefore, if you choose to keep a record of speed, remind the writer to write as legibly as they can, and that you already have a record of their writing speed.

here." [Again if you wish to keep a record of time taken, start the stopwatch when they begin writing and stop the watch when they have completed writing. Note the time in seconds].

Additional Guidelines:

- If the client does not understand the terms "lower" or "upper-case", explain that these terms mean "small letters" and "capital letters" respectively.
- If the client pauses for as long as 15 seconds before writing any of the letters of the alphabet, ask if he/she can state the first letter. If the client pauses again and is unable to start writing the first letter, write the letter '*a*' within the guidelines as a demonstration. Do the same with the '*A*' for the upper case letters if he/she is unable to write. Letters written by the examiner will be scored as illegible as the client was unable to write them from memory. Only write the beginning letter of the alphabet sequence if needed. Do not demonstrate any other lower or upper case letters.
- If the client is hesitant and unable to sequence the letters of the alphabet correctly, the examiner may verbally prompt the client twice on the same letter. Again, wait for about 15 seconds or until the client says that he/she doesn't know which letter comes next. For example, if the client has difficulty remembering the letter following 'j', the examiner would state 'k'. This letter could be repeated if the client failed to hear or recognise it after the first prompt.
- If the client writes a letter out of the alphabet sequence, or writes the letters incorrectly, make no comment.
- If the client has been verbally cued and states he/she doesn't know how to form the remaining letter of the alphabet or hesitates for about 15 seconds, tell him/her to place a dot for the

letter he/she does not know. Reassure him/her that it is okay to not know all of the letters.

- If the client makes a mistake on the letter twice and wants to erase it again, remind them that they only get to erase each letter one time, and to continue writing the alphabet.
- Only provide verbal directions, prompts and encouragement when needed.

NUMERAL WRITING

Task:

In this task the client is asked to write the numbers one through to 12 from memory.

Procedure:

Say: **"This time write the numbers 1 through to 12. Remember, if you make a mistake on a number you only get to erase it one time. You can begin writing here."** Point to the writing guidelines below 'Numeral Writing' in the client booklet. [[Again if you wish to keep a record of time taken, start the stopwatch when they begin writing and stop the watch when they have completed writing. Note the time in seconds].

Additional guidelines:

- The term 'numeral' refers to one-digit or two-digit numbers. Examples of one-digit numbers are 3,6,8. Two-digit numbers are 10,11,12.
- If the client does not remember the sequence of the numbers, and hesitates for at least 15 seconds, verbally cue the client of the next numeral to write. Again, two verbal prompts may be given per number.
- If the client hesitates after the verbal cue or does not know how to form the numeral, tell him/her to place a dot for each numeral he does not know.
- If the client writes a numeral out of sequence, or writes the letters incorrectly, make no comment.
- Again in this task, if the client makes a mistake twice on the same numeral and wants to erase, remind him/her that he/she only gets to erase each number once and needs to write the next numeral.

SENTENCE COMPOSITION

Task:

In this task the client is required to compose and write a sentence that contains at least five words.

Procedure:

State: **"This time you can make up a sentence you would like to write. Make sure the sentence has five or more words in it. I will give you a few seconds to think of the sentence and then you can write it down here."** Point to the writing lines below 'Sentence Composition' on the client booklet. **"If you don't know how to spell a word in the sentence, just do the best you can."** [Again if you wish to keep a record of time taken, start the stopwatch when they begin writing and stop the watch when they have completed writing. Note the time in seconds].

Additional guidelines:

- If the client has difficulty generating an idea for a sentence he/she may need assistance. Suggest a broad topic such as 'outdoor activities'. If he/she is unable to formulate an idea after the suggestions, narrow the subject matter to a more concrete occasion, animal, or person, such as 'today's lunch'. These suggestions may elicit the client's own ideas also.
- If ideas have been presented to enable the client to generate a sentence and he/she is still unable to do so, skip this task. Indicate this on the client booklet and score sheet. Do not formulate a sentence for the client.
- If the client asks for help spelling the word, remind him to spell the world the best he/she can. The client may not use a dictionary during the test administration.
- If the client is unable to form a certain letter, he/she can place a dot in the letters position.

- Again, if the client needs to erase he/she can only do so one time for each letter.
- If the clients' readings of his/her own sentence is different than it appears, ask him/her to read it one more time. After clarification, record the intended sentence in the client's booklet.

Scoring

This section will describe the scoring procedure for each of the subtests. Remember to place final scores on the Client's Score Sheet once scoring has been completed for each section.

PEN CONTROL AND MANIPULATION

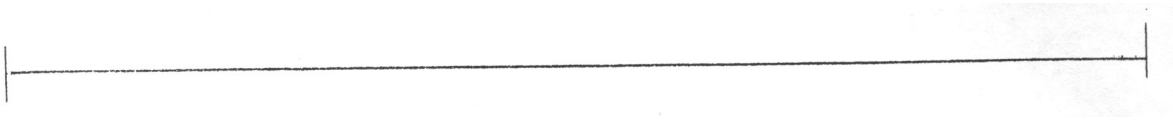
Adapted from **The Motor Assessment Scale** (Carr et al., 1985)

It is recommended that before an examiner is deemed competent at scoring, that they complete and practice scoring a minimum of six tests (Carr et al., 1985).

ADVANCED HAND ACTIVITIES - HORIZONTAL LINE DRAWINGS

- For a client to have *achieved* this task, they must have drawn *at least 10 lines with five of these horizontal lines* touching the vertical lines at either side of the page within 20 seconds.
- A client has *not achieved* the task if they have drawn *less than five of the 10 horizontal lines* touching the vertical lines on the page.
- Rate each of the three attempts as either 'achieved' or 'not achieved'
- Score the best attempt of three attempts on the client's score sheet.

Examples of *Acceptable* Horizontal Lines

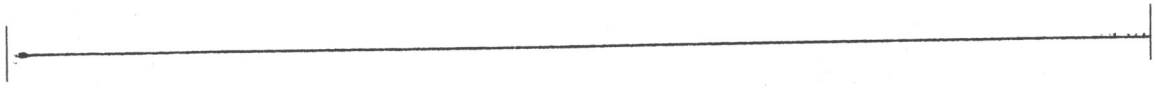


The lines touch on both sides of the vertical line

The line touches on the left vertical line and is less than approx. two millimetres over on the right side

The line touches on the left vertical line and is less than approx. two millimetres under on the right side

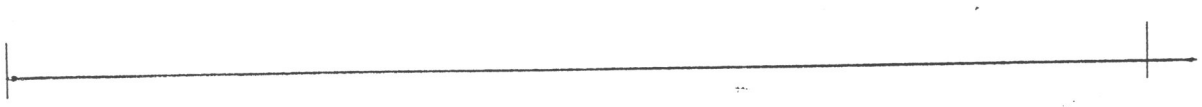
The line is less than two millimetres over on the left side and touches on the right vertical line



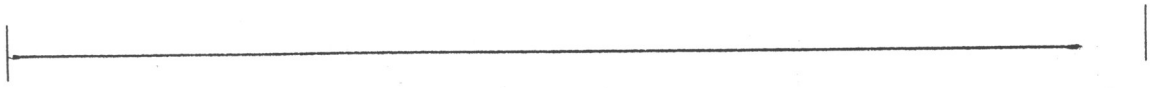
The line is less than two millimetres under on the left side and touches on the right vertical line

Examples of *Unacceptable* Horizontal Lines

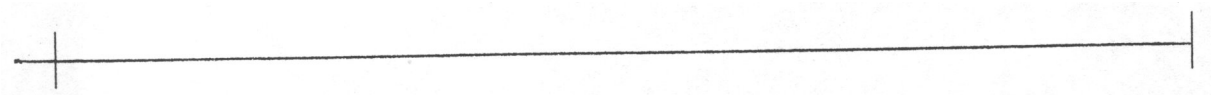
The lines do not touch on either side of the vertical line



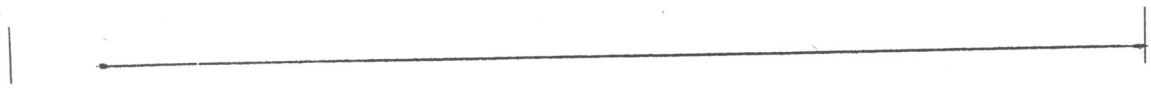
The line touches on the left vertical line but is more than two millimetres over on the right side



The line touches on the left vertical line and is more than two millimetres under on the right side



The line is more than two millimetres over on the left side and touches on the right vertical line

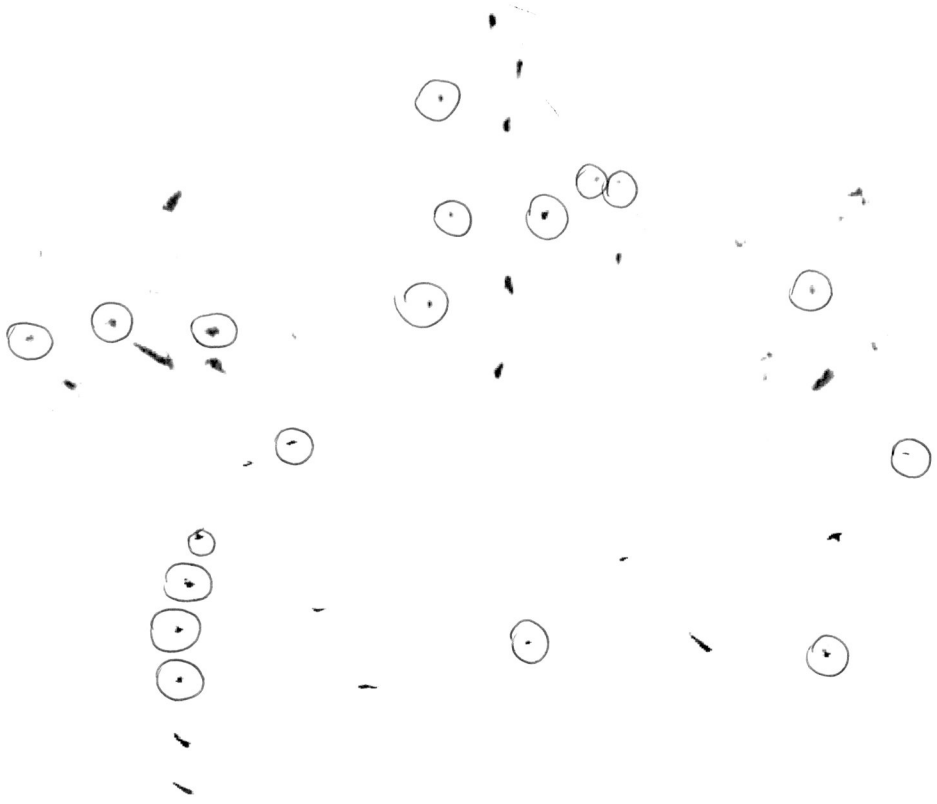


The line is more than two millimetres under on the left side and touches on the right vertical line

ADVANCED HAND ACTIVITIES – DOTS

- For a client to have *achieved* this task, a *minimum of 10 dots* needs to be recorded on the paper within 20 seconds.
- A client has *not achieved* the task if they:
    - *Draw a stroke* and not a dot or
    - *Draw a dot with a tail/stroke attached* or
    - *Draw less than 10 dots* on the page
- Rate each of the three attempts as either 'achieved' or 'not achieved'.
- Score the best attempt of three attempts on the Clients score sheet. Therefore, if the client scores 'not achieved' for Attempt 1, 'not achieved' for Attempt 2, and 'achieved' for Attempt 3, the overall score would be achieved.

Examples of *Acceptable* dots are circled. Anything not circled is considered to be *Unacceptable*.



WRITING SPEED

Adapted from **THE JEBSEN-TAYLOR TEST OF HAND FUNCTION** (Jebsen et al., 1969)

- The Speed Writing Score is calculated from the amount of time taken by the client to complete the copying of one of four sentences.
- If the client prints or misspells a word, the mistake should be pointed out and the test item repeated using an alternative sentence. The first score is ignored and the score for the alternative sentence is used.
- This score is then compared with normative data and the client is then placed within a percentile band.

Table 1: Mean Times and Standard Deviations (in Seconds) for Writing Subtest

	Male		Female	
Age	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
20 – 59	12.2s	± 3.5s	11.7s	± 2.1s
60 - 94	19.5s	± 7.5s	16.7s	± 4.7s

Interpretation (see also page 27): If a person's writing speed is slower than the average (mean) or their age group, plus or minus the standard deviation, they may benefit from rehabilitation. For example, a 78 year old man scores 39 seconds. For his age group, the mean speed if 19.5 seconds ± 7.5 seconds (range 22 to 28 seconds). His writing speed is lower than other mean of his age, indicating a performance problem which may benefit from rehabilitation.

WRITING LEGIBILITY

Adapted from **The Evaluation Tool Of Children's Handwriting** (Amundson, 1995)

Scoring of the written alphabet letters may occur during or at the completion of the testing session. However it is recommended that you score the assessment after the testing has ceased.

ALPHABET WRITING: LOWER-CASE AND UPPER-CASE LETTERS

Calculating Letter Legibility

To calculate the percentage of letter legibility, follow the steps below:

- Total the number of illegible letters. Letters are considered illegible if the client omits a letter, is unable or refuses to write a letter, erases the same letter twice, or writes an unreadable letter.

LOWER CASE LETTERS ARE ILLEGIBLE WHEN:

1. It is not easily and quickly recognised *out of context at first glance;*
2. It is poorly formed, distorted, reversed, or greatly rotated;
3. All of the descender is on or above the writing baseline;
4. It has additional, extraneous parts and/or dark writings over poor erasures;
5. Parts are omitted, improperly closed or improperly crossed. Exceptions include letters that are unmistakeable as the intended letter and where the unclosed space is < 0.5mm
6. Letters are joined, share the same part, or overlap to form individual letters;
7. It is confused with another letter or numeral
8. It is confused for a group of letters or numerals;
9. The entire letter is omitted or misplaced in sequence;
10. Upper case letter is written when lower case letter is requested *(EXCEPTION: When lower-case and upper-case letters have similar letter forms [c,k,o,s,u,v,w,x,z] and are only differentiated by spacing and size within writing guidelines. Letters with descenders [g,j,p,y] do not fall in this category.)*
11. For visual examples of legible (Table 2 on pages 28-29) and illegible lower case letters (Table 3 on pages 30-32).

UPPER CASE LETTERS ARE ILLEGIBLE WHEN:

1. It is not easily and quickly recognised *out of context at first glance;*
2. It is poorly formed, distorted, reversed, or greatly rotated;
3. It has additional, extraneous parts and/or dark writings over poor erasures;
4. Parts are omitted, insufficiently closed or improperly crossed;

5. Letters are joined, share the same part, or overlap to form individual letters;
6. It is confused with another letter or numeral
7. It is confused for a group of letters or numerals;
8. The entire letter is omitted or misplaced in sequence;
9. Lower case letter is written when upper case letter is requested *(EXCEPTION: When lower-case and upper-case letters have similar letter forms [c,k,o,s,u,v,w,x,z] and are only differentiated by spacing and size within writing guidelines. Letters with descenders [g,j,p,y] do not fall in this category.)*
10. For visual examples of legible (Table 4 on pages 33-34) and illegible upper case letters (Table 5 on pages 35-37).

- Obtain the number of illegible letters by subtracting the number of illegible letters from the total number of possible letters (26) and record the number in the LEGIBLE box on the score sheet. Even if the client forgets to write all 26 letters, the total possible number of letters remains 26.

$$\textit{Total Letter Legibility: \%} = \frac{26 - \#\ \textit{illegible total}}{26}$$

- To convert the number of legible letters to the percentage of letter legibility use Table 5: Alphabet Writing. Enter the correct legibility percentage score into the client's scoresheet.

NUMERAL WRITING

Number Writing Legibility

Scoring can occur during and/or after test administration. The focus in this task is the readability of the numerals using the scoring guidelines and criteria. Use the same scoring procedures as in Alphabet writing for verbal prompts, omitted or unacquired letter, and erasures. Legibility components addressed include number formation, size, horizontal alignment, and spacing. Letter case does not apply to numeral writing.

Calculating Numeral Legibility:

- Total the number of illegible numerals. Numbers are considered illegible if the client omits a number, is unable or refuses to write a number, erases the same number twice, or writes an unreadable number.

NUMERALS ARE ILLEGIBLE WHEN:

1. It is not easily and quickly recognised *out of context at first glance;*
2. It is poorly formed, distorted, reversed, or greatly rotated;
3. It has additional, extraneous parts and/or dark writings over poor erasures;
4. Parts are omitted, improperly closed or improperly crossed;
5. Numerals are joined, share the same part, or overlap to form individual numbers;
6. It is confused with another letter or numeral
7. It is confused for a group of letters or numerals;
8. The entire numeral is omitted or misplaced in sequence;
9. See Table 7 (page 38) for a visual example of legible and Table 8 (page 39) illegible numbers

- Obtain the number of illegible numbers by subtracting the number of illegible numbers from the total number of possible numbers (12) and record the number in the LEGIBLE box on the score sheet. Even if the client forgets to write all 12 numbers, the total possible number of numbers remains 12.

$$\textit{Total Numeral Legibility: \%} = \frac{\textit{12 - \# illegible total}}{\textit{12}}$$

- To convert the number of legible numerals to the percentage of number legibility use Table 3: Numeral Writing. Enter the correct legibility percentage score into the Numeral Legibility box in the Client's score sheet.

SENTENCE COMPOSITION

Letter legibility for sentence composition is determined using the same scoring procedure for letters.

Word Legibility:

To compute the percentage of word legibility, follow these steps.

1. Total the number of intended words, and record in the 'total possible word' box for sentence composition. If the client intended to write five words, but only wrote three words, write five in the box.
2. Count the number of illegible words.
3. Subtract the number of illegible words from the total number of intended/possible words, and record the amount in the "attained word legible" box.
4. Divide the number of legible (obtained) words by the number of total (intended/possible) words and multiply by 100% to yield the "percentage of legible words" (See formula below).

$$\textit{Word Legibility} = \frac{\textit{correct words}}{\textit{total words}} \times 100$$

$$\textit{Letter Legibility} = \frac{\textit{correct letters}}{\textit{total letters}} \times 100$$

5. Record the percentage in the percentage box in the word legibility section for sentence composition.

Once legibility is decided for words and letters, percentages are then computed by hand.

Writing Speed

Writing speed is recorded on the scoring grid for Alphabet, Numeral writing, and Sentence Composition. To calculate writing speed for sentence composition, follow these steps.

1. Mark the writing time in seconds in the seconds box under the Speed column.
2. Convert the number of seconds to minutes using Table 1: Converting seconds to minutes (In decimals) and enter this figure in the Minute box in the Speed column.
3. Divide the number of total letters written by the minutes required to write the sentence using the following formula:

   $$\textit{Writing Speed (letters/minutes)} = \frac{\textit{letters written}}{\textit{elapsed time in minutes}}$$

   For example, if the client writes 18 letters in 47 seconds (.78 minutes), the rate of writing would be computed as below:

   $$\text{Writing Speed} = \frac{\text{18 letters}}{\text{.78 minutes}} = 23.1 \text{ letters/minute}$$

4. Record the number of letters per minute to the nearest tenth in the LETTER/MIN box in the SPEED column for Task 3: Sentence Composition.

Score Tables

WRITING SPEED

Adapted from **THE JEBSEN-TAYLOR TEST OF HAND FUNCTION** (Jebsen et al., 1969)

Table 1: Mean Times and Standard Deviations for Writing Subtest

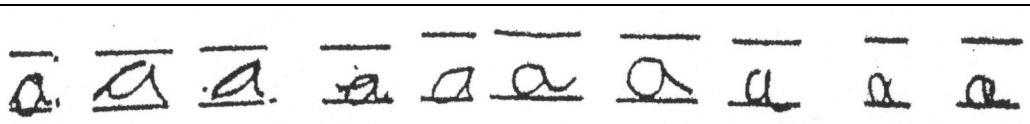
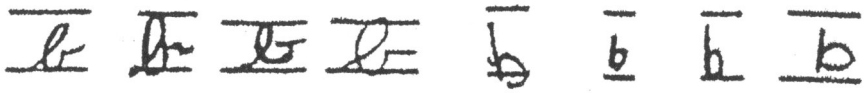
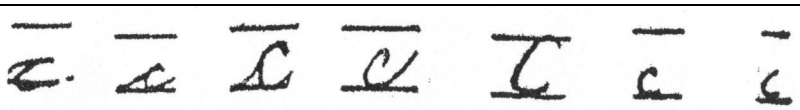
	Male		Female	
Age	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
20 – 59	12.2	± 3.5	11.7	± 2.1
60 - 94	19.5	± 7.5	16.7	± 4.7

	Male		Female	
Age	**Standard Deviation**	**Time in Seconds**	**Standard Deviation**	**Time in Seconds**
20 – 59	+5	29.7	+5	22.2
	+4	26.2	+4	20.1
	+3	22.7	+3	18
	+2	19.2	+2	15.9
	+1	15.9	+1	13.8
	mean	12.2	mean	11.7
	-1	8.7	-1	9.6
	-2	5.2	-2	7.5
60 - 94	+5	57	+5	40.2
	+4	49.5	+4	35.5
	+3	42	+3	30.8
	+2	34.5	+2	26.1
	+1	27	+1	21.4
	mean	19.5	mean	16.7
	-1	12	-1	12
	-2	4.5	-2	7.3

WRITING LEGIBILITY

Adapted from **The Evaluation Tool Of Children's Handwriting** (Amundson, 1995)

Table 2: ETCH Lower Case Legible Letters

a	
b	
c	
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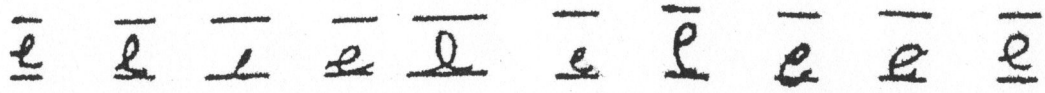
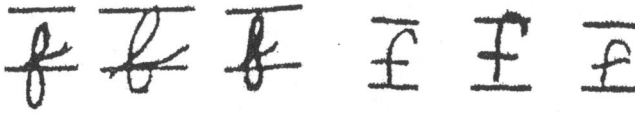
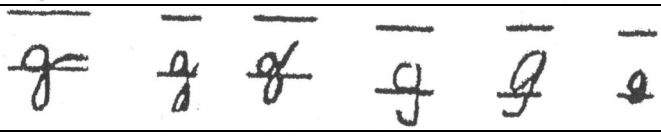
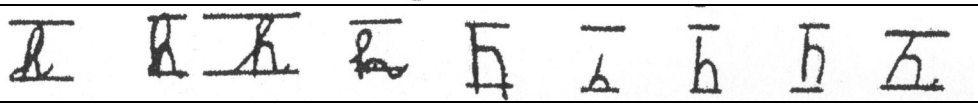
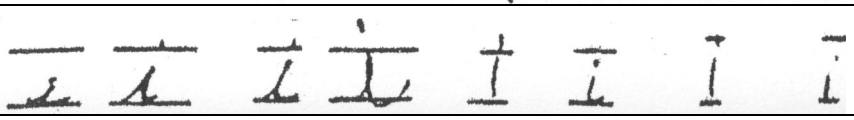
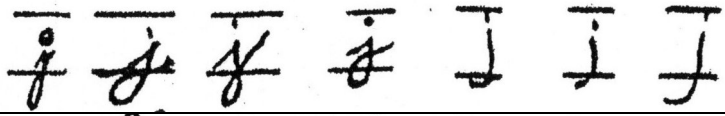
e	
f	
g	
h	
i	
j	
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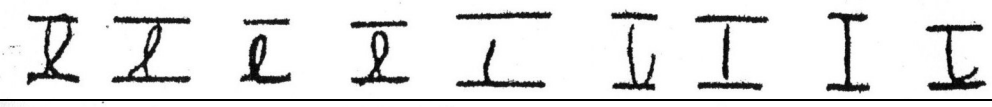
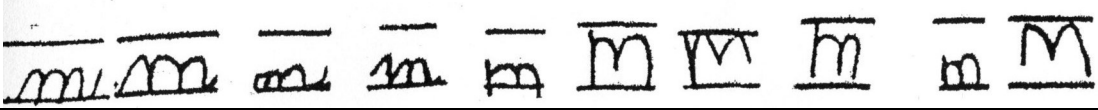
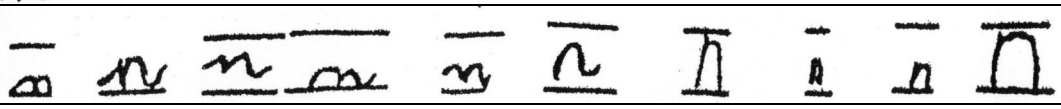
l	
m	
n	

Table 2: ETCH Lower Case Legible Letters continued	
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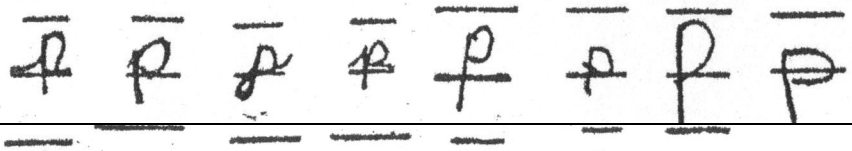
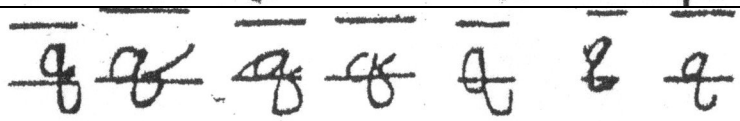
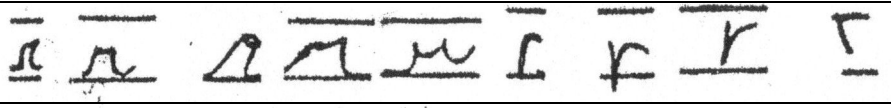
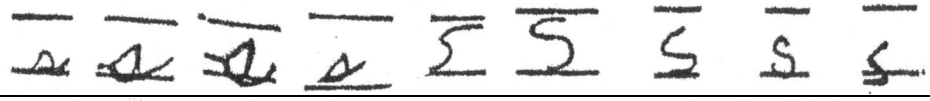
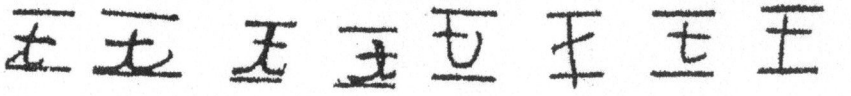
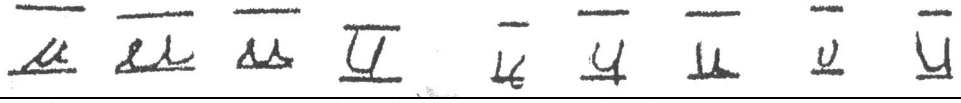
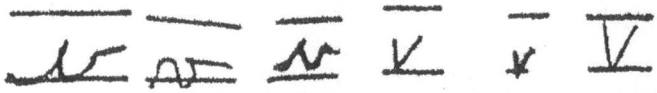
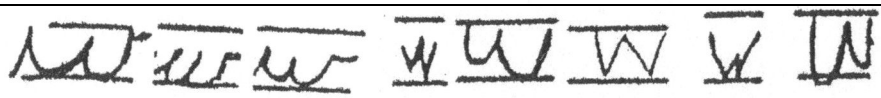
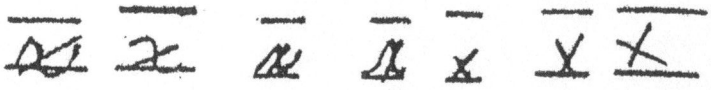
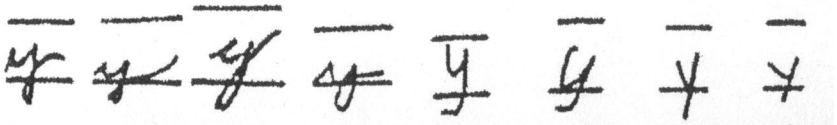
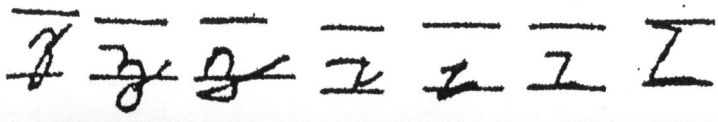
p	
q	
r	
s	
t	
u	
v	
w	
x	
y	
z	

Table 3: ETCH Lower Case Illegible Letters

Letter (L) is illegible when:

1. It is not easily and quickly recognised out of context and at first glance
2. It is poorly formed, distorted, reversed or greatly rotated
3. All of the descender is on or above the writing baseline
4. It has additional, extraneous parts and/or dark writings over poor erasures
5. Parts are omitted or improperly closed
6. Letters are joined, share the same part, or overlap to form individual letters
7. It is confused for another letter or numeral
8. It is confused for a group of letters or numerals
9. The entire letter is omitted or misplaced in sequence
10. Upper case letter is written when a lower case letter is requested *(Exception when lower and upper case letters have similar letter forms [c,k,o,s,u,v,w,x,z] and are only differentiated by spacing and size within writing guidelines. Letters with descenders [g,j,p,y] do not fall into this category)*

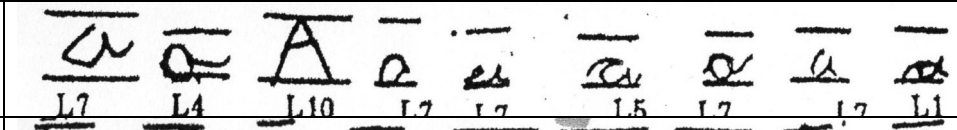
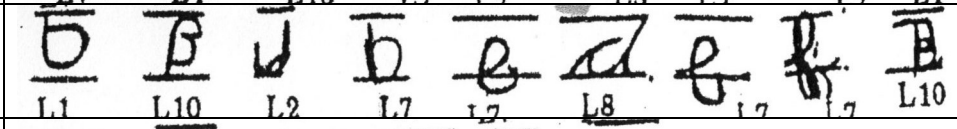
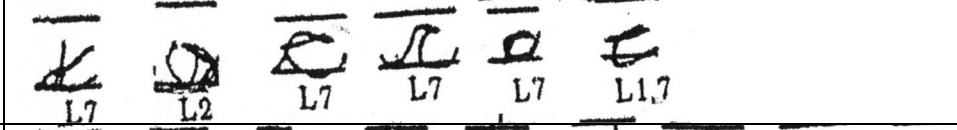
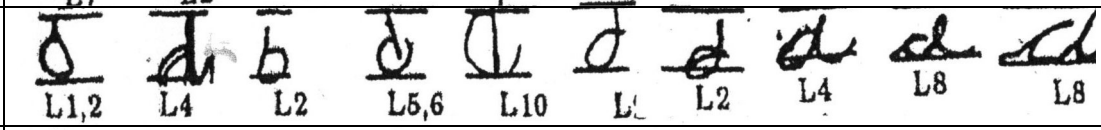
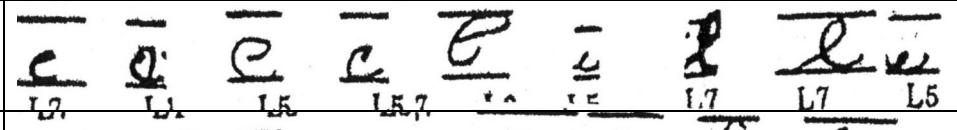
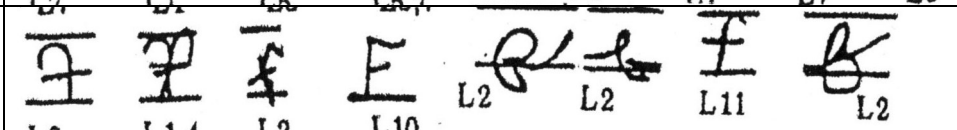
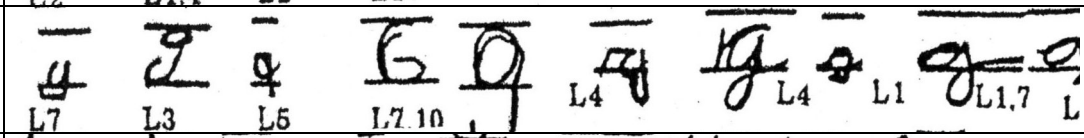
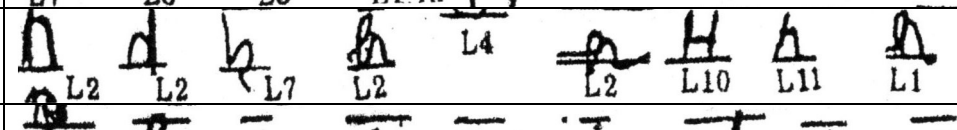
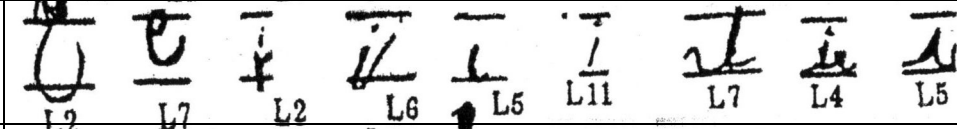
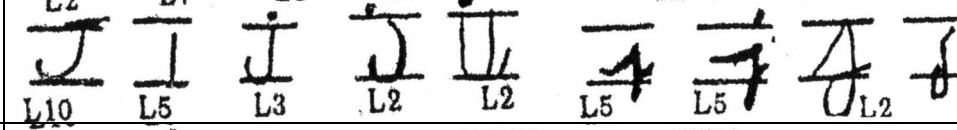
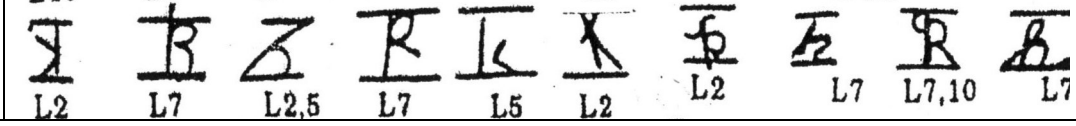
a	
b	
c	
d	
e	
f	
g	
h	
i	
j	
k	

Table 3: ETCH Lower Case Illegible Letters continued

Letter (L) is illegible when:

1. It is not easily and quickly recognised out of context and at first glance
2. It is poorly formed, distorted, reversed or greatly rotated
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10. Upper case letter is written when a lower case letter is requested *(Exception when lower and upper case letters have similar letter forms [c,k,o,s,u,v,w,x,z] and are only differentiated by spacing and size within writing guidelines. Letters with descenders [g,j,p,y] do not fall into this category)*

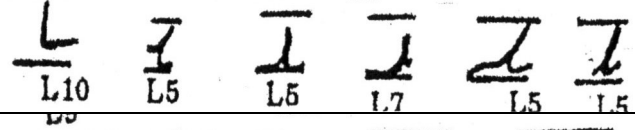
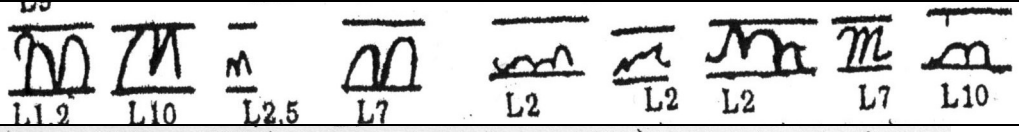
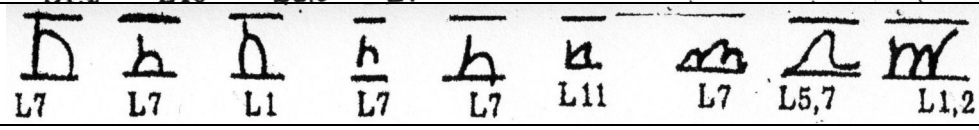
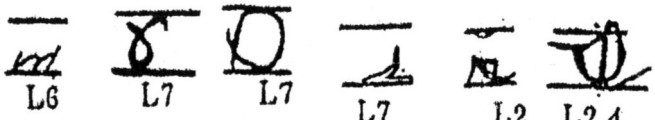
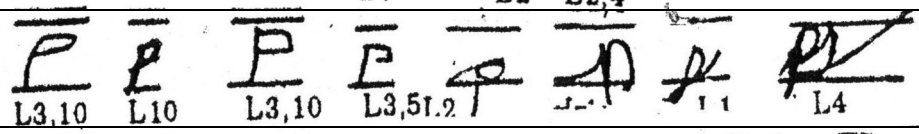
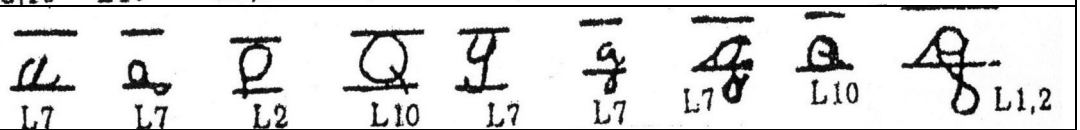
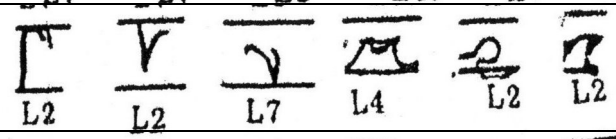
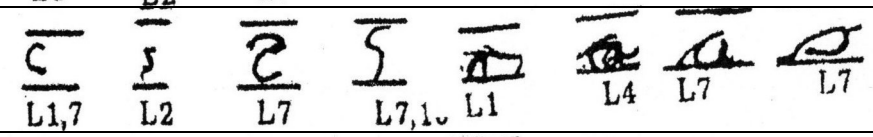
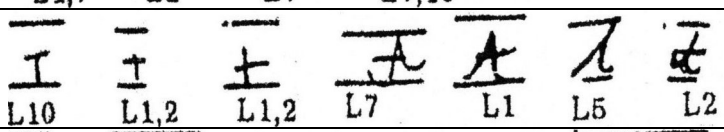
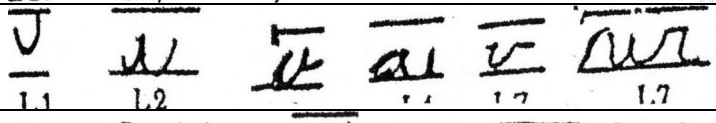
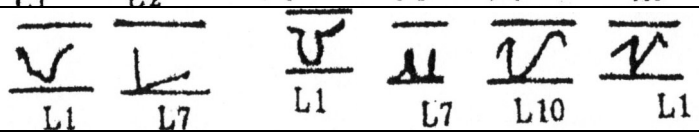
l	
m	
n	
o	
p	
q	
r	
s	
t	
u	
v	

Table 3: ETCH Lower Case Illegible Letters continued

Letter (L) is illegible when:

11. It is not easily and quickly recognised out of context and at first glance
12. It is poorly formed, distorted, reversed or greatly rotated
13. All of the descender is on or above the writing baseline
14. It has additional, extraneous parts and/or dark writings over poor erasures
15. Parts are omitted or improperly closed
16. Letters are joined, share the same part, or overlap to form individual letters
17. It is confused for another letter or numeral
18. It is confused for a group of letters or numerals
19. The entire letter is omitted or misplaced in sequence
20. Upper case letter is written when a lower case letter is requested *(Exception when lower and upper case letters have similar letter forms [c,k,o,s,u,v,w,x,z] and are only differentiated by spacing and size within writing guidelines. Letters with descenders [g,j,p,y] do not fall into this category)*

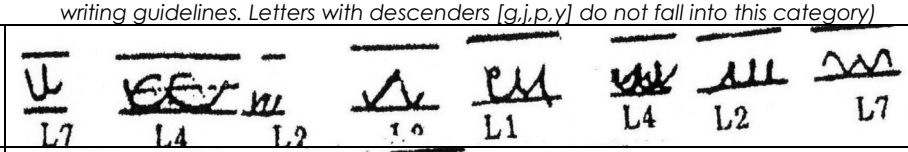
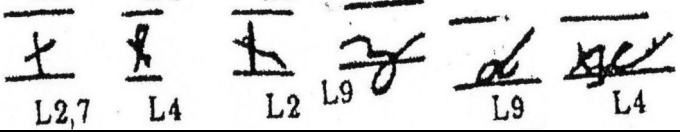
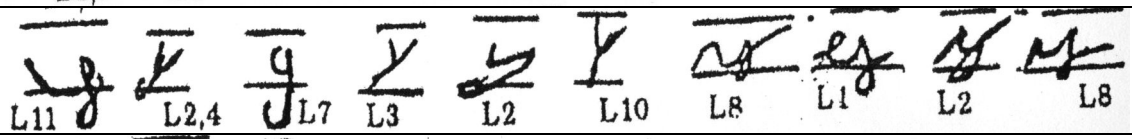
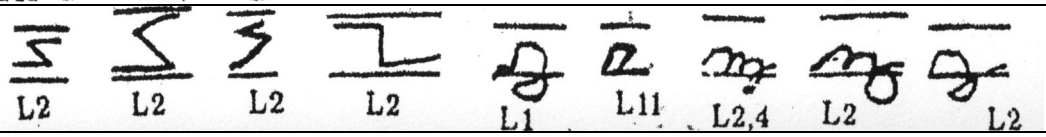
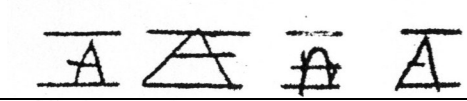
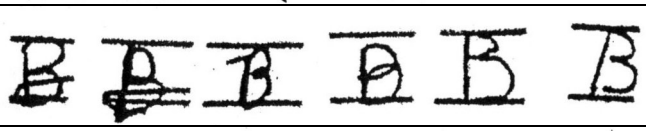
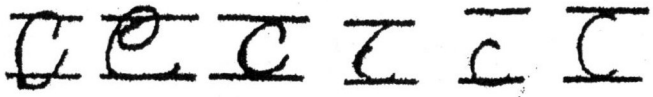
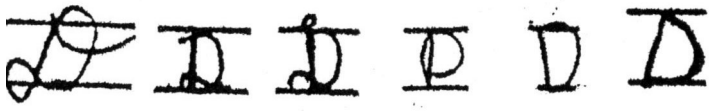
w	
x	
y	
z	

Table 4: ETCH Upper Case Legible Letters

A	
B	
C	
D	
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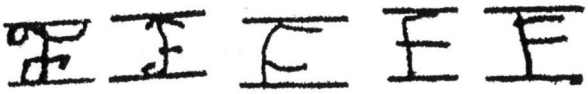
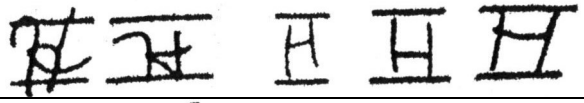
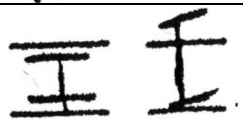
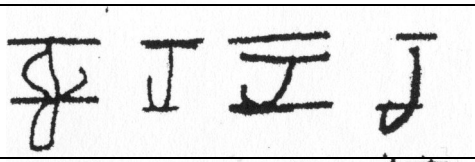
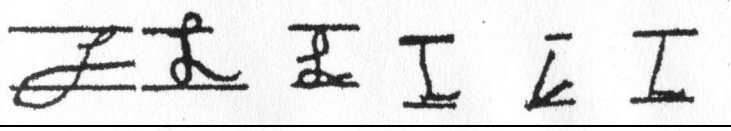
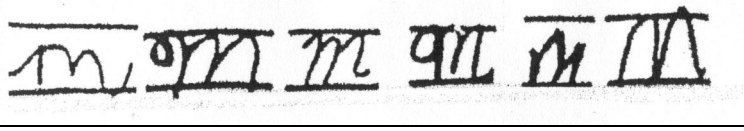
F	
G	
H	
I	
J	
K	
L	
M	

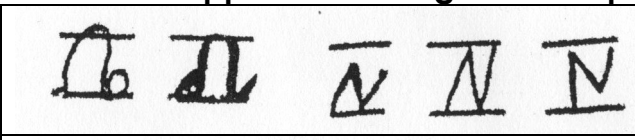
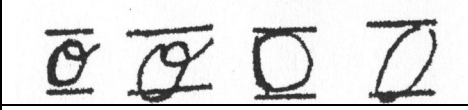
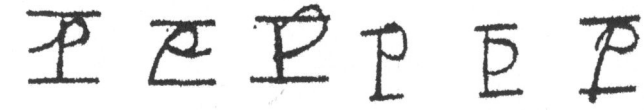
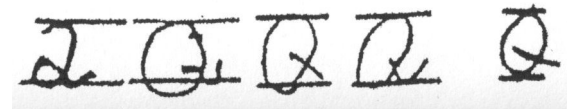
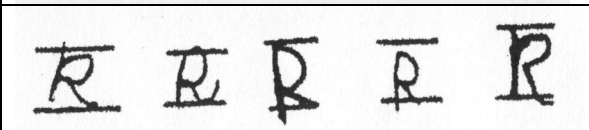
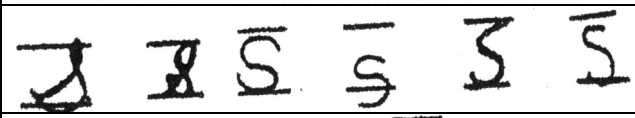
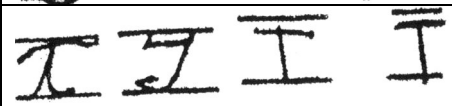
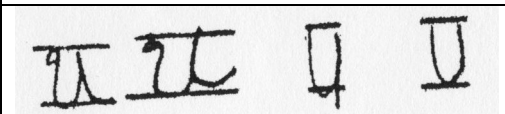
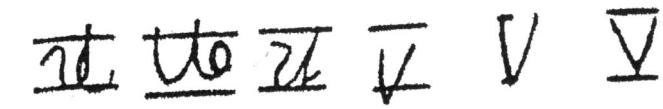
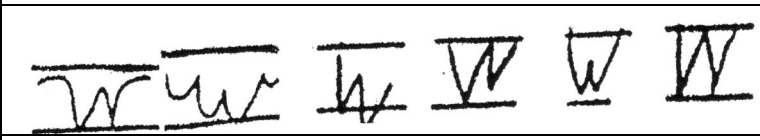
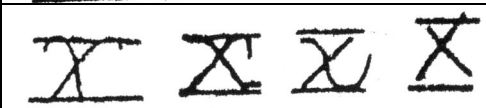
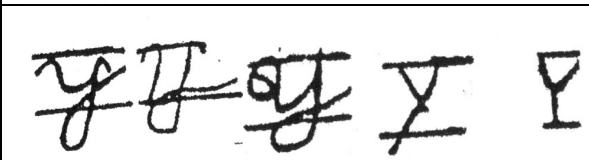
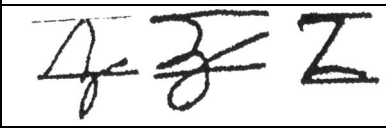
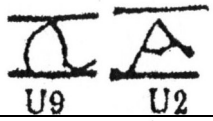
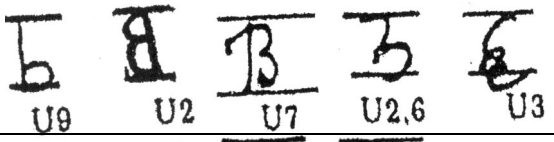
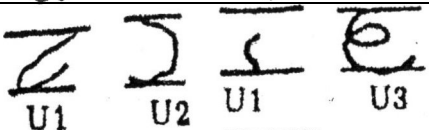
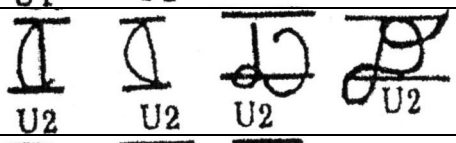
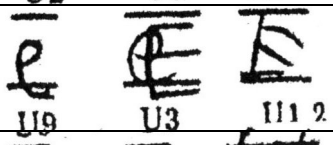
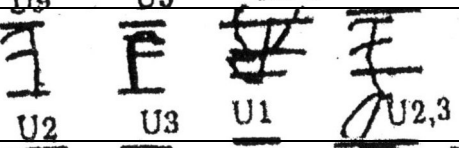
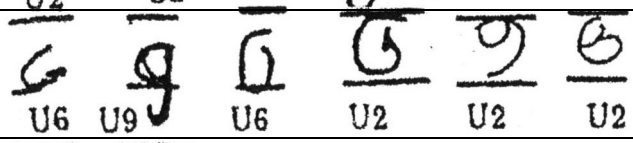
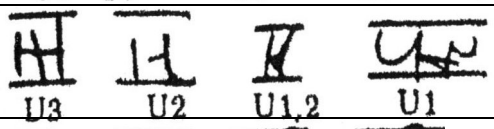
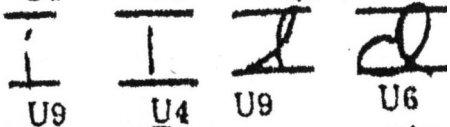
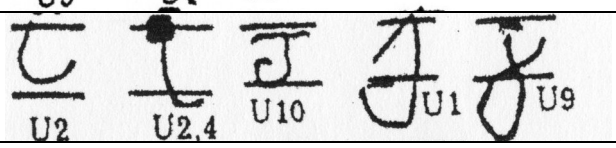
Upper Case – Legible Examples continued	
N	
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

Table 5: ETCH Upper Case Illegible Letters

Letter (L) is illegible when:

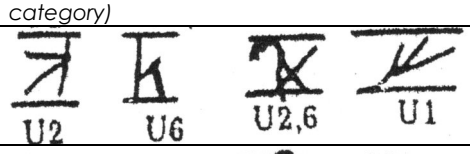
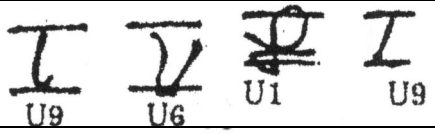
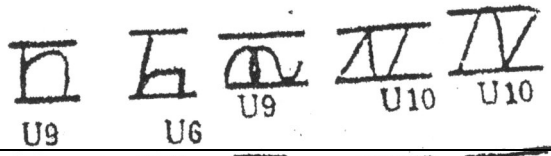
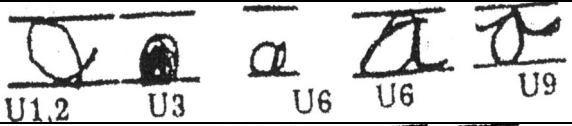
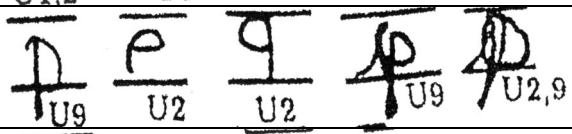
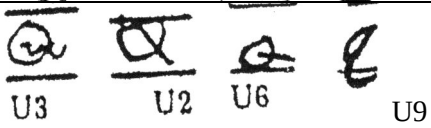
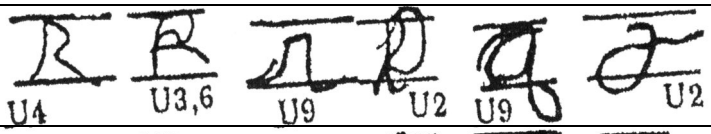
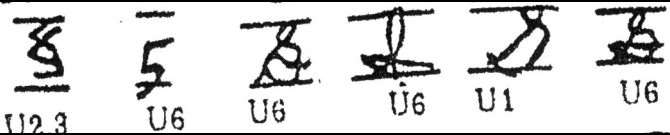
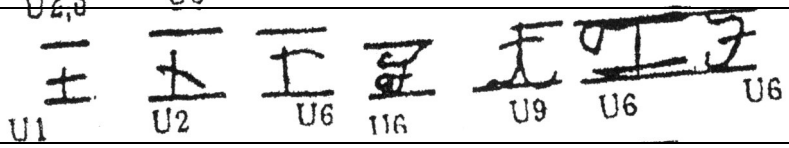
1. It is not easily and quickly recognised out of context and at first glance
2. It is poorly formed, distorted, reversed or greatly rotated
3. It has additional, extraneous parts and/or dark writings over poor erasures
4. Parts are omitted or improperly closed
5. Letters are joined, share the same part, or overlap to form individual letters
6. It is confused for another letter or numeral
7. It is confused for a group of letters or numerals
8. The entire letter is omitted or misplaced in sequence
9. Lower case letter is written when a upper case letter is requested *(Exception when lower and upper case letters have similar letter forms [c,k,o,s,u,v,w,x,z] and are only differentiated by spacing and size within writing guidelines. Letters with descenders [g,j,p,y] do not fall into this category)*

A	 U9 U2
B	 U9 U2 U7 U2,6 U3
C	 U1 U2 U1 U3
D	 U2 U2 U2 U2
E	 U9 U3 U1 2
F	 U2 U3 U1 U2,3
G	 U6 U9 U6 U2 U2 U2
H	 U3 U2 U1,2 U1
I	 U9 U4 U9 U6
J	 U2 U2,4 U10 U1 U9

Upper Case – Illegible Examples continued

Letter (L) is illegible when:

1. It is not easily and quickly recognised out of context and at first glance
2. It is poorly formed, distorted, reversed or greatly rotated
3. It has additional, extraneous parts and/or dark writings over poor erasures
4. Parts are omitted or improperly closed
5. Letters are joined, share the same part, or overlap to form individual letters
6. It is confused for another letter or numeral
7. It is confused for a group of letters or numerals
8. The entire letter is omitted or misplaced in sequence
9. Lower case letter is written when a upper case letter is requested *(Exception when lower and upper case letters have similar letter forms [c,k,o,s,u,v,w,x,z] and are only differentiated by spacing and size within writing guidelines. Letters with descenders [g,j,p,y] do not fall into this category)*

K	 U2 U6 U2,6 U1
L	 U9 U6 U1 U9
M	 U1,3 U10 U3 U9 U2
N	 U9 U6 U9 U10 U10
O	 U1,2 U3 U6 U6 U9
P	 U9 U2 U2 U9 U2,9
Q	 U3 U2 U6 U9
R	 U4 U3,6 U9 U2 U9 U2
S	 U2,3 U6 U6 U6 U1 U6
T	 U1 U2 U6 U6 U9 U6 U6

Upper Case – Illegible Examples continued

Letter (L) is illegible when:

1. It is not easily and quickly recognised out of context and at first glance
2. It is poorly formed, distorted, reversed or greatly rotated
3. It has additional, extraneous parts and/or dark writings over poor erasures
4. Parts are omitted or improperly closed
5. Letters are joined, share the same part, or overlap to form individual letters
6. It is confused for another letter or numeral
7. It is confused for a group of letters or numerals
8. The entire letter is omitted or misplaced in sequence
9. Lower case letter is written when a upper case letter is requested *(Exception when lower and upper case letters have similar letter forms [c,k,o,s,u,v,w,x,z] and are only differentiated by spacing and size within writing guidelines. Letters with descenders [g,j,p,y] do not fall into this category)*

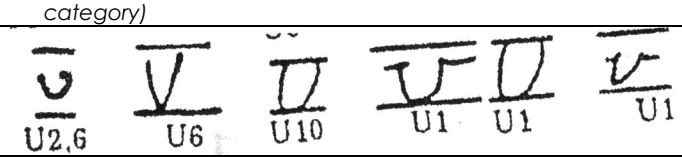
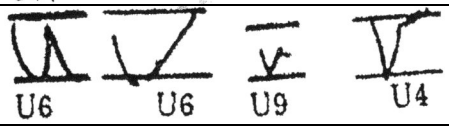
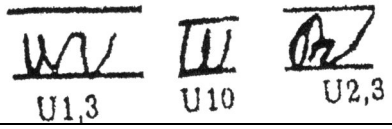
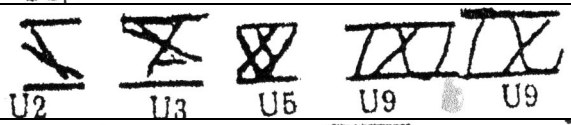
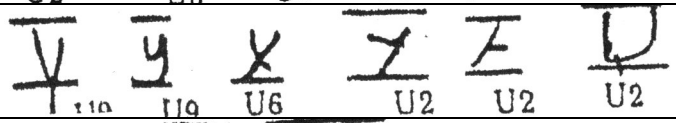
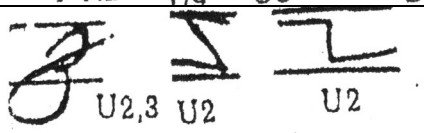
U	
V	
W	
X	
Y	
Z	

Table 6: ETCH Legible Numbers

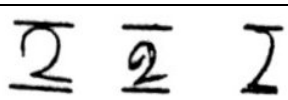
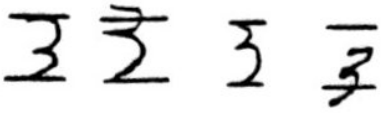
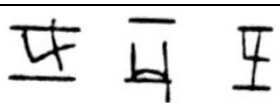
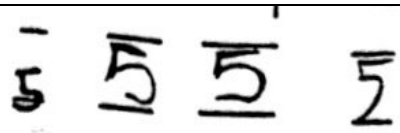
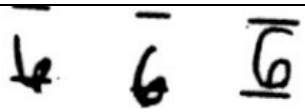
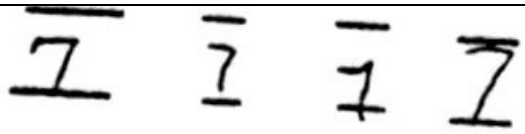
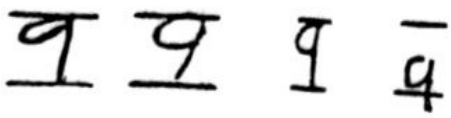
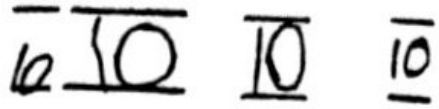
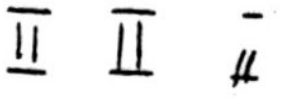
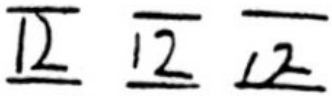
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Table 7: ETCH Illegible Numbers

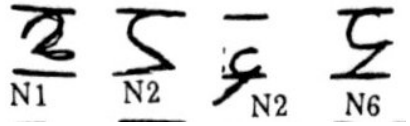
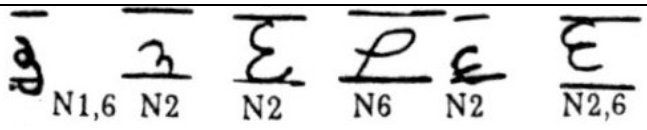
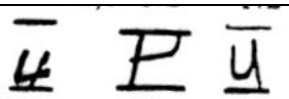
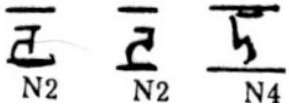
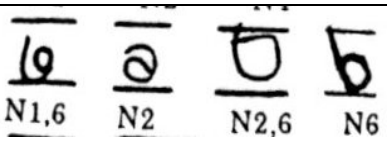
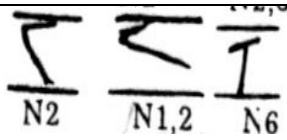
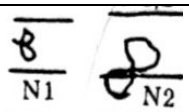
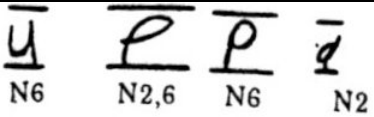
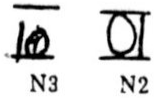
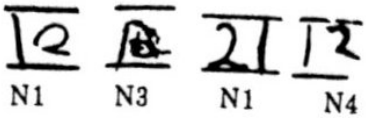
Numbers (N) are illegible when: 1. It is not easily and quickly recognised *out of context at first glance;* 2. It is poorly formed, distorted, reversed, or greatly rotated; 3. It has additional, extraneous parts and/or dark writings over poor erasures; 4. Parts are omitted or improperly closed; 5. Numerals are joined, share the same part, or overlap to form individual numbers; 6. It is confused with another letter or numeral 7. It is confused for a group of letters or numerals; 8. The entire numeral is omitted or misplaced in sequence;	
1	 N2
2	 N1 N2 N2 N6
3	 N1,6 N2 N2 N6 N2 N2,6
4	 N1 N2 N6
5	 N2 N2 N4
6	 N1,6 N2 N2,6 N6
7	 N2 N1,2 N6
8	 N1 N2
9	 N6 N2,6 N6 N2
10	 N3 N2
11	-
12	 N1 N3 N1 N4

Table 8: Alphabet Writing: Lower and Upper Case

Percentage of Legible Letters

No. of Legible Letters	Percentage	No. of Legible Letters	Percentage
26	100.0%	12	46.1%
25	96.1%	11	42.3%
24	92.3%	10	38.4%
23	88.4%	9	34.6%
22	84.6%	8	30.7%
21	80.7%	7	26.9%
20	76.9%	6	23.0%
19	73.0%	5	19.2%
18	69.2%	4	15.3%
17	65.3%	3	11.5%
16	61.5%	2	7.6%
15	57.6%	1	3.8%
14	53.8%	0	0.0%
13	50.0%		

Table 9: Numeral Writing

Percentage of Numeral Legibility

No. of Legible Numerals	Percentage	No. of Legible Numerals	Percentage
12	100.0%	5	41.6%
11	91.6%	4	33.3%
10	83.3%	3	25.0%
9	75.0%	2	16.6%
8	66.6%	1	8.3%
7	58.3%	0	0.0%
6	50.0%		

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