Toward Identifying the physical source of the Bush Memos

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ABSTRACT
The following evidence from a forensic examination of the Bush memos indicates that they were typed on a typewriter:

1. The specific font used is from a typewriter family in common use since 1905.
2. The characters “e,” “t,” “s,” and “a” show indications of physical damage and/or wear consistent with a well used typewriter.
3. The characters that are seldom used show no signs of damage or wear.
4. The quality of characters throughout the memos seem to be inconsistent beyond expectations from photocopying and/or digitizing but are consistent with worn platen and variations in paper quality.
5. Overlapping characters occasionally indicate paper deformation consistent with hammered impressions.
6. Critical indicators of digital production are missing.

Implications are that there is nothing in this evidence that would indicate the memos are inauthentic. Furthermore, from the point of view of the physical evidence in the documents (excluding any rhetorical evidence or external evidence, which is not examined in this study) no amount of additional research on the part of CBS would have lead them to exclude the documents from their *60 Minutes* report.

EXECUTIVE SUMMARY
There are a number of reasons for identifying the physical source for the recently released memos indicating that President George Bush failed to meet his obligation to the Air National Guard and disobeyed both written and spoken orders to take a flight physical.

A careful forensic examination of even the worst copies may provide some evidence of the documents’ authenticity or disprove their authenticity. For example, if the evidence demonstrates that the documents were originally digitally produced, it would disprove their authenticity.

On the other hand, if evidence indicates they were typewritten, it lends support to the credibility of CBS in general and to Dan Rather and his producers in particular. If evidence demonstrates that the memos were typewritten using a font usually available in the military, but less common among civilians, at least on this evidence they were right to air the memos.

Given the current extent of political animosity, the voice of indisputable evidence can be useful. In short, there is justification for a qualified, independent lab to examine the documents and make the results publicly available.

Qualifications of the Lab

Interactive Media Research Laboratory is a small university lab that does scholarly studies and writes about issues involving the impact of technology on communications. Among other things, it is investigates archival and authentication problems. As the principal investigator and lab director I have researched and written on these topics since 1991, with more than 50 peer reviewed publications.

In addition, I served in the U.S. military (Army) from 1963 to 1972. For five of those seven years I was an Army illustrator responsible for short run publications including memos such as those in question. Ultimately, I have a total of almost 35 years experience examining document production, including analyzing and spec'ing type. I have an archive that includes military documents produced between 1963 and 1984 and have access to a repository of military documents here at the university. Finally, I have extensive experience using computers to manage and manipulate images, including type. (See attached CV.)

Nature of the Studies

I divided the project into steps designed to identify the specific font and describe how the memos were produced.

1. Examine the physical nature of the documents. Do they look like military memos? Can they have been typed? If they were typed, did appropriate technologies exist at the time to have been typed then?

2. Identify the defining characteristics in the font used in the memos, especially focusing on the nature of the serifs but also examining the characteristics of the strokes that would be used to produce the characters. Are the serifs square or spur-like? Do the strokes vary in width or are they of consistent thickness? If some strokes vary, which ones?

3. Identify typefaces that replicated the above characteristics.

4. Identify a manufacturer who produced a typeface that fit the memos and manufactured a machine capable of producing the unique format.

5. Identify any characteristics that would indicate a typewriter and not digital impressions (e.g., worn or damaged characters).

6. Search for any typing artifacts (e.g., strikeovers).

7. Based on the above, establish a hypothesis describing how the documents may have been created and recreate scenarios that successfully reproduced the effects found in the typed memos.

OVERVIEW OF FINDINGS -- NATURE OF THE DOCUMENT

The information available in such poor reproductions is surprisingly significant. First, The documents are not Times New Roman, or any similar font, nor are they produced with word processing software (or at least, were not printed using contemporary printing technologies). The documents are almost certainly printed using an impact printer (typewriter or daisy wheel) and are not digitally produced for the following three reasons:

1. The font is a common typewriter typeface invented at the beginning of the 20th century and in continuous use until the computer replaced the typewriter. The font's name is "Typewriter." Although the typeface was somewhat modified for civilian communities in the 1960s, it remained commonplace in the military well into the 1970s. In short, the Bush memos were produced in a version of Typewriter commonly used in the military at the time.

1. It is possible to find worn and damaged characters. The top left of the "t" is clearly worn to the extent that it seldom makes an impression. The "e" shows clear indications of physical damage. It appears to have three scratches and/or gouges extending diagonally down and across the bowl and across the lower stroke. The "a" and the "s" show similar indicators of wear and damage.

2. Seldom used characters such as numbers, capitals, and the lower case "o," "q" and "p" (and the other less used lower case characters) show no signs of damage.

3. Overall inconsistency of the characters goes well beyond what one would expect from photocopying and digitizing and indicates that they were produced using an inconsistent (*i.e.*, "mechanical") process.

4. There are indications of white "blisters" cause by a character typed on paper that was deformed by the impact of a previously struck character.

I will leave it to others to verify my findings with additional physical evidence, but I contend that the memos were probably done in a proprietary IBM typewriter font redesigned specifically for proportional typing. In 1984, I wrote articles on an IBM Selectric that uses an uncondensed IBM equivalent. The font used in the memos is a variant of the font used in Figure 1, below.

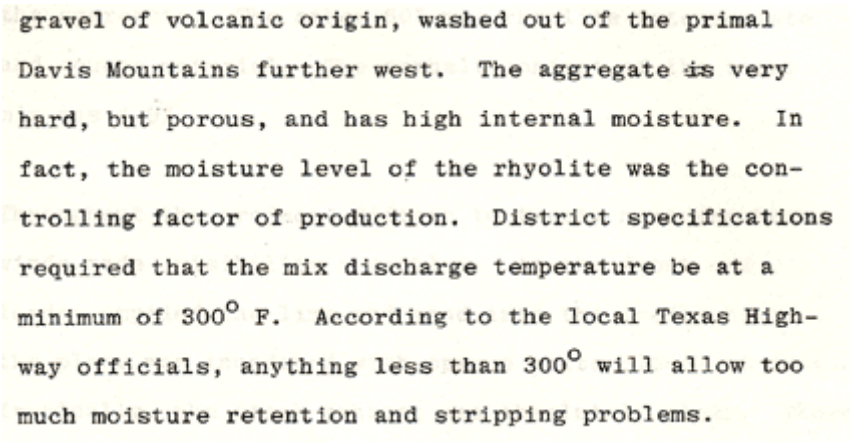

gravel of volcanic origin, washed out of the primal
Davis Mountains further west. The aggregate is very
hard, but porous, and has high internal moisture. In
fact, the moisture level of the rhyolite was the con-
trolling factor of production. District specifications
required that the mix discharge temperature be at a
minimum of 300° F. According to the local Texas High-
way officials, anything less than 300° will allow too
much moisture retention and stripping problems.

Figure 1. Example a selection typed with an IBM Selectric typewriter.

Differences between the above font and that used in the Bush memos are consistent with making the above font compatible with a proportional typewriter. The "g" on the Bush memo was narrowed with an up facing ear, the stroke at the bottom of the "t" is shortened, the numbers "6," "7" and "9" are simplified and the “”W” and “R” are slightly modified. With a few exceptions the lower case characters are condensed while the caps are left uncondensed. Oddly, the “s” is doubly condensed while the “m” is extended. These characteristics should make the specific type ball easy to identify.

Typewriter Typeface is in the larger family of typefaces called "Slab Serif." Typewriter includes ITC American Typewriter, Courier, Secret Service Typewriter and similar typefaces characterized by flat square serifs and (usually) consistent stroke widths. Common in this version of Typewriter, the upper serif on the 1 stands out like a flag in a strong wind. In the newer versions, the upper serif droops like a flag in a light wind. (Figure 2.)

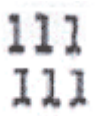

111
111

Figure 2. Example of “1” taken from Bush memos.

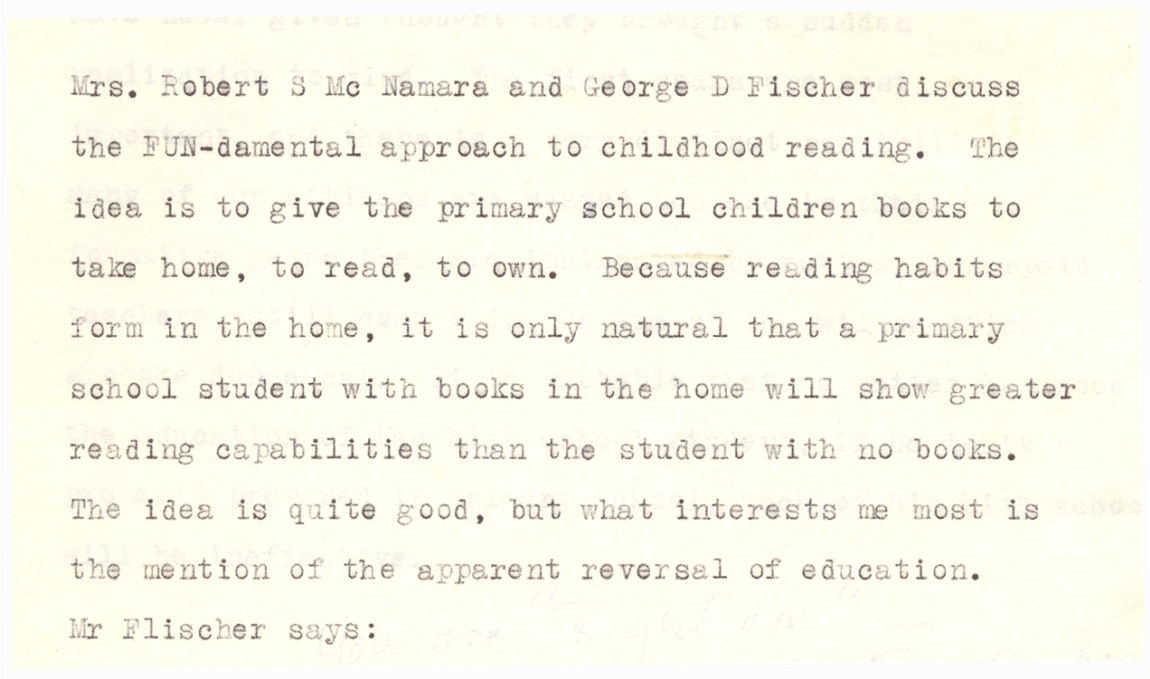
Definition: A Slab Serif is a type of serif font that evolved from the Modern style. **The serifs are square and larger, bolder than serifs of previous typestyles**. Considered a sub-classification of Modern, Slab Serif is further divided into Clarendon, **Typewriter**, and Slab Serif (a separate sub-category of Slab Serif) styles. (emph. mine)
(http://desktoppub.about.com/library/glossary/bldef-slabserif.htm)

The documents I used for comparison include military orders, letters of recommendation and commendation, security clearance evaluations. The documents were produced at American military installations in Korea, the United States, and England. Using these documents and the Bush memos, I am able to demonstrate that the font family used to

produce the Bush memos was commonly used in the military at the time, although it had become less common among civilians who tended toward slightly more decorative styles.

Variations in "Typewriter" Typeface

Different typewriter manufacturers created their own variations of Typewriter. A variety of them are currently available. Digital versions include "ITC American Typewriter," and two typefaces named "Secret Service Typewriter," and "Passport." All of these and most other digital typefaces were taken directly from impressions of old typewriters dating back to 1923 – perhaps earlier (Figure 3).



Mrs. Robert S Mc Namara and George D Fischer discuss
the FUN-damental approach to childhood reading. The
idea is to give the primary school children books to
take home, to read, to own. Because reading habits
form in the home, it is only natural that a primary
school student with books in the home will show greater
reading capabilities than the student with no books.
The idea is quite good, but what interests me most is
the mention of the apparent reversal of education.
Mr Flischer says:

Figure 3. Paragraph typed on 1923 Underwood, demonstrating existence of Typewriter typeface dating back at least that far. Typeface was invented circa 1905 by Remington and adopted and adapted by all other American manufacturers.

None of the fonts available on the Internet seem to be exact matches, however. It is unlikely that a digital typeface could have produced any of these memos. Specifically, the quality of strike between characters is inconsistent, and the effect caused by photocopying and digitizing are inadequate to explain the differences.

Identification of the Font Family in the Bush Memos

The font used in the Bush memos is characterized by slightly convex base slabs. Ironically, the font used in the Bush memos was originally and decidedly not designed for proportional spacing. Proportional spacing permits a "one" to exits in space designed

for a “one” and an “M” to exist in a space designed for an “M.” Without broad serifs, a “one” in a monospaced environment becomes isolated in a large white space. The broad serifs on the vertical characters keep a row of “ones” from looking like a row of trees in an otherwise empty field. That said, the most identifying characteristic of the Typewriter family is the broad base with occasional slightly curved bottom serifs and the flag flying at full mast on top of the "1" (as seen above).

Times New Roman?

Some of the claims presented by those who dispute the documents' authenticity are that the typeface seems to be Times New Roman. "Times New Roman," they say, "was unavailable in the early 1970's." It is also further alleged by a few that the military used courier almost exclusively. It will become clear that the Bush memos were not produced in Times New Roman. Nor was Courier in universal use in the military.

Interesting Transitional Typeface

Perhaps the thing most interesting about these memos is that the typeface seems to mark the transition between monospacing and proportional spacing (Figure 3). The characters have all of the characteristics of a monospaced type, but they are proportionally spaced. The result is characters with serifs that overlap as often as not.

Conclusions About CBS Role

There is no good way for proving the documents in question are authentic. If I were in the Texas Air National Guard, and I said, “I saw the documents in Col. Killian’s cabinet,” who would believe me? The answer to that question depends entirely on the political point of view of my audience. It is possible however to infer from physical evidence that CBS (and Mr. Rather and his producers) justifiably believed the documents to be authentic. Given enough time and concentration, any competent “expert” would have concluded that they are typed in a font commonly used in the military at the time. There is currently outside evidence indicating that the documents are inauthentic, but none of it exists in the mechanics of documents themselves. They are completely in keeping with typewritten documents of the period in question – early 1970s. Whatever the outcome of this kafuffle, I am convinced that in the end, it will be generally recognized that the documents CBS released to the public were typed – probably on an old, military typewriter.

If one considers that the thing that makes the news “news” is its immediacy, it is hard to impugn CBS for using the memos in a news story. It took IMRL three weeks of careful examination to determine that the documents are typed – implying that after all of this careful study, the result would have been to say “. . .all of our evidence suggests they are authentic.” Of course all of the evidence is not in, yet. New evidence has come to light that suggests they are inauthentic. That does not change the fact that at the time of the broadcast, all evidence CBS possessed indicated the documents were authentic.

Critical Speculation

Critics speculate that the documents are inauthentic for a number of reasons.

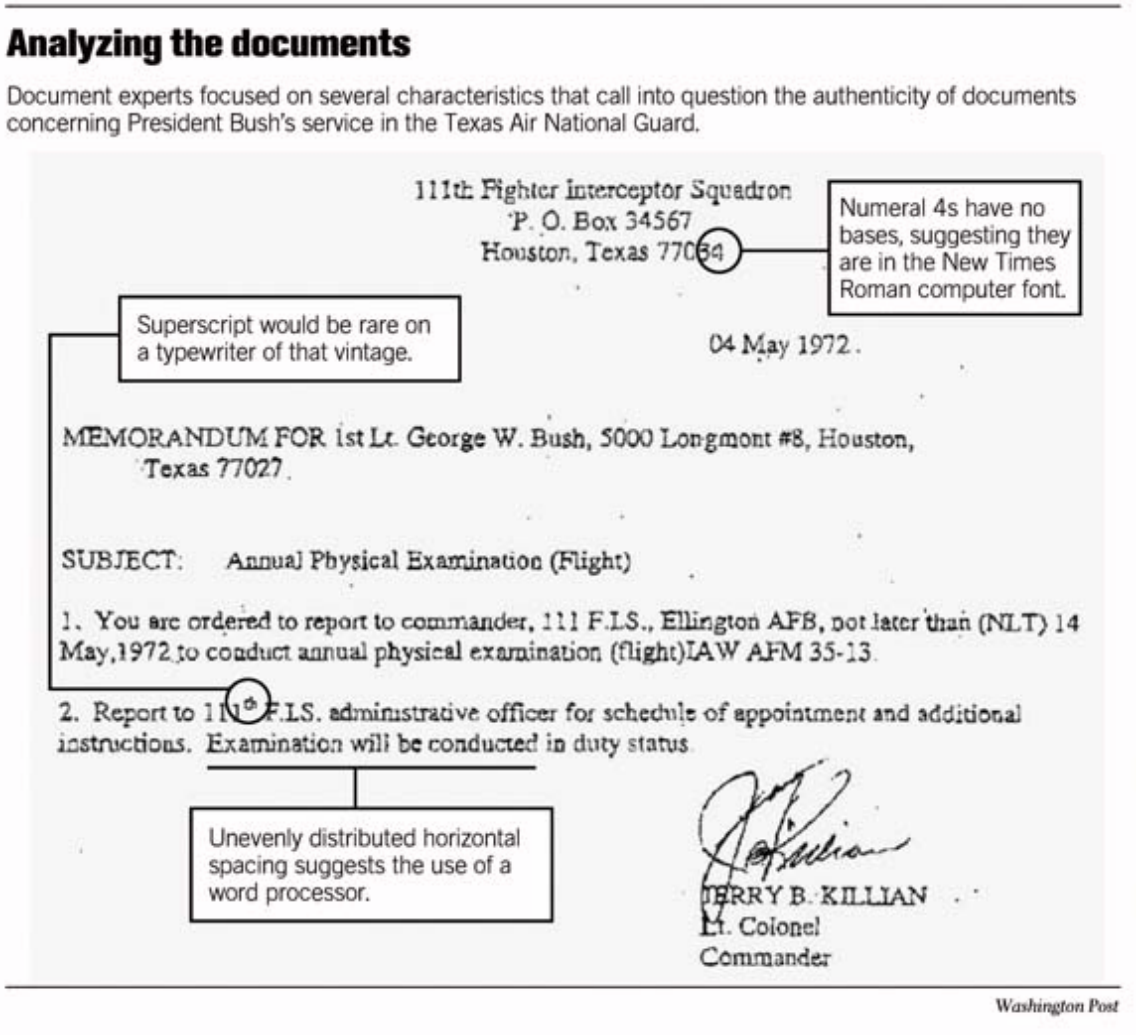


Figure 4. Washington Post analysis of criticisms advanced by "document experts." Their criticism is that the type is proportional, the superscript "th" is consistent with word processing software and not consistent with mechanical technologies of the time. Some experts are certain that the font used is Times New Roman, probably unavailable on typewriters at the time, and certainly not used by the military at the time.

MY PROCESS FOR COMPARISON

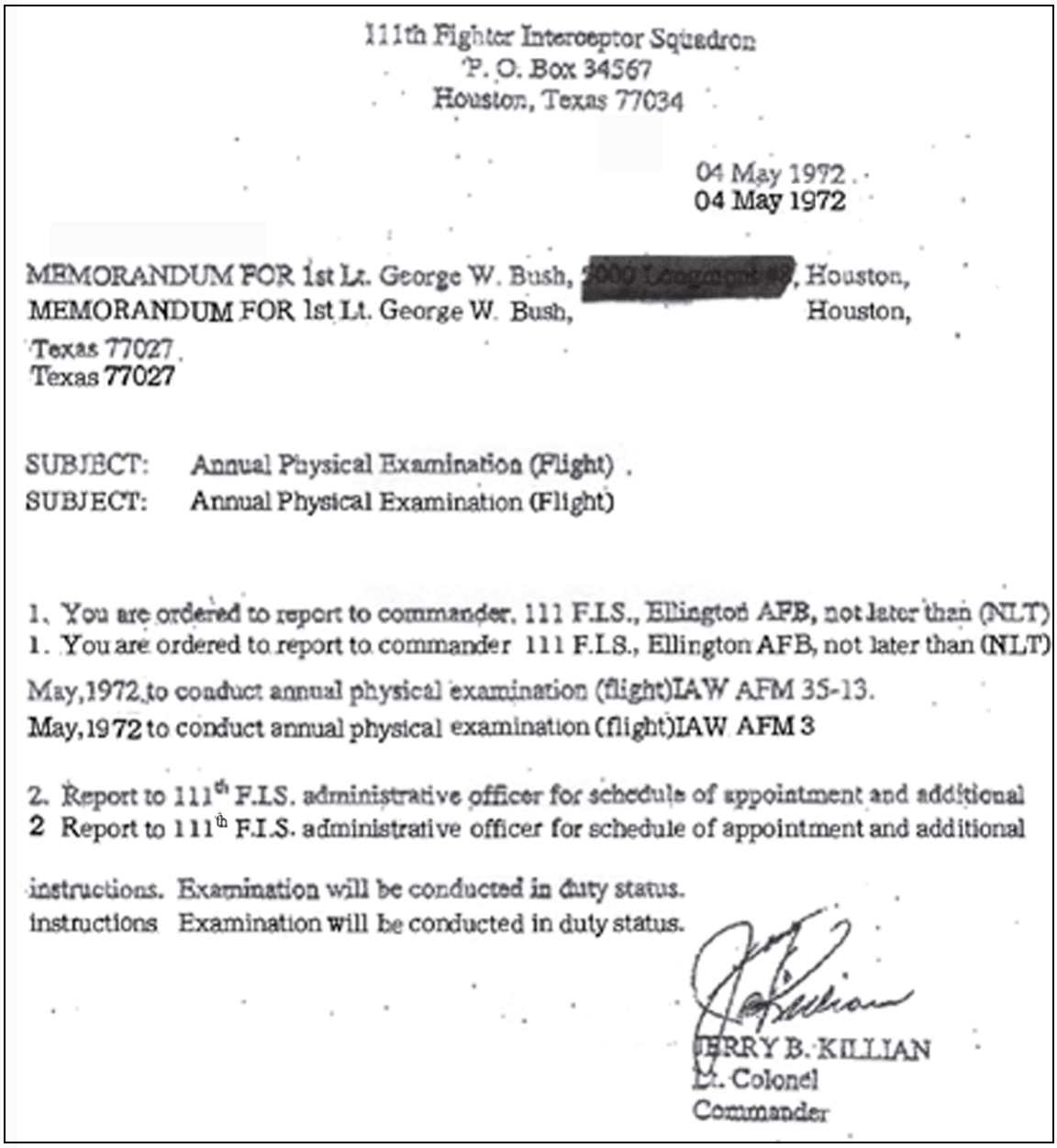
I used the copies provided by CBS, enlarging them until I could see each character clearly. Then I captured every character from every memo into a single document sorted alphabetically. So I had all of the "1's" together, all of the "2's," "a's," "b's," "c's," etc. That made it possible to identify the best examples of each character, and more importantly it makes it possible to replicate it, identifying its most important defining characteristics. For example, the "1" I use is a copy of the best of the "1's" in the memo. I

was also able to sort the characters into groups that included those with no indicators of damage (e.g., the “q”), groups with indicators of some damage (e.g., the “e”), and groups with indicators of major damage (e.g., the “t”). By recreating the characters in the memo, I was able to establish the font family based on the best examples of each character. Once I had identified the font family, I recreated the memo using characters from that font family. Do not misunderstand figure 4. My addition is not typed. It is replicated based on the characters already in the memo. It does not prove that the memos were typed, or that I can type them. It only proves that I know what the font family is and can reasonably accurately reproduce the characters in the memo. The reproductions in the memo demonstrate that and nothing more.

It is, however, critical to demonstrate you have identified the font family before doing anything else. I have examined the work of a few others who have discussed this problem. The worst of them begin by assuming that the documents are done in Times New Roman, making no effort to check their original assumptions. In one case, the author assumes that the document was done in Times New Roman and continues by assuming that he can recreate the proportions of the memos. These memos are copied. Copiers work by dragging a light across a glass plate under the document. The image of the document is reflected off a mirror proceeding with the light. The image is transmitted through a lens onto a rotating drum below. These are all mechanical processes, and anybody with extensive experience knows that these processes change the proportions of the copy. It might be shorter, or longer or narrower, or wider. Even the relationships between characters change. If we do not know anything else, we know that if you placed these photocopied memos on top of the original they would not line up.

For a person to begin by assuming that he is dealing with Times New Roman and then continue with the assumption that he can successfully divine the proportions is not unlike presenting the argument that the earth is the center of the universe, beginning the with the untested argument that the earth is flat and that the author can divine its dimensions. In fact, if the author doesn’t know the earth is not flat (i.e., not Times New Roman), the author clearly has no idea what the dimensions might have been.

The critical arguments of the above document experts are both spurious and uninformed. The ability of the military to produce the proportional text with a superscript “th” with a typewriter is beyond question. IBM is on record as saying they have made machines capable of that since 1944. The only real questions are “is this Times New Roman or similarly contemporary, digital font,” and, “is the typing mechanical or digital?” Working on the hypothesis that this is Typewriter, and was typed on a machine, I am able to exactly reproduce a Bush memo (Figure 4).



111th Fighter Interceptor Squadron
P. O. Box 34567
Houston, Texas 77034

04 May 1972
04 May 1972

MEMORANDUM FOR 1st Lt. George W. Bush, [redacted], Houston,
MEMORANDUM FOR 1st Lt. George W. Bush, Houston,

Texas 77027
Texas 77027

SUBJECT: Annual Physical Examination (Flight)
SUBJECT: Annual Physical Examination (Flight)

1. You are ordered to report to commander, 111 F.I.S., Ellington AFB, not later than (NLT)
1. You are ordered to report to commander 111 F.I.S., Ellington AFB, not later than (NLT)

May, 1972 to conduct annual physical examination (flight) IAW AFM 35-13.
May, 1972 to conduct annual physical examination (flight) IAW AFM 3

2. Report to 111th F.I.S. administrative officer for schedule of appointment and additional
2 Report to 111th F.I.S. administrative officer for schedule of appointment and additional

instructions. Examination will be conducted in duty status.
instructions Examination will be conducted in duty status.

JERRY B. KILLIAN
Lt. Colonel
Commander

Figure 5. The above is an example of a bush memo and my replica based on using Typewriter condensed as my font of choice. Note that the match is exact.

Using the hypothesis established from examining the Bush memos, it becomes possible to create a virtually flawless replica

DEFINITIONS FOR TERMS USED

I use certain terms with unique meanings that may not be made clear in this report. The following is a brief definition of these terms.

Cross stroke	The line across a vertical character (e.g., t.)
Crossbar	The line connecting two vertical lines (e.g., H).
Ear	The upper right tab common on the lc, “g.”
Font	A typeface in a specific size and style (e.g., Stymie 10pt. Bf).
Serif	The short stroke at the top and bottom of characters,
Shoulder	The upper left or right quadrant of a rounded character.
Slab	A broad, flat serif typical of typewriter typefaces.
Spur	A specialized serif that evolves from the character to a point.
Stem	Stroke in vertical characters (e.g., F, B, and l)
Stroke	Used to describe nature of lines in characters. (e.g., thin stroke).
Typeface	The generic name of a family of fonts. (e.g., Stymie).
Typestyle	I use “typestyle” and “typeface” interchangeably.
Typewriter	A specific typeface developed circa 1905 by Remington.
typewriter	A generalized term for fonts designed for typewriters.

THE PHYSICAL EVIDENCE

Identifying fonts requires examining the details and looking for specific, defining characteristics. In this case, several elements remain consistent throughout the documents and throughout comparable military documents of the period.

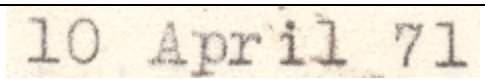
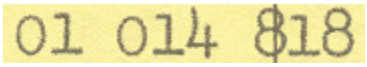
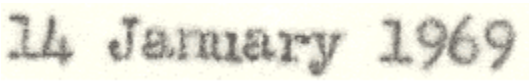
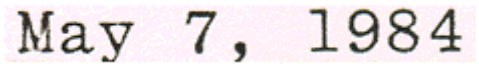
One of the important characteristics of early Typewriter is the nature of the “one.” As I mentioned earlier, the character "1" in early Typewriter is unique. It consists of a broad, thick, sometimes slightly curved base and a horizontal top serif that is often as long as left side of the base. Another characteristic is the uniform width of the stroke used to create the character.

This unique "1," can be found in many Typewriter texts, and in numerous military documents. Civilian documents from that period are largely done in more contemporary typestyles. It is not uncommon to see the “flag serif” in civilian texts but it is much more common to see a “1” with a drooping serif.

Differences in the “1”

The character “1” is the first and most obvious identifier of a Typewriter typeface. (See Table A). Even though the other numbers are often different, the “one” in each case is common.

Table A.

First generation Underwood, manual typewriter -1930s (civilian).	
Numbers typed in 1963 on security clearance form (military).	
Date from 1969 letter of commendation (military).	
Bush pay statement form (military).	
From Bush memo (military).	
From Bush memo (military).	
From article written with a civilian typewriter (civilian).	

In addition to the obvious serif on the number “1” is a characteristic of the bottom slab. It typically has an almost imperceptive concave shape. On occasion, the concave shape peaks in a dimple at the bottom of the stem. In the Typewriter typeface, this slab universally ends the down stroke of all vertical characters and usually ends the down strokes of the capital “A.”

It is easy to compare the above “1” to what is found in contemporary typefaces (Figure 4).

Figure 6. These are the contemporary typefaces found in Word and similar word processing applications. They are unlike the memo "1's" in most respects.

None of the contemporary typefaces share the unique "1" with Typewriter. In fact, apart from decorative or specialized typefaces such as Stymie (Avant Garde with serifs), I can find none that share the unique 1.

Other Identifying Characteristics

Apart from the "1," the letters of the alphabet will all have distinguishing characteristics to varying degrees. After an examination of the Bush memos and a search through my archives, I have been able to find a close match with a document typed using a type ball manufactured by IBM. Since some have alleged that Times New Roman is the font used in the Bush memos, I will include it with the IBM font in all my comparisons. My recollection is shaky, but I believe the font was called "American Typewriter."

The Typewriter variants share many characteristic with IBM' font. I have listed a collection of "Typewriter" faces for comparison.

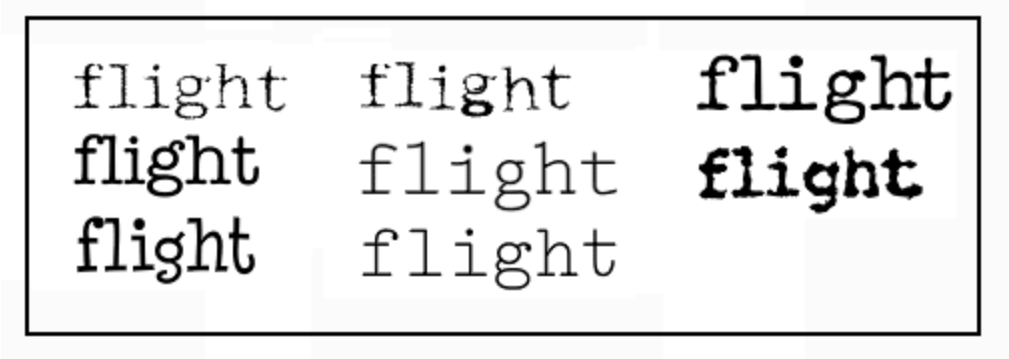


Figure 5. The above provides examples of variations in Typewriter, digitized. In some cases, the examples are taken directly from antique typewriters and digitized for use on computers. The Bush memos are done in a species from this genus.

There are a few things worth noting. The ears on the "g's" frequently vary from face to fface. On the other hand, the cross strokes on the "t's" change little. Typically, the right half of the cross stroke will be somewhat longer than the other. The serifs on the bottoms of the "f," "l," and "i" make large and stable foundations, and the top serifs on the "l's" are universal. In short, given the small modifications various manufactures will generate, the characteristics of the Typewriter font family are universal and easily identified.

The unique characteristics of the Typewriter family of fonts are found in the text in the Bush memos. I am confident that the font used to produce the Bush memos is not Times New Roman; nor is it a comparable, contemporary typeface. It seems clear that it is in a family of fonts designed specifically for use on typewriters and was, in fact, named "Typewriter."

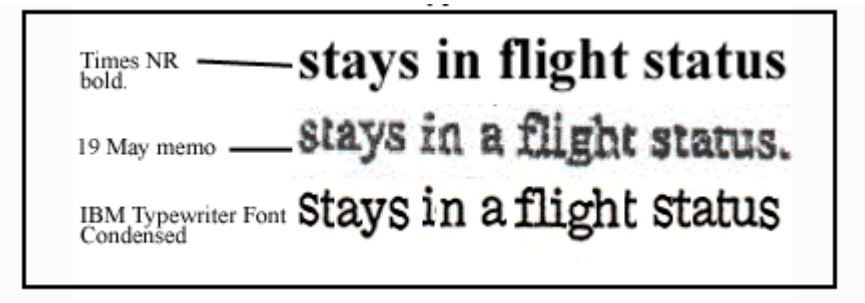


Figure 6: Comparing Times New Roman, the Bush memo and the IBM font condensed. Note the slightly curved serifs in the "f," "l," and "i." These curves are often found in the IBM Typewriter font. One can see the same convex bases in both the Bush memos and the IBM font. Their occasional exaggeration is a predictable artifact of digitizing at relatively low resolution.

In the above example, all of the characters seem to be consistent with the a condensed version of the IBM font.

1) The strokes in the text have a consistent width in both the Bush memo and IBM font. (Times characters have inconsistent width.)
2) The serifs are heavy and have consistent weight. (The Times serifs are short spurs.)
4) Cross strokes on the "t"s are heavy in both the memo and IBM font. (Times New Roman cross strokes are fine.)
5) The bowls of the Bush and IBM "a"s are of consistent width.
6) The "e"s are similarly closed in American Typewriter and the memo, and their crossbars are more dense.
7) The bottom serif in the "i" in the Bush memo is completely compatible with the IBM font. It is slab-like, and contains a comparable curve.

The vertical characters I mentioned earlier provide additional evidence.

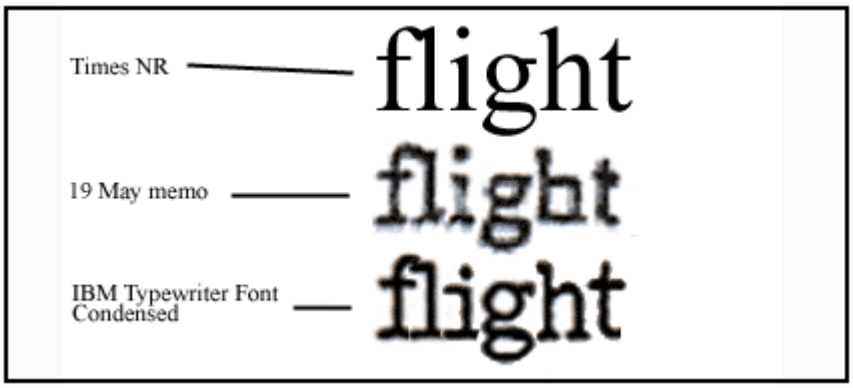


Figure 7. Comparison of the characters used in the word “flight” in the Bush memos. Times New Roman is characterized by strokes of varying widths, with vertical strokes being thick and horizontal strokes being thin. It is also characterized by pointed spurs for serifs. The difference is particularly clear in the shape of the “h” and “g.” Typewriter is characterized by strokes of consistent thickness and slab-shaped serifs.

In no sense are the defining characteristics of the characters in "flight" in the Bush memo like the defining characteristics of the characters in the Times New Roman sample. On the other hand, every defining feature of the Bush memo is comparable to the critical features of American Typewriter bold condensed font.

1) The "f" from the memo stands on the slab typical of the IBM font.
2) The "g" lacks the variation of line found in Times NR, but contains the same consistency of stroke found in the American Typewriter sample. The bowl of the "g" is very similar and lacks the variation of width found in the Times New Roman example.

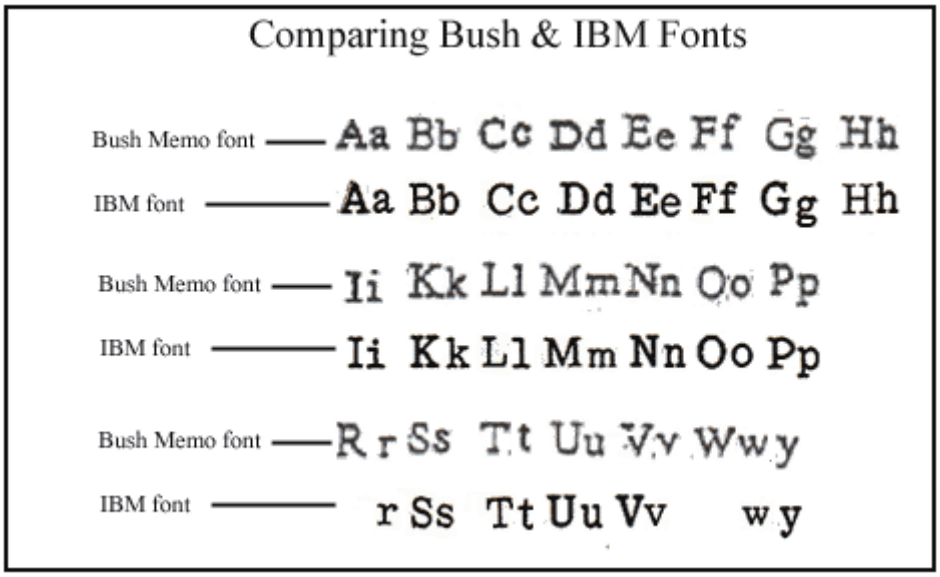


Figure 8. This is a comparison of direct matches that existed in both the Bush memo and comparable documents in our archive. Capitals are not compressed. Lower case characters are compressed, except the "m," which is extended. The lower case "s" is doubly compressed.

The majority of characters used in the Bush memo match with no manipulation beyond compression. The upper case R, however, needs a slight change to match.

ARE THE MEMOS TYPED?

That the memos are created in an old typewriter font in no way demonstrates that they were typed. Many of the examples of Typewriter I presented in Figure 5 are from digital typefaces downloadable from the Internet. Theoretically, a fraud could be perpetrated by downloading an old-looking font and using it.

Because typewritten documents are based on characters being struck into paper, certain characteristics can be expected to result from their production.

First, typists make mistakes and occasionally correct them with simple strikeovers or erasures. Notice that in the paragraph in Figure 1 the word "is" is struck through by pencil. Even the best of typed documents often contain such artifacts. In addition to strikeovers and erasures, typists often ratcheted the platen up to read what they had so far written. They did not always ratchet it back down into exactly the right place. Sometimes it would shift slightly when they resumed typing. Also, typists would occasionally remove their manuscript from the machine and later replace it. Angle and horizontal alignment can be compromised.

Secondly, because type is used and abused, it becomes damaged and worn. A well used typewriter should have indications of one, the other, or both. If I am able to find and replicate the effect of damaged type, it should provide evidence that this document was typed.

Third, because platens and paper are inconsistent, the results of damage or wear could be to be inconsistent beyond the expectations we would impute to photocopying and digitizing. In other words, if the "t" or "e" is worn or damaged, we should see the damage constantly visible while constantly changing. If someone downloaded a digital typeface, the effects of the flaws should be consistent because digital printing is of such high quality and contrast.

Fourth, because electric typewriters pound the paper and the platen, there is the possibility of seeing distortion caused by the pounding. For example, in a digitally printed document, all characters will overlap and be printed with no sense of distortion. If an "f" overlaps an "l," and there are arcs of white between them, there is a possibility that the arcs are caused by one character distorting the page as it strikes it, and the other character not hitting the page quite hard enough to overcome the distortion.

TEST 1. SEARCHING FOR HUMAN ERROR

To test for human error, I resized the documents to maximum sizes (see figures 6 and 7) and searched for symptoms of strikeovers or erasures. I found no indicators of human error in the document.

TEST 2. SEARCHING FOR DEFECTIVE TYPE

Given normal wear and tear, one might expect that the most often used characters might have defects that do not show up in the less used characters.

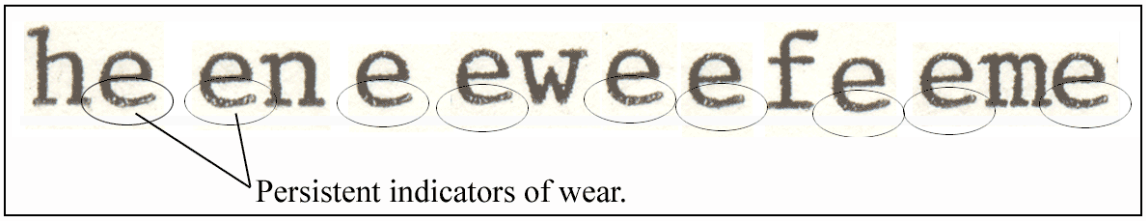


Figure 9. These characters are extracted from a high-resolution scan of a government letter typed with an IBM Selectric typewriter using a carbon ribbon. Note that all of the "e's" show indications of wear on the bottom stroke. All "e's" in the memo show this same characteristic.

Figure 10. Damage can often become more apparent at high contrast.

Even documents that have been altered by photocopying and digitizing can leave indicators of worn or damaged type. I examined type in the Bush memos for signs of damage and/or wear. I found a number of signs of well used and somewhat abused type.

Most notably, the left segment of the cross stroke and top of the ascender on the "t" show signs of wear. In almost all cases one or both are missing, indicating wear or damage. By comparing each apparently damaged character to its neighbors, I was able to determine that the "t's" demonstrate the same pattern of damage or wear throughout all of the documents.

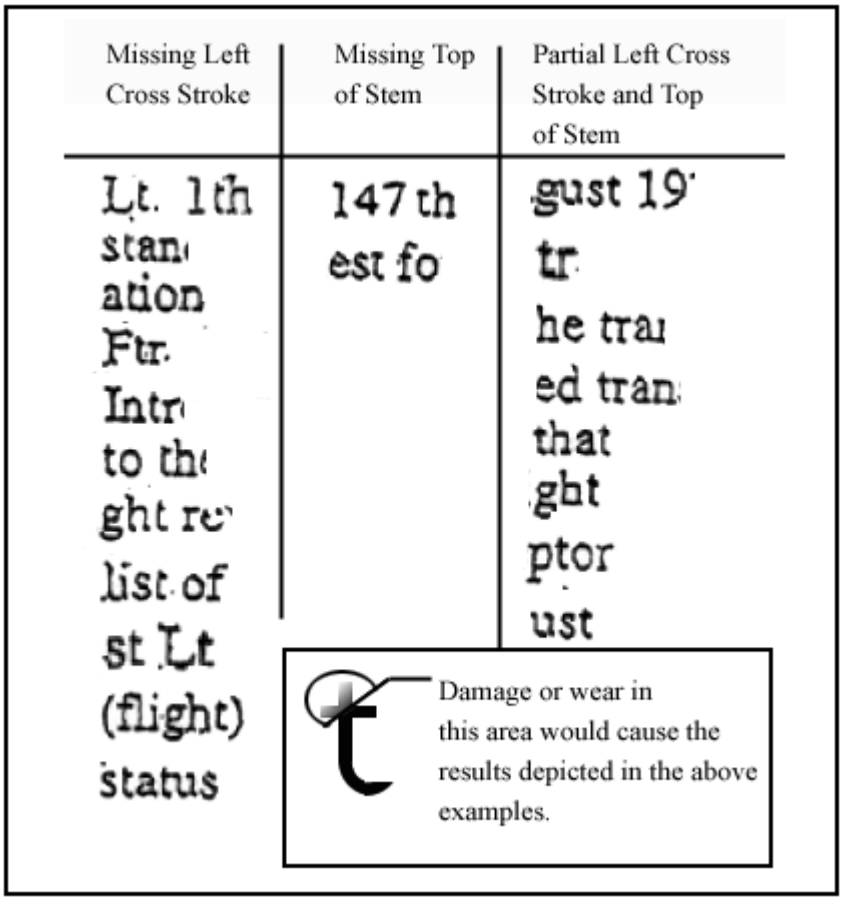


Figure 11. The above examples are consistent throughout all four memos. There are no examples of a complete "t."

By copying a "t" typed with an IBM typewriter and adding "wear" to the cross stroke and ascender consistent with my hypothesis in figure 11, I am able to replicate the problems seen in the "t's" in the Bush memos. The character appears to be worn in a pattern of fading toward the left and top of the cross stroke and ascender (Figure 12).

Figure 11. Letter "t" scanned in and artificially "worn" out; printed in high contrast; then rescanned in 72 pixel/inch resolution. Results are identical to comparable characters in the Bush memo.

If I remove the bottom of a random selection of t's from the characters and compare the tops to a character I manufacture, I find a close match (figure 12).

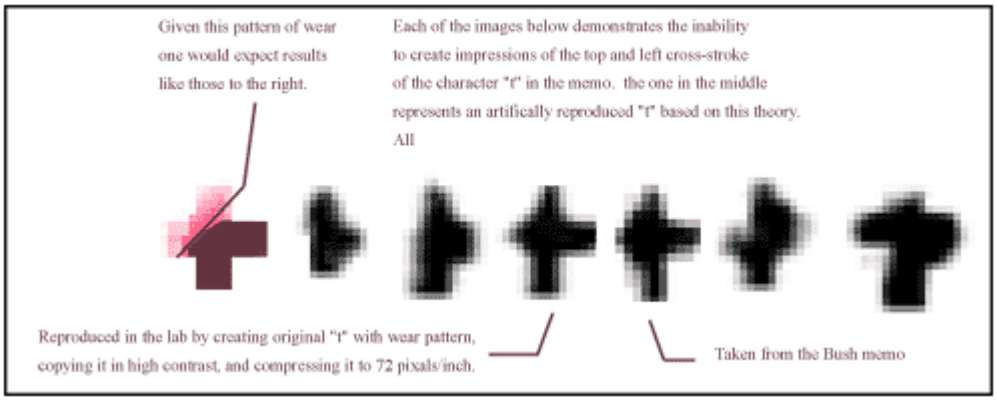


Figure 12. Five of the above characters are from the memos, representing the various configurations of "t." The one identified in the middle was produced by creating a defective "t," copying it at very high contrast, then scanning it at 72 pixels/inch.

Examining the e in the Bush Memos

Another character that shows extensive wear and/or damage is the "e." By blowing the text up to 500X, it becomes possible to see consistent indicators of damage. The damage appears to be deep scratches that pass from the upper left shoulder through the bowl and out the other side in two places. A third scratch appears to pass below the bowl .

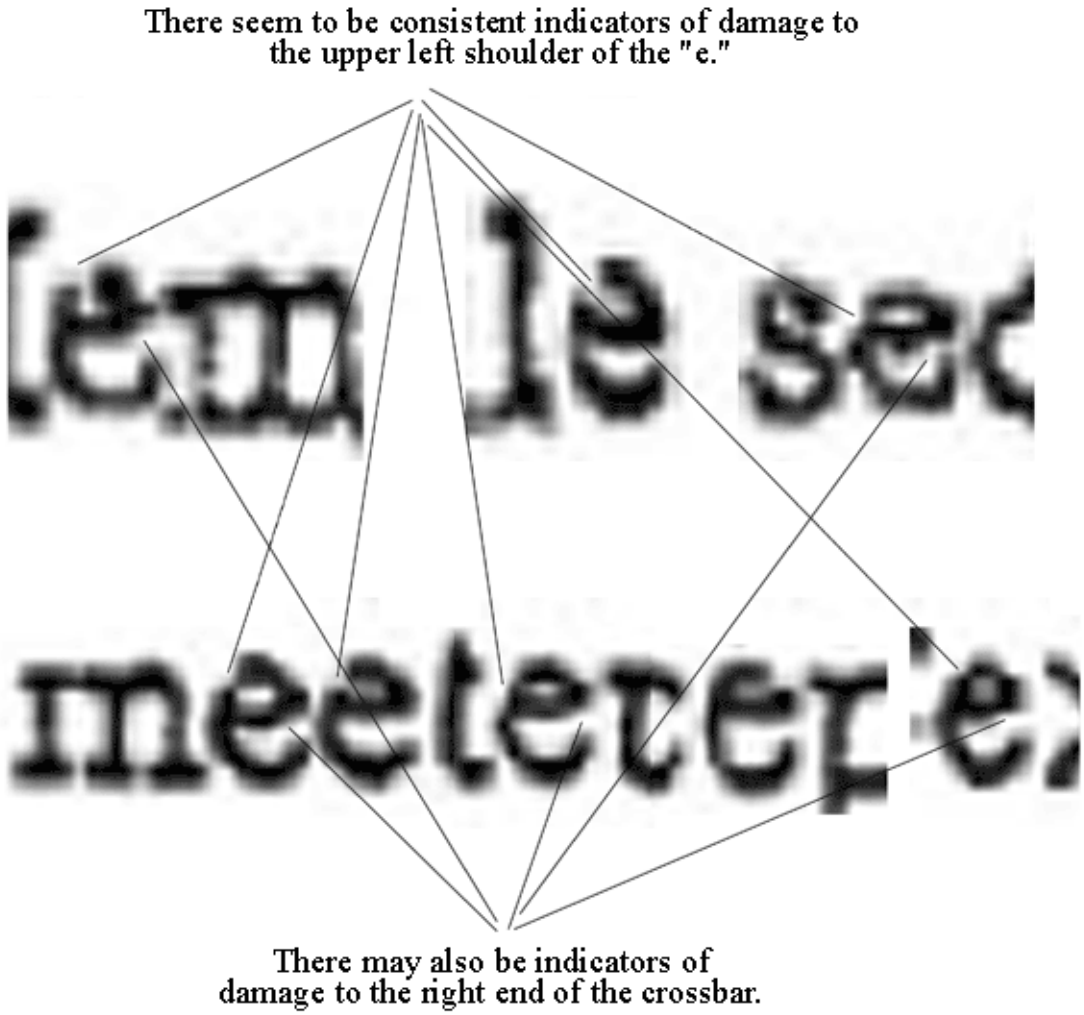


Figure 13. The upper left shoulder of the "e" shows signs of damage throughout the memos. (Image scanned at 4200 lines/inch)

The "c" and the "o" (figure 14) are deformed, but their strokes remain relatively consistent. The left middle of the "o" does show some indications of weakness that reoccurs as a pattern in the documents, but no indications of weakness comparable to the "e." The pattern in the "e" is almost certainly scratches or gouges.

Figure 13. Although there is some movement in the shoulders of round characters, there seems to be no cropping. The "c" and the "o" do not share the weakness in the upper left shoulder that the "e" displays.

An examination of all the characters indicates that the most used characters are also most likely to show indications of wear or damage.

TEST 3. INDICATORS OF INCONSISTENT PRINTING

It is possible to speculate that the Bush memos were printed using a digitized imitation of a typewriter font. If a document is typed, there are variations in impact based on placement of the platen, quality of the platen, variations in paper quality across the page, etc. Worn type will be especially prone to being effected by patterns in the paper or platen. If the paper is harder or if the key strikes a raised section of the platen, the worn character will be less complete. If the key strikes in a depression or on softer paper, the character will be more complete. A digital printing will have no such variations. A digitally printed document, photocopied and scanned will look much like the samples in figure 14.

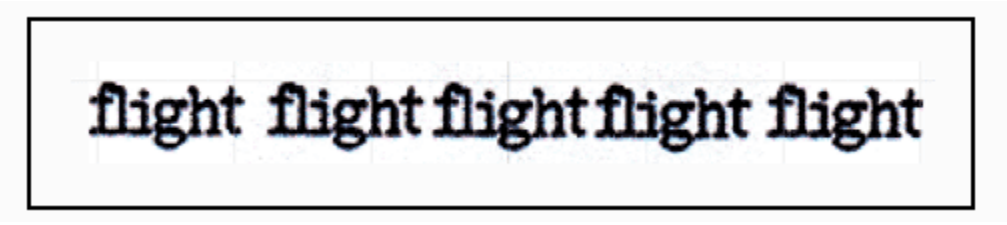


Figure 14. A digital version of "flight" photocopied and scanned at low resolution and enlarged for this figure. The effect is much like the bush memos, but the replication of affects are virtually exact.

A typewritten document photocopied and scanned will look like the variation in the e's we find in figure 10.

A different inconsistency can be seen in how the characters behave. Digitally printed characters over print each other without difficulty. Typed characters show a different

tendency which is especially visible when characters barely overlap. There seems to be a few of these examples in the Bush memos. I suggest that these examples are caused when a key strikes paper and causes an debossed impression. The next key strikes and is unable to fill in all of the impression, causing a white crescent between the characters.

Figure 15. Demonstration of crescent effect possibly caused by first character modifying second character. Digital prints tend to do the opposite. If the characters are very close, the space between them tends to fill in. This is a consistent pattern with the t and the r.

In short, there appears to be significant evidence for inconsistency in type quality consistent with a mechanical, and not a digital, process.

CONCLUSIONS

Since current odds hold that the Bush memos are faked, the question of their authenticity turns to whether CBS should have known they were inauthentic – if, in fact, they are. In fact, there seems to be nothing in the memos that indicates they are faked. All evidence points toward a mechanical production process and away from a digital process.

Furthermore, the mechanical process seems to be consistent with typewriters used in the military at the time in question.

If I had been one of the experts advising CBS, I would have advised them that there is nothing physical in the memos implying they are not authentic. All indicators imply they are authentic. I would have told them that from my point of view, the memos are worthy of presenting to the public.

FURTHER RESEARCH

I suggest that the way to demonstrate the viability of my theories is to test them. It is possible to argue that the "e" might not be damaged, that the problems with the "t" are artifacts from photocopying, but at this point such arguments are not productive. It reduces the discussion to an argument about two theories that have yet to be proven or disproven. A productive approach is to examine more documents that came from the 111th during that period. If I am right, there will be documents that look exactly like the Bush memos with flaws I believe I have identified; that would go some distance toward proving provenance. On the other hand, if there are no documents that match the type, it demonstrates that the documents are probably bogus.