



# Color in historical ceramic typologies: A test case in statistical analysis of replicable measurements



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## ABSTRACT

Three types of white-bodied, non-vitreous earthenwares distinguished primarily (though not exclusively) by color and commonly known as creamware, pearlware, and whiteware are some of the most frequently encountered artifacts on eighteenth and nineteenth century archeological sites. However, problems exist both in the definition of these types and the interpretation of their meanings. This project has applied reflectance spectrophotometry to collect replicable, highly-precise color data on a large sample of this material in order to address the nature of the color differentiation and the reality of the types themselves. Linear Discriminant Analysis (LDA) was used to assess the degree to which the visual intuitions of the archeologists making ware identifications could be predicted by the repeatable spectrophotometer values. We do not suggest a method of proving identifications “correct” or “incorrect” but analyze the nature of this attribute of the typology itself. This analysis quantifies the level of uncertainty inherent in the types as they are currently used, addresses a longstanding question about illumination during identification, and discusses one possible concrete implication of these results. This article also discusses color measurement in general, its use in archeology, and evaluations of the Munsell system.

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## 1. Introduction

This project applies the replicable measurement of color to the evaluation of three of the most well-known ceramic types in historical archeology: the non-vitreous, white-bodied earthenwares distinguished primarily by color and commonly known as creamware, pearlware, and whiteware. Almost ubiquitous on sites connected to worldwide trade routes from the mid-eighteenth to the mid-nineteenth centuries, these three wares are some of the most useful, most discussed, and possibly some of the most controversial in archeological analysis (Majewski and O'Brien, 1987; Miller, 1987; Miller, 1993; Miller and Hunter, 2001).

This project has sought to clarify some of these controversies through the application of replicable, highly precise color observations taken using a reflectance spectrophotometer. Multivariate statistical analyses were used to evaluate the resulting data set. Rather than suggesting that archeologists use this equipment to classify individual sherds or correct visual intuitions, the goal of this work has been to assess the nature of color as an attribute of these types. In effect, we assess the extent to which replicable, independent measurements conform to a priori groups made by researchers. This question has real implications

for some of the most commonly applied techniques of historical archeology, such as mean ceramic dating.

In broader terms, the use of instruments designed to make precise, replicable observations of many kinds has been growing in archeology thanks to new instrumentation and the decreasing cost of technology. Better observations in archeological data can enable more effective communication and comparisons, though always ultimately to address broad anthropological questions. That is, while archeology is and always will be an interpretive endeavor, we can ensure that our interpretations are based on understandings, definitions, and observations on which we can agree or upon which our best data converge.

## 2. Creamware, pearlware, and whiteware: problems and questions

Ivor Noël Hume, with whom most discussions of historical artifacts begin, suggests that the “most important development of the eighteenth century” in the context of ceramics was the appearance of a “thin, hard-firing, pale-yellow or cream-colored earthenware” that is “now universally known as creamware” about 1762 (Noël Hume, 1969: 124). Creamware was largely supplanted by pearlware in the 1780s and 1790s, and their bodies are nearly identical but the latter has a small amount of cobalt in the glaze, giving a whiter, bluer, or greener appearance (Barker, 1991:167, Majewski and O'Brien, 1987: 118). Large amounts of pearlwares were produced in England and exported from about 1775 through about 1830, when they were

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overtaken in popularity by whitewares, which have a more truly white appearance. This was a gradual process, involving the slow whitening of pearlware, as whiteware too sought to imitate porcelain which was growing whiter itself (Miller, 1993).

Because the history of the development of these wares is documented relatively precisely and they represent horizons, largely supplanting one another sequentially (although their production did overlap) these wares have been of substantial interest for dating, especially in techniques such as mean ceramic dating (South, 1977). Though made in England, these wares are connected to the rise of industrialism and world trade, and so can also be used to study these important developments, being found worldwide.

### 2.1. Differentiation of the types

Despite all the interest in these types, the distinctions between them have been difficult to define. Noël Hume identifies creamware's glaze as being "yellow or green in the crevices" where the glaze pools (Noël Hume, 1969: 130) and Price terms it "deep green or yellow-green" (Price, 1979: 10). Pearlware's glaze is "blue in crevices of footrings and around handles" such that it "can readily be distinguished from late creamware" (Noël Hume, 1969: 130). Lofstrum, Tordorf and George, however, suggest that the glaze of pearlware is "uniformly greenish" where evenly-spread (Lofstrum et al., 1982: 6) and Price calls it "an overall blue or blue-green cast" (Price, 1979: 14). Whitewares are characterized by the body color, since they may also have slight bluing in crevices, but appear to be completely colorless in body (Miller, 1993; Price, 1979: 13). However, these relatively simple distinctions become difficult to implement in practice. Miller (1980: 2) points out that personal opinions about the extent of the "bluing," for instance, coupled with the inherent difficulty of describing and communicating color leads different analysts to make different determinations.

Other attributes of ceramics are, of course, used in their classification, including decoration and form. Price underlines the importance of considering the color of underglaze decoration as well when defining typologies (Price, 1979: 15). Miller distinguishes between "pearlware" and a variant known as "China Glaze" in that while both have a blue tint to the glaze, the latter has decoration and forms in imitation of Chinese patterns (Miller, 1993). Ceramicist David Barker describes how some elements of decoration could be used to identify work of particular potters, although he also suggests problems with this procedure due to molds and patterns being shared among manufacturers (Barker, 1991: 169).

In this study we examine only the question of body or glaze color but do not mean to argue that it is the only factor used in classification. We focus on this attribute because in many archeological applications body color is used alone as it is often not possible to examine other attributes, since not every sherd will be decorated or identifiable as to form. In some distinctions, glaze color is the only distinguishing attribute; for instance, David Barker writes that "apart from the blue tint of the glaze, there is virtually nothing to distinguish [pearlware] from contemporary creamwares" (Barker, 1991: 167). For these reasons, we feel that investigating the attribute of color more or less in isolation is informative, even if it is not the only attribute relevant in practice.

### 2.2. Ware-based types and etic classifications

Miller (1980) and Majewski and O'Brien (1987) critique ware-based schemes such as the division of creamware, pearlware, and whiteware, because they omit the importance of decoration and because they are "unwieldy," since the differences they describe are difficult to define consistently. The latter note that "critical terms either remain undefined or are applied inconsistently or incorrectly, thus making it difficult to use the data from such a study for comparative purposes" (Majewski and O'Brien, 1987: 105). It seems likely that color and its communication is one of the critical terms Majewski and O'Brien consider here.

The problematic result is a series of typologies which are mutually-unintelligible, and a host of publications which use the same terms in different ways.

This project addresses the issue of consistency through instrumentation (discussed below), but the debate over these types is deeper than simply the ability to communicate color. Miller and Hunter (2001) have pointed out that the terms used by archeologists do not correspond to any group that would have been meaningful to contemporary potters, suggesting that merchants and customers distinguished between ceramic types more by decoration than what archeologists term "ware." Miller argues that "there is no way of knowing if the archeological definition of pearlware is the same as that of 19th century potters and merchants" (Miller, 1980: 2). There are, in effect, two parallel typologies (Miller, 1993).

This discussion returns to the more than half-century old debate between James A. Ford and Albert Spaulding about archeological typologies in general. Spaulding (1953) saw types as being the result of decisions made by people in the past: their choice of temper in ceramic production was one "mode" while their choice of rim type was another. Collectively (normatively) a particular group would agree on a particular series of choices among modes, and therefore create similar pottery. That is, types were the outgrowth of culture, and would themselves have had meaning to past peoples. Ford (1954) held the opposite view: that types were imposed in the present by the archeologist, and that past peoples would not have necessarily recognized our types as important. While the debate did not remain a focus during the 1960s rise of processual theory, it is nonetheless possible to hold that both kinds of types exist: emic ones, having had meaning to past peoples, and etic ones, imposed from the present by the analyst for particular ends.

For certain questions, such as those of economic scaling, it is entirely appropriate to focus on the emic typologies of potters and customers, whose ideas of different groups of ceramics and their prices directly relate to buying habits. But in the analysis of archeologically-recovered materials, there is sometimes a mismatch between what is needed to assign a piece to an emic type and what information is available. For instance, Miller discusses the difference between what past potters called "China Glaze" and "Pearl White" as being one of decoration and form (Miller, 1993), but for undecorated fragments there would be no way to make a determination. Emic understandings can even run contrary to traditional archeological (etic) classifications: "We need to keep the intent of the potter in mind. If it was to produce a whiteware, then the vessel should not be classified as pearlware because of a small amount of cobalt used to achieve a white appearance" (Miller, 1993). We agree that the intent of the potter is an important area of inquiry, but it will not always be clear from archeologically-recovered materials. Certainly it would be pessimistic to assume that because archeologists are not always able to access such emic typologies, that we therefore can say nothing about what is found based on its material properties.

Though etic types based on material observations—such as color—cannot always be connected to contemporary (emic) terms, they still speak to past practices and are worthy of consideration. The fact that contemporaries may not have been aware of some of these material distinctions does not make them meaningless. Trace element analysis is a thoroughly modern, etic analysis but it provides substantial new information relevant to reconstructing past lives and is valid even if those making artifacts were unaware of these elements' existence. Moreover, any disjunctions between etic and emic offer substantial ground for interpretative understanding, for if we recognize a physical distinction that was ignored in the past, or determine that a difference considered important emically was in fact not clearly distinguished, then we are understanding something about culture. But in order to recognize these distinctions, we need thorough studies of both the emic and etic. The present study should be classed among the latter, but should not be interpreted as a general argument against using the former.

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