

Secondary Impressions

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This paper provides a summary of available information relating to secondary impressions and additional findings gained through experimentation done in the New Zealand Police Document Examination Section. The culmination of this information is aimed at providing a reference to identifying the types of conditions that lend themselves to the formation of secondary impressions and, furthermore, to note any features that distinguish these secondary impressions from indentations.

Introduction

The term “secondary impression” has been coined to describe the visible image produced as a result of the transference of details arising from the contact of the reverse side of an indented paper surface with another paper surface. The phenomenon of secondary impressions is visualized following treatment with the Electrostatic Detection Apparatus (ESDA). The ESDA technique has been around since approximately 1977, however the first instance of secondary impressions was not documented until 1992 by Dr. Keith Snape, a private document examiner in the U.K. (Strach, 1993). In June 2000, the New Zealand Police Document Examination Section noted an interesting secondary impression (James, 2000). In Figure 1, the text of the indented note clearly visible at the bottom of the page is repeated in the top left corner. In addition to the text, the outline of the note’s position and paper clip mark are clearly visible. The rare finding of secondary impressions in casework lends weight to the observance that they are not a common occurrence (Strach, 1993; Barr, 1995; James, 2000). Indeed, it appears to take a rather specific set of conditions before they are produced.

The ability to differentiate secondary impressions from indented impressions is clearly important. For example, the possibility of an image on a questioned document being mistaken for indentations, after having in fact been transferred from an overlying specimen sample, could have serious ramifications.

Initial attempts at experimental reproduction of secondary impressions have met with limited success. The premise behind these initial experiments was that secondary impressions were formed by the action of a pressure applied to an “embossed” page through to another page. The discovery was soon made that, in addition to a downward pressure, a component of lateral motion between the donor and recipient paper surfaces was also required before ESDA-visible impressions were developed on the recipient paper (Strach, 1993). Following this preliminary finding, Strach et al. set up a number of “real life” experiments in an attempt to produce secondary impressions. Paper having been subject to heavy pressure writing was stapled to a blank piece of paper and placed in a desktop diary in heavy use and one under light use for a period of 3 months. The heavily used diary afforded weakly developed partial secondary impressions of the original writing that were mottled in appearance. Of special interest was that this mottling seemed to be comprised of lines corresponding to the direction of relative motion between the stapled sheets of paper produced by the action of opening the diary. The diary in light use produced no secondary impressions.

Methods and Materials

A brief overview of what is known about the processes involved in indentation formation is necessary in order to extrapolate as to the types of processes that may be involved in secondary im-

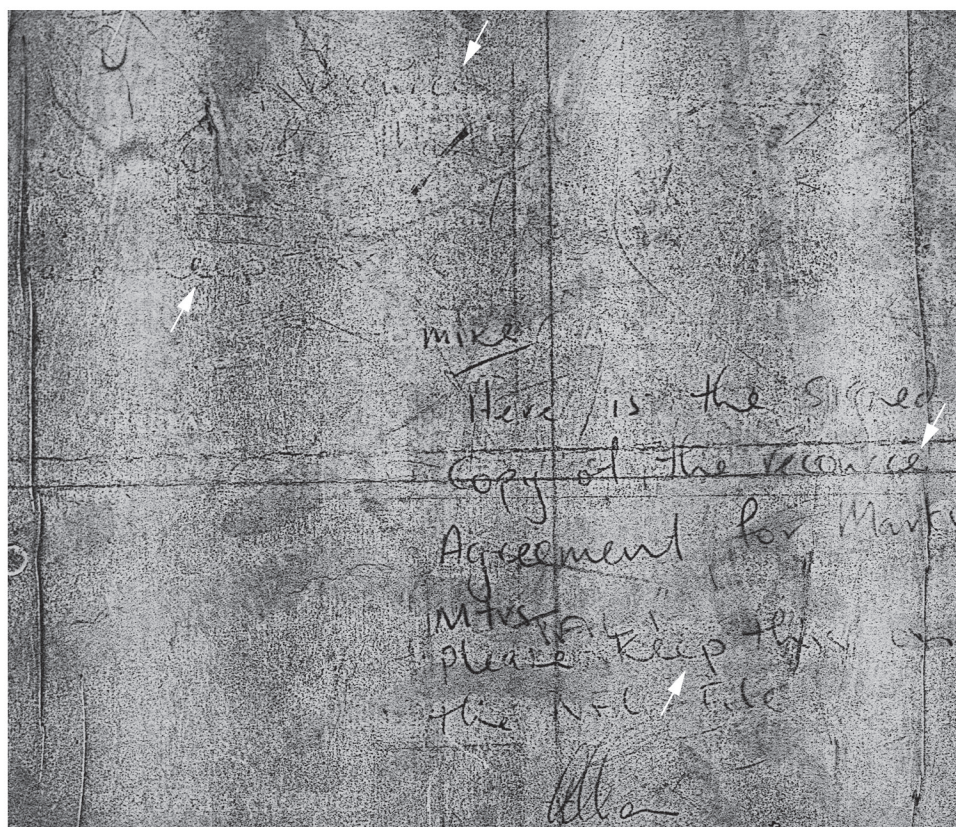


Figure 1. Note initially written overlaying the bottom of the page, then paperclipped to the upper left corner.

pression formation. It would seem quite clear that the act of writing effects changes in the paper's fibers. We observe indentations on the obverse side of the paper and embossing on the reverse. This process also manifests changes in any underlying sheets of paper, which lessen as the distance from the source increases. These subtle changes are detectable through the use of the ESDA (even in cases where sidelight does not reveal indentations). In relation to secondary impressions, it would seem that the embossing on the reverse side of the donor paper imparts some type of physico-mechanical and/or electrical disturbance to any subsequent recipient paper, given the proper conditions (Barr, 1995). It is on this premise that experimentation was conducted to better define these conditions.

The primary consideration of this research was to determine the conditions under which secondary impressions could occur under "natural" circumstances, that is, as may be seen in casework. However, as a preface to this, a number of experiments were undertaken to study how these sec-

ondary impressions could best be produced on an "artificial" basis. This was deemed to be the best way of identifying the conditions that could give rise to "natural" occurrences of secondary indentations.

General Methodology Development in the "Artificial" Setting

In previous work it was found that a strong pressure, which afforded movement between a donor and recipient paper, produced secondary impressions (Strach, 1993). To produce the sharpest secondary indentations it was envisaged that this movement would be controlled so that a discrete "back and forth" motion could be applied. In order to accomplish this, the recipient paper would need to be held fast while the donor paper moved slightly over its surface (or vice versa).

Paper Type and Writing Pressure

Variables including donor paper type and writing

pressure were briefly considered. An experiment was conducted using three different paper types (EXP Memo Cube Refill, Reflex A4 80gsm [grams per square meter] white photocopy paper and Candida A4 lined paper) to which three different writing pressures (subjectively described as light, medium and heavy) were applied. The donor papers were comprised of three sets of three (2.5 by 10 mm) strips of the above paper types, taped down at one end. The A4 80gsm recipient paper was fixed under these flaps of paper. In this way, nine images were processed at a time. An eraser was used to create a downward and lateral pressure on the donor paper such that a discrete, uniform movement resulted between the two sheets of paper. This motion was repeated three times.

Making Impressions

In the following two scenarios the prepared samples were placed between a wooden clipboard and a piece of short-pile office carpet, and rubbed vigorously for 5 minutes.

Scenario 1

A ballpoint pen was used to fill in the query areas on a piece of EXP “While you were out” message note paper. This note paper was stapled to a sheet of A4 80gsm paper, which was folded in half, such that the note paper was contained within.

Scenario 2

A ballpoint pen was used to heavily impress a series of lines, numbers and alphanumeric entries on two (76 by 76mm) yellow Post-It® notes. These papers were then stuck to the inside of a Candida self-seal (114 by 225mm) envelope. One note was stuck directly inside the envelope; the other note was stuck to a blank note, and then fixed inside the envelope.

Scenario 3

A variation on the first two scenarios involved a number of different items being used to apply the necessary movement and pressure between the donor and recipient paper. Such items included the author’s hand, a piece of cotton cloth, a grapefruit and an eraser (High-Quality plastic eraser). These objects were rubbed in a uniform, discrete motion over the donor paper for approximately 10 seconds. An ESDA was then performed on the

recipient paper to ascertain, firstly, whether an image was realized and secondly, to what degree it was visible.

General Methodology Applied to “Natural” Settings

The following situations were set up, based on findings in the “Artificial” Setting section. The notion was tested that a restricted movement between the donor and recipient paper, coupled with adequate pressure, would provide the necessary friction for secondary impression formation in a more “natural” setting.

Situation A

A Post-It® note was written on heavily. This was then stuck to another note of the same type and folded in on itself such that the writing was facing outwards. It was hoped that the writing would leave a secondary impression on the blank Post-It® note contained within. This note was then carried around in the author’s back pocket for a 24-hour period.

Situation B

An EXP Memo note was heavily written on, folded up inside a piece of lined paper and placed in an envelope. This was carried in the outer pocket of a gym bag for a 24-hour period.

Situation C

A heavily embossed EXP Memo note was stapled to the top right corner of a blank A4 page and placed in a soft-covered writing folder. This was carried around in the author’s hand and opened and closed numerous times over the course of 30 minutes.

Results and Discussion

“Artificial” Setting

Paper Type and Writing Pressure

The type of donor paper did not seem to show any significant difference in the quality of the secondary impression created in this small sample pool (Figure 2). As expected, the greater the degree of pressure exerted when writing, the darker and more distinct the secondary impression.

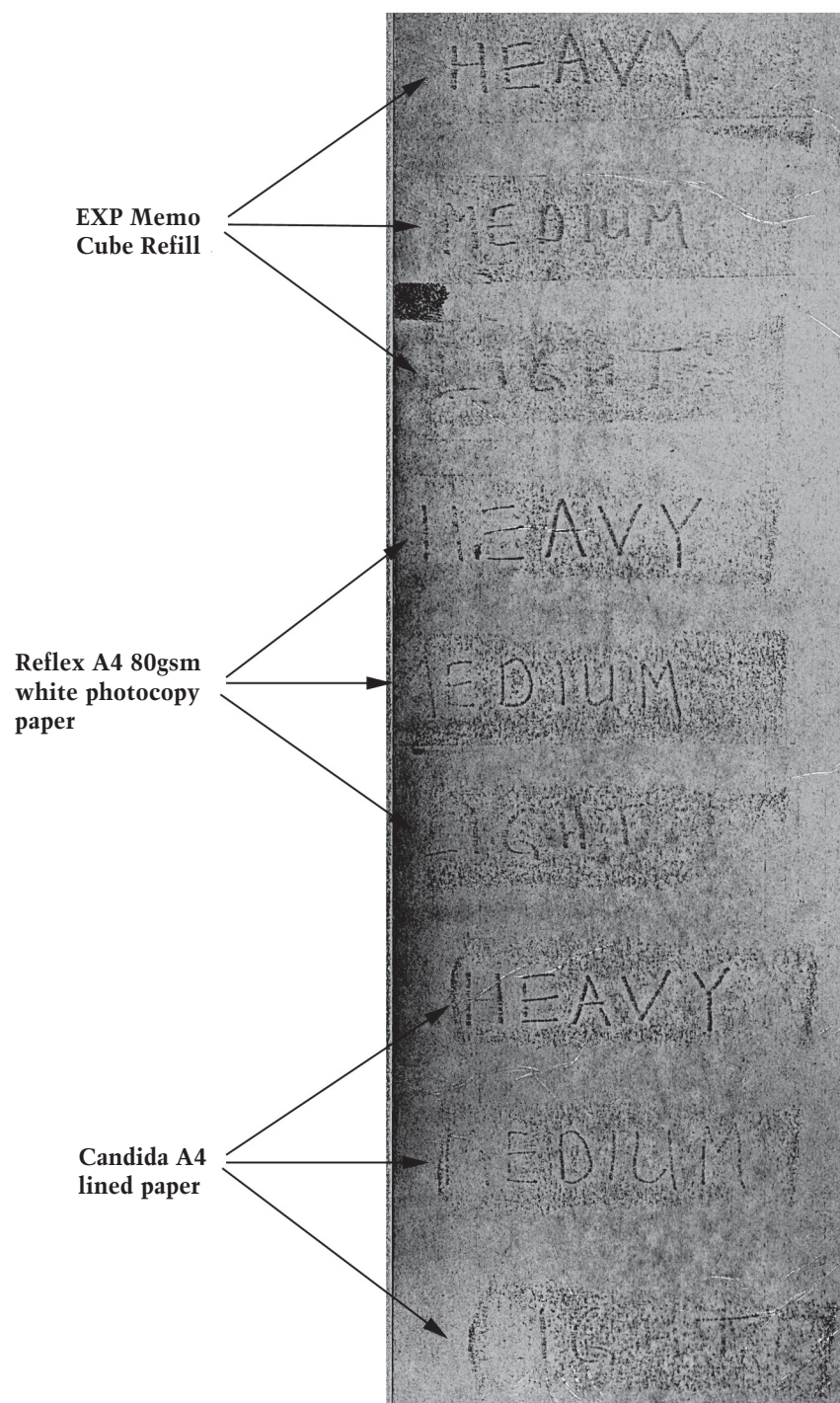


Figure 2. Results of different paper types in conjunction with different writing pressures.

Making Impressions

Faint secondary impressions resulted in the first two scenarios involving the short-pile office carpet. In Figure 3, indentations are seen where the note was initially written at the bottom of the page. The note was then stapled to the top left corner of the page; secondary impressions are seen, including an outline of the EXP Memo. In Figure 4, the Post-It® note labelled as "A" was placed on portion "B" of the envelope. Post-It®

note "C" was placed on Post-It® note "D." Both "C" and "D" were then placed on portion "E" of the envelope. Note the outlines of both notes on the envelope and the secondary impressions arising from the heavy writing.

The experiments in scenario three using the author's hand, a piece of cotton cloth, a grapefruit and an eraser, revealed that by far the best secondary impressions arose with the grapefruit and eraser being used to apply the force. For practical purposes, the eraser was used in further stud-

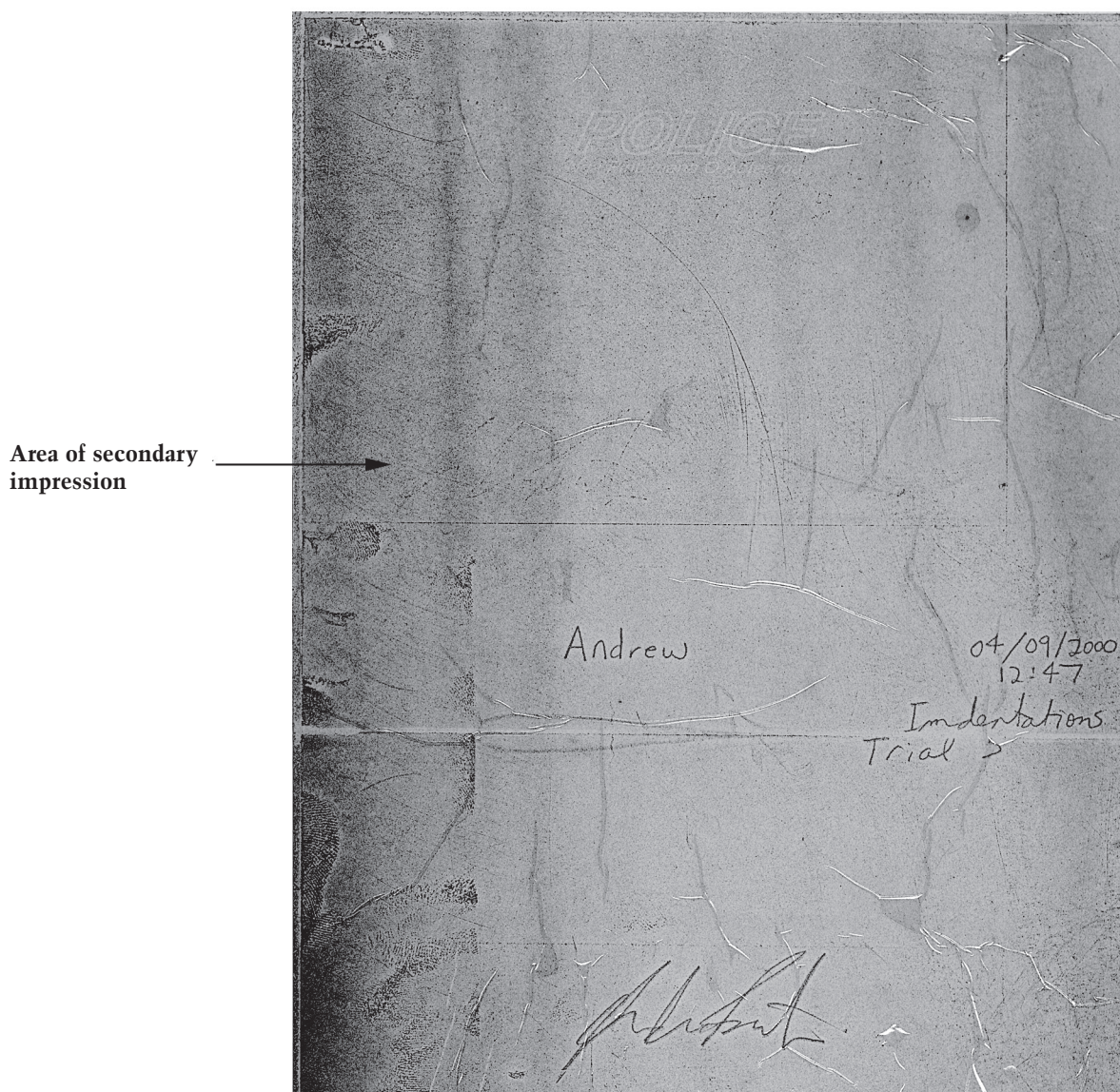


Figure 3. Note initially written at bottom of page, then stapled to top left corner of page.

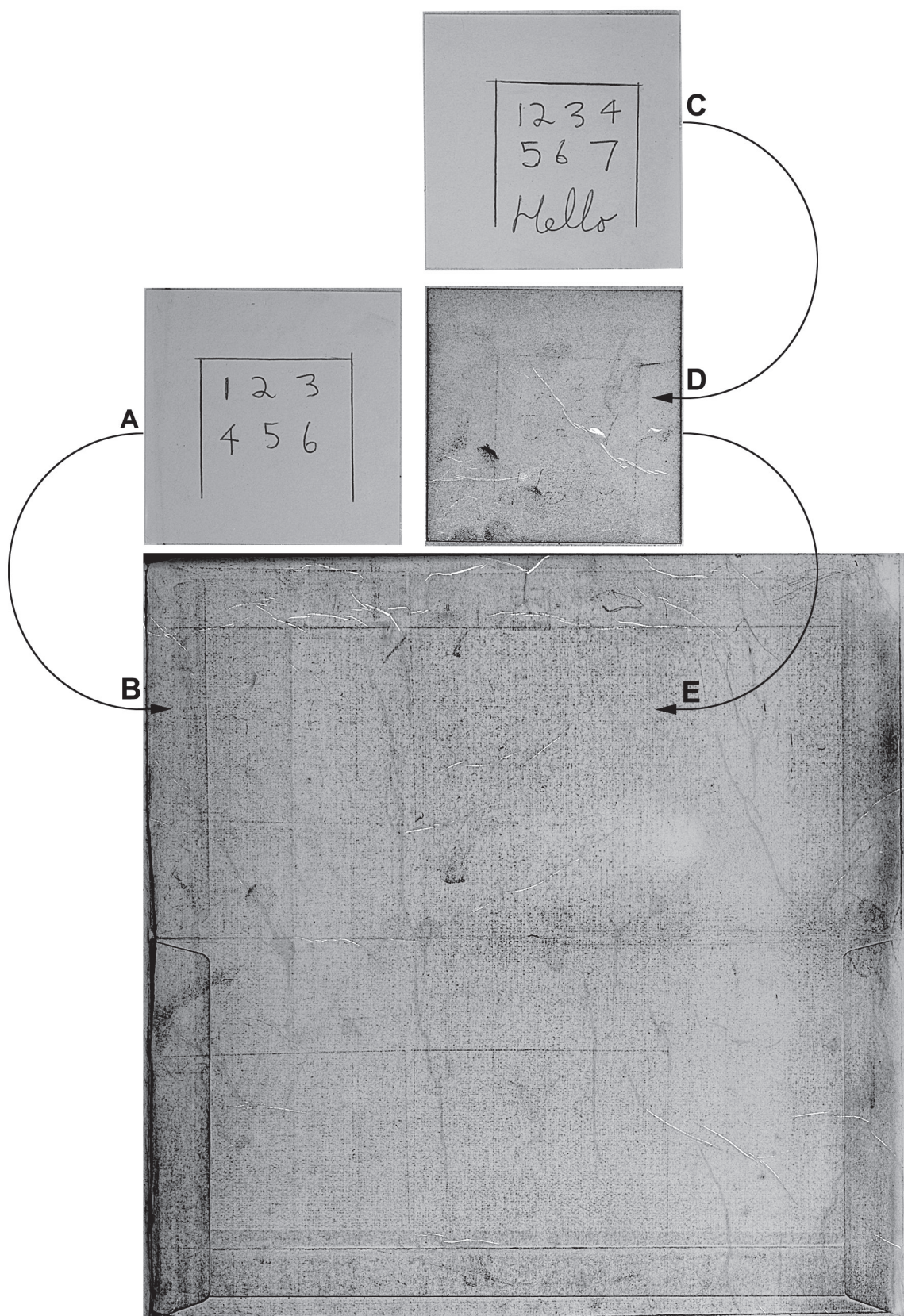


Figure 4. Note A was placed on portion B of the envelope. Note C was placed on note D and then onto portion E of the envelope.

ies. These included placing notes in envelopes, stapling notes to pages, paper clipping notes to pages and placing notes between sheets of paper. An external force applied via the eraser in a lateral motion to the situations described above invariably resulted in secondary impressions of reasonable quality.

Having successfully developed a method of reliably creating secondary impressions, it was time to apply these findings in an attempt to generate such impressions in a more “natural” setting. That is, situations that could arise during the normal course of business.

“Natural” Setting

Situation A

An ESDA of the blank underlying Post-It® note (Figure 5) revealed a relatively legible secondary

impression, however it was not wholly complete. Some parts were fainter than others. This was partly due to the varying writing pressures applied to the donor paper. Restricted movement between the donor and recipient paper in areas such as the fold and the sticky top portion may have further contributed to the “patchiness” of the image. Note that the secondary impression has a grainy appearance, which has been observed in previous papers and casework (Strach, 1993; Barr, 1995; James, 2000).

Situation B

An ESDA of the lined paper revealed only a faint outline of where the note had been held in place by the lined paper. This outline is thought to be a result of the rough donor paper edges abrading the surface of the recipient paper.

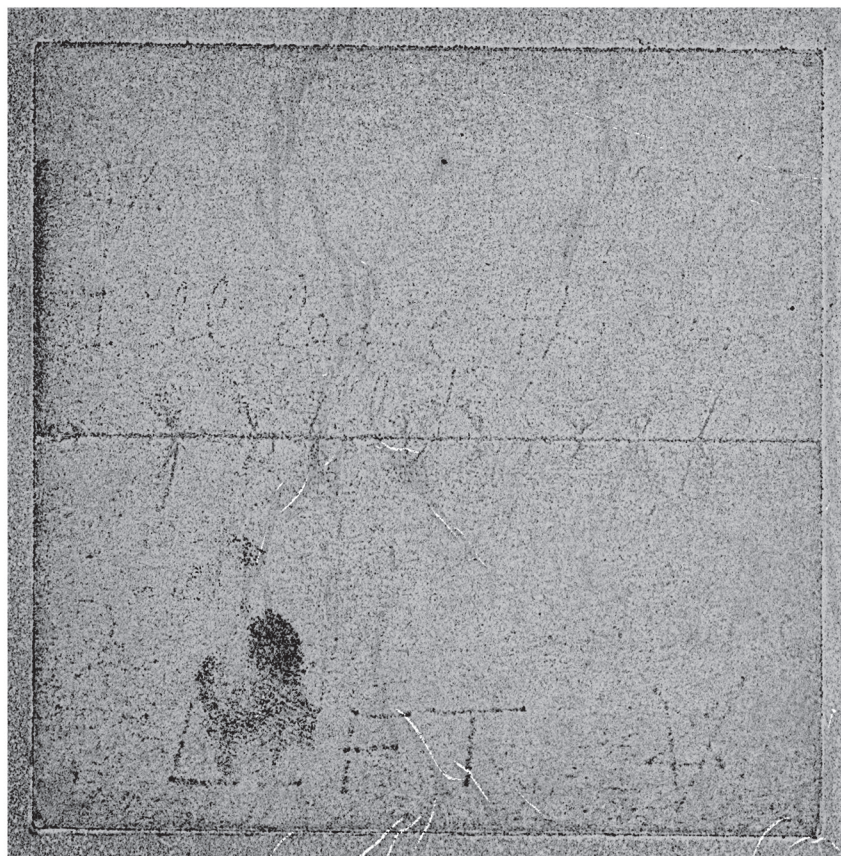


Figure 5: Secondary impressions on note carried in pocket.

Situation C

An ESDA of the blank A4 page revealed an interesting image (Figure 6). The word "WATER," written on the EXP Memo was only present from midway down but very clearly impressed. On close inspection of the writing folder it was noted that this secondary impression portion corresponded exactly with a convex seam lying behind the paper. The word "ICE" was also visible. This image was a product of the EXP Memo note rubbing between the lightly textured (fake leather look) unstitched cover of the folder and a pad of lined paper held on the opposite cover. These secondary impressions had a distinct directional graininess about them, indicating a direction of motion consistent with the opening movement of the folder.

Conclusion

Secondary impressions can be manufactured with marked consistency and ease in a laboratory environment. However, based on literature and experimentation in the New Zealand Police Document Examination Section it would seem a rarity to encounter instances of secondary impressions in the course of a document examiner's work. Furthermore, when such instances do occur, both the circumstances surrounding their position and/or general appearance on the paper should indicate the possibility of a secondary impression. General appearances to look for include strange image positioning, duplication/paperclip marks, hole punches, paper edges and/or a general graininess in the impression tending towards directional lining.

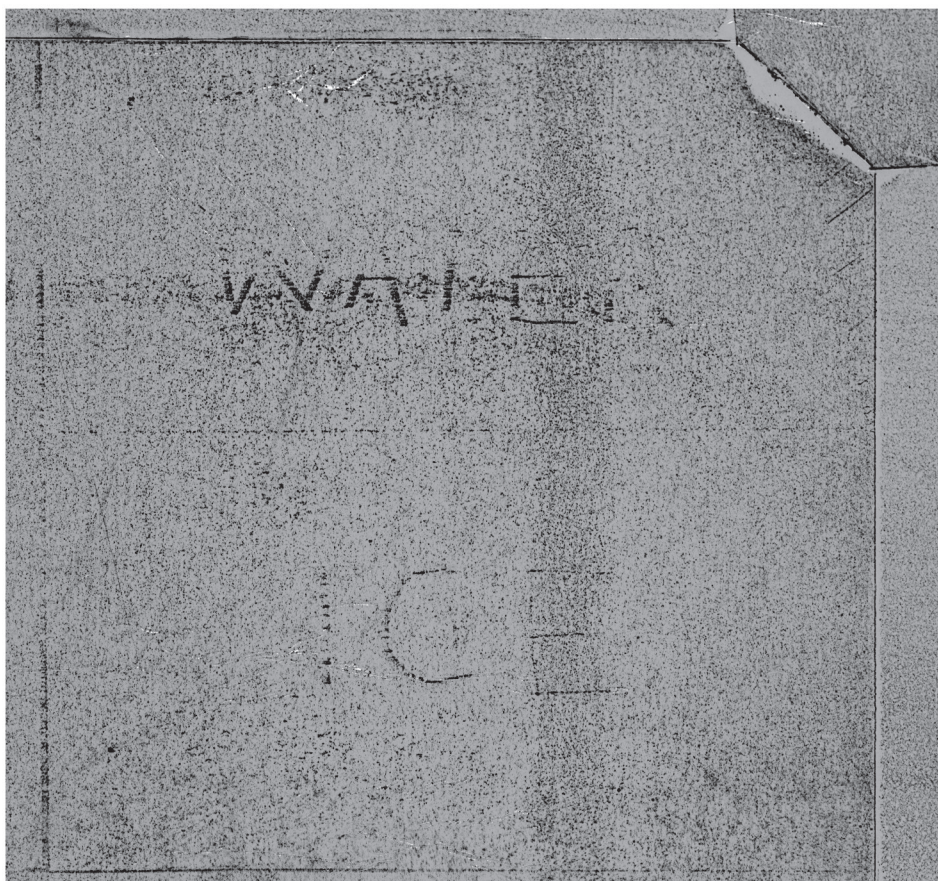


Figure 6. Secondary impressions taken from note carried in a binder.

Further research to define scenarios in which secondary impressions may be found could be conducted, but would by no means be exhaustive. The best approach to the issue of secondary impressions is for the document examiner to be aware of the types of conditions where they could be found. It is unlikely that a document examiner who is aware of the potential for secondary impressions would misinterpret a secondary impression for being anything other than just that. An awareness of the type of circumstances that may give rise to secondary impressions is the document examiners' first line of defense against misinterpretation or oversight.

References

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