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ON VERIFYING BOOK OF MORMON WORDPRINTS/AUTHORS
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In 1980 Drs. Wayne A. Larsen and Alvin C. Rencher published the first complete analysis of the Book of Mormon using the then advancing adolescent tool of computerized stylometry or wordprinting[1] as they analyzed author-specific word patterns within the book. Since then the science of wordprinting has continued to undergo considerable critical evaluation, particularly in its application to the Book of Mormon. Shortly after BYU Studies' publication of Larson and Rencher's pioneering work I joined forces with a small group of scientists in Berkeley, California to attempt to verify the accuracy of wordprinting in general and to specifically check the Larsen-Rencher results. After seven years of study and development we conclude that wordprint measurements are now at the stage where scholars can use such tests confidently and without personal bias to analyze the contested authorship in literary works including the Book of Mormon. This paper explores this conclusion in (1) reviewing the evolution of the wordprint science through some early wordprint studies, (2) new measurement technique development including important control studies to verify the objectivity of the most recent methodology, and (3) setting forth some verified Book of Mormon measurements. Before proceeding, allow me to establish the need and also discuss one important caveat.

The need for rigorous, legitimate wordprint measurements is obvious in attempting to settle some of the most prominent controversies surrounding the Book of Mormon: Are the word patterns of Joseph Smith, Oliver Cowdery, or Solomon Spaulding measurable in the Book of Mormon? Can wordprinting show that different sections of the Book of Mormon were written by different authors? Does Joseph Smith's role as translator obfuscate patterns unique to ancient authors? Fortunately the Book of Mormon is a near ideal document well suited for such objective wordprint studies, provided the measurement is made correctly.

Unfortunately, wordprint analysis, while it can measure certain facts objectively, cannot prove the holiness of the Book of Mormon. The understanding that the Book of Mormon has a divine origin is obtainable only through the steps of developing faith. While valid and objective wordprinting is no substitute for faith, yet it can bolster the establishment of faith as it rigorously demonstrates factual information about the book.

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[1] Wayne A. Larsen, Alvin C. Rencher, and Tim Layton, Who Wrote the Book of Mormon? An Analysis of Wordprints, BYU Studies 20(Spring, 1980)

DEVELOPING CURRENT STATE-OF-THE-ART WORDPRINT MEASUREMENTS

Wordprinting is a new developing science, notwithstanding that the first written suggestions that something like wordprinting might be useful in objective author identification appeared at lest as early as 1851. Yet because of the complexity of the measurements the first credible works had to await the availability of modern computers with their precise counting accuracy and high speed computation. Therefore wordprinting has undergone almost all of its significant development during the last thirty years.

As is common in all developing sciences, wordprinters have had to identify and abandon those preliminary methods and theories which later were shown to be inaccurate as the science has improved. While wordprinting will undoubtedly continue to evolve toward ever increasing reliability and sensitivity, the science has now developed to the point where one can construct a conservative rigorous measuring technique which yields reliable answers when measuring single authored documents of at least a few thousand free-flow original words.[2]

Many students find it difficult to accept the idea that a clever author cannot fool a rigorous, quantifiable approach to measuring fixed writing habits. After all, when we read the fictional words of people created by a good author, we all think the dialogue sounds like different people are speaking. Nevertheless, wordprint measurements taken with our most recent methodology continue to show that there are extensive non-contextual word patterns hidden in the dialogue that are both unique to the author and measurable by wordprint methods. As referenced below we continue to measure that even the highly skilled authors (e.g. Twain, Johnson, Heinlien, etc.), when intentionally trying to imitate the writings of different persons, are unable to successfully change their own free-flow non-contextual word patterns enough to deceive the wordprint author determination.

Because of the inability of the human mind to consciously recognize the extensive word patterns that are tabulated in the computer assisted wordprint measurement, wordprinting is practically immune to deception by a forger[3].

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[2] John L. Hilton and Kenneth D. Jenkins, <u>On Maximizing Author Identification by Measuring 5000 Word Texts</u>, unpublished working paper, dated Sept 1987, available through F.A.R.M.S, P.O. Box 7113, University Station, Provo, Ut 84602

[3] That is, works known to be written prior to computer-aided authorship are essentially immune. It is in principle arguable that a modern, computer assisted, forger could manufacture a document capable of deceiving a specific wordprint authorship determination.

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Most modern wordprint techniques measure only the placement of "non-contextual" words. Non-contextual words like 'the,' 'and,' 'a,' 'of,' etc. are often capable of being interchanged or even dropped without a loss of meaning, and they seem to add little in context information being often consciously ignored by writer and reader alike.

Obviously, measuring noncontextual words makes wordprinting less sensitive to the subject matter, but it also improves the statistical accuracy by greatly increasing the number of "events" that can be counted in a given document, as these small fill-words typically make up 20% to 45% of the total coherent English words written. Wordprint measurements continue to show that all texts, which are a single author's free-flow writings, tend to measure these abundant often interchangeable small fill-words in an habitual, near subconscious, personal and unique way[4].

Wordprinting is done by measuring whether there is a significant difference between the way non-contextual word patterns are used in two compared texts, one of which is the disputed document and the other is a comparable non-disputed text known to have been written by one of the authors suspected of having written the disputed work. If there is a statistically significant difference between the rates that a specific non-contextual word pattern can be measured between the two texts then we identify it

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To attempt such a forgery would be an enormous task and would still leave the forger unsure beforehand as to which of all of the possible word-patterns would ultimately be used by the wordprinter to test his manufactured document. Of course, such a fraudulent document would be susceptible to detection by the standard procedures now used to identify any pastiche.

[4] To be valid any words measured must be essentially the free-flow choice of the purported author. Extensive quoting of someone else's words, is different from free paraphrasing and, of course, tends to dilute the measurable wordprint from the writer toward the pattern of the one being quoted. Further, deliberately writing to an externally imposed pattern which restricts the normal non-contextual word choices of the writer, or to repetitively use normally noncontextual words in textually important ways, can also change the wordprint patterns. Examples of these wordprint problems in the Book of Mormon are the extensive quotations from the KJV Bible, and the repetitive use of the phrase "and it came to pass that...". Proper wordprint testing must take these special problems into account.

as a "rejection"[5]. The sum of the number of rejections measured as the two texts are tested for a large number of different non-contextual word-patterns is identified as the "number of rejections." The larger the "number of rejections" the more likely the disputed text was _not_ written by the same author who wrote the other known text against which it was compared. Thus by repeatedly testing a contested document against comparable known texts from all possible candidate-authors, the most likely writer can be identified by elimination.

The usefulness of any specific wordprint measuring technique critically depends on the statistical reliability with which it can detect which of its tested text pairs are _not_ written by the same author. Statistical reliability of any wordprint measuring technique is rigorously demonstrated by proof-testing it with a large number of control-author-text pairs made up from texts of the desired size and including examples of all the different literary parameters that are to be studied later. We identify the proof-test measurements made between two control-texts known to be written by the same author as within-author tests, while the tests between texts known to have come from different authors we call between-author tests. The statistical separation that can be measured between the overall distributions of a large number of the within-author and between-author tests is the valid measurement of what will be expected when a contested author is later tested with the same technique.

This proof-testing of a proposed wordprinting technique, while straight forward in principle, is in practice very tedious to complete. Thus, during the years of wordprinting technique development, many proposed wordprint measuring systems were only proof-tested superficially on a narrow set of texts. Unfortunately it was often assumed that a wordprint measuring technique shown valid for one set of literary parameters would also be valid for all others. We now realize this is not the case. It is necessary to successfully proof-test each wordprint measuring methodology with control texts which represent all literary parameters that are to be reliably measured later on.

SOME EARLY WORDPRINT TYPE STUDIES

In the United States, perhaps the earliest successful wordprint study is the classical work by the statisticians,

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[5]   A "rejection" results from the statistical calculation of a null-hypothesis rejection ($p < .05$) for any one of the tested word patterns as the two texts are compared. A rejection is considered statistically useful only for word patterns that can be found 5 or more times in either of the compared 5000 word texts.

Frederick Mosteller and David L. Wallace, who published their work on author identification in 1964[6]. While not the first scholars to attempt computer assisted stylometry, they published one of the first complete and internally consistent studies on a set of historically important documents. Their work convincingly identified the author of several anonymously published 'Federalist Papers'. They identified a simple statistical model which appeared adequately sensitive and valid, to unambiguously show that James Madison was the author of the disputed documents as they showed that the other two possible candidate-authors were overwelmingly excluded from having written any of the twelve disputed documents.

The wordprint study on the Federalist Papers had several advantages which facilitated statistical measurements. First, the documents were lengthy, written in the same genre, on the same subject, and with essentially the same vocabulary. Additionally Mosteller and Wallace had available non-contested writings of the same length, genre, subject and vocabulary to use as control writings to evaluate each of the three possible candidate-authors. That the simple Mosteller and Wallace wordprint technique had only been shown to be valid for their single, near ideal, class of texts was at first not appreciated as important.

Not all succeeding studies had documents presenting as favorable a situation as did Mosteller-Wallace. Unfortunately most later wordprinters did not execute their studies in such a thorough way. Many omitted any independent proof-testing control studies to verify that their wordprint techniques were valid for their given case. As a consequence some published studies, purportedly giving objective answers, later proved to be inaccurate.

Rev. A. Q. Morton of Edinburgh Scotland, a long time contributor in the development of wordprinting, was one of the scholars who recognized that the simple noncontextual word <u>use rate</u>, as studied by Mosteller and Wallace, was not always reliable for authorship measurements[7]. Working with several colleagues he discovered that better 'stylometric' measurements were obtained when he extended his studies to measure carefully chosen noncontextual <u>word-pattern ratios</u>. By 1985 he had studied several

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[6] F. Mosteller and D.L. Wallace. <u>Inference and Disputed Authorship: The Federalist.</u> Reading, Massachusetts: Addison-Wesley Publishing Company, Inc., (1964). Recent republication see: Frederick Mosteller, and David L. Wallace, <u>Applied Bayesian and Classical Inference: The Case of the Federalist Papers</u>, (1984)

[7] A. Q. Morton, <u>Literary Detection, How to Prove Authorship and Fraud in Literature and Documents</u>, (New York, Charles Scribner's Sons 1978), etc and p 166

different types of word patterns and recommended a battery of about 65 different tests which had been successfully used in many different literary situations. We have found his 1985 list to be generally reliable as seen below (See Appendix [1]).

A recent study (1986) that further verified the usefulness of Morton's recommended use of word-pattern ratios over the simple non-contextual word use rate, was the carefully done work of Kendra L. Lindsay. She studied non-controversial Greek documents of seven classical writers chosen for their comparability to the writings of the New Testament Paul. She found that using the standard statistical assumptions and analyzing the texts by counting the simple non-contextual word use rate, she was able to correctly identify only 2 of the 7 authors. However, when she measured the ratios of word-pattern counts, she correctly identified 6 of the 7[8].

The first extensive wordprint measurements of the Book of Mormon appeared in 1978 when Alvin C. Rencher and Wayne A. Larsen began reporting their pioneering study in author identification. This was followed by their complete study report in 1980[9]. They also coined the term 'wordprint,' and introduced to Church and world scholars the interesting possibility of objective author identification performed on the Book of Mormon. They utilized the information gained from earlier approaches, and applied the simple non-contextual word use rate of Mosteller and Wallace's technique but coupled it with powerful multivariate statistical analysis.

Unlike previous studies which introduced the concept of hand tabulated word measurements to the Book of Mormon[10] the 1980 wordprint study published by Larsen, Rencher, and Layton was widely recognized as important both from within and without the Church[11]. If the measurement technique was in fact objective and

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[8] Kendra L. Lindsay, AN AUTHORSHIP STUDY OF THE PAULINE EPISTLES, (Masters Thesis,department of Statistics,BYU, Provo, UT. April 1986)

[9] ibid Wayne A. Larsen, et. al.

[10] Perhaps the most significant of the pre-computer studies was Glade L. Burgon, An Analysis of Style Variations in the Book of Mormon, M.A. thesis, Brigham Young University, (1950)

[11] Examples of supportive publication of major portions of their work, besides those referenced in footnote 8 and 13, include New Era 10-13 Nov (1978) and Noel B. Reynolds', Book of Mormon Authorship, New Light on Ancient Origins, (Bookcraft Inc. Salt Lake City, Utah 1982).

verifiable, then any competent student could duplicate the calculations to determine answers to a number of questions that have since 1830 remained controversial among Book of Mormon believers and detractors.

Along with others who found the reported work of the B.Y.U. team of Larsen-Rencher-Layton interesting and challenging, was a small group of scientific researchers in northern California, to which I belonged. Our group later known as the 'Berkeley Group,' included major contributors from different scientific disciplines and differing religious persuasions. All of us shared the scientific curiosity which led us to test the intriguing Larsen-Rencher-Layton claim. In the fall of 1980, we began our study. As the major L.D.S. contributor in the group, I was little different from my agnostic and Jewish colleagues: each of us seriously questioned whether objective measurement, could determine who probably did or did not write a controversial document like the Book of Mormon. Therefore, we began (armed with a healthy skepticism) a confirmational study --the kind of study scientists typically perform in the physical sciences-- to recalculate the wordprint measurements while correcting any procedural or calculational flaws which could potentially have confused the results of an original study.

As most members of the 'Berkeley Group' doubted that stable wordprints could be objectively measured in the writings of most authors, we were not willing to accept the standard assumptions utilized in the Larson-Rencher-Layton study. Therefore we began the development of a completely new set of computer codes based on a very conservative independently derived and verified, theoretical model. While we thought that our study to verify Book of Mormon wordprints could be completed in perhaps a year, it soon became apparent that, with the redevelopment of wordprint theory as part

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Perhaps the latest neutral references to their work, representing those of the scholarly community, would be Joseph Rudman at the Dynamic Text Conference, Toronto, Canada, 7 June 1989, where he noted their work as significant in his presentation Authorship Attribution in the Literary Computing session.

Among the anti-Book of Mormon references, likely the most extensive work provoked by the Larsen-Rencher-Layton study was an attempt at a wordprint measurement by Ernest H. Taves M.D. as reported in his book Trouble Enough: Joseph Smith and the Book of Mormon, Buffalo N Y, Prometheus Books, (1984) pp 225-260. Unfortunately the Taves study was fundamentally flawed as described in the critique of his work. See F.A.R.M.S., Book of Mormon Book Reviews, STF-88, pp 51-70, and therefore did nothing to add to or detract from their work.

of the work, it would take much longer. It was not until September 1987, after maybe 10,000 hours of work, that a complete paper was made available describing the results of our efforts[12].

While one part of our 'Berkeley Group' was redeveloping and verifying wordprint theory, others of us prepared a computer file of the most primitive Book of Mormon manuscripts.(See Appendix 2). All reported Book of Mormon wordprint measurements in this paper were computed from files of the needed length, author, and literary form taken from this 'Most Primitive Book of Mormon Manuscript'. (See Appendix 3)

During the time our 'Berkeley Group' was doing its work, other Book of Mormon scholars were also studying the approach proposed by the Larson-Rencher-Layton team. One of the most notable of these was the University of Utah statistician, D. James Croft. His work is that of a competent scholar as well as a conscientious believer in the divinity of the Book of Mormon. His published work was a carefully reasoned critique of the Larsen-Rencher-Layton paper[13]. As would be expected from a scholar of the exact sciences, he cautioned his L.D.S. readers of the unverified nature of the methodology: "Close scrutiny of the methodology of the BYU authorship study reveals several areas which seem vulnerable to criticism ..." After calling for a redevelopment of methodology which could circumvent the specific areas he found questionable, he concludes with "certainly any research done in the future will be indebted to Larsen, Rencher and Layton, who called our attention to an interesting and challenging area of Book of Mormon study. At the present time (i.e. 1981), however...it would be best to reserve judgment concerning whether or not it is possible to prove the existence of multiple authors of the Book of Mormon."

We kept in close contact with Dr. Croft, and others [14] who were contributing to the continuing refinement of wordprinting during the years when our independent methodology was under development. The continuing contributions of these scholars were appreciated as they helped us insure that the suspect areas recognized in the

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[12] ibid. J.L. Hilton and K.D. Jenkins

[13] D. James Croft, Book of Mormon "Wordprints" Reexamined, Sunstone vol. 6 no. 2 (March-April 1981) pp 15-21

[14] Significant assistance was received from: Yehuda Radday from the Dept of General Studies, Technion University, Haifa, Israel; Kenneth R. Beesley, (Graduate student working with Prof. Sidney Michaelson and A.Q. Morton) University of Edinburgh, School of Epistemics, Edinburgh, Scotland; and A.Q. Morton, The Abbey Mannse, Culross, Fife, Scotland. Personal communications.

earlier methodologies would be avoided and that the proof-testing for our new wordprint measuring technique would be complete enough to insure reliable answers.

The rationale for our first-order wordprint model and methodology was developed from basic information theory and basic statistics. Our resulting model was found to be conservative and yet still able to calculate answers for the Book of Mormon authorship questions with very high statistical certainty. All results reported in this paper were calculated using this methodology. A detailed description of the evolution of the model and methods is reported in our previously referenced paper "On Maximizing Author Identification by Measuring 5000 Word Texts." by John L. Hilton and Kenneth D. Jenkins[15].

As compared to earlier wordprinting techniques used for studying the Book of Mormon, there are at least six differences incorporated in our new conservative measurements which contribute to improved reliability when testing 5000 word texts. These are: 1) measuring the author's wordprint by studying the use rate of 65 noncontextual word-pattern ratios proposed by Morton(1985); 2) abandoning the commonly accepted statistical assumption of "normality," and using the Mann-Whitney non-parametric statistic, which does not require the unverifiable "normality" simplification; 3) developing a "wrap-around" word-group counting method which mixes the sampled text words. This helped provide the statistically required homogeneity; 4) making comparison measurements between just two texts at a time; 5) using the oldest extant Book of Mormon manuscripts. The texts used do not include the repetative use of the potentially wordprint confusing phrase "and it came to pass that...," nor do they significantly include direct quotations from the KJV Bible; and 6) verifying the computer coding and measurement methodology with proof-testing by test measuring a diverse set of texts of non-disputed authorship, which represent all of the pertinent literary parameters.

THE ALL IMPORTANT COMPLETE PROOF-TEST OF THE TECHNIQUE

Deriving the model becomes relatively unimportant compared to the importance of the control or proof-test studies. We specifically choose our proof-test texts to be an exemplary set of literary contexts which would test the extremes that could be found in English writings. We tested the whole series of control-texts and found our method yields well defined smooth bell shaped curves, showing that our new wordprint technique is essentially insensitive to the textual changes introduced by the differing literary

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[15] ibid. J.L. Hilton and K.D. Jenkins

parameters of genre, subject matter, writing period, position in an authors career, or normal publication editing.

Specifically, this extended verification study shows the validity of this type of measurement by calculating 325 diverse wordprint proof tests. These tests studied 26 non-controversial 5000 word texts which had been written under various conditions by nine different control authors. (See Appendix 4). The individual and averaged results rigorously supported the basic wordprint assumption that although all authors have many writing habits in common, they also each show measurably unique, stable rates for some non-contextual word patterns. Among the non-disputed documents that were used in the extended proof-testing were texts by Oliver Cowdery and samples of Joseph Smith's autographic and dictated writings.

We also studied English translations of semi-classical German texts written by different German authors. These academic translations were all carefully done by the same German-to-English translator. The wordprint measurements bear out three significant results: 1) each translated author is consistent within himself; 2) each original author is clearly separable from the same translator's English rendition of other German authors' works; and 3) the translator's other English writings have consistent, different wordprints from any of his translated works[16]. This demonstrates, that at least for an academic translator as he tries to produce a literal translation from one language to another, the uniqueness of an original author's wordprint can in fact survive the translation process[17].

Displayed in Figure 2 are bar graphs showing the summarized results of the extended proof testing using our new wordprint

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[16] Subsequent to our proof-test study of the works of two German authors, we extended our work to include several more of these semi-classical German novella authors, all of whom had been translated by the same German-to-English translator, Harry Stienhauer. All of our new measurements gave the same results as before as each German author's translated work was inter-consistent, but distinctly different from all other authors' measurements.

[17] Not all translators need show these differing patterns. Some translators think their non-literal, 'free translation', is preferable. Complete 'free-translations' could be expected to yield only the translator's personal paraphrase of the ideas from the original text. In the extreme, this would produce only a single wordprint pattern for all of this kind of translator's personal writings and translations of different foreign authors works.

measuring technique. 33 of these tests are made by comparing a text of one known author to another text by the same author, while 292 of the tests compared one known author's writing against a different known author's writing. The dark distribution is from the 33 "within-author" measurements which yield a statistically smooth distribution peaking at about 2 "rejections," as is theoretically to be expected[18]. Also note that the number of "rejections" measured for the 293 "between-author" tests are plotted as light bars in Figure 2. As seen in the figure, the distribution peak is about 7 "rejections." Therefore about two thirds of the true "between-author" measurements fall above even the extremes of the "within-author" distribution. This means we may expect that when any comparable 5000 word disputed text is tested against a known author's comparable works and measures 7 or more "rejections", then the two texts are very likely not written by the same author[19]. The lower the number of rejections, the greater the likelihood that the two texts were written by the same author; the higher the number of "rejections," the more likely that different authors composed the two comparied texts. If we have but two 5000 word texts and their paired testing measures 1 to 6 "rejections" (as is expected for a true between-author pair in about one third of the cases) we cannot assign authorship unambiguously, as the "within-author" and "between-author" distributions overlap each other in this range. Similarly, for the few tests (about 10% of the true within-author cases) that measure zero "rejections" there is a high probability that the compared texts were written by the same author. Figure 3 graphically illustrates these Same-Author, Uncertain-Author, and Different-Author "rejection" ranges.

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[18] Typically between 40 to 47 of Morton's 65 testable word patterns are measured often enough to be accepted as statistically useful. We therefore expect, and did measure, that true "within-author" comparisons show an average "rejections" number at slightly over 5 percent (i.e. .05 x 40 = 2) as we compare the two texts, at 95% probability, written by the same authors.

[19] The confidence of determining that any single paired text test is "between-author" when it measures a total of 7 to 10 "rejections" is calculated against the full "within-author" distribution by using a one tailed Student "t" test from xbar=2.58, s=1.60, df=32 as:

For 7 "rejections" (t=2.76) giving >99.5% confidence that the two texts were written by different authors,
For 8 "rejections" (t=3.39) giving >99.9% confidence that the two texts were written by different authors,
For 9 "rejections" (t=4.02) giving >99.99% confidence that the two text were written by different authors,
For 10 "rejections (t=4.64) giving > 99.997% confidence that the two texts were written by different authors.

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PAIRED BETWEEN-AUTHOR/PAIRED WITHIN-AUTHOR

Figure 2

Figure 3
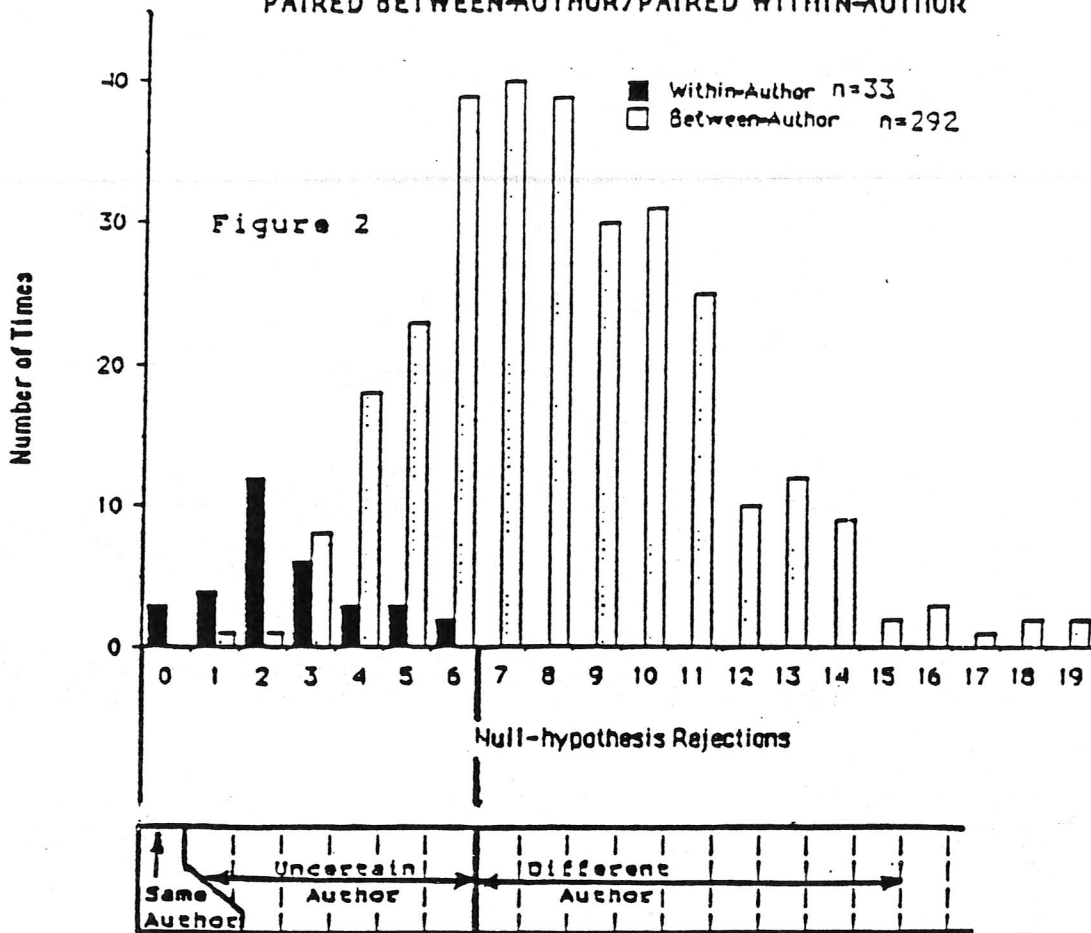
SOME VERIFIED BOOK OF MORMON WORDPRINT MEASUREMENTS

We wish to make the most conservative measurement possible, therefore we compare the two Book of Mormon authors who have the largest number of 5000 word texts. Further, even though our proof-testing shows our new wordprint measuring technique not to be overly sensitive to normal changes of genre, we still choose the more conservative comparison by testing only within the same literary form. Therefore, we select for our critical Book of Mormon verification measurements the three independent, 5000 word texts from the didactic (i.e. instructive, or sermon like) writings of each of the two major purported Book of Mormon authors, Nephi and Alma. They are the largest same-genre author pair in the book. Besides eliminating any possible lingering concern that changing genre might cause artificial additional "rejections," the use of the didactic genre has the advantage of essentially excluding the possibly troublesome phrase "and it came to pass that." "And it came to pass..." is the only word phrase used repetitively enough in the Book of Mormon to be troubling to the wordprint measurements.

Find displayed on the first line of Figure 4 the measured distribution of the number of wordprint "rejections" for the six possible "within-author" tests of Nephi against Nephi and Alma against Alma. As seen the within-author tests for both purported Nephi and Alma show the same scattering as the known "within-author" proof-tests of Figure 2, ranging from 1 to at most 5 "rejections", peaking at 2. Similarly, the other "within-author" proof tests displayed in Figure 4 show a tight internal consistency between the two Oliver Cowdery, two Solomon Spaulding, and three Joseph Smith 5000 word texts [20].

Figure 4

Figure 4 "WITHIN-AUTHOR"	number of "Rejections"															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ni vrs Ni & Al vrs Al		●	●	●	●	●										
Cowdery vrs Cowdery		●														
Spaulding vrs Spaulding			●													
Smith vrs Smith	●		●													

Figure 5 is a plot of the rejection distribution calculated from the "between-author" tests of direct interest to the Book of Mormon authorship question.

Figure 5

Figure 5 "BETWEEN-AUTHOR"	number of "Rejections"															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Nephi vrs Alma			O			8	8	O	O	O	O					
Smith vrs Ni & Al				8	8	O		8	8		O	O	O			
Cowdery vrs Ni & Al							O	8	O	O			8		O	O
Spaulding vrs Ni & Al							8		8		O	O	8		O	8

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[20] Care was taken to insure that the texts used to represent the free-flow writing of Oliver Cowdery, Solomon Spaulding, and Joseph Smith were correctly chosen for minimal editorial rework and that they were correctly entered into the computer. In the case of Joseph Smith two of the three 5000 word files were taken from his own autographic writings, the third from the earliest version of his dictated work used for 'Joseph Smith Tells His Own Story.' Solomon Spaulding was sampled from a certified transcript of his manuscript labeled 'Manuscript Story'. Oliver Cowdery is represented from bylined articles taken from numbers of the Kirtland, Ohio, newspaper 'Messenger and Advocate' printed during the time when he was the active editor.

The top line shows the nine comparisons of the purported Nephi against purported Alma tests which show the same relatively large number of "rejections" found in the "between-author" proof-test distribution derived from the comparisons between the texts of known different authors of Figure 2. In 8 of these 9 tests, 5 or more "rejections" resulted. Four of these tests produced 7, 8, 9, and 10 "rejections." Taken individually, these four high "rejections" tests independently measure a statistical confidence of greater than 99.5%, 99.9%, 99.99%, and 99.997% that these texts from Nephi were written by a different author than wrote Alma[21]. Therefore the Book of Mormon measures to be multi-authored according to its own internal description. In Figure 5 we also see the increasingly higher statistical probability that these sections of the Book of Mormon were <u>not</u> written by Joseph Smith, Oliver Cowdery, or Solomon Spaulding. Table 1 shows the measurements for the individual wordprint tests used in producing Figures 4 and 5.

TABLE 1

The Number of Independent Wordprint Tests Tabulated Under the Number of "Rejections" Measured for Each Test. Tests Were Calculated Between All Possible Pairs of Three Each Book of Mormon Texts Attributed to Nephi and Alma Along with Intercomparisons with Seven Other Non-con-contested Texts Authored by Known Writers of Interest.

TEXT vrs TEXT	NUMBER of "REJECTIONS"																NO. OF TESTS
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Nephi vrs Nephi			1		1	1											3
Alma vrs Alma		1	1	1													3
Smith vrs Smith	1		2														3
Cowdery vrs Cowdery		1															1
Spaulding vs Spaulding			1														1
Nephi vrs Alma			1			2	2	1	1	1	1						9
Smith vrs Nephi					1				2		1	1	1				6
Smith vrs Alma				2	1	1		2									6
Cowdery vrs Nephi							1	1			2		1	1			6
Cowdery vrs Alma								4	1	1							6
Spaulding vrs Nephi										1	1	1		1	2		6
Spaulding vrs Alma							3		2				1				6

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[21] Furthermore, because the data are categorical and in a statistical sense (approximately) independent, the probability of measuring all four of these high "rejections" simultaneously and yet have all of the Nephi and Alma texts written by the same writer, is vanishingly small as the combined probability would approach 1.3×10^{-14}. (The calculation is simply the product of each of the four probabilities for same authorship,-one minus the probability for different authorship reported above- which would be .005 x .001 x .0001 x .00003 = 1.3×10^{-14}. Approximate independence of the four paired test texts is assumed as is customary in wordprinting (see footnote 7, A.Q. Morton, page 154-155). This approximate simultaneous calculation' shows an enormous statistical overkill, demonstrating overwhelming statistical separation between the didactic writings of the purported Book of Mormon authors Nephi and Alma.

CONCLUSIONS

In summary, by using this new verified wordprint measuring methodology, we show that it is statistically indefensible to propose Joseph Smith or Oliver Cowdery or Solomon Spaulding as the author of the 30,000 words from the Book of Mormon manuscript texts attributed to Nephi and Alma. Additionally these two Book of Mormon writers have wordprints unique to themselves, and measure statistically independent from each other in the same fashion that other non-contested different authors do. Therefore the Book of Mormon measures multi-authored, with authorship consistent to its own internal plan. These results are obtained despite that the writings of Nephi and Alma were "translated" by Joseph Smith. We also showed control studies of modern language academic translations where in practice a single translator can consistently preserve the unique wordprints of the several original authors he has translated.

APPENDICES

Appendix 1.

Useful non-contextual word patterns meet the following conditions: they yield a non-ambiguous count, they occur frequently, they have common alternate expressions, and their use rates tend to become habitual. Patterns should be minimally affected by the period of the writer's career, the subject matter, and genre. Therefore, useful word patterns are typically made up from key words such as common articles, conjunctions, and prepositions. Measurements are calculated from the ratio of the overall key word use rate against the same key word use rate in certain sentence positions, word collocations, proportional pairs, or their use adjacent to certain parts of speech and novel vocabulary words.

After defining his meaning of "sentence" as all groups of words ending in a logical full stop, Morton(1985) lists his battery of word-pattern ratios as follows: where "#"=number of end of "sentence" markers, "(fws)"= first word in "sentence", "(lws)"=last word in "sentence", "(2nd to last)"=2nd to last word in "sentence", "(fb)"=followed by, "(pb)"=preceded by, "(...x...)"=any word, "(r+1)"=the word to the right and left are unique within the original 1000 word Word-Block.

A(fws)/#|	AS x AS/AS|	TO(fb BE)/TO|
AN(fws)/#|	AS x x AS/AS|	TO(fb THE)/TO|
AND(fws)/#|	BE(fb A)/BE|	TO x TO/TO|
IN(fws)/#|	BE(pb TO)/BE|	TO x x TO/TO|
IT(fws)/#|	BUT(fb A)/BUT|	YOU x YOU/YOU|
IT(lws)/#|	BY(fb THE)/BY|	YOU x x YOU/YOU|
OF(fws)/#|	I(fb AM)/I|	TO(between)VERBs/TO|
OF(2nd lws)/#|	I(fb HAVE)/I|	AN/AN+A|
THE(fws)/#|	I x I/I|	ANY/ANY+ALL|
THE(2nd lws)/#|	I x x I/I|	NO/NO+NOT|
WITH(2nd lws)/#|	IN(fb A)/IN|	UP/UP+UPON|
A(2nd lws)/A|	IN(fb THE)/IN|	WITH/WITHOUT+WITH|
A(fb adj)/A|	OF(fb A)/OF|	A(r)/A(r+1)use only|
A(fb x AND)/A|	OF(fb THE)/OF|	AND(r)/AND(r+1)only|
A(fb x OF)/A|	OF(fb x and)/OF|	IN(r)/IN(r+1)only|
A x A/A|	THE(pb AND)/THE|	IT(r)/IT(r+1)only|
A x x A/A|	THE(pb OF)/THE|	I(r)/I(r+1)use only|
AND(fb ADJ)/AND|	THE(pb IN)THE|	OF(r)/OF(r+1)only|
AND(fb THE)/AND|	THE(pb TO)/THE|	THAT(r)/THAT(r+1)|
AND(fb x OF)/AND|	THE(fb x AND)/THE|	THE(r)/THE(r+1)only|
AND x AND/AND|	THE(fb x THE)/THE|	TO(r)/TO(r+1)only|
AND x x AND/AND|	THE(fb x x THE)/THE|	

Appendix 2.

The photo-negative of the 1966 filming of the Book of Mormon (Printer's) Manuscript was courteously supplied, without endorsement, by the History Commission of the R.L.D.S. Church. By October of 1982 a board of seven editors working with: 1) a computer file of the 1830 Palmyra first printed edition of the Book of Mormon developed in the BYU Language Research Center by L.K. Browning, 2) the photo-offset copy of First Edition printed by Wilford C. Wood, 3) a copy of the text of extant sections of the original Dictation Manuscript collected by L.K. Browning, and 3) the complete Printer's Manuscript, had prepared a composite computer file of the oldest sections from each manuscript to complete a Book of Mormon text computer file which we named "The Most Primitive Book of Mormon Manuscript Text". The editors also prepared and verified line headers which identified the apparent original author, the literary form, modern book, chapter, verse and line notation for each line of text. Similar line headings are now published in the F.A.R.M.S. "Book of Mormon Critical Text".

Appendix 3.

Many extended word listings and counts were prepared from this composite Book of Mormon manuscript computer file during the time of its preparation and verification. Representative of these studies are:

A LISTING OF THE (Salt Lake) BOOK OF MORMON REFERENCES TO PASSAGES FROM THE TEXT OF THE PRINTER'S MANUSCRIPT OF THE BOOK OF MORMON FOR THE TWENTY-FOUR MAJOR AUTHORS, THEIR LITERARY FORMS AND WORD COUNTS

DIFFERENCES BETWEEN THE 1930 EDITION AND THE PRINTER'S MANUSCRIPT OF THE BOOK OF MORMON

WORD COUNTS AND LISTINGS OF MODERN (Salt Lake) BOOK OF MORMON REFERENCES TO PASSAGES FROM THE TEXT OF THE PRINTER'S MANUSCRIPT OF THE BOOK OF MORMON FOR EACH OF THE NINETEEN AUTHORS HAVING MORE THAN 2000 WORDS IN A SINGLE LITERARY FORM

INDIVIDUAL VOCABULARIES AND WORD COUNTS FOR EACH OF THE TWENTY-THREE SECTIONS WHICH WERE ASSIGNED AS A SINGLE LITERARY FORM FROM TEXT TAKEN FROM THE PRINTER'S MANUSCRIPT OF THE BOOK OF MORMON

COMMON PHRASES BETWEEN THE KING JAMES BIBLE AND THE BOOK OF MORMON (in three volumes)

Appendix 4.

All text samples were drawn from what were thought to be statistically independent source texts from each author's heretofore non-contested works. Care was taken in author and text selection so as to represent a wide variety of writing ability, general background and time period, literary training, genre or literary forms, working vocabulary, and apparent purity of the nominally specified single author. The authors and texts (of 4998 words each unless marked otherwise) used in the proof-test study are as follows:

1) Samuel Clemens (Mark Twain)
   a) Everyone Loves a Lord, an essay on American and European mores.(1902)
   b) Early Days, Autobiography, narrative (1875)
   c) The Diary of Adam, fanciful fiction, a spoofing translation, likely a satire on the Book of Mormon, (1893)
   d) The Diary of Eve, companion to c) above, author attempting to write for two different people. (1905)
2) Oliver Cowdery
   a) Written religious discourse, and biographical essays, (1830)
   b) second section, of same Messenger and Advocate article series as used in a) above. (1830)
3) Dr. William Dodd
   a) Shakespeare, an essay. (about 1770) -only 3528 words-
4) Robert Heinlein
   a) The Number of the Beast, fanciful science-fiction narrative, 1st person narrative chapters simulating the writing of his character Hilda. (1980)
   b) second section, of a) above except chapters simulating the 1st person narrative of his character Deety. (1980). Another attempt to write for two different people.
5) Samuel Johnson
   a) Rambler, first part of newspaper essays (1750)
   b) second section, of a) above. (1751)
   c) Idler, newspaper essays (1758)
   d) Journey to the Western Island of Scotland, a personal travelogue. (1775)
   e) second section, of d) above. (1775)
   f) The Fountain, A Fairy Tale, fanciful narrative. (1766) -only 4879 words-
6) Joseph Smith
   a) autographic letters, to wife Emma, friends, and Church. (1834-8)
   b) second section, of a) above. (1836)
   c) Joseph Smith Tells His Own Story, dictated and carefully polished (with the assistance of his clerks). (1834-8)
7) Harry Steinhauer
   a) The Novella, an essay, written in English.   (1977)
   b) second section, of a) above plus 1000 words from c) below (1977 and 1974)

   c) <u>Heine and Cecile Furtado: a Reconsideration</u>, biographical essay, written in English. (1974)

8) Heinrich Von Kleist
   a) <u>Michael Kohlaas</u>, novella, written in German (about 1850), translated into English by Harry Steinhauer (1977)
   b) <u>second section</u>, of a) above (about 1850)
   c) <u>third section</u>, of a) above (about 1850)

9) Christoph M. Wieland
   a) <u>Love and Friendship Tested</u>, novella, written in German (about 1770), translated into English by Harry Steinhauer (1977)
   b) <u>second section</u>, a) above (about 1770)