Applying the Seriation Dating Method

Posted on July 10, 2018

Seriation is a relative-dating method used to arrange archaeological assemblages in a sequence according to changes in artifact style or frequency. It does not ordinarily provide calendar years by itself. Instead, it helps archaeologists determine that one assemblage is earlier, later, or partly contemporary with another. The method is particularly useful when several sites belong to the same broad cultural and geographic context and contain artifact types whose popularity changes through time. (Dunnell, 1970)

This laboratory exercise uses colored potsherds from eight island sites to reconstruct an occupation sequence. The original report identifies the resulting order as A, E, G, C, B, F, D, H and observes a movement from the island's exterior toward its interior. That sequence should be understood as a model derived from artifact frequencies and the assumptions of seriation, not as an absolute proof. The laboratory demonstrates both the analytical power of pattern ordering and the importance of accurate data, independent chronological anchors, representative samples, and careful interpretation.

Objectives of the Lab Report

The first objective is to arrange the eight archaeological sites in the most plausible relative chronological order using the distribution of colored potsherds. The exercise asks which site was occupied earliest, which was occupied latest, and which assemblages represent intermediate phases. The second objective is to identify possible overlap among sites by examining whether artifact styles rise, peak, and decline across adjacent assemblages.

A further objective is to understand the assumptions behind frequency seriation. Students should learn why an artifact type may form a unimodal or "battleship-shaped" distribution, how a typing error can disrupt the sequence, and why archaeological conclusions should be supported by more than one line of evidence. The map also allows consideration of spatial settlement change after the chronological order has been proposed.

Background: Relative and Absolute Dating

Relative dating establishes sequence without assigning exact calendar ages. Stratigraphy, typology, cross-dating, and seriation are common relative methods. Absolute or chronometric methods, such as radiocarbon dating, dendrochronology, luminescence, or archaeomagnetic dating, estimate age in calendar or elapsed-time terms under appropriate conditions. (Renfrew, 2020)

Seriation can be strengthened by chronometric anchors. If one site has a secure radiocarbon date or a historically dated imported artifact, the relative sequence can be connected with a broader calendar. Without such anchors, the exercise can identify order but cannot state how many years separate A from H or how long any site was occupied.

Types of Seriation

Contextual Seriation

Contextual seriation orders assemblages according to the presence or absence of artifact types. It assumes that styles appear, remain in use for a period, and eventually disappear. Assemblages sharing many types are likely to be closer in time than assemblages sharing few types, provided that the sites belong to the same cultural system and that mixing is limited.

Frequency Seriation

Frequency seriation uses the proportion of each artifact type in each assemblage. A style often begins at low frequency, becomes more popular, reaches a peak, and then declines. When correctly ordered, the frequencies form a lens-shaped or battleship-shaped pattern. This laboratory uses the frequency form because the counts of purple, white, light-green, red, blue, and dark-green sherds vary among sites.

The original report says that the method "works with numbers." More precisely, it works with relative frequencies rather than raw counts alone. A site yielding 200 sherds and another yielding 20 should be compared through percentages, because larger excavation samples otherwise dominate the pattern. The laboratory materials may already have standardized strips or counts, but the principle should be stated.

Samples and Materials

The sample consists of potsherds collected from eight island sites labeled A through H. The sherds are grouped into six color-defined types: purple, white, light green, red, blue, and dark green. In a classroom simulation, color represents changing pottery styles. In real archaeological work, types may be defined through decoration, paste, temper, surface treatment, rim form, manufacturing technique, vessel shape, or combinations of attributes.

Graph paper, scissors, tape, pencils, and the site map are used to record and rearrange frequencies. A spreadsheet or statistical program could perform the same organizational task, but manual strips make the pattern visible and encourage students to test alternative sequences. The original exercise also includes clue 15, apparently an external indication of direction or endpoint. Its role must be kept separate from the frequency evidence so that students understand which conclusion comes from which source.

Methods

Recording the Assemblages

For each site, the number of sherds in every color category was recorded. The total number of sherds per site should then be calculated, and each category converted to a percentage of that total. Recording must be checked carefully because one transposed value can change the pattern. The original group encountered a typing error that produced an unexpected result. This was not merely an inconvenience; it demonstrated that chronological models are only as reliable as their underlying data.

Creating Frequency Strips

Each site can be represented as a row showing the relative frequency of the six pottery types. The rows are rearranged until every type forms the smoothest possible single peak. A well-ordered sequence should minimize abrupt disappearance and reappearance. No type should ideally rise, fall, and rise again unless another process explains the pattern.

Testing Alternative Orders

Several sequences may initially appear plausible. The team should compare alternatives and select the one producing the most coherent battleship curves across all types. One pottery type alone cannot determine the complete order because two sites on opposite sides of its peak may have similar frequencies. Multiple types with different periods of popularity help resolve the direction and placement.

Determining Direction

Frequency seriation can produce a sequence whose direction is reversible. If A–E–G–C–B–F–D–H forms a valid pattern, the reverse H–D–F–B–C–G–E–A may also satisfy the curves. An independent clue is needed to identify which end is earliest. Clue 15 may supply that information in the exercise. Without it, artifact evolution, stratigraphy, dated imports, radiocarbon samples, or spatial evidence would be necessary.

Results

The team produced the following relative occupation sequence:

A → E → G → C → B → F → D → H.

Site A was interpreted as the earliest occupation and site H as the latest. Sites E and G followed A, while C and B represented the central part of the sequence. F, D, and H formed the later portion. This ordering gave the most coherent rise-and-fall pattern for the colored potsherd types in the classroom dataset.

The exercise also suggested temporal overlap. The original report identifies overlap between H and D and between B and C. Overlap should be described cautiously. Similar artifact frequencies may mean that two sites were occupied at approximately the same time, but they can also reflect conservative style use, exchange, mixed deposits, or different community preferences. Seriation orders assemblages; it does not prove simultaneous occupation without additional evidence.

Interpretation of the Battleship Curves

A battleship curve reflects the changing popularity of one type. At the beginning of its use, few examples appear. As the type becomes common, its percentage increases. It reaches a maximum and then declines as another style replaces it. When assemblages are arranged correctly, the distribution resembles a symmetrical or asymmetrical lens.

Real curves are rarely perfect. Styles can revive, persist in isolated communities, or be used differently according to status and function. Production and discard rates may differ, and pottery can remain in use for many years. The laboratory simplifies these processes to teach the method. Archaeologists should not force data into ideal curves by ignoring inconvenient assemblages.

Settlement Pattern on the Island

After the chronological sequence was established, the site map suggested that settlement moved from the island's exterior toward the interior. Site A and other early sites apparently occupy more peripheral positions, while later sites approach the interior. This spatial trend may indicate changing security, access to water, agriculture, population, trade, environmental conditions, or social organization.

The pattern is an interpretation rather than an explanation. Chronology alone cannot show why people moved. The team would need environmental data, topography, resource locations, architecture, subsistence remains, and evidence of conflict or climate change. Sites may also have served different functions rather than representing one community physically relocating.

Role of Clue 15

The original report asks whether the earliest and latest sites could be identified without clue 15. The middle order might still be reconstructed from frequency curves, but the direction would often remain ambiguous. Counting sherds alone cannot necessarily identify the earliest end because a type's low frequency can occur both before its peak and after its decline.

If one pottery type is independently known to be earlier than another, direction may be inferred. Stratigraphy can also show that one type lies below another in an undisturbed deposit. Without an external chronological anchor, the team should report the order as reversible rather than claim certainty.

Selection of Three Sites Under a Small Budget

The original team selected A, B, and H because they represent the beginning, middle, and end of the proposed sequence. This is a defensible sampling strategy when the objective is to test the broad chronological range. Site A can provide evidence about early settlement, B about the central transition, and H about late occupation.

The choice should also consider preservation, site size, research questions, accessibility, threat, and whether the sites contain datable organic material. If B is not the most informative middle site or if it is badly disturbed, C or F may offer a better sample. A stratified strategy would select sites representing distinct phases and environmental zones.

Studying only three sites would leave important uncertainty. The sequence of E, G, C, F, and D might remain untested; short phases could be missed; and overlap could not be evaluated adequately. The limited project should therefore state that it samples the chronological endpoints and midpoint rather than reconstructing the complete island history.

Problems in Real-World Seriation

Mixed Deposits

Artifacts from different periods may become mixed through digging, erosion, animal activity, agriculture, construction, looting, or redeposition. A mixed assemblage can contain early and late styles and disrupt the expected curve. Archaeological context must be evaluated before the counts are included.

Different Cultural Communities

Frequency seriation assumes assemblages participate in a shared stylistic tradition. Two communities can prefer different pottery at the same time. Combining them may create a false chronology. Geographic and cultural comparability should be established independently.

Functional Differences

A ceremonial site, household, workshop, storage area, and burial may contain different vessel types even when contemporary. Artifact frequency can reflect activity rather than age. Archaeologists should compare like contexts and consider function.

Unequal Sample Size

Small samples produce unstable percentages. Finding one red sherd in a sample of two creates a 50 percent frequency, but that figure is not robust. Minimum sample thresholds, confidence intervals, and sensitivity analysis can help assess reliability.

Long-Lived and Reused Artifacts

Some pottery remains in use long after production, and heirlooms or traded objects may enter later deposits. Stone tools can be collected and reused. Seriation dates the assemblage pattern rather than the manufacturing date of every individual artifact.

Style Revival

Fashion can return. A decoration may become popular, decline, and reappear. The unimodal assumption would fail, and a forced sequence could be misleading. Additional attributes and independent dating are needed.

Sampling and Recovery Bias

Excavation strategy, screen size, preservation, and collector preference affect what is recovered. Surface collections may overrepresent durable or visible artifacts. Comparisons require consistent methods.

Artifact Typology

Seriation depends on reliable types. Color alone may be affected by firing atmosphere, weathering, soil chemistry, or subjective perception. In real pottery analysis, archaeologists combine technological, morphological, and decorative attributes and test whether categories can be reproduced by different analysts.

Types should be chronologically sensitive. An arrow shape that remains unchanged for centuries offers little ordering power. The original report correctly suggests using additional qualities such as material and color when design changes slowly. More generally, analysts should choose attributes shown to vary through time rather than assume every difference is chronological.

Independent Verification

A seriation sequence should be tested against stratigraphy, radiocarbon dates, imported goods, coins, inscriptions, dendrochronology, or other evidence. Agreement increases confidence. Disagreement may reveal mixing, incorrect type definitions, spatial variation, or a mistaken direction. (O'Brien & Lyman, 1999)

Remote sensing and survey can locate sites, as the original report notes, but these methods do not by themselves date them. Aerial photography, satellite imagery, lidar, magnetometry, ground-penetrating radar, pedestrian survey, and local knowledge help identify archaeological features. Dating then requires artifacts, contexts, and appropriate chronometric evidence.

Error Control

The typing error encountered by the team demonstrates the need for quality control. Counts should be entered twice or checked against field sheets. Automated range checks can identify impossible totals, while plots can reveal abrupt anomalies. Every correction should be documented rather than silently changed.

Reproducibility also requires preserving the original counts, percentage calculations, ordering decisions, and alternative sequences. Another analyst should be able to understand how A–E–G–C–B–F–D–H was selected.

Team Process

The group's collaborative rearrangement reflects archaeological reasoning. Team members can challenge assumptions, notice errors, and propose alternatives. However, consensus is not evidence by itself. The final report should explain the criteria used, not simply state that the team “played around” until an order appeared.

A stronger description states that rows were rearranged iteratively to minimize discontinuities and produce one peak per artifact type, then evaluated against the external clue and map. Precise methodological language makes the result transparent.

Limitations

The exercise uses simplified color categories and an artificial dataset designed to produce a sequence. It assumes that pottery popularity changes smoothly, sites share one cultural tradition, samples are comparable, and deposits are not mixed. It also provides no calendar dates or direct evidence about occupation duration.

The spatial interpretation depends on the accuracy of the map and the assumption that each site’s assemblage represents its principal occupation. Multiple occupations could combine phases. The reported overlap is approximate and should not be treated as proof that people at two sites interacted at the same moment.

Conclusion

Frequency seriation arranged the eight island assemblages in the relative order A, E, G, C, B, F, D, H. The order was selected because it produced the clearest unimodal patterns in the colored potsherd frequencies. Site A was interpreted as earliest and H as latest, with possible overlap between some central and late sites. The map suggested a general movement from the island’s exterior toward its interior.

The exercise also demonstrates important limitations. Frequency seriation may identify a reversible order unless an independent clue establishes direction. Raw counts should be converted to proportions, typing errors can alter results, and similarities may reflect function or culture rather than time. Real deposits can be mixed, styles can persist or revive, and sample sizes can differ.

Seriation is therefore most reliable when artifact types are well defined, assemblages are comparable, data are checked, and the proposed sequence is tested against stratigraphy or chronometric dates. It is a powerful method for organizing archaeological evidence, but it produces a hypothesis about chronology rather than an unquestionable calendar.

References

Dunnell, R. C. (1970). Seriation method and its evaluation. *American Antiquity, 35*(3), 305–319.

O'Brien, M. J., & Lyman, R. L. (1999). *Seriation, stratigraphy, and index fossils*. Kluwer Academic/Plenum.

Renfrew, C., & Bahn, P. (2020). *Archaeology: Theories, methods, and practice* (8th ed.). Thames & Hudson.