Understanding Conflict through Burial: Neural Network Analysis of Death and Burial in the War of 1812

Stephanie Spars

This paper concerns methods and theories for analyzing and interpreting burials related to wars and other conflict situations. Spars (2000; 2005) developed a conflict burial model to facilitate the identification of material differences in burials that will, in turn, help in understanding burial circumstances (e.g., whether a death occurred during conflict on the battlefield, as a direct consequence of battlefield injuries or other trauma, from execution, or in circumstances unrelated to the conflict, and whether the subsequent burial was by a "friendly," "neutral," or "hostile" group). Data from burials in the War of 1812 mass grave site of Snake Hill, Fort Erie, Ontario (1814) are compared to those from the conventional cemetery at Prospect Hill, Newmarket, Ontario (1824–1879). The variables of the model include body positioning; cause of death; presence or absence of mutilation; burial container; and ritual markers, including clothing and grave goods. The quantitative methodology neural networks (self-organizing maps) provides a clear, accessible and repeatable means of exploring, classifying—and ultimately making predictions from—smaller, more complex datasets, such as those reflecting the many attributes of human activity preserved in archaeological contexts.

Introduction: Modelling the Signatures of Death and Burial

The physical aspects of deaths and burials during periods of conflict may vary significantly from conventional funerary patterns. The burial process brings together the victim and the people handling the body in a setting with distinctive material features. Burials are, therefore, not just remains. In the nature, arrangement, and spatial relationships of the material evidence at a burial site, they are also representations of attitudes and behaviours of the living towards the dead, be it friend, enemy, or unknown victim. To illustrate this aspect of burials, this paper compares the treatment of the dead at a War of 1812 military gravesite to that at a conventional nineteenth century cemetery. The Snake Hill site, located in Fort Erie, Ontario (Figure 1), contains the remains of people who died during the siege of Fort Erie, Ontario, in 1814. Prospect Hill cemetery, located in Newmarket, Ontario (Figure 1), contains burials dating between 1824 and 1879. Spars (2005) relates differences in the treatment of the dead to variations in attitude about the victim in conflicts dating from medieval to modern times. The focus of this paper is how these differences are manifested in burial behaviours in a small sample from the War of 1812. To this end, it compares and contrasts military and conventional burials, identifies significant differences, and suggests possible explanations for variations from the norm.

Human beings bury their dead within a dynamic context. In a conflict setting, burial behaviours become more fluid in order to allow people to operate under vastly different conditions. It is therefore important to develop a flexible model and methodology (quantitative technique) to analyze qualitative behavioural data.

The burial model and methodology discussed below not only study the remains and artifacts within the context of a site, they also take into account the variability of these behaviours in normative peacetime and conflict periods in order to provide a socio-cultural context within which to interpret death and disposal of individuals.

A key component in this approach is the non-linear statistical method known as neural network

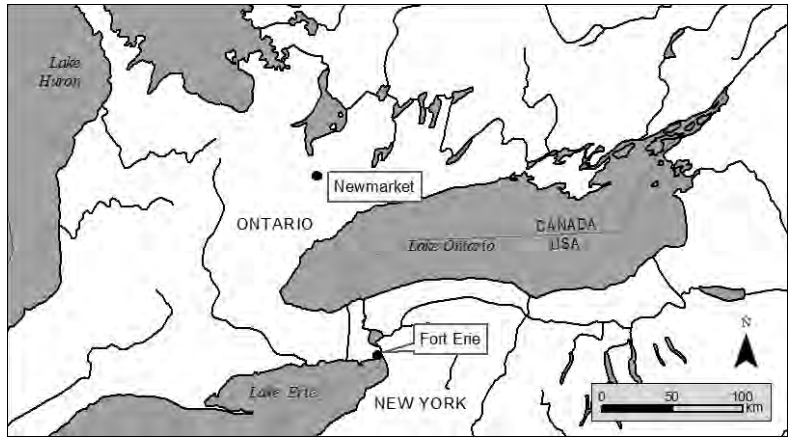

Figure 1. *The locations of the Snake Hill site in Fort Erie and the Prospect Hill site in Newmarket, Ontario.*

analysis. Neural networks are methods of analyzing data inspired by the nervous system of the brain. The process learns by example (training) and then applies this experience to recognize patterns in new data. Neural networks applications are relatively novel in archaeology, but the results of my previous investigations (Spars 2005) suggest they hold great promise for the analysis of the social complexities of warfare.

The type of neural network used here is the self-organizing map (SOM) (Kohonen 1995, 2001), which is based on the presence or absence of variables. The system mimics the basic structure of brain processing through a network of interconnected elements and layers that analyze and display the data. The unique structure connects the cases in such a way that every input is locally analyzed and compared to its neighbouring cases, which allows for non-linear processing. Because the pattern of relationships affecting mortuary behaviour—and indeed any human behaviour—is not linear, this approach has the potential to enable new insights into archaeological phenomena. In traditional multivariate statistics, each case is related to two neighbours. In neural network analysis, however, each case is compared to up to six neighbours; it thus incorporates more complexities in the relationships of variables.

The conflict burial model identifies the key variables in the process—from the death of a soldier or civilian to the preparation of the body and the grave to the burial. These variables include the cultural or national affiliation of victims and buriers; cause of death; grave type; disposition of the remains; nature of grave goods; and evidence of selectivity based on status, sex, or age.

The goal of the analysis is to determine the nature of the affiliation of the buriers to the buried. The basic working premise of the analysis is that a person buried by comrades will be treated and interred differently than a person buried by indifferent or hostile groups. A "friendly burial" should closely resemble a conventional burial because it is the work of compatriots, friends, or family. A "neutral burial" may lack some conventional features—particularly if the buriers are members of a different culture and/or religion—but it will lack features that suggest hostility, such as deliberate mutilation or disarticulation of the remains. A "hostile burial" may depart significantly from the norm because the individuals involved had a religious, political, or ideological antipathy towards the dead. The ability of the model to discern anomalous grave types and behaviour is of course contingent on the researcher having evidence related to the conventional burial practices of a region, culture, or social and/or political group, as recorded in documents and mortuary studies. The sites discussed here occur in well-documented contexts and therefore provide an ideal illustration of the approach.

Datasets

Snake Hill

The Snake Hill dataset consists of individual graves of American soldiers prepared by US

forces while the Americans were under siege for several months by the British in Fort Erie, in mid- to late 1814. Archaeological Services, Inc. (ASI) conducted the excavations, with contributions from several agencies in Canada and the United States (ASI 1988; Pfeiffer and Williamson 1991; Litt et al. 1993). This excavation was noteworthy for its impeccably detailed excavation and recording—still a rarity in the study of conflicts.

Most of the burials are single graves of relatively uniform size (about 2 x 0.7 x 0.6 m), with the exception of one containing three individuals and another containing two individuals. The burials are primary, with almost completely articulated remains. Evidence of recent medical treatment in some remains suggests that the interments occurred shortly after the battle. Three "medical waste pits" (Pfeiffer and Williamson 1991) were not included in the analysis, as they are probably commingled limbs from amputations or other medical procedures.

Prospect Hill

ASI excavated a number of individual graves from the cemetery at Prospect Hill, Newmarket, Ontario (ASI 1990). The detailed dataset consists of the remains of 39 individuals of civilian status in 39 individual graves of relatively uniform size and shape (about 1.9 x 0.7 x 0.5 m), dating between 1824 and 1879. They represent a variety of body types and circumstances.

Model and Variables

Model

Conventional and friendly burials follow social prescriptions; neutral and hostile burials do not. Even when a burial must be done quickly in the heat of conflict, friendly groups will likely try to follow conventional tradition out of respect for the dead. In contrast, neutral or hostile groups will show either indifference or malice—and, if they are of a different culture than their opponents, they will probably not know the appropriate burial conventions. By comparing the conflict burial data with the conventional situation, it is therefore possible to identify variations in body treatment that may reflect attitudinal differences in the burial act (Spars 2000, 2005).

For the purposes of this research, the words grave or burial refer to the inhumation of an individual, a group, or a mass of individuals in the ground or in a mound, with or without a coffin or ritual grave ornaments or treatments. Burial may consist of single (i.e., primary) or multiple periods of interment. Whether or not the method of burial is in accordance with legal or religious rites, the artifacts present are the remnants of the behaviour associated with disposal. Burials may take place in a formal or informal cemetery or burial ground or they may be placed randomly as a matter of expedience.

Variables

Variables are summarized in Table 1 and described in detail below.

Cemetery type (Cem type). The cemetery type (that is, the grave's location) variable has two options: conventional or non-conventional. In a conflict, a cemetery used by a friendly group should follow a conventional pattern where possible. A conflict cemetery may be near a church or on the outskirts of a settlement, at the scene of the death, or behind defensive lines. Burial on the battlefield may also take place to serve as a memorial to the dead; at the Little Bighorn Battlefield National Monument, in Montana, for example, many members of George Armstrong Custer's Seventh Cavalry troop are buried more or less where they fell (Scott et al. 1998:97). A burial performed by a neutral group may deviate from conventional locations because of indifference or lack of knowledge of burial traditions—for example, victims may be buried facing the wrong direction, in a grave too shallow or too deep, improperly arranged and clothed, or they may be placed in a mass grave on or near the battlefield. A hostile group will typically use unmarked mass graves, either pits or trenches, for the burial of casualties, with no attention to appropriate disposition, because they will be antagonistic or indifferent to appropriate burial rituals or treatments.

Status (Status). The status variable identifies whether an individual is civilian or military. The identification is made based on a combination

Table 1. *Characteristics of conventional and conflict-period friendly, neutral, and hostile burial models.*

	Conventional Burials	Friendly Burials	Neutral Burials	Hostile Burials
Cemetery type	Permanent; Traditional locale	Temporary/Non-conventional or traditional locale	Temporary/Non-conventional, Non-traditional locale	Temporary/Non-conventional, Non-traditional locale
Grave	Single plot: one body	Single or Mass Grave (multiple bodies)	Mass grave: multiple bodies	Mass grave: multiple bodies
Markers	Present	Present or Absent	Absent	Absent
Conventional Container	Present	Present (limited) or Absent	Absent	Absent
Traditional grave goods	Present	Absent (or few in number)	Absent	Absent
Grave goods (examples)	Flowers, plants, rings, other offerings	Flowers	--	--
Miscellaneous Artifacts	Absent	Present	Present	Present
Misc. Artifacts (examples)	--	Personal items, armaments	Personal items, armaments	Personal items, armaments, trash
Clothing	Placed in best clothing or none	What victim died in	What victim died in	What victim died in
Cause of Death	Natural; Sickness/Disease	Combat Related; Extra-Judicial	Combat Related; Extra-Judicial	Combat Related; Extra-Judicial
Mutilation	Absent	Absent or Present	Absent or Present	Absent or Present
Body Positioning	Conventional: Consistent pattern in orientation of bodies	Conventional: Signs of attempt for order; commingling	Not Conventional: No consistent order; Layering/ commingling	Not Conventional: No order; Layering and commingling

other variables, such as age, sex, and the presence of markers in the form of specific types of clothing and/or equipment.

Cause of Death (CoD). Four listed causes of death are represented in the variables: gun shot wound(s), blunt trauma, sickness or disease, and natural causes. These specific causes fall into one of four general categories representing the manner of death, that is, combat related (CoDCR); sickness (CoDSD); extra-judicial (CoDEJ); and natural (CoDN). In order to test the applicability of the model and its statistical methodology, it was necessary in some instances to determine cause of death from other aspects of the burial (e.g., sex, age, skeletal completeness).

Mutilation (Mut) – yes/no. Mutilation is peri- or post-mortem trauma deliberately inflicted upon the deceased, prior to or immediately after death. Mutilation is clearly a hostile act, but in some instances the victims may be recovered after death by friendly groups—for example, at the Little Bighorn battlefield, where the American Indian victors mutilated many bodies for trophies before the bodies were buried by a friendly force. While this case is exceptional, it does emphasize that mutilation does not always signify hostile burial circumstances and that therefore interpretation of the burial circumstances requires additional contextual evidence. Mutilation can also take the form of a medical procedure—such as a surgical amputation. Burial 12 at Snake Hill, for example, has had his left leg amputated at the femur.

Body Positioning (Bod Pos) – yes/no. Body treatment is a strong indicator of the identity of the buriers. It is assumed that friendly groups will follow as much as possible the conventional routines and rituals. Neutral groups may not be aware of the mortuary process, but they tend to bury the bodies individually without commingling or layering. Hostile groups disposing of bodies are not concerned with keeping to mortuary traditions or showing other measures of respect, so the dead may be dumped into pits or trenches, where they eventually commingle. The buriers may even position the body in an individual burial in a vulgar way as a message to the enemy.

Grave Marker (Marker) – yes/no. Grave markers, such as tombstones and crosses, are common elements of burials. Under normal conditions, they are inscribed with the name and other details of the deceased. During conflicts, however, markers may be improvised from materials

at hand. At the end of hostilities, permanent markers may replace these temporary markers—unless they have been removed or destroyed. The absence of markers usually suggests burial by neutral or hostile groups, who would act more expediently and, in any case, would not likely know the names or affiliations of the dead.

Clothing (Cloth) – yes/no. In a conflict situation, it is expected that individuals would be buried in the clothes they died in, for reasons of expediency. If the grave consisted of legitimate war casualties, that is, soldiers, the bodies would be in military dress, but this may not always be the case, especially when the fighters were not in a formal army. The presence or absence of clothing, or specific articles of clothing, may contribute to evidence of intent. However, the absence of clothing may also be attributable in some instances to taphonomic processes that destroy organic materials.

In both the Snake Hill and Prospect Hill burial sites, decomposition was extensive, so the evidence of clothing came mainly from more resistant materials, such as buttons or shoe fragments. For example, all that remained of the garments on Snake Hill burial 21 were several large, flat pewter buttons discovered on the thorax.

Container (Contain) – yes/no. A container may be a coffin, shroud, or other ritually sanctioned holder for a body. The use of a container strongly suggests a friendly burial. But because in a conflict situation buriers may lack time or resources to follow the conventional procedures, the absence of a container alone is not sufficient proof of intent.

As with clothing, a container is subject to decay over time and may be evidenced only by patterns of nails and/or wood fragments or stains. Outlines of nails indicate that Snake Hill burials 4 and 19 were buried in coffins.

Grave Goods (GG) – yes/no. Grave goods are ritually prescribed items placed in or around a burial. Their presence strongly suggests a friendly context, but a friendly burial in the heat of battle may lack grave goods.

Miscellaneous Artifacts (Misc) – yes/no. Unlike grave goods, which may be present under conventional conditions, miscellaneous artifacts are objects and materials that would not normally be present in and around a conventional or friendly conflict-period burial. Depending on the burial tradition, such items may include ordnance, wallets, photos, documents, or in some instances rubbish or animal carcases. In some cases, the object that caused injury and possibly death (e.g., lead shot, projectile point) can also remain present in the grave after the body has decomposed. It is expected in a neutral or hostile burial that personal items—excluding valuables and, possibly, identification—would simply be left on the body. Bodily decomposition before burial may also discourage the stripping of the body, resulting in a scatter of artifacts in the grave. There was lead shot in Snake Hill burials 24 and 27, two of the three burials with such miscellaneous artifacts.

Quantitative Analysis: Neural Networks

The study of mortuary behaviour during a conflict requires the exploration of a context dramatically altered from the social norm, one in which death and burial vary according to the conflict situation. The flexibility of neural networks analysis may reveal additional information about the circumstances that surround the death and burial of individuals and groups in wartime.

The neural networks analysis presented here of the Snake Hill and Prospect Hill burials uses a self-organizing map (SOM)—a data visualization technique in which the neural networks appear in the form of a map-like array (for information on how the SOM works, see Kohonen 1995, 2001; Kaski 1997; and Vesanto et al. 2000). The visualisation and interpretation methods used here are based on Simula et al. (1999); Siponen et al. (2001); Vesanto (1999, 2000); and Vesanto and Alhoniemi (2000).

The SOM method was applied to identify clusters and correlations among the presence or absence (or alternative states) of the following variables:

cemetery (conventional or non-conventional);
status (civilian or military);
combat-related cause of death (y/n);

sickness-related cause of death (y/n);
extra-judicial cause of death (y/n);
natural cause of death (y/n);
mutilation (y/n);
body positioning (y/n);
grave marker (y/n);
clothing (y/n);
container (y/n);
grave goods (y/n);
miscellaneous artifacts (y/n).

The projection (map) created by the SOM consists of non-linear, two-dimensional representations of the topology of the input vectors, or cases (that is, the individual burials). The SOM created a general map to illustrate clusters and patterns in the nineteenth century Canadian data—a u-matrix (unified distance matrix) clustering of the burial types and the individual burials that best represent a series of variables. The u-matrix, developed by Ultsch (1993), organizes variables and cases by locating them in a spatial matrix of nodes (hexagons) arranged and shaded according to the distances between the weights of neighbouring cases. A simplified version of the map used for this analysis is shown in Figure 2.

The map consists of the following features: a distribution of hexagons in different shades of grey representing one iteration of each case (burial) superimposed on the cluster area, and a grey scale showing the numeric and tonal gradations (correlations).

Every hexagon is characterised by a dimensional topological weight. In processing, each new case is given a location in a node on the map. The location may contain more than one case (and may not be labelled in Figure 2); it is automatically classified or categorized based on a level of similarity to a case's neighbours. Similarity is based on the characteristics that the case possesses, and that case's neighbours are similar based on the variables each one possesses. Consequently, related cases are placed close to each other. The grey scale indicates that the lighter the tone of a hexagon, the smaller the relative distance between proximal variables and hence the greater the similarity with its neighbour. At the extremes of the scale, white indicates that proximal cases are identical, while black indicates that they are different.

The SOM also identifies the case that consists of the highest number of variables present for each combination of variables from the data. For clarity, only this optimum output is represented on the simplified map in Figure 2.

Quantitative Analysis Results

U-matrix display

The most basic u-matrix (Figure 2) produced by the SOM shows that the process successfully distinguished between the conflict and conventional burials: the Snake Hill burials are at the top of the map, while the Prospect Hill burials are at the bottom.

Furthermore, three separate areas on the u-matrix correspond to variations within the broader conventional and conflict categories that the model defines and represents: cluster 1, the Snake Hill conflict site; and cluster 2 and subclusters 2A and 2B, all representing the Prospect Hill cemetery conventional site (see Table 2 for descriptions of the clusters).

These conventional and conflict clusters are separated by a roughly scattered cluster near the centre (grey-black hexagons). This cluster contains either conflict or conventional burials with anomalous features that make them distant from other burials.

Snake Hill

A discussion of the band of grey-black hexagons provides an introduction to the workings of the u-matrix and shows the interpretive value of the conflict burial model. This band exists in part because some burials at the Snake Hill site consistently contain attributes found in conventional burials (presence of a burial container and a conventional body position) (see Table 1). This places them somewhat closer to the conventional cluster 2 (including its sub-clusters) than to the other Snake Hill burials—and indicates that these particular burials were more formal than the other Snake Hill burials. Why the difference within this group of friendly burials? Were these individuals of higher rank? Did these burials take

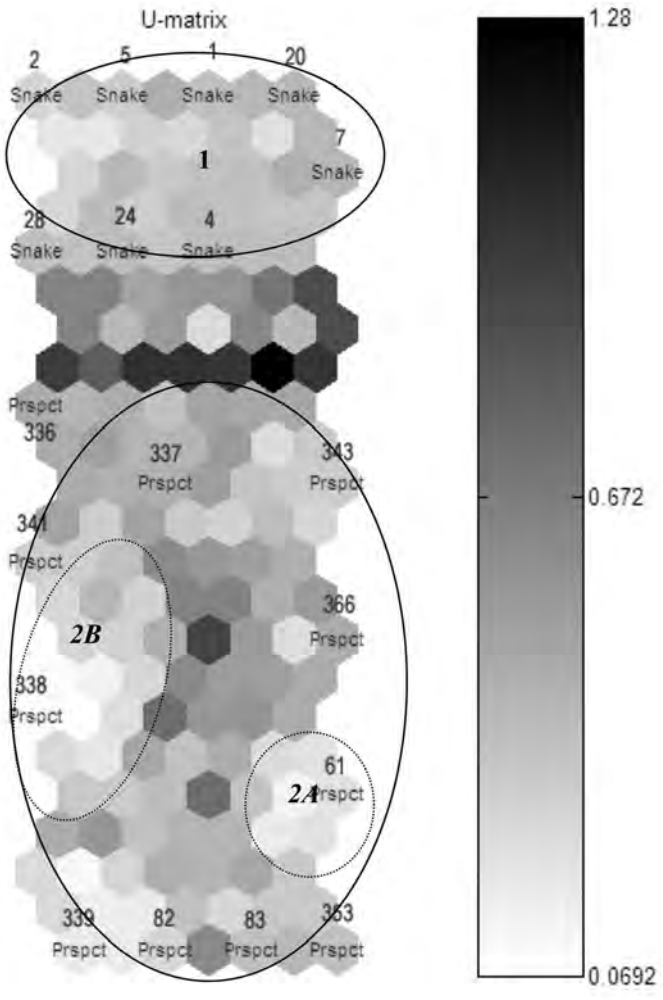

Figure 2. *U-matrix for Snake Hill and Prospect Hill (visually defined clusters are circled).*

place during a lull in the siege sufficient for a more formal ceremony? In this instance, the existing data does not provide an answer, but the findings point to a research direction that may yield further detailed information about the events.

Snake Hill cluster 1 has a relatively low contrast variation in shading, which represents a high degree of similarity between burials. In fact, 89 percent of these burials have the characteristic normative body positioning, which is consistent with variables expected in a conflict grave.

In a vertical plane, the tonal gradations indicate some variation in the degree of friendly behaviour, increasing from the top left corner to the bottom centre-left—that is, moving closer to the variable clusters representing conventional burials. In the horizontal plane, the shading pattern of the upper one-third of the u-matrix illustrates the differences in the burials. The fact that the left side of the conflict cluster is lighter than the right side suggests that the burials on the left side are more similar to each other than are the burials that form the right side.

Significantly, the system was able to identify and cluster burials based on slight variations in context and burial. One example among many illustrates the gradual altering of attributes from left to right. The Snake Hill burial with mutilation (burial 20) is located in the far right corner; the burials with mutilation and conventional body positioning (burials 1, 8, 27) are in the centre; and the adjacent burials (burials 5, 10, 17) possess conventional body positioning and clothing, but not mutilation.

Table 2. *Cluster assignment for Snake Hill and Prospect Hill. Clusters refer to the areas marked on Figure 2.*

Cluster	Burial Type	Variable(s)
1	Friendly	Military Status, Cause of Death-Combat Related, Clothing, Miscellaneous Artifacts, Body Position
2	Norm	Civilian Status, Cause of Death-Sickness, Container, Body Position, Norm Cemetery
2A	Norm	Civilian Status, CoD-N, Norm Cemetery, Container, Body Position
2B	Norm	Civilian Status, CoD-SD, Norm Cemetery, Container, Body Position, Marker, Grave Goods

The top left corner consists of 29 percent of the conflict burials, and these burials possess the fewest number of attributes (e.g., only evidence of combat-related cause of death, clothing, and normative body positioning). The number of variables present increases to the right of this corner. Conventional body positioning is present in all of the conflict burials, albeit with some slight differences based on the completeness of the skeletal elements. The bodies were placed in the supine position with their arms placed across the thorax region. The apparent care taken to place the bodies neatly in the graves strongly suggests friendly burial.

Adjacent to the right of these burials are a series of darker burials, indicating some slight differences. In one burial, the difference is a positive hit for the variable Misc, which is a tool located alongside burial 12. This Y-shaped tool is a musket tool, not something that would normally be found in a conventional grave.

The right side of the conflict cluster is made up of four burials that posses the basic conflict characteristics (e.g., CoD-CR, clothing, body position) and the mutilation variable. Burial 12 has signs of mutilation, although in the form of a medical amputation.

As noted above, another subtle difference in the overall friendly conflict burial behaviour is the presence of a coffin. The burials that are at the bottom of the conflict cluster (just above the grey-black band that separates the two general burial types) are marked by the presence of a container and by items that would be present in more conventional burials (two of three conflict burials, namely burial 24 and 4, adjacent to the darker band that separates conflict and conventional burials, suggesting friendly behaviour based on the proximity to the conventional cluster).

In this type of visualization process, broad similarities across the dataset are not detectable on a simplified u-matrix map (although they are on the standard u-matrix), but they are evident in the tables, which represent another, more conventional, way of looking at the results. For example, the presence of the conventional body positioning variable across the dataset, including 81 percent of the conflict burials, shows that effort was taken in the placement of the conflict dead, indicating a friendly burial.

Prospect Hill

The conventional non-conflict cluster has a higher degree of internal variation than the conflict cluster, so it includes two sub-clusters (sub-clusters 2A and 2B). The burials in the general cluster typically share the expected characteristics (e.g., civilian status, conventional cemetery, conventional body positioning, non-violent cause of death, presence of clothing, a coffin, grave marker, and grave goods). The variation comes from the presence of less common features, such as miscellaneous artifacts; burials with such artifacts are placed at the bottom of the conventional cluster.

Sub-cluster 2A is set apart from other conventional burials because of the difference in the cause of death (natural versus sickness or disease). Subcluster 2B is distinguished because it is made up of seven variables (all of the conventional variables except CoD-N), thus making this sub-cluster the prototype of conventional burials.

Diagonally to the right of sub-cluster 2B are burials 337, 50, and 52. These burials resemble the other burials in the conventional cluster, but they also contain grave goods. One individual was buried

with a copper bead, and the two other burials had copper pins.

Because the variations in behaviour measured here are intra-site variations, the map produced a finer resolution of these differences, which is most clearly noted by the conventional burials. For example, burial 336, at the top edge of the conventional cluster, has all of the expected characteristics of a conventional burial, but it also contained an instance of the Misc (miscellaneous) variable: several metal fragments were associated with the remains. While these may be remnants of coffin hinges, they were too rusted to identify and thus were labelled as Misc. This contributed to this burial's placement adjacent to the grey-black band that divides the two burial types. There was only one other conventional burial with the variable Misc, burial 83, isolated at the bottom of the map.

Discussion

The SOM effectively separated conflict burials from peacetime conventional burials, with conflict burials clustered in the top section of the map and conventional burials in the bottom section. Furthermore, this visualization method clustered the data by several dimensions of similarity—an advantage over the two dimensions available in traditional linear statistics.

The method using 12 variables produced good differentiation of conventional versus conflict burials, identified friendly conflict burials, and highlighted the degrees of variation among the latter. Significantly, the SOM differentiated the higher degree of friendly burial behaviour by clustering two burials (burials 4 and 24) apart from the other friendly burials, based on the presence of ritual markers (container and body positioning). This placed them closer spatially—and behaviourally—to the conventional burials. The fact that the burials from the Prospect Hill site cluster almost certainly had a burial container, that they indicated death by sickness or disease, and that they contained grave goods provides a quantitative analogue to what our common sense tells us.

The SOM also revealed other subtleties. For example, the variables Misc (miscellaneous artifacts) and GG (grave goods) were on opposite sides of the sides of the map, indicating that these artifacts were unlikely to be in the same burial. The absence of overlap suggests mutually exclusive behaviour—in this instance, perhaps a difference in the care taken in the burial.

In general, the results show the extent of friendly burial behaviour in these burials by their placement on the map and the characteristics of their neighbours. While there was some variation in the degree of friendly behaviour in the conflict burials closer to the conventional burials (e.g., the two burials with formal body positioning and traces of coffins), even the less friendly burials in the top right corner of Figure 2, distinguished by the presence of miscellaneous artifacts (bullets, lead shot), support the notion that those responsible for the burials at Fort Erie took care of the bodies. This is reinforced by the fact that the band that divides the clusters is not a solid black barrier, which suggests that the burial detail attempted to bury the dead in as traditional a way as possible under the circumstances.

Conclusion

The effects of conflict have several different physical manifestations. The burials studied here are not just remnants of conflict, but also representations of attitudes and behaviours of the living towards the dead, be it friend, enemy, or unknown victim. The focus is on the identity of the persons responsible for burial—not the dead themselves—because it is their behaviour that is represented in the form of the grave. In order to recognize the patterns of behaviour manifested in conflict burials, it was necessary to develop and refine a theoretical framework to incorporate quantitative and qualitative analysis.

Many individuals buried at Snake Hill died despite receiving medical attention, often in the form of amputation. And their comrades who survived to bury them had also been under siege for months. Yet, the similarities between the Snake Hill and the Prospect Hill burials indicate that the soldiers at Snake Hill took great care and effort when interring their comrades under these difficult conditions.

The visualisation abilities of the SOM make it a valuable tool to classify data, identify correlations among variables, and compare variables

among individual data sets or within the whole dataset. The method was able to identify and separate subtle differences in burial behaviour. In addition, the u-matrices illustrated the similarity not only between the clusters, but also between individual burials. Furthermore, the structure of the map, with six immediate neighbours, showed the progression in more than one or two directions, indicating how one case is related to its neighbours and how those neighbours are related (by degree of similarity) to each other.

The SOM was able to separate burial types at a broad level (conventional versus conflict), but the non-linear algorithm was also able to distinguish some of the more subtle human behaviours suggested by the evidence. For example, the absence of some key indicators in one case (burial 20) suggests that one soldier at Snake Hill was buried hastily, possibly in the middle of an attack or towards the end of the siege, while two others with some features of a conventional burial probably died at the beginning of the siege or during a lull in the fighting (burials 4 and 24). Furthermore, the SOM provided a good platform for identifying and analyzing correlations among variables and indicating which variables had the strongest impact on the data—showing, for example, that there is a positive correlation between the presence of mutilation and the presence of miscellaneous artifacts in the same burials.

The self-organizing map methodology applied here is neither site-specific, nor level-specific, nor limited to a particular place or time period, nor focused on internecine or international conflicts where there is little or no documentary evidence indicating the agents of burial. An example of the latter is the Neolithic mass grave at Talheim, ca. 5000 B.C., of 34 individuals, including 16 children, 9 adult males, and 7 adult females (Wahl and König 1987). The social context of these deaths might be clarified using the approach outlined here.

It is a methodology that can be applied to various regions, to various conflicts, and in different time periods. The method can also be used to support hypotheses about those responsible for burial from burials where there can be conflicting interpretations of the evidence—for example, the Crow Creek massacre, which occurred in the early fifteenth century along the Missouri River in present-day South Dakota, USA (Pringle 1998, Zimmerman 1985). There are also cases from the Napoleonic wars to the present that, if excavated and recorded to the degree of detail outlined here, would be ideal tests of the applicability and effectiveness of the proposed model and methodology for identifying those responsible for burial.

Most important, it is possible with this method to make judgments on the identity of the burier based on body treatment as an indicator of attitudes towards the dead—information that transforms expedient body recovery into anthropology. Such judgment can only be made when sufficient data and information are extracted from a site. Otherwise, we lose the chance to gain a full understanding of the stories of those who were buried.

By resolving the circumstances of conflict burials rather than confining the work to the disinterment of victims, it may be possible to redefine the landscapes of death represented in traditional historical accounts. The analysis of the small but fascinating sample of burials summarized here offers one possible approach to this more comprehensive archaeology of conflicts.

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Comprendre le conflit par l'entremise de l'enterrement - Analyse du réseau neuronal de mort et d'enterrement de la Guerre de 1812

Cet article touche les méthodes et les théories qui analysent et interprètent les enterrements reliés aux guerres et à d'autres situations de conflits. Spars (2000, 2005), pour faciliter l'identification des différences de matériels utilisés lors d'enterrements, a mis sur pied un modèle d'enterrement lié aux conflits qui aidera, à son tour, à comprendre les circonstances d'inhumation. (Par exemple, découvrir si le décès a eu lieu lors d'un conflit sur le champ de bataille, s'il est directement lié à des blessures ou autres traumas du champ de bataille, s'il est la conséquence d'une exécution ou s'il est le résultat de circonstances non-reliées au conflit et découvrir si ce décès a été infligé par un groupe « amical », « neutre » ou « hostile ».) Des données d'enterrements de la Guerre de 1812 du charnier de Snake Hill, Fort Érié, Ontario (1814) ont été comparées à celles du cimetière conventionnel de Prospect Hill, Newmarket, Ontario (1824–1879). Les variables du modèle incluent la position du corps, la cause de la mort, la présence ou l'absence de mutilation, le conteneur d'ensevelissement et des indices de rituels tels les vêtements et les présents funéraires. La méthodologie quantitative du réseau de neurones (cartes autoorganisables) offre un moyen clair, accessible et reproductible pour explorer et classifier (et ainsi faire des prédictions) les plus petits et les plus complexes ensembles de données tels ceux reflétant les maintes attributs de l'activité humaine préservés dans des contextes archéologiques.

Stephanie Spars
Department of Archaeology
University of Glasgow
Scotland G12 8QQ
saspars@hotmail.com