The Initial Profiling Trial of a Program to Characterize Forensic Handwriting Examiners' Skill

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This paper reports the results of the first profiling trial of a program that was developed to provide information concerning the skill characteristics of document examiners in expressing authorship opinions on handwritten text and signatures. This information is provided to participants of the profiling trials in the form of a certificate that numerically describes the nature of their skill in terms of correct, error, and conservatism rates. The rationale for the program, given recent criticisms of opinion identification evidence of this type, and some elements of the testing program are described. The performance feedback package is overviewed which provides examiners with the opportunity for corrective action where required. In this trial, 20 government employed document examiners provided opinions on the process of production and authorship of 250 questioned signatures that were a mixture of genuine, disguised, simulated, and auto-simulated signatures. Findings for the group included a very low error rate (0.04%) for authorship opinions, with a high correct rate for genuine signatures, and a high conservatism rate for simulated and auto-simulated signatures. Examiners correctly identified that signatures were simulated in 95% of instances.

Introduction

Forensic handwriting examination is currently enjoying an upsurge in practitioners' interest in the betterment of their field of study. In recent times we have seen the publication of validation studies (Kam, Fielding, Conn, 1997; Kam, Wetstein, Conn, 1994; Kam, Gummadidala, Fielding, Conn, 2001; Found, Sita, Rogers, 1999; Sita, Found, Rogers, 2002) which have provided significant support to the expertise and skill claimed by examiners. There are reports of movement toward the written standardization of handwriting comparison methods which are being coordinated through organizations such as the Scientific Working Group for Forensic Document Examination and ASTM International in the United States, the European Network of Forensic Handwriting Experts in Europe and the Special Advisory Group (Document Examination) in Australia and New Zealand (Found, Rogers, 1999). Suggestions regarding the standardization of opinion terminology, and the abandonment of alternate opinion scales, are being argued (Evett, 1998). Along with these developments, is the addition to traditional texts by Osborn (1929), Harrison (1958), Conway (1959), Hilton (1982), Ellen (1989), and the detailed, updated text on handwriting identification that embraces historical, theoretical, and contemporary issues within this study by Huber & Headrick (1999).

The richness of the current discussions, both inside and outside of the literature, can be sourced mainly to two related events which were critical of the field: the publication of the Risinger, Denbeaux and Saks article in 1989, and the

Starzecpyzel decision in 1995, ruling that handwriting identification testimony was not a science as defined by the United States Supreme Court in *Daubert v. Dow* (1993), but was admissible as expert testimony. Although much has been written regarding the criticisms of forensic handwriting examination articulated in these events, for the purposes of the current paper, we will focus on the shortfall in "validation" evidence. Risinger and Saks offer a detailed account of their views concerning this shortfall in a 1996 article discussing handwriting expertise in light of the *Daubert* decision.

Validation of forensic handwriting examiners' beliefs does not arise from performing casework as, in most instances, examiners have no indisputable method of knowing whether their opinions were correct. It is interesting that Risinger and Saks (1996) consider that the *Starzecpyzel* decision (that forensic handwriting examination is not a "science") has dangerous implications. They argue that plummeting validation standards for admissibility may result from this decision as the "burden appears to be on the opponent to prove affirmatively that the skilled witness cannot do what they claim they can do (p. 33)." However, Risinger and Saks go on to state that "science can examine the dependability of the results of such a process (handwriting identification) even when the process is not a science." In this, the authors agree with the statement: "Whatever the future course, if courts are to decide intelligently on the appropriate judicial treatment of handwriting identification testimony, they must learn what forensic document examiners' claims to expertise consist of, what evidence supports or contradicts those claims, and the areas in which evidence is lacking." Risinger and Saks proceed to offer suggestions as to how the field of forensic handwriting examination might address its current shortfalls. It is hoped that what is presented here goes some distance in satisfying the criticisms raised.

Handwriting opinion evidence in the Australian and New Zealand judicial environments has not been challenged as it was in the *Starzecpyzel* case. In spite of this, and subsequent to the Risinger, Denbeaux, and Saks publication in 1989, a number of practitioners felt that the criticisms, particularly those associated with the lack of validation information, were serious and warranted immediate action. In the early 1990's, the first of the validation studies were produced by the authors with support from the majority of Australian and New Zealand police and government document laboratories (Found, Sita, Rogers, 1999). Since 1995 collaborations between the School of Human Biosciences (La Trobe University, Australia), the Special Advisory Group (which represents police and government document examiners in Australia and New Zealand), and the National Institute of Forensic Science have been formalized. As a result, a number of different validation studies have been undertaken, culminating in the profiling trials, the first of which is described in this report.

The testing philosophy involved embracing the following elements that have been discussed by a number of authors; mainly, that handwriting comparison relies almost exclusively on perceptual and cognitive skills and, as such, is a subjective process where practitioner strength of belief in the nature and scope of the expertise is not supported through published blind tests.

- "The level of correctness of the assertions made by examiners from the day to day casework is not likely to prove to be a credible source for the (validation) data needed (Huber & Headrick, 1999)."
- "A process such as handwriting identification presents a number of potential subtasks dealing with variables such as writing instruments, forgery of various sorts, age, health, and so forth. No single test can map the abilities of any one practitioner, or any group of practitioners (Risinger & Saks, 1996)."
- "A great many tests … would be necessary to know what, if anything, (examiners) can do accurately, and under what conditions (Risinger & Saks, 1996)."
- "A complete testing regime would have tests which covered the entire spectrum of conditions and difficulties (Risinger & Saks, 1996)."

By virtue of these trials, up until the first profiling trial, over 15,000 blind trial opinions have been collectively expressed by the participants on handwriting and signature trials. Over time it became clear to the experimenters and participants alike that skill does vary from individual to individual and from laboratory to laboratory, and that the error, correct, and

conservatism rates vary from test to test. Accordingly, the program further developed into a system of validation of expert opinion along with a mechanism to provide feedback to individuals that may assist in the acquisition of the skills required to perform forensic handwriting and signature comparisons successfully. The authors call this feedback mechanism the Revision and Corrective Action Package (RACAP).

Between the years 2000 and 2003, document examiners participating in the profiling program were exposed to two trials per year, every year. No context information was provided to examiners. At least 200 questioned signatures or text samples were provided for comparison with the known material. Examiners were required to express opinions regarding the authorship (and in some instances the "process" of image production: for example, whether a signature was produced using a simulation process) for each of the questioned images presented. At the conclusion of each trial, examiners were provided with a RACAP. In addition, each participant was provided with a profiling certificate containing the compounded results of the profiling trials. This certificate numerically describes a picture of the examiner's expertise according to correct, error, and inconclusive rates that can be used by the examiner to demonstrate the nature of their skill.

Methods and Materials

Participants

Twenty document examiners employed at six Australian and New Zealand police and government forensic laboratories undertook the trial. They provided informed consent for the results to be published while maintaining anonymity of their results.

Material Studied

The 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. All writings were made using the same make of blue ballpoint pens and using the same make of writing material. All writings in the study were performed on a backing-pad of ten A4 sheets of paper.

The specimen writer was selected from the academic staff at La Trobe University. This writer was provided with all materials required to form the specimen material. The specimen writer, each day, was required to write 21 normal signatures, 6 disguised signatures (where the specimen writer was asked to change their signature in order to deny it at a later stage), and 6 auto-simulations. Auto-simulations are a type of disguised signature where the writer attempts to deny the signature by introducing features that they believe would make it appear as though someone other than themselves has forged it. This was repeated for seven days.

The specimen group comprised 21 of the normal signatures taken from seven days. These signatures were attached to backing boards (three to a board) for use in the trial. An example of a specimen signature is given in Figure 1.

Two individuals described here as "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

Figure 1. An example of a specimen signature.

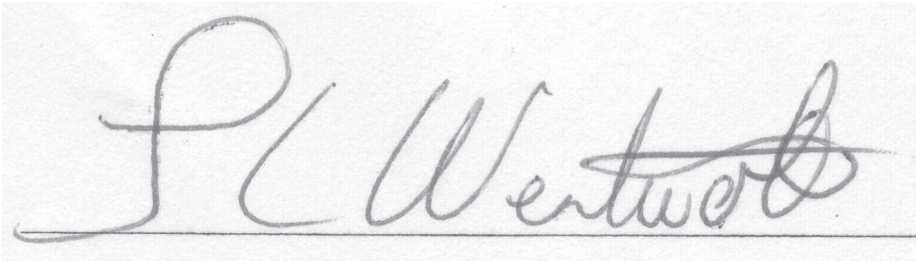

Figure 2. An example of a questioned simulated signature.

of the forgers was provided with nine normal signatures from the specimen group described in the previous section. Each of the forgers' specimen signature group represented three signatures from each of three days of specimen writings; i.e., forger A's specimen group was taken from the specimen writer's day one, three, and five signatures, and forger B's specimen group was taken from the specimen writers day four, six, and seven signatures. The forgers were instructed to produce unassisted simulations only in this trial. The specimen signatures were not traced or machine reproduced.

The forgers, each day for a seven-day period, practiced 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 attempted simulations were made by each of the forgers over the seven-day period. An example of a specimen signature is given in Figure 2.

The questioned group contained the following types of signatures: 50 genuine signatures (these comprised 10 signatures from days one and seven, and 6 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 four, five, and six from each of the seven days); 21 auto-simulations (these were auto-simulated signatures four, five, and six from each of the seven days); and the 260 questioned signatures were given a random number and attached to backing boards (three to a board).

Procedure

All participating document examiners were provided with the same originals of the specimen and questioned signature groups and an answer booklet. 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 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" through "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 through 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 disguise/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.

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 among 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." Examiners were given the option of providing peer-reviewed responses which meant that the returned answer booklets could be the agreed responses of two or more examiners or an individual examiner's responses.

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 that 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.
% *Correct*	Equals 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 (opinion units) were analyzed to produce scores for each of the different questioned signature types. The following definitions of the score categories are used in subsequent results tables regarding process opinions:

# *Sim/dis*	The number of times that examiners expressed the opinion that the signature was the product of a disguise and/or simulation process.
# *Not Sim/dis*	The number of times that examiners expressed the opinion that the signature was not produced using a disguise and/or simulation process (that is the signature was written normally).
# *Inc Sim/dis*	The number of times that examiners expressed an inconclusive opinion regarding whether the signature was the product of a disguise and/or simulation process.
% Sim/dis	The number of times that examiners expressed the opinion that the questioned signature was the product of a disguise and/or simulation process divided by the total number of process opinions (expressed as a percentage).
% Not Sim/dis	The number of times that examiners expressed the opinion that the questioned signature was not the product of a disguise and/or simulation process divided by the total number of process opinions (expressed as a percentage).
% Inc Sim/dis	The number of times that examiners expressed an inconclusive opinion regarding whether the signature was the product of a disguise and/or simulation process, divided by the total number of process opinions (expressed as a percentage).

Results

In all, ten answer booklets were submitted. These booklets represented the responses from the 20 document examiners. Six of the booklets were the agreed opinions from two examiners, two were the agreed opinions of three examiners and two were nonpeer-reviewed opinions. For each signature, all examiners provided an authorship opinion and a process opinion.

Overall Group Results: Authorship

An authorship opinion relates to whether a questioned signature was or was not written by the specimen writer. Examiners' authorship responses (opinion units) were scored and grouped together for each of the different questioned signature types. These scores for the group of examiners' are given in Table 1. A major finding for this trial was that, as can be observed in Table 1, the error rate for the group was very small (.04%). Only 2 erroneous authorship opinions were expressed over the 5,200 opinions expressed by the group. These two erroneous opinions came from one answer booklet and were opinions that had been peer-reviewed. This error was associated with expressing the opinion that a simulated signature was genuine; i.e., that is, the examiners were of the opinion that a forgery was written by the specimen writer. These erroneous opinions resulted in a "% error" of "called rate" of 100% since all other opinions regarding the questioned simulations were inconclusive regarding authorship (a 99.9% inconclusive rate). For all other categories of questioned signatures no erroneous authorship opinions were expressed. It should be noted, however, that a large difference in the inconclusive rate was recorded between the auto-simulation group (99.5%) and the disguise and genuine groups (11.4% and 1.2% respectively) which is considered further below.

Signature Type	Opinion Scores							
	Correct			Error			Inconclusive	
	#	%	% called	#	%	% called	#	%
Genuine	988	98.8	100	0	0	0	12	1.2
Disguised	372	88.6	100	0	0	0	48	11.4
Auto-sim	2	0.5	100	0	0	0	418	99.5
Simulated	0	n.a.	0	2	0.1	100	3358	99.9
Total	1362	26.19	99.85	2	0.04	0.15	3836	73.77

Table 1. Scores for examiners' opinions regarding the authorship of each of the questioned signature types.

Overall Group Results: Process

A process opinion relates to whether a questioned signature was or was not the product of a disguise/simulation process. Examiners' process responses (opinion units) were grouped together for each of the different questioned signature types. The scores for responses according to whether examiners believed that each questioned signature was or was not the product of a disguise/simulation is given in Table 2. As can be observed from the results, the distribution of responses for each of the different types of questioned signatures varies. Examiners showed considerable skill at identifying that the questioned simulations and auto-simulations were the product of the simulation/disguise process. There were only 2 erroneous opinions (out of 3,360 opinions) that simulations were not the product of a simulation process and 2 of 420 opinions that auto-simulations were not the product of a simulation process. For these two types of signatures, examiners also displayed low conservatism rates of 4.3% and 6.7% for simulations and auto-simulations respectively. It should be noted that the two erroneous opinions on simulated signatures were associated with the two erroneous authorship opinions noted in Table 1. The two erroneous process opinions regarding the auto-simulations in Table 2 relate to the two correct authorship opinions in Table 1 (that is, the examiners expressing the correct authorship opinions relating to this questioned auto-simulation did so as they believed that the signature was not the product of a simulation process).

The nature of examiners' opinions differed for the different categories of questioned signatures. A consideration of the examiners' responses for each type of questioned signature follows.

Opinions for Questioned Genuine Signatures

There were no erroneous opinions expressed that any of the genuine questioned signatures were the product of a simulation process (Table 2) and consequently, no examiners expressed the opinion that any of the 50 questioned genuine signatures were not written by the specimen writer (Table 1). The group achieved a high correct rate for authorship opinions and a low inconclusive rate. In addition, only 2% of the opinions regarding process were inconclusive.

Table 3 presents individual examiners' scores regarding their authorship opinions on questioned genuine signatures. Of the 20 examiners, 10 were 100% correct, 8 were inconclusive on one of the genuine signatures, and 2 of the examiners were inconclusive regarding the authorship of two of the signatures. The inconclusive rate for process opinions was slightly higher suggesting that in a few instances, examiners were not sure that the specimen writer was not trying to disguise or simulate their own signature. Of the 20 examiners, 9 were 100% correct in their opinions regarding the process of writing, 5 were inconclusive on one of the signatures, 3 were inconclusive on two signatures, and 3 were inconclusive on three signatures.

Opinions for Questioned Disguised Signatures

Only two of the 420 opinions expressed regarding the process of formation of the questioned disguised signatures were correct. Of the 420 opinions, 318 indicated that the signatures were

Signature Type	Opinion Scores					
	Sim/dis		Not Sim/dis		Inc Sim/dis	
	#	%	#	%	#	%
Genuine	0	0	980	98.0	20	2.0
Disguised	2	0.5	318	75.7	100	23.8
Auto-sim	390	92.9	2	0.5	28	6.7
Simulated	3212	95.6	2	0.1	146	4.3

Table 2. Scores for examiners' opinions as to the process by which each of the questioned signature types were produced.

Examiner code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Opinion Scores																			
# Correct	50	50	50	50	50	50	50	50	50	49	49	49	49	49	48	48	50	49	49	49
# Error	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# Inc	0	0	0	0	0	0	0	0	0	1	1	1	1	1	2	2	0	1	1	1
% Correct	100	100	100	100	100	100	100	100	100	98	98	98	98	98	96	96	100	98	98	98
% Error	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Inc	0	0	0	0	0	0	0	0	0	2	2	2	2	2	4	4	0	2	2	2
% Correct called	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% Error called	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3. Scores for examiners' opinions regarding the authorship of questioned genuine signatures only.

not the product of a disguise process. This may appear to be an erroneous result on the part of the examiner group. It must be remembered that, although the specimen writer was instructed to disguise their writing, the disguise strategy adopted may have been so poor that it was not detected by the examiner. In this case, referring back to Table 1, no erroneous authorship opinions were expressed on the disguised signature group and 372 correct authorship opinions were expressed. This indicates that the disguise process, for this writer, was largely ineffective.

No examiner expressed the opinion that a disguised signature was not written by the writer of the specimens. The number of inconclusive opinions varied from 0 to 16 opinions (which represents an inconclusive rate of between 0%and 76.2% respectively). Four examiners gave the opinion that all of the 21 disguised signatures were written by the specimen writer. Seven examiners were inconclusive on one signature. Three were inconclusive on two signatures. Three were inconclusive on three signatures, two on five signatures, and one examiner was inconclusive on sixteen signatures.

Only two examiners expressed the opinion that any of the 21 questioned disguised signatures were written using a disguise process. This only occurred with one of the questioned disguised signatures. Of the 20 examiners, 4 were of the opinion that none of the questioned disguised signatures were the product of the disguise process. The remainder of the examiners were inconclusive regarding the process by which these questioned signatures were formed (an inconclusive rate of between 4.8% and 95.2%).

Opinions for Questioned Auto-Simulations

No examiner expressed the opinion that an auto-simulated signature was not written by the writer of the specimens. Only two examiners expressed the opinion that any of the 21 questioned auto-simulated signatures were not written using a simulation/disguise process. This only occurred with one of the questioned auto-simulated signatures (which translated into a correct opinion regarding authorship). For the rest of the examiner group, the inconclusive rate regarding the authorship of the questioned auto-simulated signatures was 100%. Of the 20 examiners, 14 were of the correct opinion that all of the questioned auto-simulated signatures were the product of the simulation/disguise process. The remaining six examiners exhibited an inconclusive rate regarding the process by which these questioned signatures were formed (which varied from 4.8% and 57.1%).

Opinions for Questioned Simulated Signatures

Eighteen examiners were 100% inconclusive regarding the authorship of the questioned simulated signatures. However, all these 18 examiners were of the correct opinion that all of the questioned simulated signatures were the product of a simulation/disguise process. The two other examiners expressed the incorrect opinion

that one simulated signature was written by the writer of the specimens (not using a simulation/disguise process). They were inconclusive regarding authorship of the remaining 167 signatures. Of these signatures, they were of the opinion that 94 were the product of the simulation/disguise process and were inconclusive regarding the process of production of 73 signatures.

Summary of Results

The data presented here provides support for the proposition that examiners, given adequate samples of a complex signature, can determine whether questioned signatures are genuine or simulated. The low error rate observed over the body of questioned material (.04%) provides support for the proposition that examiners have skill at comparing questioned to specimen signatures, of the type used in this trial, and expressing valid authorship (in the direction of identification) opinions. The results provide evidence that although examiners display skill at determining whether or not a questioned signature was produced using a simulation process, they were not able to translate this process opinion into one that indicated whether or not the specimen writer wrote the simulation.

Discussion

The above findings are in themselves of importance. The value of a trial such as this does not, however, cease with these findings. Once all participants have completed the trial and the results subsequently analyzed, the participants receive the RACAP for the trial. The RACAP has been developed so that participants have the opportunity to review each questioned image, look at their opinion and the opinions of other participants, and learn from the experience. In this way the characteristics of individual skill acquisition and reinforcement have an ideal environment to be enhanced.

The RACAP contains summaries of group results in the form of tables similar to Tables 1 and 2 of this report. In addition, it contains tables with the scores for each examiner's opinions regarding the different types of questioned signatures (genuine, disguised, auto-simulated, and simulated) used in the trial. Each table gives the results for all of the questioned signatures of the one type grouped together. For each signature type there is one table for authorship opinions and one for process opinions. Table 3, which shows the scores for examiners' opinions regarding the authorship of questioned genuine signatures, is an example of one of these tables. Along with these tabulated summaries, some commentary is provided to guide participants through the results.

In addition, the group results and individual examiner's results for each of the 250 questioned signatures are provided in conjunction with a high resolution image of the signature.

Conclusion

Expertise profiling, of the type overviewed in the current paper, is likely to become a routine aspect of forensic handwriting examiners' work. The program emphasis is directed toward testing the underlying belief system of practitioners, building a picture of individual and group uncertainty rates for different types of forensic handwriting and signature comparisons, and providing a mechanism to enhance skill acquisition and consolidation. Contrary to the fears of Risinger and Saks (1996) mentioned in this paper's introduction, there appears to be growing willingness of examiners to validate their skills.

Since 2002, document examiners from nine countries were enrolled in the profiling program. This will generate in excess of 30,000 blind trial opinion units annually which will contribute to portraying a meaningful picture of the skills of examiners generally. The compounded results of these trials will provide examiners and their client groups (including the courts) with a picture of both group and individual expertise unlike that available in the past. This picture can then be used as a means to assess both the skill claimed by an examiner within the current belief system (whether this be, for example, in determining the authorship of questioned text or determining that a signature is the product of a simulation process) or testing the belief system itself. Although testing of the type described here will always have shortfalls, we believe that it is a significant step forward in addressing the professional obligations of practitioners in the field. However, at this stage there must be caution in generalizing the results from one group as tested here to all document examiners.

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