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Truth or Cherry Picking: A Statistical Approach to Chiastic Intentionality

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Chiasmus is an ancient inverted-parallel literary form that states a number of literary elements and then restates these elements in reverse order. For example, Matt 10:39 is a simple two-element chiasm:

Example 1: Matt 10:39

A He that **findeth his life**
  B shall **lose it**:
  B′ And he that **loseth his life** for my sake
A′ shall **find it.**

This verse has two appearances of element A ["find(eth) his life (it)"] and two appearances of element B ["lose(eth) his life (it)"], arranged in the inverted parallel form, ABBA. Examples of chiasmus can be found in many ancient and modern works.[1]

Chiasms can be separated into two groups: "intentional" chiasms whose authors intentionally applied the chiastic form during composition and "inadvertent" chiasms whose authors did not. Intentionality is important because without evidence of intentionality, conclusions drawn from the chiastic analysis of a text might not reflect the meaning intended by its author.

The only way to know for sure about the intentionality of a chiasm is for its author to state whether he intentionally applied the chiastic form during composition. In many cases of interest, no such statement exists, and scholars are left to assess intentionality using only the text of the chiastic passage itself. To this end, several scholars have proposed

criteria for evaluating chiasms,[2] and we have introduced statistical tools for such evaluations.[3]

In this paper, we apply these tools to a chiasm in a physics abstract to demonstrate the importance of including all repeated literary elements in the analysis.

The following chiastic structure can be found in the abstract of a physics research publication written by one of us (B. F. Edwards).[4]

Example 2: Physics Abstract, Take 1

A Poiseuille **flow** between parallel plates advects

B **chemical reaction fronts,** distorting them and altering their

C **propagation** velocities.

D Analytical **solutions** of the cubic reaction-diffusion-advection equation

E resolve the chemical concentration for narrow **gaps,**

E′ wide **gaps,** and small-amplitude flow.

D′ Numerical **solutions** supply a general description for fluid flow

C′ in the direction of **propagation**

B′ of the **chemical reaction front,**

A′ and for **flow** in the opposite direction.

Example 2 shows two appearances of element A ["flow"], two appearances of element B ["chemical reaction front(s)"], two appearances of element C ["propagation"], two appearances of element D ["solutions"], and two appearances of element E ["gaps"]. Example 2 is an example of a "simple" chiasm, that is, a chiasm in which each repeated element appears exactly twice in the passage, and in which each pair of elements fits the chiastic form. For example 2, the chiastic form is ABCDEEDCBA, which states five elements in a particular order and then restates these five elements in reverse order.

Statistics can, in some cases, shed light on the intentionality of proposed chiasms. To do so, we consider random rearrangements of the repeated literary elements in a chiasm and calculate the likelihood L that one such rearrangement will be chiastic. Such likelihoods are expressed as numbers between 0 and 1. Values of L that are smaller than 0.01 can be considered to give strong evidence of intentionality because fewer than 1 in 100 rearrangements will be chiastic, on average. Such likelihoods are small enough to give reasonable confidence that the chiasm resulted not by chance, but by design. Values of L that are larger than 0.1 can be considered to give no evidence of intentionality because more

than 1 in 10 random rearrangements will be chiastic, on average. Values of *L* between 0.01 and 0.1 can be considered to be inconclusive. Sometimes, this inconclusive range is replaced by a single cut-off value of 0.05, with *L* values smaller than this cut-off considered to give evidence, and *L* values larger than this cut-off considered to give no evidence.[5] Whatever system is adopted, the smaller the *L* value, the stronger the confidence that the chiasm resulted not by chance, but by design.

For example 2, the likelihood that random rearrangements (such as the non-chiastic arrangement DAEBCEDCAB) will be chiastic is *L* = 0.0011.[6] This value is well below 0.01 and therefore provides strong evidence of intentionality.

The problem is that this chiastic structure was not actually intentional! B. F. Edwards asserts that he did not consciously, intentionally, or deliberately apply the chiastic form in writing this abstract.

Some suggest that writers who know about the chiastic form, as B. F. Edwards did when he wrote this abstract, might incorporate this form subconsciously into their writing.[7] To be successful, such a process would need to be powerful enough to modify the conscious process of writing and rewriting in search for a logical organization of ideas, so that the end result would be chiastic. B. F. Edwards doubts that such a subconscious process was at work.

A simpler explanation for the chiastic structure of this physics abstract is revealed by accounting for all repeated elements in the text:

Example 3: Physics Abstract, Take 2

A Poiseuille **flow** between parallel plates *(F) advects*

B **chemical reaction fronts,** distorting them and altering their

C **propagation** velocities.

D Analytical **solutions** of the cubic reaction-diffusion- *(F) advection* equation

E resolve the chemical concentration for narrow **gaps,**

E′ wide **gaps,** and small-amplitude *(A) flow.*

D′ Numerical **solutions** supply a general description for fluid *(A) flow*

C′ in the *(G) direction* of **propagation**

B′ of the **chemical reaction front,**

A′ and for **flow** in the opposite *(G) direction.*

Besides the appearances of elements A, B, C, D, and E that fit the chiastic form (in bold face, also shown in example 2), there are two extra appearances of element A that do not fit the form (in italics). In

addition, there are two other element pairs, F ["advects / advection"] and G ["direction"], that could have participated in the chiastic structure, but do not (also in italics). Thus, in example 3, ten elements fit the chiastic form (five pairs of chiastic elements, in bold face) and six elements do not (in italics). Because of these elements, the case for intentionality for example 3 is less compelling than for example 2.

When the elements that do not fit the chiastic form are included in the statistical analysis, the evidence of intentionality disappears. Because of these elements, example 3 is not simple and its likelihood does not equal $L = 0.0011$ (for example 2). Instead, we must calculate the likelihood that chiastic structure with five elements could appear in random rearrangements of all of the elements in example 3. This calculation gives $L = 0.044$.[8] This value falls between 0.01 and 0.1, the inconclusive range, and therefore erases the strong evidence of intentionality drawn from example 2.

Values of L that are larger than 0.1 say nothing about intentionality. They do not say whether or not the author applied the chiastic form in composing the text. Statistics cannot *prove* that a chiasm was inadvertent but can provide evidence of intentionality when the likelihood of appearing by chance is below 0.01 and when all repeated elements are included in the analysis.

In the case of the physics abstract, we have more information than statistics can provide. We know that its chiastic structure was inadvertent because its author asserts that it was. And a careful statistical analysis including all repeated elements is consistent with this conclusion.

There is no need to invoke the subconscious mind to explain how chiastic structure with five elements made its way into the physics abstract. Why? Because once all repeated elements are accounted for, this structure has a reasonable likelihood ($L = 0.044$) of appearing by chance, that is, of appearing in random arrangements of the words in the abstract. The chiastic structure of the abstract appeared not by design (conscious or subconscious), but by chance. Cherry picking only those elements that fit the form would give a small likelihood ($L = 0.0011$) of appearing by chance and strong (but erroneous) evidence of intentionality.

Inadvertent chiastic structure in an INFORMIX-OnLine Database Administrator's Guide Introduction provides another example. Including only the elements that fit the form gives $L = 0.000000029$ for a simple chiasm with nine elements, which would give strong (but erroneous) evidence of intentionality. Correctly including all repeated

elements gives $L = 0.66$, which gives no evidence of intentionality.[9] In this example, eighteen elements fit the chiastic form (nine pairs of chiastic elements) and thirty-nine elements do not. It is these extra elements that provide the flexibility needed to easily find chiastic structure with nine elements, which would have been extremely unlikely otherwise.

In our analysis of hundreds of chiasms in various works, we have seen this scenario played out time and time again: Someone proposes a chiastic structure that looks compelling at first glance (like example 2), but closer inspection reveals many repeated elements that do not fit the structure (like in example 3). After accounting for these elements, the evidence of intentionality disappears.

We have never found a chiasm for which the subconscious explanation is necessary.

Some chiasms enjoy strong evidence of intentionality that survives close inspection. Two examples are Lev 24:13–23, a simple chiasm with seven elements and $L = 0.0000074$; and Alma 36:1–30, a simple chiasm with eight elements and $L = 0.00000049$.[10]

Our results refute simple rules of thumb that favor intentionality above some minimum number of chiastic elements, such as four or five.[11] Chiasms with large numbers of chiastic elements have small likelihoods of appearing by chance only when the number of elements that do not fit the chiastic form is small or zero.

Enthusiasm for chiasmus has led to the discovery of stunning examples of chiasmus. But this enthusiasm has also produced many chiastic proposals of dubious intentionality. As shown above, accounting for all repeated elements can help to distinguish compelling examples from weak ones. To promote integrity, chiastic analysts should account for all repeated elements in their assessment of each new chiastic discovery.

In conclusion, cherry picking only those elements that fit the chiastic form gives misleading chiastic patterns and meaningless statistical results and can lead to false conclusions regarding intentionality. On the other hand, including all appearances of all repeated literary elements gives truthful chiastic patterns, valid statistical results, and reliable conclusions regarding intentionality.

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evaluate chiasmus: "When Are Chiasms Admissible as Evidence?" (*BYU Studies*); "Does Joseph's Letter to Emma of 4 November 1838 Show That He Knew about Chiasmus?" (Dialogue Paperless, E-paper); "Response to Earl Wunderli's Critique of Alma 36 as an Extended Chiasm" (*Dialogue*); and "Does Chiasmus Appear in the Book of Mormon by Chance?" (*BYU Studies*).

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Notes

1. John W. Welch and Daniel B. McKinlay, *Chiasmus Bibliography* (Provo, UT: Neal A. Maxwell Institute for Religious Scholarship 1999), https://publications.mi.byu.edu/book/chiasmus-bibliography/.

2. David J. Clark, "Criteria for Identifying Chiasm," *LB* 5 (1975): 63–71; Craig Blomberg, "Structure of 2 Corinthians 1–7," *CTR* 4, no. 1 (1989): 3–20; John W. Welch, "Criteria for Identifying and Evaluating the Presence of Chiasmus," *Journal of Book of Mormon Studies* 4 (Fall 1995): 1–14; Mark J. Boda, "Chiasmus in Ubiquity: Symmetrical Mirages in Nehemiah 9," *JSOT* 71 (1996): 55–69; David P. Wright, "The Fallacies of Chiasmus: A Critique of Structures Proposed for the Covenant Collection (Exodus 20:23–23:19)," *Zeitschrift für Altorientalische und Biblische Rechtsgeschichte* 10 (2004): 143–68.

3. Boyd F. Edwards and W. Farrell Edwards, "Does Chiasmus Appear in the Book of Mormon by Chance?" *BYU Studies* 43, no. 2 (2004): 103–30; Boyd F. Edwards and W. Farrell Edwards, "When Are Chiasms Admissible as Evidence?" *BYU Studies* 49, no. 4 (2010): 131–54.

4. Boyd F. Edwards, "Propagation Velocities of Chemical Reaction Fronts Advected by Poiseuille Flow," *Chaos* 16 (2006): 043106.

5. Anthony Hayter, *Probability and Statistics for Engineers and Scientists* (4th ed.; Boston, MA: Brooks/Cole Cengage Learning, 2012), sec. 8.2, pp. 351, 352; Boyd F. Edwards and W. Farrell Edwards, "When Are Chiasms Admissible as Evidence?" 141.

6. Edwards and Edwards, "Does Chiasmus Appear in the Book of Mormon by Chance?" 115.

7. Clark, "Criteria for Identifying Chiasm," 71–72; Blomberg, "Structure of 2 Corinthians 1–7," 20; Welch, "Criteria for Identifying and Evaluating the Presence of Chiasmus," 12.

8. The value $L = 0.044$ was obtained using a computer program to make ten million random rearrangements of the elements of example 3, with the result that 4.4 percent of these rearrangements show five-element chiastic structure. This is the data entry for this program, and its output:

```
Number n of chiastic elements: 5
Number of appearances of each chiastic element: 4, 2, 2, 2, 2
Number m of non-chiastic elements: 2
Number of appearances of each non-chiastic element: 2, 2
Number r of rearrangements: 10000000
```

```
Number of duplicate levels (normally 0): 0
Calculating... Type command-. to quit.
|---------|---------|---------|---------|
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Reordering likelihood L =0.0440820000000000
Margin of error (+ or -) =0.0000663942768618
```

Readers interested in using this program to analyze chiasms are invited to write to B. F. Edwards, boyd.edwards@usu.edu, for a free copy. Versions for Macintosh and PC are available.

9. Edwards and Edwards, "Does Chiasmus Appear in the Book of Mormon by Chance?" 125.

10. Edwards and Edwards, "Does Chiasmus Appear in the Book of Mormon by Chance?" 110.

11. Blomberg, "Structure of 2 Corinthians 1–7," 7.