
COMPARISON OF DOCUMENT EXAMINERS' OPINIONS ON ORIGINAL AND PHOTOCOPIED SIGNATURES

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Abstract: *There is a lack of empirical evidence concerning document examiners' ability to perform handwriting comparisons on photocopied writings. This study aimed to compare the accuracy of examiners' opinions on 260 original questioned signatures and on the same signatures that had been photocopied. Six of the examiners from the Document Examination Section of the New Zealand Police participated in the study, which comprised two trials. Each trial was constructed according to the accepted process of comparing a group of known (specimen) signatures with a group of questioned signatures where the writer was known to the experimenters but not to the document examiners. One trial contained originals of the specimen and questioned signatures and the other comprised photocopies of the same specimen and questioned signatures. No errors regarding authorship were made for original or photocopied signatures, and there were no instances where an identification/elimination opinion was reversed between a photocopy and its original. Only 2.3% of opinions relating to an original signature differed in any way from that offered for its photocopy. The high correct rates for questioned genuine signatures were similar for original (100%) and photocopied signatures (98%). The correct opinion rate regarding the process of production of original and photocopied, simulated, questioned signatures combined was 99.7%. The results provide evidence that examiners are able to make comparisons on a complex signature with the same accuracy and similar sensitivity when using either originals or photocopies.*

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1. Introduction

Document examiners may be requested to perform handwriting examinations on documents that are photocopied. As the photocopying process produces handwriting that contains less feature information than original handwriting, many examiners are hesitant to express authorship opinions on this type of material. However, a number of authors (Hilton, 1982; Ellen,

1989; Morton, 1989), while strongly emphasising major restrictions when expressing opinions regarding non-original writings (see Discussion), consider that fruitful comparisons can often be made. Hilton (1982), regarding the examination of non-original writing, wrote that "...general handwriting can often be tentatively and sometimes be positively identified" (p. 384) and that this condition also holds for signatures. This author does, however, recognise that "Some workers refuse to examine all copies, but the practical examiner recognises that it is necessary to rely on copies at times" (p. 385). Along similar lines Ellen (1989) has written "Although some of the detail will not be apparent, in many examples of good quality photocopies there will be adequate material

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for a useful comparison to be made” (p. 62), and that “It is possible to identify photocopied writing as having been made by a known writer” (p. 62). Morton (1989) presented a study on non-original signatures and handwriting reproduced using seven plain paper photocopiers. The original images were produced using combinations of four paper types and different writing implement classes (ballpoint, roller ball and fiber tip pens). This author concluded that “most of the copiers reproduced the signatures, genuine and forged, well enough for a fruitful examination” (p. 464).

Despite the perceptions of these authors, there is a lack of studies that provide evidence regarding examiners’ abilities to express comparison opinions on non-original writings.

A detailed study regarding experts’ assessments of line quality features in non-original signatures was presented by Dawson and Lindblom (1998). These authors investigated the extent to which the photocopying to which the photocopying inhibits the ability of experts to assess a variety of line quality features, and whether the non-original features impacted on the assessment of overall line quality. These authors surveyed document examiners from a number of countries who provided comparative line quality feature assessments between non-original and corresponding original signature groups. In all, seventy-two genuine and forged signatures were evaluated by the examiner group (one questioned signature and ten specimens per person) These authors found that although not all line quality features were correctly identified by the examiners, this did not result in significant inaccuracies in the overall assessment, as evidenced by an accuracy rate of 95.8%. This study provides an interesting backdrop for the experiment described here.

In our study we aimed to investigate the skill of forensic document examiners in provided opinions regarding the process of production and authorship on both non-original and original signatures. The non-original signatures were second-generation photocopies of the original signatures.

2. Method

2.1 Participants

Six document examiners employed at the Document Section of the New Zealand Police undertook the study. They provided informed consent for the results to be published, while maintaining anonymity of their results.

2.2 Material studied

The study comprised two trials. Each trial was constructed according to the accepted process of comparing a group of known (specimen) signatures with a group of questioned signatures, where the writer was known to the experimenters but not to the examiners. One trial contained originals of the specimen and questioned signatures and the other comprised photocopies of the same specimen and questioned signatures.

All original writings were made using the same make of blue ball point pens and using the same make of writing material. All writings in the study were performed on a backing-pad often A4 sheets of paper.

2.3 Signatures provided by the specimen writer

The specimen writer was selected from the academic staff at La Trobe University. This writer was provided with all of the materials required to form the specimen material. The specimen writer, each day, was required to write 21 normal signatures, 6 disguised signatures and 6 signatures which might appear to be forgeries (auto-simulations). This was repeated for seven days.

2.4 Construction of the specimen signature group

The specimen group comprised 21 of the normal signatures taken from seven days. These signatures were attached to backing boards (3 to a board) for use in the trial.

2.5 Generation of forged signatures not written by the specimen writer

Two ‘forgers’ were selected from the academic staff at La Trobe University. These individuals had both been used by the authors as forgers in previous

studies. Each of the forgers were provided with 9 normal signatures from the specimen group described in the previous section. Each of the forger's specimen signature group represented 3 signatures from each of 3 days of specimen writings (forger A's specimen group was taken from the specimen writers' day 1, 3 and 5 signatures, and forger B's specimen group was taken from the specimen writers' day 4, 6 and 7 signatures. Forgers were instructed to produce only 'free-hand' (i.e., not traced) simulations in this trial.

Each day for a seven-day period, the forgers practised simulating the specimen signature 15 times and then performed 12 simulations from which the trial set would be constructed. In all, 105 practices and 84 at tempted simulations were made by each of the forgers over the seven day period.

2.6 Construction of the questioned signature group

The questioned group contained the following types of signature:

- 50 genuine signatures (these comprised ten signatures from days 1 and 7 and six signatures from each of the other five days of writing).
- 168 simulated signatures (84 simulations from each of the two forgers, which comprised all simulation attempts from each of the seven days).
- 21 disguised signatures written by the specimen writer (these were disguised signatures 4, 5 and 6 from each of the seven days).
- 21 auto-simulations (these were auto-simulated signatures 4, 5 and 6 from each of the seven days).

The 260 questioned signatures were given a random number and attached to backing boards (3 to a board).

The boards containing the specimen and questioned signatures were copied on a Canon photocopier onto A4 sheets of paper, which were again photocopied. The photocopied signatures used in the trial were, therefore, second generation copies of their original form.

3. Procedure

The document examiners were initially provided with the photocopies of the specimen and questioned signature groups and with an answer booklet. Ten months later, following the return of the first answer booklet, they were provided with the originals of the specimen and questioned signature groups and with the second answer booklet. For each trial, examiners were informed that the date range over which the specimen material was taken was around the time that the questioned signatures were written. They were then asked to compare each questioned signature independently with the specimen signature group and to express an opinion using the answer booklet provided. The answer booklet comprised 260 lines, each line corresponding to one of the questioned signatures. On each line were the numbers 1 to 7. Each number was a code representing one of the seven possible opinions. For each questioned signature, examiners were required to circle a number that corresponded to their opinion. The answer (opinion) codes (1 to 7) corresponded to the following explanations.

1. There is evidence that the questioned signature was produced using a disguise/simulation process. There is evidence that the questioned signature was written by the writer of the signature specimens.
2. There is evidence that the questioned signature was produced using a disguise/simulation process. There is evidence that the questioned signature was not written by the writer of the signature specimens.
3. There is evidence that the questioned signature was produced using a disguise/simulation process. No opinion can be expressed as to whether or not the writer of the signature specimens wrote the questioned signature.
4. There is evidence that the questioned signature was not produced using a disguise/simulation process. There is evidence that the questioned signature was written by the writer of the signature specimens.
5. There is evidence that the questioned signature was not produced using a disguised/simulation process. No opinion can be expressed as to

whether or not the writer of the signature specimens wrote the questioned signature.

6. No opinion can be expressed as to whether the questioned signature was produced using a disguise/simulation process. There is evidence that the questioned signature was written by the writer of the signature specimens.
7. No opinion can be expressed as to whether the questioned signature was produced using a disguise/simulation process. No opinion can be expressed as to whether or not the writer of the signature specimens wrote the questioned signature.

In addition, on each of the 260 lines of the answer booklet there were the letters 'm' and 'vs'. Examiners were requested that if their opinion was related to identification or elimination (responses 1, 2, 4 or 6), they should indicate the strength of that opinion by circling either 'm' which refers to a moderate strength ('indications') opinion, or 'vs' which refers to a very strong opinion.

The above answers represent the range of opinions that could be expressed by examiners. It is noted that the statement 'There is evidence that the questioned signature was not produced using a disguise/simulation process caused concern amongst some examiners and after discussion was generally taken to mean that 'There is no evidence that the questioned signature was produced using a disguise/simulation process'.

Following completion of the first trial (comprising photocopies), answer booklets were returned to the investigators for analysis. The subjects did not review their answers prior to the undertaking of the second trial (comprising the originals), which they received 10 months after returning the answers to the first trial. They were not provided with any results until all analyses for both trials were finalised.

4. Analysis

Examiners' authorship responses (opinion units) were marked as correct, erroneous or inconclusive. These marks were then analyzed to produce scores for each of the different questioned signature types [genuine, disguised, auto-simulation and simulation (forgery)]. The scores are presented as numbers of

opinions or as percentages, which represent opinion rates. The following definitions of the score categories are used in subsequent results tables in this report

Correct

The number of authorship opinions that were correct.

Error

The number of authorship opinions that were erroneous.

Inconclusive

The number of authorship opinions that were inconclusive.

% Correct

The number of correct authorship opinions divided by the total number of authorship opinions (expressed as a percentage).

% Error

The number of erroneous authorship opinions divided by the total number of authorship opinions (expressed as a percentage).

% Inconclusive

The number of inconclusive authorship opinions divided by the total number of authorship opinions (expressed as a percentage).

% Correct called

The number of correct authorship opinions divided by the sum of the correct and erroneous authorship opinions (expressed as a percentage).

% Error called

The number of erroneous authorship opinions divided by the sum of the correct and erroneous authorship opinions (expressed as a percentage).

The 'called' scores do not include inconclusive opinions and, therefore, equate to a number that reflects the opinion rate when an examiner is expressing an opinion that is other than inconclusive.

Opinions regarding process are ones that relate to whether or not the signatures were considered to be the product of a disguise and/or simulation process. Examiners' process opinions were recorded and analysed. They have been reported in the Results where relevant.

Signature Type	Opinions									
	# correct		#Inc		% Correct		% Inc		% Correct called	
	Phc	Or	Phc	Or	Phc	Or	Phc	Or	Phc	Or
Genuine	147	150	3	0	98	100	2	0	100	100
Simulated	0	0	504	504	0	0	100	100	N/a	N/a
Autosim	0	0	63	63	0	0	100	100	N/a	N/a
Disguised	59	61	4	2	93.7	96.8	6.3	3.2	100	100

Autosim = Auto-simulation

The strength of identification opinions is not shown in this table.

TABLE 1. Scores for examiners pairs' opinions regarding the authorship of photocopied (Phc) and original (Or) signatures for each of the questioned signature types.

5. Results

For each trial, three answer booklets were submitted. These booklets were the agreed opinions from two examiners where a peer review process had been used. The same pairings of examiners were used for each trial. Each pair carried out the trials independently of the other pairs.

The group results for authorship opinions on both original and photocopied signatures are shown in Table 1. There were no errors made by this group for original or photocopied signatures. There were no instances where an identification/elimination opinion was reversed between a photocopy and its original. In fact, no elimination opinions were given. There were only three inconclusive opinions regarding genuine signatures, all on the photocopied signatures. The remaining opinions on genuine signatures were all correct. For all the simulations not written by the specimen writer, an inconclusive opinion regarding authorship was given. In all but two of these, for both original and photocopied simulations, examiners gave opinion code 3 (described in the Method) indicating that there was evidence of the simulation process but they were not prepared to exclude the specimen writer as having made them. In the two other instances, examiners were inconclusive regarding process (one in stance for originals and one for photocopies). The results for Auto simulations were similar. All opinions regarding authorship were inconclusive. However, in all but one of these types of signatures, examiners

gave opinion code 3 indicating that there was evidence of the simulation process. The one instance where there was an inconclusive opinion regarding process for auto-simulated signatures concerned a photocopy.

Most authorship opinions relating to disguised signatures were that the writer of the specimens wrote the signatures. This suggests that the disguise process adopted by the specimen writer was not particularly effective. The difference between authorship opinions for original and photocopied signatures for this type of questioned signature, although small, was proportionally greater than for other types of questioned signature. In addition, as described below, half of the differences in opinion between an original signature and its photocopy were in the strength of the opinion relating to authorship for this type of signature (which is not shown in Table 1).

6. Consideration of differences between opinions for original signatures and their photocopies

For a numerical comparison of opinions regarding an original signature and its photocopy, we have used the term coupled opinion unit. A coupled opinion unit is the two opinions expressed by an examiner pair regarding one signature (the original and its photocopy - coupled signatures). Thus there were 780 coupled opinion units expressed by the group (260 signatures per trial by 3 examiner pairs). A coupled opinion unit could be either concordant (where the opinions were the same for the original signature and its photocopy) or discordant (where the

opinions differed for the original and its photocopy).

Three types of discordant, coupled opinions were given by the examiners. They occurred when there was:

- an authorship opinion for one of the coupled signatures and an inconclusive opinion for the other signature.
- a 'very strong' authorship opinion given for one of the coupled signatures and a 'moderate' strength opinion for the other signature.
- an opinion that there was evidence of a simulation process for one of the coupled signatures and an inconclusive opinion regarding process for the other signature.

For the whole group of examiners, the difference in authorship opinions between an original signature and its photocopy was very small. The total number of the three types of discordant opinion units was 18 (2.3% of the 780 coupled opinion units). Thus 762 of the opinions expressed on the photocopied signatures were the same as the opinions expressed on the originals. For opinions in the direction of identification, when we ignored the strength of the opinions indicated by the examiners, only five of the 780 coupled opinion units were discordant (0.6%). All five discordant opinions occurred when an examiner pair had given an inconclusive opinion regarding the authorship of a photocopied signature, but gave an opinion that the original signature was written by the writer of the specimens. Three of these signatures were genuine, and two were disguised.

There were 10 discordant opinions that were due to a difference in the strength of authorship opinions. Of these, there were nine instances where an examiner pair had given a moderate opinion that the photocopied signature was written by the writer of the specimens, but gave a very strong opinion that the original signature was written by the writer of the specimens. Eight of these signatures were, in fact, attempts at disguise by the specimen writer, and one was a normal, genuine signature. There was one instance where an examiner pair had given a very strong opinion that the photocopied signature was

written by the writer of the specimens, but gave a moderate opinion that the original signature was written by the writer of the specimens. This signature was in fact an attempt at disguise by the specimen writer.

Three of the discordant opinions were related to the process of signature production. One was where, for an auto-simulated signature, an examiner pair had given the opinion that a photocopied signature was the product of a simulation process, but gave an inconclusive opinion regarding the process of production of the original signature. The other two discordant opinions were for the same signature that was, in fact, simulated by someone other than the specimen writer. In one instance, an examiner pair had given the opinion that the photocopied signature was the product of a simulation process, but gave an inconclusive opinion regarding the process of production of the original signature. In the other instance, an examiner pair had given an inconclusive opinion regarding the process of production of the photocopied signature, but gave the opinion that the original signature was the product of a simulation process.

7. Discussion

The results clearly indicate that this group of examiners are able to make comparisons on a complex signature with the same accuracy and similar sensitivity when using either originals or photocopies. No errors regarding authorship were made for original or photocopied signatures, and there were no instances where an identification/elimination opinion was reversed between a photocopy and its original. The high correct rates for questioned genuine signatures were similar for original signatures (100%) and photocopied signatures (98%). While none of the examiners were prepared to eliminate or identify the specimen writer as having written the simulations or auto-simulations, 99.7% of their opinions were that the original and photocopied signatures were produced using a simulation process. The remaining opinions (of which there were three) regarding the process of production of these simulated signatures were inconclusive.

In terms of the Dawson and Lindblom (1998) study, our findings illustrate that when using

photocopies, examiners can translate observations regarding non-original line quality characteristics and address whether the observed characteristics are consistent with a genuine writing act or with an act of simulation.

The total number of discordant opinions (18 opinions or 2.3%) was very small. The majority of the discordant opinions (10 of 18) were due to a difference in strength of identification opinions. Eight of these involved signatures where the specimen writer had attempted to disguise her signature, and examiners provided a moderate opinion that the photocopied signature was written by the specimen writer, but a very strong opinion that the original was written by the specimen writer. This seems to suggest that there was information missing in the photocopy that, in the original, provided the examiners with extra confidence regarding their opinion. In addition, there were proportionally more discordant authorship opinions for 'disguised' signatures than for the other questioned signature types.

Although it may be attractive to consider that the small number of discordant opinions expressed by the group is directly attributable to the original/non-original nature of the images, this must be taken in light of the time delay variable. There was a 10-month time difference between when the examiner group submitted their first opinions on the photocopied signatures and their final opinions on the originals of these signatures. It may have been that at least some of the discordance was due to longitudinal inter-examiner opinion variation where the extent to which examiner opinion changes over time is essentially unknown. We feel that the effect of this variable is likely to be negligible due to each opinion unit being the agreed opinion of two examiners.

This study does have certain limitations. The sample size is small and it is not possible to say that the results for this group of examiners are representative of what would be found for document examiners in general. In addition, the results for this group may be different for less complex signatures, for extended text, or for a more limited writing sample. The quality of the photocopy will obviously affect the results.

Despite these limitations, it can be said that this study provides support for the perceptions of those authors (Hilton, 1982; Ellen, 1989; Morton, 1989)

who consider that in certain circumstances examiners can express fruitful comparison opinions on non-original writings. This should, however, be considered in relation to the major restrictions when expressing opinions regarding non-original writing highlighted by all of these authors. This was appropriately summarised by Ellen (1989) who wrote "Care must be taken to distinguish between the writing and the document on which it appears to have been written. The writing could be genuine but the document may not. The photocopy could be a composite of two or more documents, and so the writing appears in a context different from that in which it was written" (p. 62-63). It is clear that any opinion expressed regarding the authorship of non-original questioned writing should carry with it some explanation of the limitations imposed on the examination. Huber and Headrick (1999) wrote that "Findings must be so worded ... that they clearly indicate: 1. The identification is of a writing on a document of which the material at hand purports to be a trustworthy reproduction," and "2. The findings are subject to confirmation of their existence as original writings, upon examination of the original document."

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