A Study of Trauma Linked to Contemporary Human Sacrifice Practices: A Pilot Study Exploring Machine Learning in Criminological Analysis

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INTRODUCTION

•While news headlines reporting occult killings and Satanic ritual abuse seem sensational, they can also be viewed conceptually as potential instances of **modern human sacrifice**.

•Analyzing the **symbolic aspects of these crimes** from the perpetrators' perspective **can reveal ideological beliefs and reasoning** aligned with various theories explaining the historical purposes of human sacrifice.

- Sacrifice may serve supernatural purposes by offering gifts to deities for favors, or social functions by reinforcing hierarchies, channeling communal violence, and justifying killing.

•Analyzing **trauma patterns** in victims can help **differentiate modern sacrifice from non-ritualistic murders**, offering insight into the crime and its potential recurrence.

•**Machine learning/AI** can help forensic experts **identify new patterns** not previously recognized, **reducing bias and improving the accuracy of criminological models**.

MATERIALS AND METHODS

•Reputable news sources from 1923-2023 were searched using key phrases (human sacrifice, ritual murder, ritual homicide, Muti, Satanic murder, Vampire murder). N=39.

•Based on case details, perpetrators were classified using Perlmutter's (2003) Symbolic Analysis criteria classifications

- True Criminals (N=8)
- Dabblers (N=15)
- True Believers (N=16)

•Presence/absence of broad categories of trauma inflicted upon victims were recorded.

- Categories included: sharp force, blunt force, gunshot wound(s) (GSW), mutilation, strangulation, sexual assault, dismemberment, poisoning and/or drugging, burning and/or boiling, cannibalism, blood drinking and/or draining, and hanging.

•Perpetrator(s), victim(s), victim age(s), year, country, and purported religion involved was also recorded.

•The number of cases involving each category of trauma was calculated for each classification and translated into frequencies.
•Fisher's exact tests compared trauma types across perpetrator classifications.

•Two types of machine learning clustering analysis were performed to see how trauma types were objectively clustered.

- (1) Unsupervised K-means clustering (Hartigan-Wong algorithm, model trained using cross-validation)
- (2) Supervised K-means clustering (*k*-nearest neighbor algorithm, model trained using leave-one-out cross validation)

Category	True Believer	Dabblers	True Criminals	P-Value
Sample Size	**16 (42.03%)**	**15 (38.46%)**	**8 (20.51%)**	
Sharp Force Trauma	10 (62.50%)	13 (86.67%)	4 (50.00%)	0.1664
Blunt Force Trauma	7 (42.75%)	8 (53.33%)	2 (25.00%)	0.5002
Gunshot Wounds	3 (18.75%)	1 (6.67%)	5 (62.50%)	0.0160 **
Mutilation	9 (56.25%)	9 (60.00%)	3 (37.50%)	0.6467
Strangulation and/or Smothering	1 (6.25%)	1 (6.67%)	1 (12.50%)	1.0000
Sexual Assault	3 (18.75%)	2 (13.33%)	3 (37.50%)	0.4558
Dismemberment	11 (68.75%)	4 (26.67%)	0 (0.00%)	0.0020**
Poisoning and/or Drugging	2 (12.50%)	0 (0.00%)	1 (12.50%)	0.4091
Burning and/or Boiling	3 (18.75%)	0 (0.00%)	0 (0.00%)	0.2122
Cannibalism	2 (12.50%)	3 (20.00%)	0 (0.00%)	0.5049
Blood Drinking and/or Draining	0 (0.00%)	3 (20.00%)	2 (25.00%)	0.0796*
Hanging	1 (6.25%)	0 (0.00%)	0 (0.00%)	1.0000

Table 1: Associations between trauma categories and perpetrator classifications
Note: ** indicates a statistically significant result $p < 0.05$.
* indicates a suggestive p-value.

	Cluster 1	Cluster 2	Cluster 3
True Believer	9	3	4
Dabblers	4	7	0
True Criminals	2	6	4

Table 3. Comparison of supervised machine learning clusters to Perlmutter classifications; See *Figure 2*

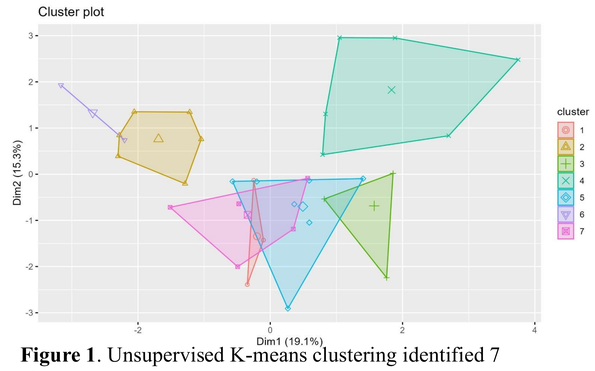

Figure 1. Unsupervised K-means clustering identified 7 clusters

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
True Believer	0	4	0	5	4	2	1
Dabblers	3	4	0	0	5	0	3
True Criminals	1	0	4	1	0	0	2

Table 2. Comparison of unsupervised machine learning clusters to Perlmutter classifications; See *Figure 1*

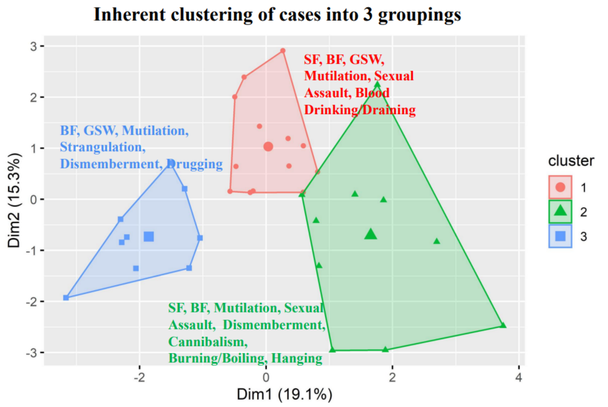

Figure 2: When 3 clusters were specified, the groupings did not precisely mirror the symbolic analysis classification categories. Combinations of trauma appeared to factor most heavily in clustering cases. Cluster 2, exhibiting the greatest variation overall, encompasses a greater number of religions than clusters 1 or 3.

RESULTS

•Significant/suggestive associations with perpetrator classifications

- **Dismemberment (p=0.0020)-** ***True Believers***
- **Gunshot wounds (p=0.0160)-** ***True Criminals***
- **Blood drinking and/or draining (p=0.0796)-** ***Dabblers/ True Criminals***

•Machine learning cluster analysis (1) (*Figure 1* & *Table 2*)

- **Cluster 3; comprised of only True Criminals**
- **Cluster 6; comprised of only True Believers**
- **Cluster 4; majority True Believers**
- **Clusters 2 & 5; True Believers and Dabblers**
  - ➢ May be sub-types of True Believers that overlap with Dabblers, or experiential differences

•Machine learning cluster analysis (2) (*Figure 2* & *Table 3*)

- **Partial overlap with Perlmutter groupings** (accuracy of 58.97%)
- Combinations of trauma appeared to factor most heavily in clustering

CONCLUSIONS

•Analysis of types of trauma identified associations that can be utilized within forensic contexts to interpret and distinguish behavioral patterns of modern human sacrifice.

- **Significant associations** among instances of **dismemberment** and **gunshot wounds**
- **Suggestive associations** among instances of **blood drinking and/or draining**

•Some overlap is noted between Perlmutter's perpetrator classifications and combinations of trauma sorted by machine learning, as well as novel clusters

- Suggests **combinations of trauma should be analyzed further** for more nuanced insight into ritual homicide.

•**Machine learning and/or AI** can enhance criminology by **increasing accuracy and improving classifications**, helping forensic experts **identify novel patterns**, **reduce bias**, and **address the low variance explained by traditional criminological models**

WORKS CITED

SCAN FOR A LIST OF REFERENCES:

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