Identifying Mimbres Artists

A Quantitative Approach

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Art is said to be original, infused with meaning, rendered skillfully, and demanding of attention (Munson 2011:41). Scholars (e.g., Russell and Cochrane 2014) are increasingly recognizing such qualities in ancient and non-Western traditions, including Mimbres painted pottery. Mimbres artists painted vibrant, creative, and sometimes apparently humorous designs on vessels that were important in many social realms, marking the society as different from surrounding traditions, referencing cosmological symbols, and accompanying many people to their graves. Understanding these processes expands our view of art and its sociocultural significance. Compositional analyses provide information on where Mimbres pottery was produced and how it was distributed (Creel and Speakman 2015; Powell-Martí and James 2006; Speakman 2013; Speakman et al. 2011). A few archaeologists have also begun to study the creative process (Crown 2001, 2014; LeBlanc 2010). Our work contributes to this line of research by developing techniques that focus on the stylistic and artistic decisions made by painters. Analyses of these decisions result in a method of identifying individual styles systematically and quantitatively.

ABSTRACT

Past researchers have identified individual styles of painting in Mimbres Black-on-white bowls, leading Steven LeBlanc to recently call for the development of quantitative methods to enable and assess such identifications. We propose such a methodology here. Through a process of pair-wise, micro-stylistic comparisons, bowls painted by a single artist or group of closely cooperating artists are analytically linked in chain-like fashion. Two bowls are attributed to the "same hands" if their similarity measure is at or above 70 percent. Similarity measures are determined by comparing minute details that reflect artistic decisions. The method takes into account diachronic development of artistic skill, subject matter diversity, and the transfer of style across generations. Results can contribute to an understanding of stylistic development, craft specialization, and the role of artists in traditional societies.

Investigadores anteriores han identificado estilos individuales de pintura en cajetes Mimbres Negro-sobre-blanco (Mimbres Black-on-white), llevando recientemente a Steven LeBlanc a exhortar el desarrollo de métodos cuantitativos para permitir y evaluar dichas identificaciones. Proponemos un ejemplo de dicha metodología en este trabajo. Por medio de un proceso de comparaciones micro-estilísticas por pares, los cajetes pintados por un solo artista o un grupo de artistas cooperando cercanamente se vinculan analíticamente de una manera en cadena. Dos cajetes se consideran como pintados con "las mismas manos" si su medida de similitud se encuentra en o arriba del 70 por ciento. Las medidas de similitud se determinan comparando detalles diminutos que reflejen las decisiones artísticas. El método toma en cuenta el desarrollo diacrónico de las habilidades del artista, la diversidad del tema y la transferencia del estilo a través de generaciones. Los resultados pueden contribuir a entender el desarrollo estilístico, la especialización artesanal y el papel de los artistas en sociedades tradicionales.

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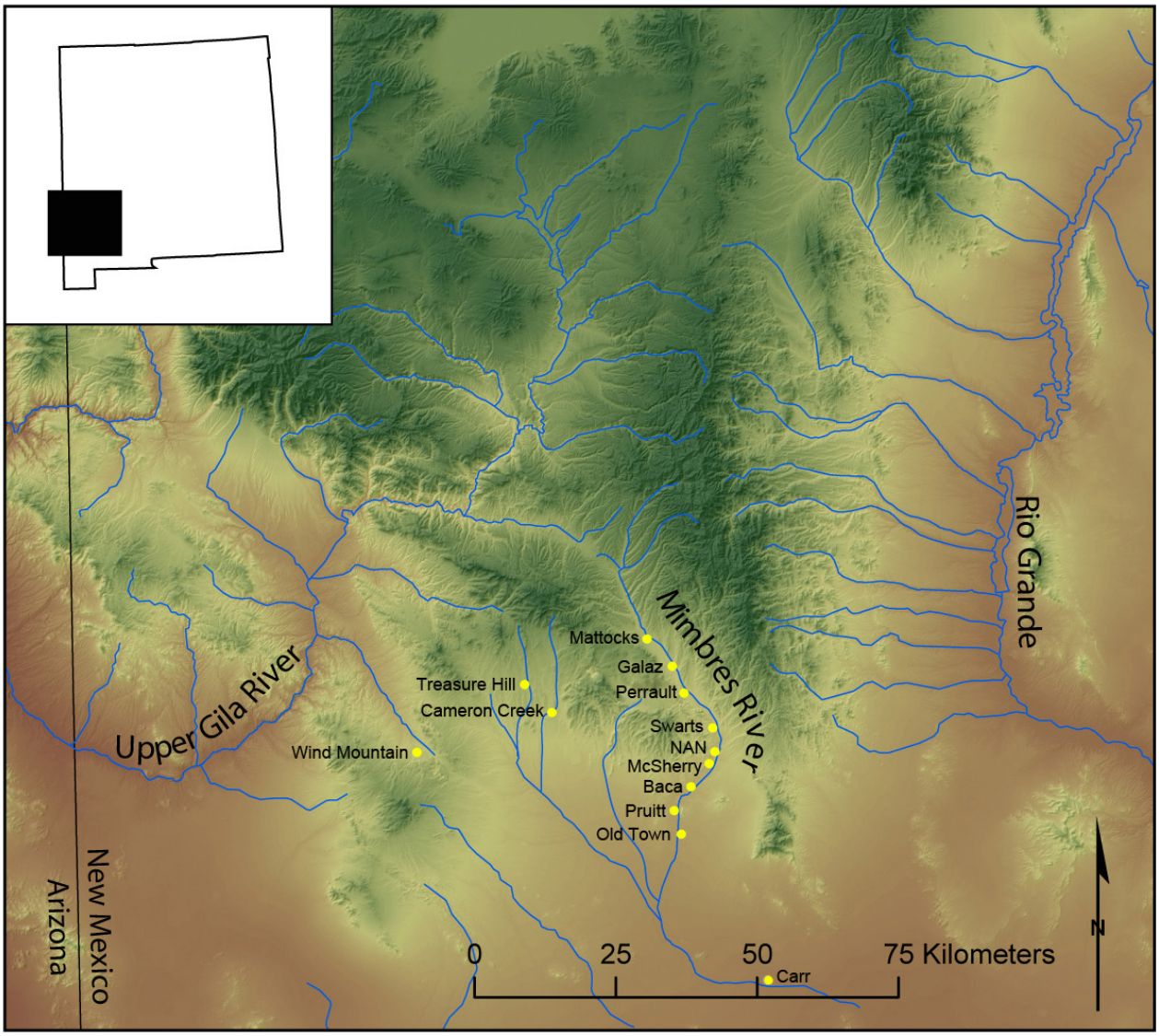


FIGURE 1. The Mimbres region, showing sites discussed in this paper.

MIMBRES SOCIETY AND POTTERY

The Mimbres region (Figure 1) is centered in southwestern New Mexico, and recent summaries of its archaeology include Hegmon (2002) and Nelson and Hegmon (2010). After centuries of fairly gradual growth during the Early and Late Pithouse periods (A.D. 200–550 and 550–1000), the tenth century was a time of rapid change in ritual organization, architecture, and pottery designs. This culminated in a shift to above-ground pueblos and the beginning of the Mimbres Classic period (A.D. 1000–1130). Population grew and peaked during the Classic, concentrated in a dozen or so villages, including a few with upwards of a few hundred people at their peak.[1] Some were occupied for centuries, and a mortuary tradition of subfloor burial is interpreted as a means of establishing land claims (Shafer 2006).

Mimbres Black-on-white pottery has local antecedents in the Mogollon brown ware tradition, and the sequence of types and micro-styles is well-dated (Shafer and Brewington 1995).[2] The earliest white-slipped types appear as early as A.D. 730. Around A.D. 1000, potters introduced new designs (Hegmon and Kulow 2005). These innovations developed into the tradition recognized as Mimbres Black-on-white Style III, which has geometric and representational designs, the latter depicting many animals and the occasional human.

Mimbres Black-on-white pottery—Style III, in particular—is a distinguishing characteristic of the Mimbres region during the Classic period (Brody 2004; Hegmon et al. 1999). Whereas earlier Mimbres styles shared characteristics with neighboring pottery traditions, Style III is unique, with designs and technology unlike anything else at that time in the Southwest. Few pieces were exported during the Classic period and even less foreign pottery was brought in. The region became increasingly distinct at a time of increasing pan-regional interaction, leading Hegmon and Nelson (2007) to suggest that people were deliberately

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isolating themselves. This changed markedly after A.D. 1130, when Mimbres Black-on-white was no longer made, and many other types entered the region through exchange and migration (Nelson 1999).

Mimbres pottery was socially significant at several levels. It marked the region and separated it from events elsewhere, including the expansion of regional systems and increasing violence. Use-wear studies indicate it was used in daily activities (Bray 1982). Many burials included a bowl over the head; thus the pottery also accompanied people into the afterlife. Designs depict animals and everyday life, along with cosmological characters and events (Brody 2004; Carr 1979; Gilman et al. 2014). Through time, the pottery was made at many locations, though production became more concentrated by Classic times (Creel and Speakman 2015; Gilman et al. 1994; Powell-Martí and James 2006; Speakman 2013; Speakman et al. 2011). It was also widely distributed, possibly through a system of ceremonial exchange (Shafer 2013); even villages such as Galaz Ruin that produced substantial amounts of pottery also acquired vessels from other sources (Creel and Speakman 2015).

The vibrancy and creativity of Mimbres designs has attracted considerable attention from art historians (e.g., Brody 2004; Moulard 1984), and the painters are commonly referred to as artists. Archaeologists are beginning to consider how the tradition developed and was passed between generations (Crown 2001, 2014; Munson 2011). LeBlanc (2010) even suggests that the reason the art is so aesthetically pleasing and emotionally evocative is that artists were encouraged to develop individual styles. The goal of our analysis is to systematically document and better understand these individual styles.

IDENTIFYING ARTISTS

The archaeological recognition of individuals has a place in both the New Archaeology (Hill and Gunn 1977) and more recent work on agency (e.g., Knapp and van Dommelen 2008; Meskell 1999; Thomas et al. 2009). One issue of particular concern here is that pottery production is often a cooperative endeavor (Crown 2007), making it difficult to distinguish between the work of an individual and that of a work group (Hardin 1977). We refer to vessels painted by a single individual or a group of closely cooperating individuals as having been "painted by the same hand" (sensu Redman's [1977] "analytical individual").

Interest in recognizing individuals has an even longer history in Mimbres archaeology. Nearly a century ago, Bradfield attributed several bowls from the Cameron Creek site to a single artist (Walter 1925:175–176). Soon afterward, Cosgrove and Cosgrove (1932) noted some sets of Mimbres bowls with similar motifs, styles, and artistic content. Berlant (1983) later suggested that Mimbres artists could be identified systematically by studying such similarities. Accepting the challenge, LeBlanc (2004, 2006, 2010) used various techniques to identify sets of bowls with similar styles that were arguably painted by the same hand.

Different approaches have been used to study other Southwestern pottery types and wares, yielding various results. Fine-grained analyses have discerned the work of production groups and perhaps individuals based on idiosyncratic motor habits or brush-stroke sequences (e.g., Hill 1977; Van Keuren 2000) or through the recognition of "maker's marks" (Trowbridge 2006). In contrast to work with Mimbres pottery, however, these identifications are not based on the recognition of distinctive, visually obvious styles. Even when studying pottery with what seem to be signatures, analysts could not identify artistic styles (LeBlanc and Henderson 2009). Working with traditional potters in the early twentieth century, Ruth Bunzel drew similar conclusions. She reported that Zuni artists could "always tell by looking at a jar who made it" (Bunzel 1972:65). However, despite familiarity with the pottery and collaboration with its makers, Bunzel herself was unable to make such identifications. She concluded that the Zuni pottery style was "so formal that personal peculiarities of style would be displayed in minute variations only" (Bunzel 1972:65).

Mimbres pottery is unusual—perhaps unique—in the prehispanic Southwest in that it displays distinct artistic styles, apparently painted by the same hand. These are not unlike the artistic schools of European painting.[3] Thus, we draw on techniques developed in European art history in developing our methods to identify and study these styles.

In the late nineteenth century, Giovanni Morelli verified the identities of Renaissance artists by studying details of paintings to discern idiosyncratic variation. This approach, now known as the Morellian method (Thomas et al. 2009), has since been used extensively in art history (e.g., Berenson 1952; Jeppson 1970) and in handwriting identification (e.g., Bunker 1963; Harrison 1958; Hill 1977). In archaeology, it has been used, implicitly or explicitly, to study materials ranging from stone tools (Gunn 1977; Johnson 1977; Kay 1977; Whittaker 1987) to slate plaques (Thomas et al. 2009) and many kinds of pottery (Beazley 1963, 1984; Donnan and McClelland 1999; Hardin 1977; Hill 1977; Huse 1976).

Morellian analyses consider variation in how people create things, consciously or otherwise. Such variation is detectable by expert analysis and often supported by statistical or microscopic techniques. Our goal is to apply Morellian techniques to the sets of Mimbres pottery that appear to have been painted by the same hand and thus to substantiate, reject, refine, and occasionally expand the sets. The resulting approach emphasizes the choices and decisions that underlie artistic expression—such as deciding how to portray an animal in profile—and thus can complement techniques that focus on technological sequences or motor habits.

DEVELOPING THE BASIC METHODOLOGY: PAIR-WISE COMPARISONS

Here we develop a means to systematically recognize vessels painted by the same hand. At its core is the comparison of pairs of bowls. We quantify each pair's degree of similarity and establish a threshold indicating that the pair was painted by the same hand. We then create similarity matrices that allow us to identify sets of bowls painted by the same hand.

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FIGURE 2. A portion of the original Forward-Facing People Set, not to scale: (a) MimPIDD-2881, Galaz Ruin (Mimbres bowl, earthenware with slip and pigments, 7.6 x 17.5 cm. Collection of the Frederick R. Weisman Art Museum at the University of Minnesota, Minneapolis. Transfer, Department of Anthropology, University of Minnesota. 1992.22.414 (11B-521); (b) MimPIDD-7318, unprovenienced (courtesy of the Division of Anthropology, American Museum of Natural History, cat. no. 29.1/290 1919-31); (c) MimPIDD-7313, unprovenienced (courtesy of the Division of Anthropology, American Museum of Natural History, cat. no. 29.1/285 1919-31); (d) MimPIDD-142, McSherry Ruin (Arizona State Museum, cat. no. GP4896/26527X4); (e) MimPIDD-198, Treasure Hill (Museum of Northern Arizona, cat. no. 834/3288.4); (f) MimPIDD-no. 1231, Cameron Creek Village (Mimbres Black-on-white bowl 1000–1140, Museum of Indian Arts and Culture, Laboratory of Anthropology, cat. no. 20409/11); (g) MimPIDD-1737, unprovenienced (courtesy, National Museum of the American Indian, Smithsonian Institution, cat. no. 054094.000), photo by and used with the permission of Steven LeBlanc; (h) MimPIDD-3614, Osborn Ruin (cat. no. A286328, Department of Anthropology, Smithsonian Institution); (i) MimPIDD-7866, 2C Ranch site (St. Louis Art Museum, cat. no. 119:1944); (j) MimPIDD-8114, Mimbres Valley (Amerind Foundation, cat. no. MS-28).

An oeuvre-wide approach that identifies sets of material all sharing a particular characteristic would probably not recognize the total life's work of a single artist (Beazley 1963:2). Rather than trying to identify life-long collections at once, our approach takes into account the dynamics of artistic creation and change. To this end, we begin with pair-wise comparisons and then extend the comparisons in chain-like fashion. To develop the techniques we first consider two narrowly defined groups of designs that LeBlanc (2004, 2006, 2010) identified as painted by the same hand. Later, we extend the methodology to identify bowls with different content but also painted by the same hand.

Our analysis utilizes the Mimbres Pottery Images Digital Database (MimPIDD), which is available as part of tDAR, the Digital Archaeological Record (tDAR 2015). MimPIDD contains photographs of and data on nearly all known decorated Mimbres vessels (n > 9,500), including material owned by public institutions and private collectors. In this article, and in our other

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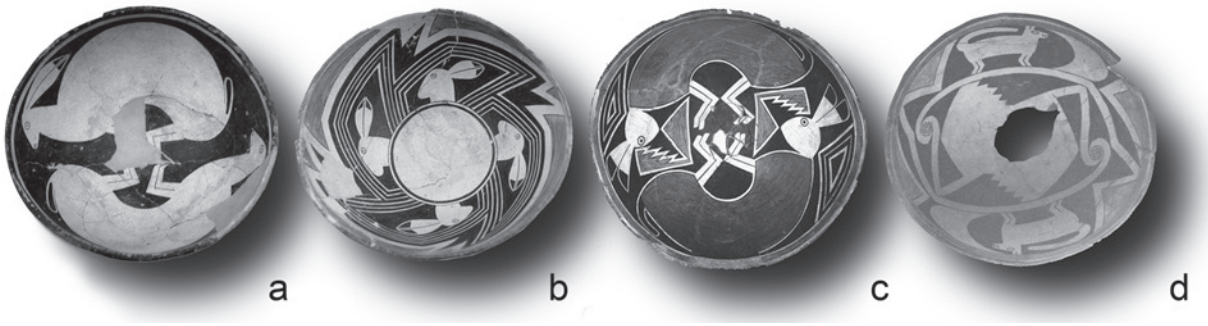


FIGURE 3. A portion of the Negative Rabbit Set, not to scale: (a) Rabbits, MimPIDD-2608, Swarts Ruin (Peabody Museum of Archaeology and Ethnology, cat. no. 94710); (b) Rabbit heads, MimPIDD-2704, Swarts Ruin (Peabody Museum of Archaeology and Ethnology, cat. no. 96177); (c) Rabbits, MimPIDD-7863, Pruitt Site (St. Louis Art Museum, cat. no. 115:1944); (d) Possible dogs, MimPIDD-6614, Galaz Ruin (courtesy of the Southwest Museum of the American Indian Collection, Autry National Center, Los Angeles; 2.E.33).

publications (e.g., Nelson and Hegmon 2010), we illustrate only material housed in public institutions, following Brody (2004:xvi) and in accord with MimPIDD guidelines (tDAR 2013). Readers who wish to see other vessels used in our analysis can access them in MimPIDD.

Establishing the Basis for Analysis

Drawing on Bradfield (Walter 1925), Cosgrove and Cosgrove (1932), and Berlant (1983), LeBlanc identified sets of Mimbres bowls apparently painted by the same hand, originally relying on his own impressions (2004) and then recruiting others to sort bowls (2006). Although the results are compelling, LeBlanc (2006:143) emphasized the need for a more systematic methodology: "the approaches taken here raise methodological issues … [but] … it should be possible to devise additional means of testing the observed patterns." Our goal here is to develop such tests. We begin by assembling groups of bowls with fundamentally similar designs, focusing first on two of LeBlanc's motif classes. We then refine the groups into same-hand sets, using the techniques described below. Note that the word "group" refers to bowls with generally similar designs and "set" refers to those attributed to the same hand.

LeBlanc (2006) concluded that four bowls showing squatting humans were decorated by the same painter. We began with a group of 31 similar bowls (listed in Appendix 1, with examples in Figure 2). We eliminated the squatting stance as a requisite attribute, instead including bowls with anterior (rather than profile) depictions of people with unrealistically wide heads and relatively detailed rendition. We refer to these as "forward-facing people" and rely heavily on their analysis to refine and describe our methods. Their heads are often squarish, adorned, and tilted to the right. Facial expressions seem passive or grim. Several figures, perhaps costumed, incorporate both human and animal traits. There are a total of 31, although two have extensive damage and cannot be analyzed. Ultimately, 20 were retained in a single same-hand set. Using procedures described later, we also identified three additional bowls, with non-human designs, that were painted by the same hand and thus added to the Forward-Facing People Set.

A small number of Mimbres bowls depict negative rabbits, created by filling in a black background and leaving the underlying white slip visible in the shape of a rabbit. LeBlanc (2004, 2006, 2010) suggested that 10 such bowls were painted by the same artist (see also Berlant 1983:17). We began with a group including all 30 negative rabbits in MimPIDD (listed in Appendix 1, with examples in Figure 3). We ultimately retained 21 in a same-hand set and later added three bowls with other kinds of negative animals. These 24 bowls form the Negative Rabbit Set.

Measuring Similarity

As Morelli realized, designs created by the same hand can be recognized based on subtle details of style and execution, even when subject matter differs. The challenge is to isolate and quantify these details. Our approach involves comparing two designs systematically (this subsection), and then extending the analysis, one pair at a time, to form a chain of linked designs based on those comparisons (the next section). We begin with general groups of bowls that have similar designs. Within these groups, there are no common attributes shared by every bowl that could serve as the basis for every comparison. Instead, each pair-wise comparison is based on attributes common to that pair. Where possible, the same attributes are used in other comparisons, but most pairs have slightly different sets of comparable attributes. The alternative to this approach— maintaining an ever-increasing list of every encountered attribute, potentially unique to each bowl—would be impractical, and the mutual absence of rare attributes would artificially inflate the similarity ratio of any given comparison. This alternative approach of using one long list would also require that the analysis be continually redone as new vessels (with new attributes) are encountered. For example, an analysis may have considered 40 separate bowls, each depicting a bear. This would entail 780 pairwise comparisons, each involving attributes common to bears. If a new bowl came to the analyst's attention, containing both a bear and a flower, it could of course be compared to the other 40 bowls. However, the introduction of flower attributes to the analysis would require that all flower attributes be added to the master attribute list. Because the master attribute list was modified, it would require that the original 780 comparisons be recalculated, even though no other bowls contained flowers.

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TABLE 1. Pair-Wise Comparison of Two Forward-Facing People (MimPIDD-2881 [Figure 2a] and MimPIDD-7318 [Figure 2b]).

Attribute	Status of Comparison	Differences
Layout	Executed similarly	n/a
Motif	Executed similarly	n/a
Therianthropic qualities	Executed similarly	n/a
Gender	Executed similarly	n/a
Posture	Executed similarly	n/a
Direction body facing	Executed similarly	n/a
Direction head facing	Executed similarly	n/a
Headgear	Executed similarly	n/a
Headgear construction	Executed similarly	n/a
Headgear decoration	Executed similarly	n/a
Hair style	Executed similarly	n/a
Hair bundle attachment	Executed similarly	n/a
Hair bundle shape	Executed similarly	n/a
Hair bundle division	Executed similarly	n/a
Hair bundle coloration	Executed similarly	n/a
Hair bundle positioning	Executed similarly	n/a
Hair bundle aspect	Executed similarly	n/a
Brow depiction	Executed similarly	n/a
Brow construction	Executed similarly	n/a
Nose shape, general	Executed similarly	n/a
Nose attachment	Executed similarly	n/a
Nose coloration	Executed similarly	n/a
Mouth construction	Executed similarly	n/a
Facial expression	Executed similarly	n/a
Eye construction	Executed similarly	n/a
Head posture	Executed similarly	n/a
Direction of head tilt	Executed similarly	n/a
Chin delineation	Executed similarly	n/a
Shoulder construction	Executed similarly	n/a
Torso shape	Executed similarly	n/a
Torso coloration	Executed similarly	n/a
Underarms	Executed similarly	n/a
Upper arms	Executed similarly	n/a
Forearms	Executed similarly	n/a
Wrists	Executed similarly	n/a
Hands	Executed similarly	n/a
Fingers	Executed similarly	n/a
Hip construction	Executed similarly	n/a
Tails	Executed similarly	n/a
Tail positioning	Executed similarly	n/a
Tail shape	Executed similarly	n/a

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TABLE 1. Pair-Wise Comparison of Two Forward-Facing People (MimPIDD-2881 [Figure 2a] and MimPIDD-7318 [Figure 2b]).

Attribute	Status of Comparison	Differences
Tail decorative theme	Executed similarly	n/a
Tail stripe specifics	Executed similarly	n/a
Upper anterior legs	Executed similarly	n/a
Thighs	Executed similarly	n/a
Knees	Executed similarly	n/a
Shins	Executed similarly	n/a
Calves	Executed similarly	n/a
Ankles	Executed similarly	n/a
Direction feet facing	Executed similarly	n/a
Heels	Executed similarly	n/a
Head shape	Executed differently	2881: rectilinear; 7318: curvilinear
Cap element above headgear	Executed differently	2881: absent; 7318: present
Hair bundle conformity	Executed differently	2881: does not conform; 7318: conforms to shoulder curvature
Brow embellishment	Executed differently	2881: none; 7318: anterior triangles
Brow attachment	Executed differently	2881: attached at temples; 7318: unattached
Basal nose treatment	Executed differently	2881: straight; 7318: concave
Chin line	Executed differently	2881: straight; 7318: curved
Arm positioning	Executed differently	2881: both arms at side; 7318: one arm raised
Finger proportionality	Executed differently	2881: progressively longer; 7318: realistic proportions
Tail-leg conformity	Executed differently	2881: tail conforms to legs; 7318: no conformation
Tail length	Executed differently	2881: tail hangs to calves; 7318: tail hangs to ankles
Upper tail specifics	Executed differently	2881: cross-hatching; 7318: checkerboard
Interior knee angularity	Executed differently	2881: curvilinear; 7318: angular
Feet	Executed differently	2881: non-human; 7318: human

TABLE 2. Examples of Margins of Error for 70 Percent Similarity, Given Different Sample Sizes. Margins Calculated at 95 Percent Confidence Interval.

Number of Comparable Attributes per Pair	Number of Matching Attributes per Pair	Proportion of Similarity	Margin of Error	Range of Potential Error
10	7	70 %	37.3	32.7–100 %
20	14	70 %	20.1	49.9–90.1 %
40	28	70 %	14.2	55.8–84.2 %
60	42	70 %	11.6	58.4–81.6 %
80	56	70 %	10	60–80 %
100	70	70 %	9	61–79 %

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In comparing and analyzing designs, archaeologists as well as art historians often recognize similarities and differences based on impressions that are based on substantial experience but difficult to verbalize. Our method strives to identify the basis of those impressions in a systematic and replicable manner. Attributes common to both vessels are first identified, and they are then coded by focusing on variables that reflect decisions made by the artist and that are discernible to the analyst at the finest scale possible. Our stringent approach, tailored on a case-by-case basis, is designed to mitigate bias and produce replicable results.

For example, in considering the rabbits depicted in Figures 3a and 3c, we do not ask how the rabbits' necks are depicted but rather:

- How many lines are incorporated between the lower jaw and foremost leg? (One, in both cases).
- What is the relationship between the bottom of the ears and the back? (In Figure 3a, a straight line separates ears from back, representing both the back of the rabbit's head and the top of its neck. In Figure 3c, a curved line connects ears to back, forming the back of the rabbit's head but giving no suggestion of a neck).
- At what angle does each line run? (In both cases, arcing lines begin toward the lower front legs, thereafter curving inward).
- Are the lines straight, concave, or convex? (Convex, in both cases).
- What are their proportionate lengths? (In both cases, the neck/breast lines are about 33 percent longer than the ears).

After shared attributes are identified and analyzed, we calculate the proportion of attributes that were similarly executed. For example, consider the two forward-facing people shown in Figures 2a and 2b. A total of 65 attributes are common to both and can be compared (Table 1). Characteristics present in only one (like the caterpillar) are not included. Of the 65 shared attributes, 51 were executed similarly, resulting in a similarity measure of 78 percent.

Binary attributes are sometimes appropriate, but multi-state attributes are often necessary to capture idiosyncratic differences. The attributes we use are specific to the Mimbres tradition, although the general method could be applied to a different body of material using different attributes. Results are more robust, with larger numbers of compared attributes and we consider margins of error (see Moore and McCabe 1999) when deciding on minimum numbers of attributes. Margins of error for several sample sizes are shown in Table 2. In our analyses, the smallest number of shared attributes is 20, of which 90 percent were similar. The margin of error in this case is 13.1 percent (95 percent confidence), giving a range of 76.9 to 103.1.

Assessing the Significance of Pair-Wise Comparisons

After quantifying the degree of similarity between two designs, we must determine whether it indicates that they were painted by the same hand. A series of analyses is used to establish a threshold, beginning with the 29 undamaged forward-facing people bowls. These are examined in pair-wise fashion—examining every possible one-to-one combination—for a total of 406 comparisons. Similarity measures for these comparisons approach a normal distribution (x = 51 percent, d = 13; Figure 4). Thus, one standard deviation above the mean (64 percent; yellow and green in Figure 4) might be an appropriate threshold, beyond which two bowls could reasonably be attributed to the same hand. To understand what might be included or excluded using this threshold, we examine several cases.

Many Mimbres bowls have the same motif repeated two or more times. It is likely that any two motifs on a single bowl were painted by the same hand and thus can be used to test the 64 percent threshold. We analyze 20 bowls bearing duplicate motifs (including those in Figure 5), assessing the similarity of multiple designs on the same bowl. Similarity measures range from 65–100 percent (x= 88 percent). Thus, similar designs painted by the same hand may display minor variation but have a high degree of similarity, above the potential 64 percent threshold.

The threshold can also be evaluated by considering pairs of bowls previously argued to have been painted by the same hand, such as two bowls (Figure 6) that LeBlanc (2006) attributed to one individual. These depict crawling men in bifold, rotationally symmetrical layouts, with an interstitial, geometric element. Of 45 shared attributes, 34 are similar (76 percent).

As expected, pair-wise comparisons detect a high degree of similarity between similar motifs that were likely painted by the same hand. To address the possibility of false positives, we examine shared motifs painted by different hands, with four sets of analyses. First, we examine pairs of bowls that have very similar motifs but substantially different overall appearances. For example, the bowls shown in Figure 7 have nearly identical content (left-facing, decorated pronghorn, centered within geometric rings) but look quite different. Of 35 shared attributes, only 16 (46 percent) are similar.

Second, we randomly select 20 bowls depicting rabbits and 20 depicting humans, dividing each sample into ten pairs.[4] The degree of similarity within the random pairs is quite low, ranging from 25–53 percent (x= 39 percent) for the rabbits and 22–39 percent (x= 38 percent) for the humans.

Third, some Mimbres bowls depict the same narratives, even though they may not have been painted by the same hand. Three such bowls show two men who are singing, holding rattles, and dancing atop a waterbird (MimPIDD-11, MimPIDD-2698, MimPIDD-8775; one shown in Figure 8). Three pair-wise comparisons among these bowls consider 62–65 shared attributes. Similarity measures range from 57 to 60 percent, just below the potential 64 percent threshold.

Fourth, Mimbres Black-on-white designs were made for nearly four centuries, with some motifs used throughout. We select four pairs of bowls with shared motifs, each pair including an early (Style I) and late (Mimbres Polychrome) bowl, thus comparing identical subject matter painted by different people, centuries apart. Similarity measures range from 10–41 percent (x= 26 percent).

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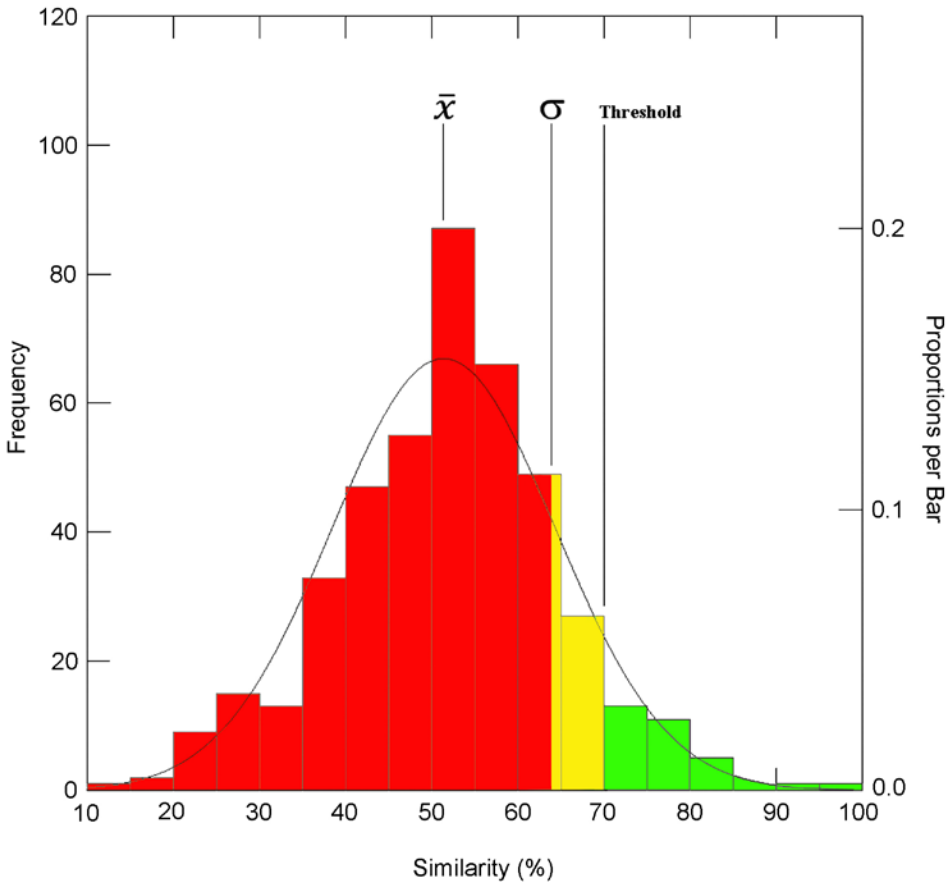


FIGURE 4. Distribution of 406 similarity measures resulting from pair-wise comparisons of 29 forward-facing people designs.

These analyses help establish a threshold for deciding whether two bowls were painted by the same hand. The 1σ starting point (64 percent) separates those very likely painted by the same hand from those that clearly were not. To err conservatively, making false positives less likely, we elevate this to 70 percent (green in Figure 4). Thus, if 70 percent or more of the attributes considered in a pair-wise comparison are similar, we conclude that the two bowls were painted by the same hand.

Similarity Matrices

Pair-wise comparisons can be expanded in chain-like fashion in order to identify sets of linked bowls, arguably painted by the same hand. Each bowl in a set has at least 70 percent similarity with at least one other bowl in the set, although not all pairs share the same degree of similarity. We illustrate this with our two initial groups, forward-facing people and negative rabbits.

The forward-facing people group includes 29 bowls that can be analyzed. A total of 406 one-to-one comparisons result in similarity measures ranging from 14–98 percent, and a matrix of these results is shown in Figure 9. Of the 406 comparisons, 31 meet or exceed the 70 percent threshold. Some bowls are similar to several others, which in turn are linked to even more; all the bowls linked in this fashion are attributed to the same hand and assigned to the Forward-Facing People Set. In contrast, two bowls (MimPIDD-780 and MimPIDD-3614) are linked to each other but not the larger set; these are labeled the Small Forward-Facing People Set. Others, like MimPIDD-9053, have no linkages at all. To visualize these connections, a network of connectivity (Figure 10) was generated using UCINET, a social network analysis program that graphically structures data based on pair-wise linkages (Borgatti et al. 2002). This shows connections among 20 of the 31 bowls, with the outlying pair, and seven others not connected. Each of the 20 bowls in the Forward-Facing People Set is at least 70 percent similar to at least one other bowl in the set, represented by red lines. Different bowls at either end of the network might be quite dissimilar due to factors such as artistic development.

To demonstrate an application of these schematic and quantitative assessments, we return to the bowls illustrated in Figure 2, most of which are included in the Forward-Facing People Set. One (Figure 2f) was too damaged to compare. Another (Figure 2h) was found not to be connected to the others and is demonstrably different: The forehead line is contoured around the eyes, forming eyebrows; its arms are thinner, its torso is longer, its legs are farther apart, its chin line is higher, and teeth are shown.

A similar procedure is undertaken with the negative rabbit group. The 435 pair-wise comparisons in this group produce similarity measures ranging from 44–92 percent. Of the 30 bowls,

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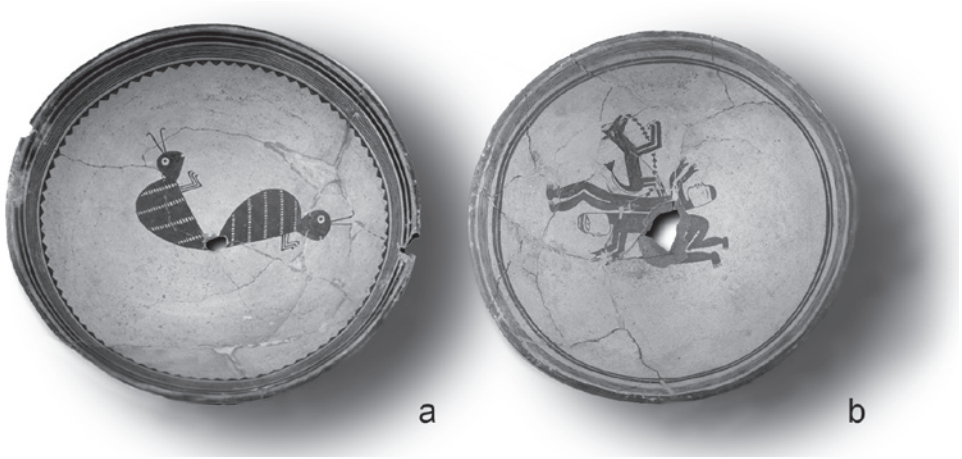


FIGURE 5. Three of 20 designs with duplicate motifs used for intra-bowl comparisons, not to scale: (a) MimPIDD-1189, Cameron Creek, similarity measure = 100 percent (Mimbres Black-on-white bowl, 1050–1200, Museum of Indian Arts and Culture, Laboratory of Anthropology, cat. no. 19986/11); (b) MimPIDD-1733, unprovenienced, similarity measure = 81 percent (courtesy, National Museum of the American Indian, Smithsonian Institution, cat. no. 043540.000), photo by and used with the permission of Steven LeBlanc.

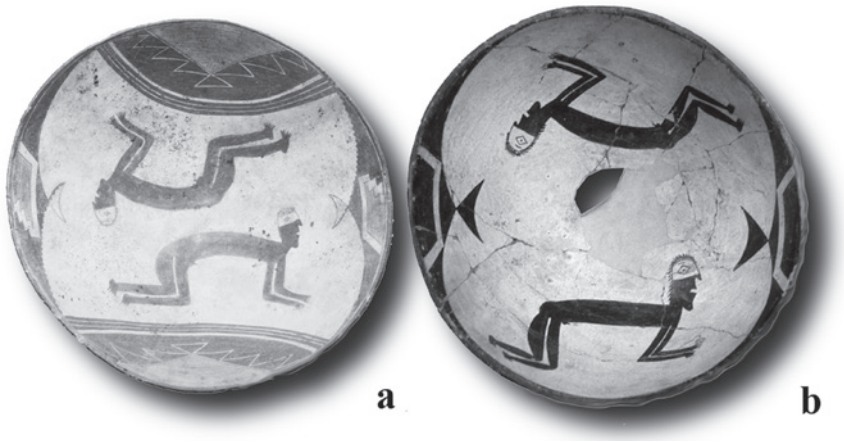


FIGURE 6. Two bowls believed to have been painted by the same hand, not to scale: (a) MimPIDD-4371, unprovenienced (bowl, Mimbres, eleventh century, Denver Art Museum Collection, cat. no. XPH-142-EX); (b) MimPIDD-2104, Swarts Ruin (Peabody Museum of Archaeology and Ethnology, cat. no. 94502).

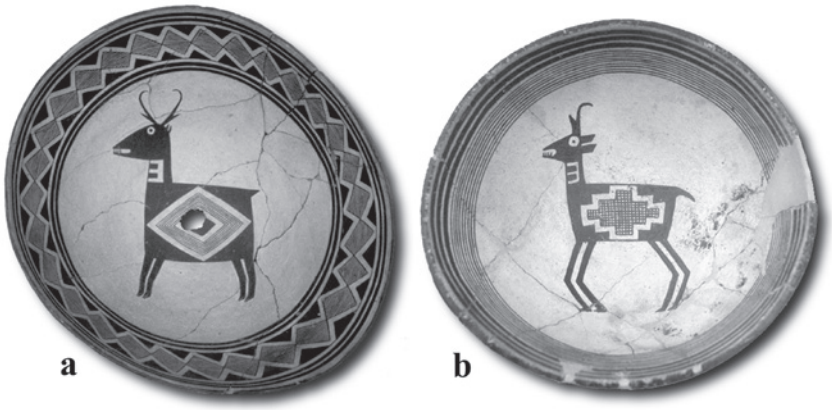


FIGURE 7. Two bowls depicting pronghorns and likely painted by different hands, not to scale: (a) MimPIDD-87, Pruitt Site (Arizona State Museum, cat. no. GP4953); (b) MimPIDD-2614, Swarts Ruin (Peabody Museum of Archaeology and Ethnology, cat. no. 94636)

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FIGURE 8. One of three known Mimbres bowls showing two men dancing on the neck of a large waterbird (MimPIDD-2698, Swarts Ruin; Peabody Museum of Archaeology and Ethnology, cat. no. 94627).

21 are linked by similarity measures at or above 70 percent, thus forming the Negative Rabbit Set.

EXTENDING AND EVALUATING THE METHODOLOGY

Above, we developed techniques for quantifying and assessing pair-wise similarity. This allowed us to determine whether similarly decorated bowls were likely painted by the same hand. Here we extend the technique to enable comparisons between different motifs in order to expand the same-hand sets and to recognize additional sets. We then draw on data regarding production, distribution, and deposition to assess our sets.

Same Hands, Different Designs

Our methodology was developed by focusing on bowls with similar motifs. It is likely, however, that artists painted a variety of designs and motifs. Here, we develop two means of extending same-hand sets to encompass such variety.

First, we examine secondary motifs on bowls from the earlier identified same-hand sets. For example, the bowls shown in Figures 11a and 11b are included in the Forward-Facing People Set and are linked to one another. The latter has both forward-facing people and pronghorns in profile. Using the pair-wise method, we compare these pronghorns to other pronghorns in MimPIDD. One (Figure 11c) is 72 percent similar to Figure 11b. Figure 11c also has a mountain lion with human hands that are similar to the hands in Figure 11b. Comparing the mountain lion on Figure 11c to other mountain lions in MimPIDD reveals one that is 70 percent similar (Figure 11d). Thus, Figure 11c and Figure 11d are added to the Forward-Facing People Set. Though labor intensive, this series of bridging links demonstrates one way to identify dissimilar designs painted by the same hand.

Second, we can expand general groups to include multiple motifs with overarching stylistic similarities. For example, we consider all bowls with negative imagery for inclusion in the Negative Rabbit Set. Three are at least 70 percent similar to one or more rabbits in the Negative Rabbit Set: a toad (MimPIDD-9553, not illustrated), possible dogs (Figure 3d), and bighorn sheep (MimPIDD-783, not illustrated). This exercise also allows us to recognize four additional same-hand sets with negative designs, listed in Appendix 1.

New Groups, New Sets

We next consider groups not previously mentioned in the literature, using the procedures developed above. We assemble liberally defined groups of bowls with similar designs, and then use pair-wise comparisons to refine these into same-hand sets. One such group includes eight bowls depicting birds with triangular torsos, heads turned in profile, wings spread, and pendant feathers (listed in Appendix 1, with examples in Figure 12). These are the basis of 28 pair-wise comparisons, resulting in four similarity measures of 70 percent or higher. These link five of the eight bowls, suggesting that they were painted by the same hand (the Triangular Bird Set). A second group includes five bowls with fork-like geometric designs (listed in Appendix 1, with examples in Figure 13). Ten pair-wise comparisons yield three similarity measures of 70 percent or higher, linking four of the five bowls in the Fork-Like Set.

Time, Space, and Treatment

Temporal, spatial, and contextual data can be used to further examine same-hand sets. We do so in an exploratory sense, with expectations that are general and tentative for several reasons. First, our method is intended to identify sets that might have been made by a single production group spanning several generations (cf. LeBlanc and Henderson 2009). Second, as discussed above, compositional analyses suggest that by the Classic period pottery was made at relatively few locations and widely distributed within the Mimbres region. We have also demonstrated that vessel designs were widely distributed (Hegmon et al. 2015). Thus, even if all bowls in a set were made at the same location, it is doubtful they would all be deposited there. Nevertheless, we expect that bowls in a same-hand set will be somewhat concentrated in time and space (see LeBlanc 2006:129–130).[5]

The temporally sensitive micro-styles recognized by Shafer and Brewington (1995, see note 2) can establish temporal ranges for same-hand sets (the temporally sensitive attributes were excluded from the pair-wise comparisons). All of the bowls in our Triangular Bird Set are classified as Style II or Style II/III (i.e., A.D. 880–1020) based on their hachure and rim treatment. Of the 23 bowls in our Forward-Facing People Set, all are generally Style III. Fifteen can be more precisely assigned to Middle Style III (A.D. 1060–1110) and six to Late Style III (A.D. 1110–1130). In both cases, if bowls in a set were made in the middle of the date range, they could have been painted by one individual

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Bowl	142	198	780	1737	2881	3614	3646	4840	6062	6231	7313	7318	7690	7866	7967	7984	8114	8247	8326	8339	8431	8450	8771	8783	9053	9370	9374	9832	9857
198	61																												
780	54	52																											
1737	62	56	44																										
2881	54	62	69	57																									
3614	52	45	71	55	54																								
3646	57	46	56	52	57	54																							
4840	48	56	63	58	52	68	57																						
6062	50	27	36	67	43	45	36	63																					
6231	52	72	54	83	58	50	53	68	57																				
7313	69	46	52	58	69	55	58	48	52	59																			
7318	48	58	54	52	78	50	63	52	38	64	50																		
7690	59	48	52	42	67	50	80	48	29	55	60	52																	
7866	73	55	61	39	59	60	66	53	35	57	64	69	63																
7967	42	78	44	48	63	46	53	59	52	77	63	44	40	41															
7984	60	40	63	58	43	56	49	58	48	54	67	47	42	48	43														
8114	56	41	58	42	69	48	70	32	27	54	62	67	50	67	38	50													
8247	52	57	65	37	52	50	64	54	33	64	81	65	61	67	43	52	76												
8326	47	24	47	35	41	69	47	37	55	76	29	56	42	55	27	59	44	45											
8339	48	33	38	50	32	52	36	33	55	36	50	26	21	40	35	33	24	41	40										
8431	44	32	52	44	59	36	52	24	27	38	40	66	43	62	62	35	56	41	20	33									
8450	28	20	44	38	41	36	36	26	20	29	20	37	27	33	19	46	33	29	14	43	61								
8771	57	54	46	56	61	57	59	52	45	63	56	64	48	59	63	52	52	74	53	42	58	35							
8783	67	46	41	48	48	54	45	50	50	54	64	38	45	55	43	47	52	35	42	35	35	19	54						
9053	50	40	50	58	54	59	52	37	39	61	52	52	33	45	43	62	52	27	46	43	48	56	60	58					
9370	61	44	60	50	60	56	98	52	36	54	58	65	83	68	36	52	69	60	46	38	56	38	63	46	52				
9374	54	56	56	61	75	41	50	54	58	81	75	50	48	60	62	45	76	45	33	27	41	32	48	48	56	52			
9832	71	50	60	40	60	45	54	46	22	56	48	63	65	54	67	46	58	60	44	53	70	48	52	39	52	59	52		
9857	62	79	58	46	50	52	49	57	41	60	44	61	41	56	70	45	43	48	74	46	46	36	60	52	61	52	48	71	
9981	41	70	52	67	54	50	58	58	52	94	64	58	55	45	72	52	52	76	65	50	41	27	56	48	54	56	71	67	78

FIGURE 9. Similarity measures resulting from pair-wise comparisons of forward-facing people bowls. Measures at or above 70 percent are in yellow.

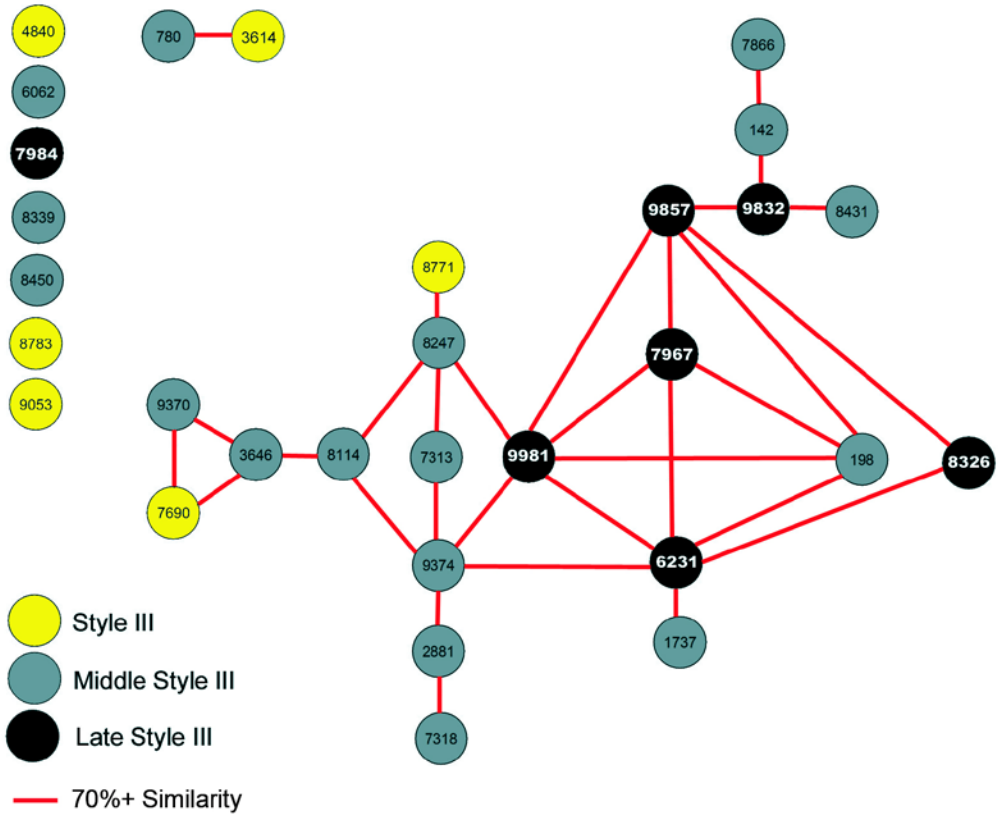


FIGURE 10. Modified UCINET matrix showing links among forward-facing people bowls. Lines represents similarity measures of 70 percent or greater. Line length and relative positioning are not scaled.

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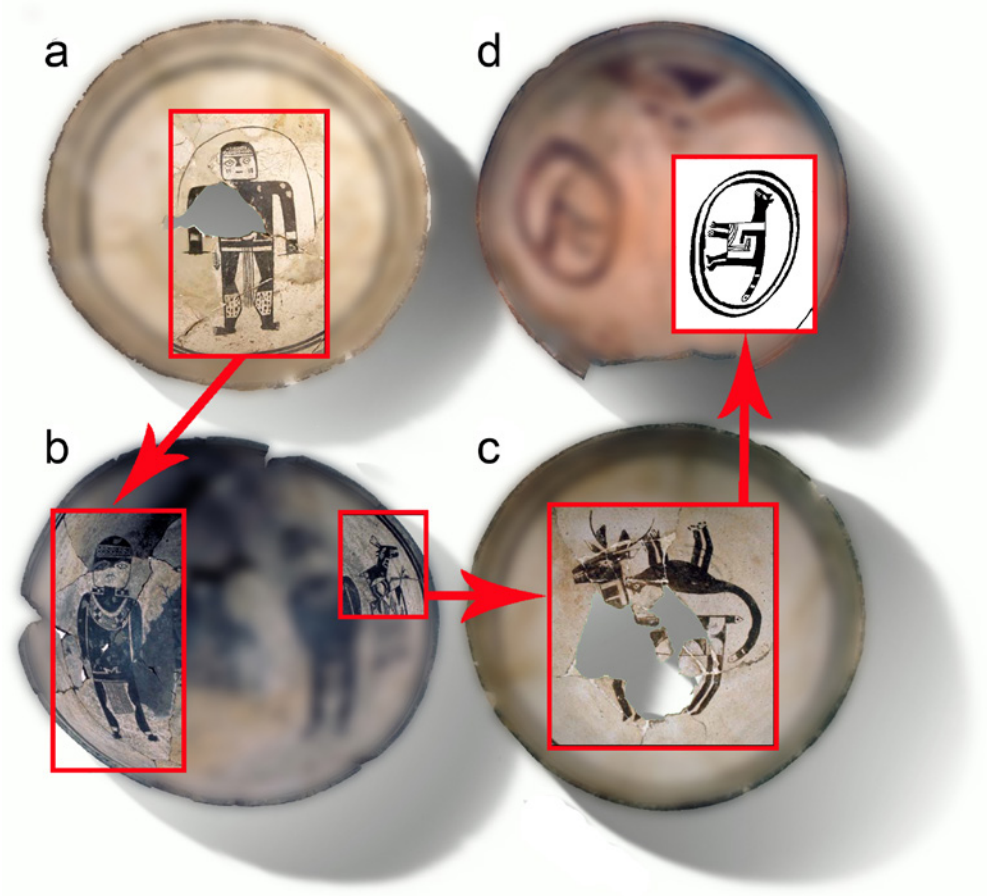


FIGURE 11. Example of expanding a same-hand set to include alternate motifs; 11a and 11d are ultimately attributed to the same hand, yet contain markedly different motifs: (a) MimPIDD-8114, Mimbres Valley (Amerind Foundation, cat. no. MS-28); (b) MimPIDD-3646, Mattocks (Logan Museum of Anthropology, cat. no. 16121); (c) MimPIDD-2068, Swarts (Peabody Museum of Archaeology and Ethnology, cat. no. 95843); (d) illustration of MimPIDD-906 by Will Russell, unprovenienced bowl at Maxwell Museum of Anthropology, cat. no. 133182/404.



FIGURE 12. Two bowls considered in the triangular bird analysis, not to scale: (a) MimPIDD-1685, unprovenienced (courtesy, National Museum of the American Indian, Smithsonian Institution, cat. no. 051914.000), photo by and used with the permission of Steven LeBlanc; (b) MimPIDD-5061, unprovenienced (Millicent Rogers Museum, cat. no. 59A MRM 1972-8-1).

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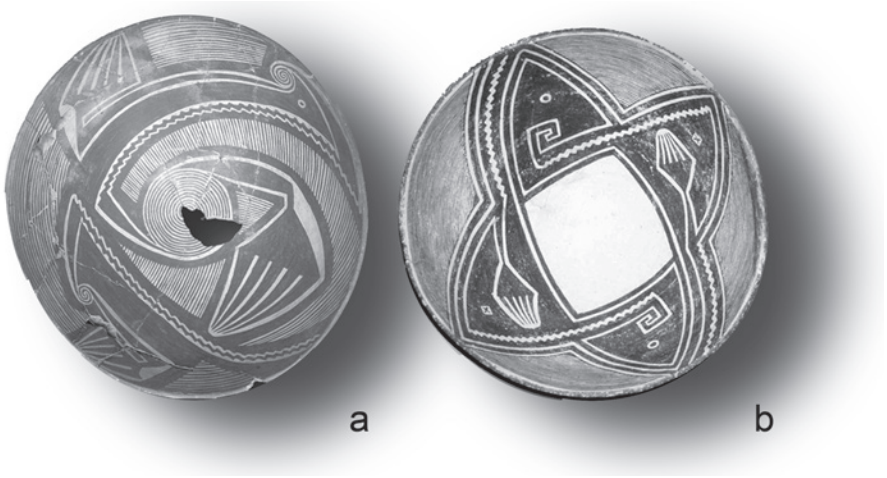


FIGURE 13. Two bowls with fork-like geometric decorations ultimately attributed to the same hand, not to scale: (a) MimPIDD-7312, unprovenienced (courtesy of the Division of Anthropology, American Museum of Natural History, cat. no. 29.1/284 1919-31); (b) MimPIDD-7999, Wind Mountain (Amerind Foundation, cat. no. WM1162).

who changed the style of rim treatment over the course of a few decades. Alternatively, if the sets actually span the entire temporal range, the bowls could have been made by one multigenerational group.

In contrast, of the 24 bowls in our Negative Rabbit Set, three are Late Style II or Style II/III (i.e., A.D. 970–1020), 10 are Middle Style III, one is Late Style III, and the others are undifferentiated Style III. While most of these could have been made by the same artist, the earliest and latest members of the set are separated by at least 90 years. Thus, it is very likely that this particularly distinctive style was produced by a multigenerational group. The four small negative animal sets include only undifferentiated Style III bowls and thus could have all been made over a fairly short period of time.

If our sets do represent the work of one artist or cooperative group, we would expect consistency in source materials. Compositional analyses will eventually allow us to examine this expectation systematically. Thus far, at least two analyses of Mimbres pottery demonstrate some correlation between designs and compositional groups (Creel and Speakman 2014; Powell-Martí and James 2006), although compositional analyses have mostly targeted sherds, which are rarely amenable to our methods. Darrell Creel is spearheading an effort to gather more data, including whole vessels, and we expect to integrate these data as they become available.

Although provenience is unknown for many Mimbres vessels, we can utilize what information is available (see Appendix 1). The provenienced bowls from two small sets show some spatial clustering; three of four bowls in the Negative Toad A Set were recovered at Swarts, while both bowls in the Negative Toad-and-Bird Set came from Galaz. The larger Forward-Facing People Set is harder to interpret, with nine provenienced bowls from nine different sites. In contrast, the Negative Rabbit Set, with its wider chronological distribution, is more concentrated spatially, with multiple bowls coming from several sites.

Finally, if the sets we recognize were culturally significant in the past, the bowls in a set may have been used or treated in a similar manner. Many Mimbres bowls were ultimately deposited in burials, with "kill holes" pecked through the bottom. There are 4,687 bowls in MimPIDD with definite kill holes, and most have just one. Multiple kill holes are difficult to execute and rare, occurring in less than two percent of killed bowls. They are, however, quite common in our Negative Rabbit Set—of the 21 bowls in this set, 11 are killed and 27 percent of those have multiple holes (an example is illustrated in Figure 14). A Fisher's Exact test confirms the statistical significance of this association (two-tailed, $p = .0024$; $Q = .86$). This similar treatment—exceedingly rare beyond the set—suggests that what we recognize as same-hand sets were culturally meaningful in the past.



FIGURE 14. Illustration of a Classic-period Mimbres bowl with three kill holes (MimPIDD-4282, Mattocks Ruin).

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DISCUSSION AND CONCLUSIONS

Generations of archaeologists have recognized sets of Mimbres painted pottery that share similar styles and appear to have been painted by the same artist. This article develops a systematic and quantitative method for substantiating, refining, and expanding these sets, which we regard as having been painted by the same hand (i.e., by a single artist or group of cooperating artists). The method relies on pair-wise comparisons that determine the degree of similarity between two designs, based on the rendition of shared attributes. A matrix of comparisons then establishes same-hand sets. Such sets do not all share a single characteristic; rather, each bowl is shown to be similar to at least one other bowl in the set. The method is well-suited for identifying the life-long work of an artist or even a multigenerational group. Our method, which focuses on artistic style, is complementary to other methods used on other kinds of Southwestern pottery that focus more on technology, and we expect that different methods will be more or less appropriate for different materials. Combining our general method with other approaches might also be appropriate. Our method, which involves multiple pair-wise comparisons, is labor intensive and probably not appropriate for searching vast collections of pottery for otherwise unrecognizable artists. Rather, it would be most useful in cases in which the hands of individual artists are already suspected.

Mimbres pottery is already an important example of non-Western art (Brody 2004; Munson 2011). Analysis of this renowned tradition allowed us to develop methods—relatively new in archaeology—that focus on artistic and stylistic decisions made by the artists and thus provide some insights into their artistic processes. Our results support LeBlanc's (2010) suggestion that Mimbres painting is so aesthetically pleasing and compelling because the artists were encouraged to develop individual styles. They thus contribute to an archaeology of creativity and suggest the need for future comparative work that considers the association between identifiable individual styles and periods of artistic florescence.

The method can eventually be used to identify more same hands sets, which can be linked to our growing understanding (based on compositional analyses) of pottery production and distribution. This would make it possible for us to observe the role of artists in the shift towards community specialization, asking, for example, whether villages that came to dominate production had a long tradition of distinctive painting. It would also be possible to consider the social significance of a distinctive set of work. Our results so far show that the same-hands sets are widely distributed and thus do not mark spatially distinct groups. Alternatively, it is possible that the distribution had a special significance and that it was important for each village or social group to have some pieces made by a particular artist or group, analogous to Bradley's (2000) "pieces of place" (see also Spielmann 2002). Pursuing these and similar questions will contribute to an understanding of art and artists in Mimbres society.

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Data Availability Statement. All data contributing to our analyses are available through the Mimbres Pottery Images Digital Database (MimPIDD), which is maintained in perpetuity by the Digital Archaeological Record (tDAR). Access to tDAR and MimPIDD is available online at www.tdar.org and http://core.tdar.org/collection/22070, respectively.

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NOTES

1. Recent estimates (Peeples 2015) calculate the cumulative and momentary population of Classic period Mimbres villages and conclude that the seven villages in the largest size class (126-plus rooms) would have had a population of around 300.
2. Style I (A.D. 800–900); Early Style II (A.D. 880–980); Late Style II and Style II/III (A.D. 970–1020); Early Style III (A.D. 1010–1080); Middle Style III (A.D. 1060–1110); Late Style III (1110–1130); Mimbres Polychrome (A.D. 1060–1130) (Shafer 2003; Shafer and Brewington 1995:Table 1)
3. We use "schools" in the sense of Western art history (e.g., Yu 2009), in contrast to Watson Smith's (1962) suggestion that local manifestations of archaeological recognizable types could be considered to be "schools."
4. The random samples were made from the universe of all bowls in MimPIDD depicting rabbits and all those depicting anthropomorphs, including only bowls in non-private collections.
5. One report of a burial at Cameron Creek, excavated by Bradfield, describes a grave that had been reopened twice to inter additional people, for a total of three individuals. Each person was accompanied by bowls said to be "so closely related in design, as to have been apparently made by the same hands" (Walter 1925:175–176). Unfortunately, the Cameron Creek material is difficult to interpret, and we are not currently able to ascertain which vessels in MimPIDD were in this burial. If ongoing work with the notes from the Cameron Creek excavations (Russell 2015) can resolve this issue, we will apply our analytical method to them.

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APPENDIX 1. Analyzed Bowls.

Group / Set	Status[1]	Temporal Style	MimPIDD #	Fig.	Site	Motif(s)
Forward-Facing People	Confirmed	III	7690		NAN Ranch	Person, fish
	Mid-III	III	8771		Old Town	People (5)
	Mid-III	Mid-III	8114	2j		Person, rope
	Mid-III	Mid-III	142	2d	McSherry	Person, fence
	Mid-III	Mid-III	198	2e	Treasure Hill	Persons (2)
	Mid-III	Mid-III	1737	2g		Person, squatting
	Mid-III	Mid-III	2881	2a	Galaz	Person
	Mid-III	Mid-III	3646		Mattocks	People (2), pronghorn (2)
	Mid-III	Mid-III	7313	2c		Person, squatting
	Mid-III	Mid-III	7318	2b		Person, caterpillar
	Mid-III	Mid-III	7866	2i	2C Ranch	Person
	Mid-III	Mid-III	8247			Person, rope
	Mid-III	Mid-III	8431			Person
	Mid-III	Mid-III	9370			People (2)
	Mid-III	Mid-III	9374			People (2), squatting
	Mid-III	Late III	6231			Person, squatting
	Mid-III	Late III	7967			Person, squating
	Mid-III	Late III	9832		Kenley No. 1	Person
	Mid-III	Late III	9857			Person
	Mid-III	Late III	9981			Person, squatting
	Mid-III	Late III	8326			Chimera (bear w/wings)
	Removed	III	8141			Person
	Removed	Mid-III	1231	2f		Person
	Eliminated[2]	III	3614	2h		Person
	Eliminated	III	4840			Person, squatting
	Eliminated	III	8783			Person, clouds
	Eliminated	III	9053			Person, lizards
	Eliminated[2]	Mid-III	780			Person
	Eliminated	Mid-III	6062			Person, squatting
	Eliminated	Mid-III	8339			People (2)
	Eliminated	Mid-III	8450			People (2)
	Eliminated	Late III	7984			Person giving birth
	Added	Mid-III	2068		Swarts	Pronghorn, quadruped
	Added	Mid-III	906		Baca	Quadrupeds (2)
Negative Rabbit[3]	Confirmed	II/III	1261		Mattocks	Rabbit
	Confirmed	II/III	9018		Mattocks	Rabbit
	Confirmed	III	505		Pruitt	Rabbit
	Confirmed	III	2608	3a	Swarts	Rabbit
	Confirmed	III	8218			Rabbit

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Group / Set	Status[1]	Temporal Style	MimPIDD #	Fig.	Site	Motif(s)
	Confirmed	III	8231			Rabbit
	Confirmed	III	8571			Rabbit
	Confirmed	III	9014			Rabbit
	Confirmed	III	9140			Rabbit
	Confirmed	III	9566		Swarts	Rabbit
	Confirmed	III	7095			Rabbit
	Confirmed	Mid-III	2704	3b	Swarts	Rabbit
	Confirmed	Mid-III	790		Baca	Rabbit
	Confirmed	Mid-III	2852		Galaz	Rabbit
	Confirmed	Mid-III	4282	13	Mattocks	Rabbit
	Confirmed	Mid-III	4469			Rabbit
	Confirmed	Mid-III	5889			Rabbit
	Confirmed	Mid-III	7965			Rabbit
	Confirmed	Mid-III	8113			Rabbit
	Confirmed	Mid-III	4177		Carr	Rabbit
	Confirmed	Late III	7863	3c	Pruitt	Rabbit
	Added	Late II	783		Baca	Bighorn
	Added	III	9553		Swarts	Toad
	Added	Mid-III	6614	3d	Galaz	Dog?
	Eliminated	III	771			Rabbit
	Eliminated	III	5946			Rabbit
	Eliminated	III	8960			Rabbit
	Eliminated	Early III	5978			Rabbit
	Eliminated	Mid-III	6234			Rabbit
	Eliminated	Mid-III	334			Rabbit
	Eliminated	Mid-III	9340			Rabbit
	Eliminated	Mid-III	9874			Rabbit
	Eliminated	Mid-III	9142			Rabbit/snake combination
Negative Toad A	Added	III	9559		Swarts	Toad
	Added	Mid-III	1488		McSherry	Toad
	Added	Mid-III	2573		Swarts	Toad
	Added	Mid-III	9557		Swarts	Toad
Negative Toad B	Added	III	2746		Mattocks	Toad
	Added	Mid-III	2708		Swarts	Toad
Negative Toad-and-Bird	Added	Mid-III	2775		Galaz	Toad
	Added	Mid-III	2905		Galaz	Bird
Negative Shell Bracelet	Added	II-III	2790		Galaz	Shell Bracelet
	Added	II-III	9554		Swarts	Shell Bracelet

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APPENDIX 1. Analyzed Bowls.

Group / Set	Status[1]	Temporal Style	MimPIDD #	Fig.	Site	Motif(s)
Fork-Like	Confirmed	II	7312	12a		Geometric
	Confirmed	Early II	464		McSherry	Geometric
	Confirmed	Late II	7999	12b	Wind Mtn	Geometric
	Confirmed	III	1058		Cameron Cr	Geometric
	Confirmed	III	9898			Geometric
Triangular Bird	Confirmed	II	2016			Bird
	Confirmed	Early II	810		Baca	Bird
	Confirmed	Early II	8674			Bird
	Confirmed	Late II	1685	11a	Peralta	Bird
	Confirmed	Late II	9356			Bird
	Eliminated	II	3868			Bird
	Eliminated	II/III	182			Bird
	Eliminated	Late II	5061	11b		Bird

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