Representation and Structure Conflict in the Digital Age

Reassessing Archaeological Illustration and the Use of Cubist Techniques in Depicting Images of the Past

Eric S. Carlson

> *The things that Picasso could see were the things which had their own reality, reality not of things seen but of things that exist.*
>
> Gertrude Stein [1984 (1938):4]

The acceleration of new digital imaging technologies has enhanced archaeological research and profoundly expanded the scale of the discipline's potentialities. High-resolution digital photography, digital scanning, three-dimensional (3D) scanning, virtual reality software, and Geographic Information System (GIS) technology are but some of the new tools that archaeologists use for documenting, analyzing, and presenting

ABSTRACT

Digital imaging technologies have enhanced archaeological research and profoundly expanded the scale of the discipline's potentialities. As illustrators and archaeologists move away from using hand-drawn images (of hand-held, real-life objects) to depict artifacts and other archaeological information, certain capabilities of the traditional illustrative process are lost. One such loss is the ability to present a complete and informed representation of an artifact free of the distortions and visual limitations that single-perspective (i.e., digital or photographic) imagery produces. This is accomplished by the illustrator through the unification of multiple views of the artifact from various perspectives into a single two-dimensional image that communicates to the viewer important attributes of the artifact, free of distortion and remaining true to the measured, analytical conventions of the illustrative process. Liberation from the single-viewpoint perspective was one of the fundamental elements of the Cubist movement. Traditional archaeological illustrators utilize Cubist principles to communicate visually to the viewer a complete, accurate, and undistorted package of information about an artifact. The supplanting of hand-drawn illustrations by digital images in today's archaeological publications threatens to revert the visual representation of data back to uninformed, surficial "snapshots" of incomplete objects.

Las tecnologías de imágenes digitales han enaltecido los métodos de investigación arqueológica y ampliado abismalmente la escala de potenciales de la disciplina. Al alejarse los ilustradores y los arqueólogos de la representación de objetos dibujados a mano alzada, sosteniéndolos con la mano, inclusive de otro tipo de información arqueológica, se han perdido capacidades específicas del proceso clásico de la ilustración. Una de éstas es la capacidad de la ilustración para mostrar una representación completa e informada de un artefacto, sin las distorsiones y limitaciones visuales que introduce la perspectiva de un solo plano de las imágenes digitales o fotográficas. Esto se logra por el ilustrador a través de unificar las múltiples vistas de un artefacto desde varias perspectivas, en una imagen de dos dimensiones que comunica al observador los atributos importantes del artefacto sin distorsión alguna, permaneciendo fiel a las convenciones analíticas y mesuradas del proceso de ilustración. El liberarse de la perspectiva de un solo plano fue uno de los elementos fundamentales del movimiento cubista. Los ilustradores clásicos dentro de la arqueología utilizan los principios del movimiento cubista para comunicar al observador un paquete de información completo, preciso y sin distorsión en torno a un artefacto. La sustitución de ilustraciones hechas a mano por las imágenes digitales de las publicaciones arqueológicas amenaza con revertir la representación visual de los datos en una "instantánea" superficial, desinformada e incompleta de los objetos.

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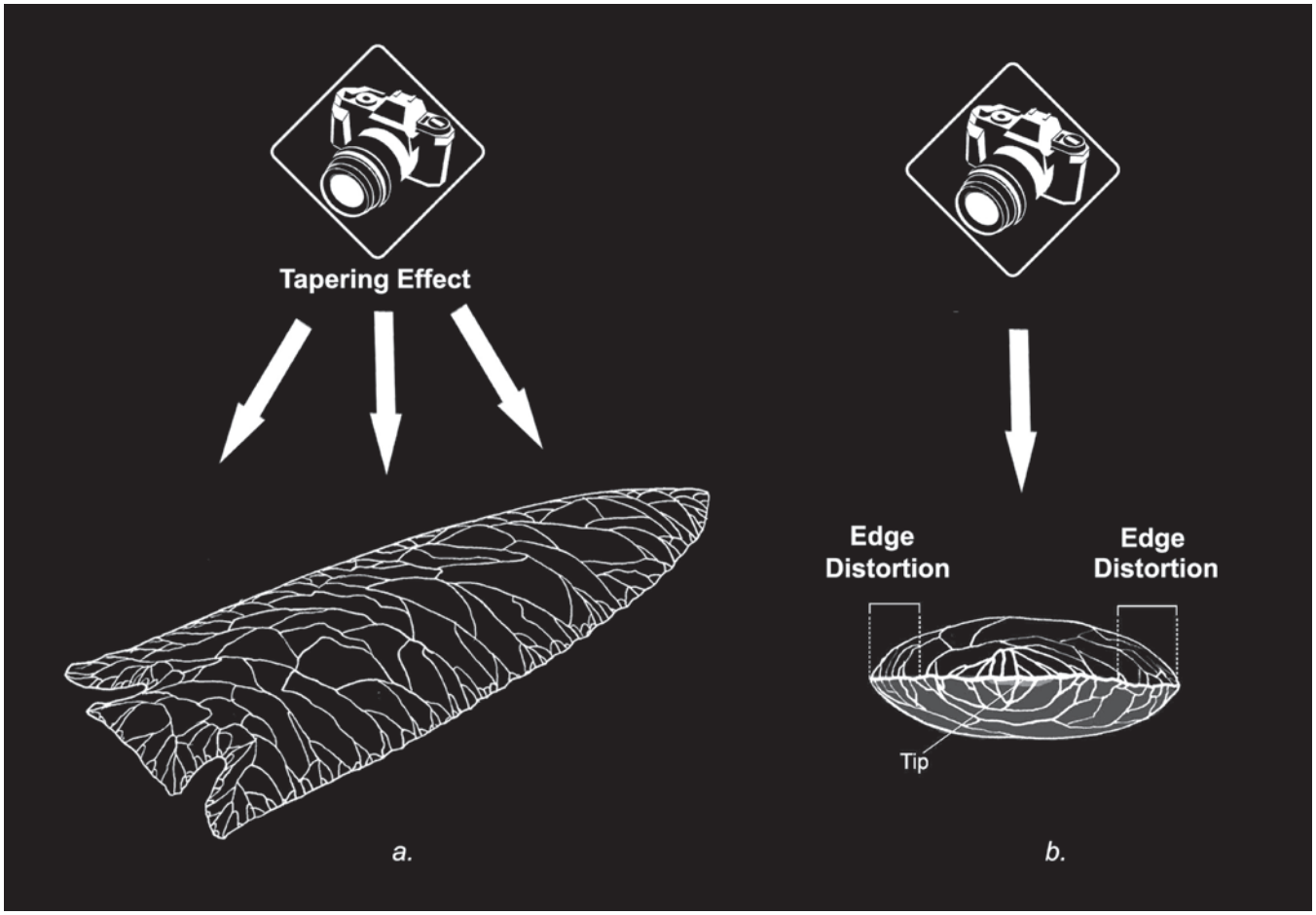

FIGURE 1. Graphic showing (a) the tapering distortion that occurs at the ends of a flaked stone spear point when using a single perspective representation, and (b) those areas along the rounded edges of the same spear point that are distorted or obscured when using a single perspective representation (by Eric S. Carlson).

data visually. The new technologies, coupled with graphics software like *Adobe Illustrator*, *Adobe Photoshop*, *ArcGIS*, and others, allow the production of high-quality, accurate, multi-scalar images that are relatively cost-effective and that link well with the digital nature of today's publishing industry. It is unsurprising that their use has permeated the discipline, and is supplanting traditional hand-drawn illustrations.[1]

As illustrators and archaeologists move away from using hand-drawn images (of hand-held, real-life objects) to visually depict artifacts and other archaeological information in their publications, certain capabilities of the traditional illustrative process are lost. One such loss, and the subject of this article, is the ability of the hand-drawn illustration to present a complete and informed representation of an artifact free of the distortions and visual limitations that single-perspective (e.g., digital or photographic) imagery produces. This is accomplished when the illustrator unifies multiple views of the artifact, from various perspectives and from varying light sources, into a single two-dimensional (2D) image that (ideally) communicates clearly to the viewer important attributes of the entire artifact, free of distortion and with relational accuracy, while remaining true to the measured, analytical conventions of the illustrative process.[2] Digital imaging, even 3D scanning in which one can rotate and explore an exact digital avatar of an artifact on a computer screen, limits the viewer to a single viewpoint of the object at any single moment in time and contains inherent distortions and visual limitations caused by the object's shape.

Liberation from the single-viewpoint perspective was one of the fundamental elements of the Cubist movement, which began in early twentieth-century Paris (Golding 1988). Cubism, considered by some "the most important and certainly the most complete and radical artistic revolution since the Renaissance" (Golding 1988:xiii), originated as an analytic art, attempting a more conceptual and intellectual approach to depicting the structure of objects. Early Cubists, such as Georges Braque and Pablo Picasso, who were both inspired by Paul Cézanne and by the masks and sculptures of African and Polynesian carvers, sought to depict objects more knowledgeably, more completely, and free of the illusionary tricks of traditional painted perspective (i.e., foreshortening, vanishing points, and *chiaroscuro*). In the process, "the early Cubists took the great step, as Kahnweiler puts it, and pierced the 'skin' of objects, reducing them and the

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FIGURE 2. Eight "snapshots" of a 3D scanned Mimbres bowl taken from various perspectives. Online resource at the Arizona State Museum's 3-D Pottery Storeroom. Snapshots altered and arranged by the author.

world in which they existed to what we would now call subjective process" (Motherwell 1949:vii).

In an effort to represent an object as it exists, rather than how it is perceived, archaeological illustration utilizes many of the original Cubist principles that fueled the movement, including the practice of representing objects or artifacts as a fusion of various viewpoints. Such conceptual representation is critical to the illustrator when important attributes of an artifact need to be communicated, in whole, to the viewer, but the structure of the object interferes. Often it is necessary for the illustrator to shift his or her viewpoint multiple times across the surface of a large artifact to avoid distortion, or to "see around" its curved edges to illuminate important attributes. In these cases, the freedom of the illustrative process allows the presentation of a complete package of information about an object.

The process of drawing from multiple perspectives is subtle and often unknown to the viewer. The illustrator uses this technique in two very different ways. Most commonly, illustrators draw as they move down the length of a stationary object, viewing and drawing from a variety of locations along this course. This allows the object to be drawn without the distortion inherent in the single-perspective or realist depiction in which, for example, the edges taper out with perspective, not only obscuring much of the fine detail of the artifact but also distorting its shape and size. Figure 1 shows how a flaked stone spear point can be distorted when viewed from a single perspective point at a single moment in time. Problems of perspective and distortions are corrected by utilizing the multiple-perspective approach.

In a more complex use of the concept, various oblique viewpoints of a rotating object can be combined in the illustrative process to create a single two-dimensional (2D) image. In Figure 2, for example, multiple views of a 3D scanned Mimbres bowl are presented.[3] Each view is a snapshot taken as the bowl is rotated on the author's computer screen. Stuck in a single moment of time and confined by a single perspective, each snapshot presents only a portion of the complete painted design, and portions of the design are distorted by perspective. Though the snapshot taken from directly above the bowl nearly captures the complete design (upper left of Figure 2), those areas of the design near the rim are indecipherable. In order to overcome the distortions and visual barriers caused by the structure of the bowl shape, the illustrator conceptually separates the design from the bowl form and fuses the many incomplete snapshots in Figure 2 into a single 2D representation of the complete painted design (Figure 3). Another way of describing

FIGURE 3. Illustration of the Mimbres bowl from Figure 2, combining multiple perspectives (by Eric S. Carlson).

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this process is—temporally—in the illustrative process, time is "stretched" beyond the moment of a snapshot to the duration it takes to move around the vessel or to rotate the vessel in one's hands, capturing and fusing into one the many perspectives viewed in the process.

In both examples of *simultaneity*, a Cubist term used to denote the simultaneous viewing of multiple perspective points, the illustrator is conceptually "lifting" selected attributes from the 3D form of the artifact (in these cases, the flake scar patterning of the spear point and the painted design of the bowl) and translating them in their entirety into 2D.

The following paper further details the traditional illustrator's use of Cubist principles in generating artifact illustrations of flaked stone tools and painted ceramic vessels and, in another common application, the documentation of rock art. These principles and techniques are then extended theoretically to the process of rendering archaeological reconstruction illustrations, in which an informed visual image of a site is created, showing what the buildings, people, and activities may have looked like when that site was occupied. Reconstruction illustrations provide a unique ability to visually present varied and even seemingly conflicting interpretations of a site in a single image (Carlson 2012; Carlson et al. 2010). Important throughout this discussion is the tension between conceptual and realist approaches in depicting the past. Though incredibly accurate and useful, digital imaging technologies and photography provide only surficial views of objects and are limited to a single viewpoint that obscures and distorts portions of the complete artifact—a limitation only of our own perception and not of the object itself. The Cubist painters rebelled against surficial (or realist) representations of objects and the Impressionists' focus on color and light, with the aim of presenting a more essential, complete, and informed representation of objects (Golding 1988), one in which the conflict of structure and representation is reconciled (Kahnweiler 1949:1).

This article is in no way an attack on new digital imaging technologies. As an illustrator myself, I utilize digital photography, digital scanners, and graphics software and have come to rely on them to enhance the quality and accuracy of my hand-drawn illustrations. The recent inundation of these new technologies into the archaeological discipline simply provides a context for reassessing and discussing aspects of traditional archaeological illustration and for sharing certain archaeological illustration techniques that may be unfamiliar to some readers .

CUBISM AND SPLIT REPRESENTATIONS

Cubist painters in the early twentieth century revolutionized Western art by breaking free of the single-perspective, realistic style of representation that had been in place since the 1500s (Miller 2001). These new artists, supported by members of the Paris *avant-garde* and greatly influenced by tribal art[4] of Africa and Polynesia, were part of a larger Modernist movement that also involved literature, physics, philosophy, and music (Miller 2001). Modernism, powered by advances in science and technology (i.e., photography, X-rays, airplanes, and wireless telegraphy) challenged common notions of space and time and grew to question certain paradigms that had come to define a narrow, positivist point of view. As summed up by Motherwell (1949:vii), Modernism revealed that, "all thought and feeling is relative to man, he does not reflect the world but invents it."

In the visual arts, Pablo Picasso and Georges Braque expanded on the earlier work of Paul Cézanne to produce images free of the restrictive paradigm of realistic and figurative imagery that relied on single perspective vanishing points (Golding 1988), challenging the legitimacy of such a limited reality and even the reliability of the realist painter's perceptions.

A variety of non-Western cultures had been practicing advanced and highly stylized techniques for depicting 3D forms and designs in two dimensions long before the early Cubists (and long before archaeological illustrators!). One such technique, known as split representation, was utilized by cultures of the Northwest Coast of North America, New Zealand, China (Amur Region), and Brazil. Franz Boas (1927) and Levi-Strauss (1963) have written extensively about the technique in which the indigenous artist, to present a 3D design on a flat surface, "splits" the design in half, and unfolds the sides onto a flat plane, resulting in a multiple-perspective image with two sides and the front of the design being shown simultaneously. Boas uses a carved Tlingit bracelet to describe split representation:

> In the decoration of a silver bracelet a similar principle is followed but the problem differs somewhat from that offered in the decoration of square boxes. While in the latter case the four edges make a natural division between the four views of the animal,-front and right profile, back and left profile,-there is no sharp line of division in the round bracelet, and there would be great difficulty in joining the four aspects artistically, while two profiles offer no such difficulty … The animal is imagined cut in two from head to tail, so that the two halves cohere only at the tip of the nose and at the tip of the tail. The hand is put through this hole and the animal now surrounds the wrist. In this position it is represented on the bracelet … the transition from the bracelet to the painting or carving of animals on a flat surface is not a difficult one. The same principle is adhered to. [Boas 1927:222-224]

Continuing this thought, Levi-Strauss (1963:46) notes, "The principle of split representation would gradually emerge in the process of transition from angular to rounded objects and from rounded objects to flat surfaces." The principle is used by archaeological illustrators to present attributes of archaeological artifacts (such as painted designs on curved vessels) that are split and lifted from the rounded form on which they reside and then rendered as a 2D drawing. Part of the technique involves *dislocation*, a process by which visual elements are deconstructed from the original form and then reassembled (or retranslated) onto a 2D image (Levi-Strauss 1963).

Figure 4a shows a split representation Haida bear design. Note how the "skin" of the bear has been split vertically along its back, and the sides of it unfolded to the front and flattened to the left and right of its frontal axis (dashed line). The two sides now meet face to face at the point where it coheres (one can easily imagine the design carved in three dimensions onto a

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FIGURE 4. (a) Split representation painting of a bear, Haida, from Boas 1927 (reprinted with permission of Dover Publishing); (b) Portrait de Dora Maar, 1937, by Pablo Picasso. Musee National Picasso, Paris (© 2014 Estate of Pablo Picasso/Artists Rights Society (ARS), New York). Online resource: http://www.ago.net/ago-to-present-major-picasso-exhibition-in-2012#

wedge-shaped mask or totem pole). In the 2D design, the head is presented in both profile and straight on (two profile views placed nose to nose, which together form a second perspective: the straight-on view of the face). The mouth extends between the profiles and is shared by both halves, serving as a unifying presence in the design and allowing the image to be seen, ingeniously, in both perspective and straight-on facial views simultaneously. Figure 4b shows the same principle utilized by Picasso in his *Portrait de Dora Maar, 1937*. Here, the artist has taken both left and right profiles and the frontal view of the face and presented them as a unified whole.

Levi-Strauss (1963:62) presents a dramatic illustration of a Maori chief's facial tattoo as another cultural example of the use of split representation (Figure 5). As in the case of the Haida bear design, the tattoo is comprised of two profile views of a highly stylized face that meet along a vertical, central axis, nose to nose at the point at which they cohere, together forming a complete frontal view. Figure 5 is doubly informative in the context of this discussion because the artist has employed the multi-perspective technique in the "lifting" of the tattoo design from its structure (the face of the Maori chief) and translated it into a 2D illustration. In the illustrative process, the design is simply "unfolded" and flattened onto a single plane. What separates archaeological illustration from this depiction is that the archaeological illustrator must refit the complete, unfolded design within the measured/to-scale outline of the face (as would be conventionally done when translating the flake scar patterning or a painted design into the to-scale outline of a projectile point or the rim circumference of a ceramic bowl).

ARCHAEOLOGICAL ILLUSTRATION

The function of the archaeological illustration is to convey an informed package of information about an object to the viewer. The illustrator, often working in collaboration with an archaeologist, first conducts a thorough analysis of the object and identifies attributes that are archaeologically important. These attributes are then highlighted in the illustration, while less salient attributes are de-emphasized or even omitted. It is a subjective process that presents not only descriptive information, but also an interpretation of that information (Adkins and Adkins 1989). Assessments of the function, history, and relevance of the artifact are made and communicated through the drawings. In much the same way, Gertrude Stein describes Picasso's Cubist paintings in the opening quote of this article. The illustration is a representation of what is *known* about an object, and not simply how we perceive it.

For example, in illustrating a flaked stone spear point, certain attributes are critical to document visually in the drawing. The most important of these include the precise dimensions of the artifact, the flake scar patterning, culturally or temporally diagnostic features, and use-wear. Less important attributes that are omitted from the illustration are color and (usually) texture, as well as the 3D form of the artifact. Much like the split representation, the important attributes of the spear point are "lifted" from the lenticular form and redrawn in 2D. This allows the attributes to be presented visually in their complete form without the structure of the artifact obscuring or distorting them. The illustrator uses subtle inking tricks to direct the viewer's attention to the most salient attributes of the artifact and to give suggestions

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FIGURE 5. Maori chief's drawing representing his own tattooed face. After H.G. Robley, *Moko, or Maori Tattooing,* from Levi-Strauss (1963). Reprinted with permission of Basic Books.

of the object's 3D form. Throughout the illustrative process, the illustrator is viewing the artifact from multiple perspectives, turning and rotating it constantly, pulling it closer to the eyes or squinting at it from a distance, and utilizing a variety of light sources. The varying viewpoints, the extended duration of time involved in the drawing process, and the knowledge gained through analysis are combined to form the illustration.

To effectively convey information visually, the illustrator utilizes established illustrative conventions, a visual language that can be understood across the globe and through time. Conventions determine how an artifact is oriented on a page, where a cross section is placed, what type of pen lines or stippling are used, and how to depict use-wear along edges. Conventions for illustrating stone tools are described in detail in the work of Addington (1986), Chase (1985), Dauvois (1976). For discussion of a wider range of artifacts, including ceramics, see Adkins and Adkins (1989) and Dillon (1985). In conveying knowledge about the artifact through visual means, it is critical that the illustrated image be clean, reproducible, and exude a clear sense of what is important about the object. One of the benefits of the illustration over the photograph is that an illustration can be reproduced to third or fourth generation copies and still be legible (this anachronistic practice is still important to the field archaeologist who relies on photocopied site forms when revisiting sites.).

When teaching archaeological illustration workshops, I present a ranked list of illustrative goals that guide the illustrator through each drawing. Table 1 summarizes these goals and notes the limitations of realist or photographic representations in meeting them.

With these goals and functions of illustration in mind, I now present a discussion of how Cubist concepts are utilized by illustrators when drawing two common types of artifacts: flaked stone tools and painted ceramic vessels. I then move on to the documentation of rock art. Cubist techniques and concepts are expanded to a more theoretical application in generating reconstructed images of the past. All of the examples in the following discussion involve past or present projects of mine.

FLAKED STONE TOOLS

Flaked stone tools include those tools (and weapons) manufactured by the removal of flakes from the outer edges of a stone, either through percussion blows with a billet or hammerstone or by pressure flaking with an antler tine. As flakes are removed throughout the lithic reduction sequence, the form of the object takes shape and leaves a patterned "texture" across both faces of the tool consisting of concave flake scars separated by narrow ridges. Accurately depicting the flake scars reveals not only the sequence of flake removals, but also the culturally and temporally diagnostic manufacturing techniques and evidence of retouch or use-wear. As noted above, the flake scar pattern and other archaeologically important aspects of these objects "lie" upon the curved, lenticular surface of the object. Flaking detail and use-wear along its more abrupt or rounded edges may be obscured or distorted when viewed from a single perspective directly above the artifact. Tapering distortion at the ends of the artifact may also be a concern (see Figure 1).

To avoid distortion and other limitations of the single-perspective representation, the illustrator utilizes the Cubist technique of multiple-perspective drawing in which various viewpoints are combined into a single 2D image. When drawing a flaked stone tool, the illustrator shifts his or her point of focus across the surface of the artifact, from top edge to bottom edge and from left to right, stopping at multiple points along the way to draw the small portion directly below eye level. Importantly, the illustrator has the artifact in hand and is constantly turning or rotating it into varying light sources, continuously analyzing the piece to gain a deeper understanding of the specific area being drawn and how it integrates with adjoining areas.

This process is not unlike drawing stratigraphic profiles or architectural elevations. With profiles, for example, field archaeologists begins at one end of a balk or trench wall, drawing only the small portion of the profile directly in front of them. When finished with that area, they move two or three paces down the line, stop, and continue the drawing by depicting the new area directly in front of them. In the end, five or more perspective points will have been utilized, all of which are combined into the single profile drawing. By doing this, field archaeologists avoid the tapering distortion that would occur at the ends of the profile if they were to draw (or photograph) from a single, central perspective point.

To illustrate a projectile point from the central Alaskan Mesa Site,[5] the outline of the artifact is first carefully traced with the aid of a small piece of kneaded eraser placed on the underside of the point to anchor it to the drawing paper and keep its orientation flush with the surface of the paper. In outlining, the illustrator positions his or her eye and head directly above the

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TABLE 1. Ranked List of Goals for Illustrating Artifacts.

Rank	Goal	Realist/Photographic Limitations
1	To convey accurate dimensions (width, height, thickness) of artifact, not only of the outline, but also of diagnostically important features.	Artifact photos and realist depictions are distorted by perspective, especially at the edges of the artifact, where perspective "tapers out" those areas at the periphery of the focal point. The thickness of the artifact raises its top surface from the background, causing the lower portion of the artifact to "taper down," resulting in discrepancies in scale. Shadows may obscure portions of an artifact. All of these factors make measuring dimensions of an artifact from photographs unreliable.
2	To convey method of manufacture. For example, flake scar patterning reveals method of manufacture and stage of manufacture for flaked stone tools. Other stone tools are made from pecking, grinding, or polishing.	Flake scar patterning, grinding, and pecking are often not visible in a photograph because of shadows, color, and texture of the artifact.
3	To convey the function and history of the artifact. Revealing how a stone tool was used involves analyzing its edges for evidence of polish from working hides, sheen from cutting grasses/plants, striations from "sawing," step-fractures or battering from hammering, etc.	These details are often too subtle to show up in photographs without zooming in. Illustrations allow the rendering of the complete artifact with the subtle use-wear enhanced and clearly visible.
4	To highlight unique/idiosyncratic characteristics, such as decoration and other stylistic attributes that express the character of an artifact or the individual who created it. Illustrations must present the complete, undistorted decoration as accurately as possible. This may mean "seeing around" the curved edges of the artifact to show hidden portions.	Photographs and realist depictions of decorations on artifacts are distorted by the shape of the artifact and are often incomplete. Photographs do not differentiate between carved decoration and natural cracks that may be mistaken for decoration.
5	To highlight qualities of the base material the artifact is made from. Natural imperfections in stone that might have affected its manufacture should be represented. Bone and antler tools should be drawn to emphasize any distinguishing characteristics that identify the material by species, or bone element.	Photographs and realist depictions cannot distinguish between diagnostic and non-diagnostic attributes of bones, or between the general texture of stone and imperfections that may have affected an artifact's manufacture.

pencil tip at a point along the edge of the artifact. As the pencil moves around the periphery, the illustrator's eye and head move as well, always staying directly above the pencil tip. The ever-changing, fluid perspective point allows for the most accurate documentation of the outline and, thus, the dimensions of the object, probably the most critical information conveyed in the illustration.

Once the outline is completed, the flake scar pattern and other attributes are "lifted" from the curved body of the artifact, translated in their entirety into two dimensions, free of both distortions of the artifact's shape and distractions from color and texture, and fit within the traced outline of the artifact. Figure 6 shows the various perspective points used when illustrating the Mesa Point. As noted above, the artifact is constantly being rotated, held up to various light sources, viewed with hand lenses, etc., so that the area being drawn is thoroughly known and understood, and integrated with adjoining areas.

Figure 7a visually shows the "lifting" of the flake scar pattern from the form of the artifact and the redrawing of it in two dimensions. Note how the flake scar pattern, when simply unfolded along its central axis and flattened out, is larger than its traced outline (Figure 7b). In translating it into 2D, then, the illustrator must slightly reconfigure (through a process of *dislocation*, to use Levi-Straus' term from above) the flake scars to allow them to be visible in their entirety, especially along the more curved surfaces near the edge (Figure 7c). In this case, the slight proportional compression of the flake scar patterning across the peripheral regions of the design allows the small flaking scars, retouch, and basal grinding along the edges to become visible in the illustration. This is done without compromising the inter-relationships of the complete flake scar patterning. The slight compression of the flake scars in some areas of the illustration is unavoidable when translating the curved, 3D pattern into two dimensions. Remember that the single-perspective photograph is much less accurate in documenting the sizes of flake scars because of the curved form of the artifact and the tapering effect of perspective, especially along the rounded edges; the structure of the object conflicts with the accurate representation of the flake scar.

In Figure 7d, the flake scar pattern is shaded lightly with rings of compression radiating from the point of impact of the flake removal strike, giving a dynamic/active quality to the piece where the viewer can imagine the placement, motion, and

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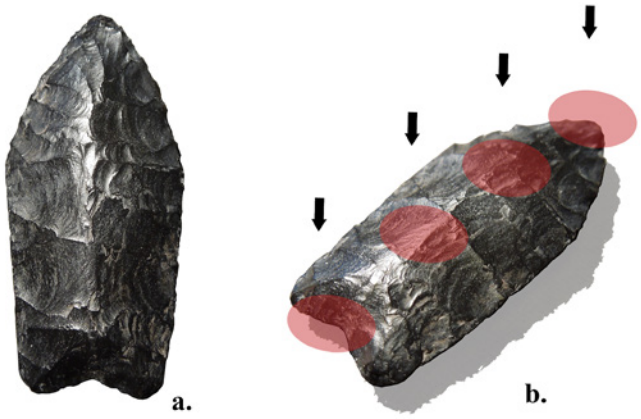

FIGURE 6. (a) Photograph of a cast of a Mesa Point, and (b) graphic showing various perspective points used by the illustrator (arrows), and the areas of the artifact associated with them (red circles). Photo by Eric S. Carlson.

sequencing of the lithic reduction process. Shading is light enough to show details of retouch along lower lateral sides. Shading is also used to revive an impression of three-dimensionality across the entire artifact (even though this is a 2D representation), utilizing a light source at the upper left. The shading is lightest at the upper left and grades to darkest at the lower right. In actuality, a variety of light sources are utilized throughout the illustrative process, as the illustrator rotates and analyzes the artifact in their hands; however, the final illustration must, by convention, return to the single, upper left light source.

PAINTED DESIGNS ON CERAMIC VESSELS

A more advanced use of Cubist-based multiple-perspective drawing is utilized in the illustrating of painted designs on ceramic vessels in which multiple oblique viewpoints are combined to form a single 2D illustration that captures the completeness of the artifact. Whereas flaked stone tools are illustrated using varying (but controlled) viewpoints perpendicular to the face of the artifact, fusing multiple oblique viewpoints allows the illustrator much more freedom. The process is more subjective, even hermeneutical, as it involves the interpretation and translation of the design from its 3D form to a flattened 2D form. As stated earlier in this paper (see Figure 2), single-perspective representations of painted designs are often incomplete and distorted by the structure of the vessel shape they are painted on. Even with a 3D scan in motion, rotating on the computer screen, it is difficult to understand the interrelations and underlying structure of the design because, again, only a portion of it is visible at any one time.

Presenting the whole painted design from a ceramic vessel in a 2D illustration allows the viewer to discern the (often subtle) interrelationships and integration of the various design elements that comprise the overall pattern. "Structural grammar," design layout, and design symmetry are more clearly discerned in the 2D drawing (Hodder 1982; Wallace 2004; Zaslow 1977). Importantly, because illustrators must understand how the design was painted before they can reproduce it in two dimensions, the

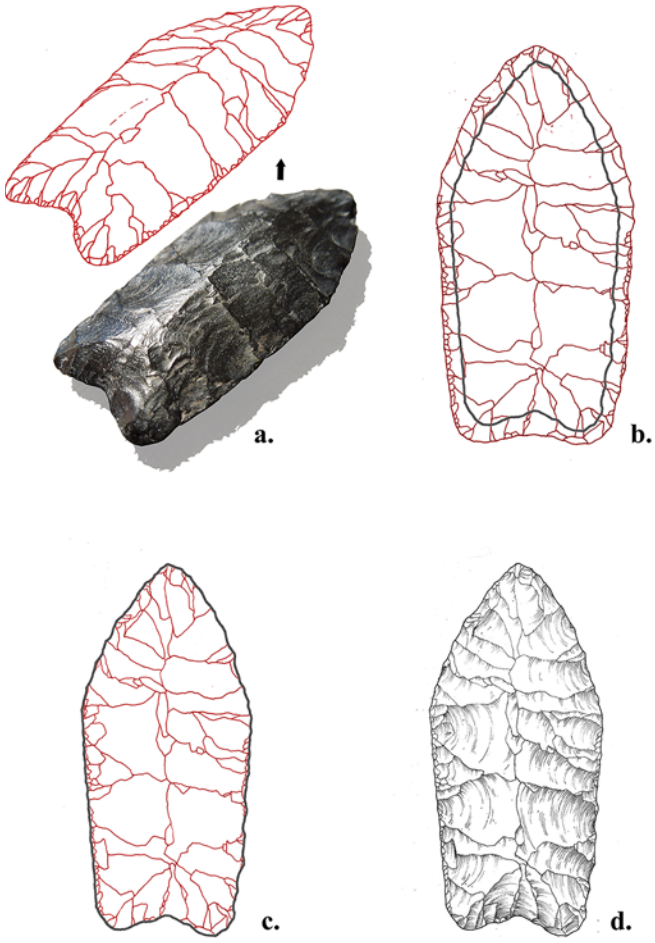

FIGURE 7. Sequence of illustrations showing the "lifting" of the flake scar pattern from a Mesa Point and the translating of it into two dimensions. Photo and illustrations by Eric S. Carlson.

illustration functions to convey knowledge about the design structure to the viewer, often subconsciously.

Illustrative roll-outs are conventionally used to represent painted designs on the outsides of bowls and jars, and illustrative circular footprints are used for design elements painted on the interior surface of bowls. In both cases, illustrators utilize Cubist principles of multiple-perspective drawing to represent the complete design, free of its 3D form. Two illustrations of painted ceramic vessels from the Hohokam site of Snaketown in southern Arizona serve as an example for this discussion. In Figure 8, a large jar viewed from a realist/photographic angle shows only a portion of the exterior painted design from any one perspective. In illustrating this piece, in a process not unlike split representation, discussed earlier, the design is separated from its vessel form and re-drawn in its entirety as a 2D illustration. This is done by consolidating hundreds of visual "snapshots" of the vessel from multiple angles around the entire vessel and presenting them simultaneously in a "roll-out" design (Figure 9).

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FIGURE 8. Hohokam jar with painted exterior design shown in single perspective. Photograph by Janelle Weakly, Arizona State Museum. Archaeology Southwest, Tucson, AZ provided access and permission for the use of this image.

To accomplish this, a thin strip of tracing paper is looped around the vessel where the circumference is widest, and prominent design elements are traced that function as reference points, or guides. The strip is removed, cut, and laid out flat on a larger sheet of paper. The illustration is made by tracing over the strip and utilizing the mapped-in elements as spatial guides, keeping within the circumferential length of the vessel. A vertical datum or frame of reference is placed against the actual jar throughout the process to aid the illustrator; upright triangles work best. A portion of the painted design is drawn from one angle, and then the vessel is rotated one-eighth of a turn and the drawing is added to from this new perspective point. Though the process is one of "rolling-out," what is being presented in the illustration is the complete painted design, as if it were being viewed simultaneously from multiple viewpoints around the vessel.

Some distortion of the design occurs in the roll-out because of variation in the ceramic vessel's circumference. The upper portion of the roll-out illustration is stretched wider to match the longer circumference of the wide lower shoulder of the vessel. The illustration, however, maintains a holistic or gestalt quality from which the viewer can clearly discern the structural elements that comprise the overall design. In this case, it consists of six pairs of lizard motifs; the upper lizard of each pair is set within one of six panels defined by triangular forms originating at the rim. Eccentricities of the design include the one exceptionally large lizard and intentional gaps left along the top and bottom of the design.

In Figure 10 are two depictions of a painted ceramic bowl, also from the site of Snaketown. The left side shows a photograph of the vessel taken from directly above it. Note how the steep walls of the bowl compress and distort the design elements when seen from this single point of view. The hand-drawn image on the right has corrected the distorted portion of the design by utilizing the multiple-perspective approach. By rotating the bowl and viewing it from oblique angles, the illustrator is able to capture all portions of the design without distortion and compress them into a single 2D image. For accuracy, the painted elements within each rectangular, triangular, and square shape that structure the overall design, including each row of "tic marks," were traced directly from the actual bowl, reduced slightly in size, and then placed within the larger pattern.

The illustration clearly communicates that the general design is constructed from four rectangular shapes originating along the edges of an open square in the center of the bowl and extending out to the rim of the vessel. Concentric triangular shapes fill the gap between the termini of the rectangular shapes along the rim. Interlocking scrolls, meandering lines, and rows of tic marks act as secondary design elements filling in the open spaces of the larger structural elements. The accurate representation by the illustrator of these secondary elements is critical to the analysis of the vessel, especially when discerning subtle patterns in design layout and symmetry (Wallace 2004).

ROCK ART

Rock art imagery on uneven or faceted surfaces of large boulders or cliff faces is rendered by the illustrator in a way similar way to the depiction of painted designs on ceramic vessels and the flake scar patterning on flaked stone tools. The rock art design is separated or "lifted" in its entirety from the curved, 3D form and translated into a 2D illustration, albeit at a larger scale (and often during inclement field conditions involving rain and mosquitoes!). A recent project of mine in northwestern Alaska serves as an example for this section.

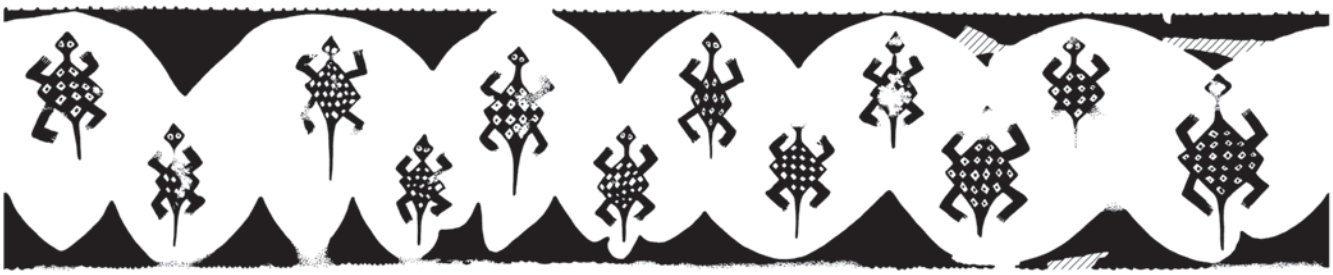

FIGURE 9. Roll-out illustration of the Hohokam jar from Figure 8. Note: cross-hatching denotes missing sherds and stippling denotes faded portions of the original design. Illustration by Eric S. Carlson. Archaeology Southwest, Tucson, AZ provided access and permission for the use of this image.

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FIGURE 10. Left: Sacaton red-on-buff painted pot from the Hohokam site of Snaketown (photograph by Janelle Weakly, Arizona State Museum); Right: Illustration by Eric S. Carlson. Note: blank spaces in the center of the illustration on the right represent missing sherds on the reconstructed vessel. Archaeology Southwest, Tucson, AZ provided access and permission for the use of these images.

The National Park Service and the Museum of the North cosponsored a team of archaeologists in 2011 and 2012 to record rock art and conduct subsurface testing at three late prehistoric villages in the Western Brooks Range (Shirar et al. 2012). At one village site (XHP-00017, Desperation Lake) the remains of a semi-subterranean rock-lined qargi (ancestral Inupiat ceremonial structure), situated in the center of a cluster of residential pithouse depressions, revealed pecked and incised rock art designs. One boulder, 32, contains an elaborate integrated design of pecked and incised lines, and cupules extending across four of its faces (Figure 11). When photographing the boulder from any single perspective, only an incomplete portion of the entire design is visible. By presenting multiple views of the boulder simultaneously, in a single illustration, the completeness of the design can be represented and better understood by the viewer (Figure 12).

To accomplish this, the illustrator first traces all portions of the design by draping pieces of clear plastic acetate over the various faces of the boulder and using a wax pencil to draw the edges of the lines and cupules. The tracings are then taped together and flattened to form a Mercator-style collage. The final step is to translate the tracings into a cohesive and integrated design that captures the workings and character of the whole design. This is accomplished by tracing over the rough acetate drawings with a clean sheet of tracing paper, using the top of the boulder as the natural center of the illustration. The petroglyphic designs on the sides of the boulder are simply drawn as extensions from the center and integrated through this point. Slight altering of the design is necessary, especially along the edges of the boulder (which get splayed-out in the flattening of the design field tracings). However, the relationships between the elements and the character of their manufacture remain intact. In this technique, the illustrated design is not confined within the outline of the boulder (as is the case in the Mesa Point and the Snaketown painted bowl examples in Figures 7 and 10, respectively). This allows for a more spatially accurate representation. One is reminded of the split representation technique discussed earlier in the article, where the design is "cut" and the sides then unfolded forward to a flattened plane, releasing the design from the form of the boulder.

The complete design layout is presented in its entirety, free from the distortions of perspective and the distractions of the boulder's natural color, texture, and lichen growth (see Figure 12). There are also no visual impairments from the boulder's structure. The illustration shows the design dominated by the centrally placed concentric ovals across the top surface of the boulder, intersected by vertical lines running down the interior and exterior faces. Clusters of cupules dominate the lower or outermost areas of the design.

RECONSTRUCTION ILLUSTRATIONS

Visual depictions of the past, sometimes referred to as archaeological reconstruction illustrations, provide an opportunity to simultaneously present multiple views of the past from the archaeologists' theoretical perspective. Similar to a variegated Cubist painting broken into geometric facets or constructive elements, each unfolded to reveal unseen but known information, a reconstruction illustration communicates to the viewer a variety of archaeological data in a single, informed, and accurate image of the site. Conducting archaeological research today is an increasingly collaborative endeavor, and it is clear that a

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FIGURE 11. Photograph of petroglyph 32-1 at site XHP-00017, Desperation Lake (photo by Eric S. Carlson; image used with permission from the National Park Service).

single point of view, offered by a single individual, is inadequate to understand or interpret the complexities of the past.

Archaeological analysis involves specialists from many sub-disciplines (lithic and faunal analysts, micromorphologists, geomorphologists, etc.) who contribute unique knowledge to the overall understanding of a site. Archaeologists also work closely with members of indigenous communities and, although the two groups may, at times, have differing concepts of the past, both have a shared interest in preserving, learning, and communicating knowledge about it. Each of these contributors to the archaeological process has a unique and varied perspective of a site and its environmental and cultural contexts. Creating an illustration of the site is a means by which each stakeholder and specialist can communicate and contribute to the overall understanding and interpretation of the site.

By establishing an open dialogue with the illustrator, each stakeholder can participate in the process of creating an illustration based on the data, incorporating his or her specific research (or viewpoint) into the larger understanding of the site and, importantly, avoiding the projection of modern stereotypes into the past (Carlson 2012; Carlson et al. 2010; Gifford-Gonzalez 1993; Moser 2004). For instance, a faunal analyst may identify a certain butchering practice that occurred at the site in their analysis and ask for an illustration showing a person performing that activity. A micro-morphologist who identifies a particular layered construction technique for the prepared floor on which the butchering activity occurred may then request a cut-away drawing, below the butchering scene, that shows floor stratigraphy in profile. A lithic analyst may identify microwear polish on stone tools recovered near the butchered bones during the excavation and suggest that the illustration also incorporate plant processing by showing discarded tools and processed plant remains in a basket near the butchering scene. This process continues as other specialists incorporate their findings into the developing image. The process allows all contributors a means not only to communicate their specific findings through a single illustration, but also to explore how their findings interrelate with the findings of others. Figure 13 shows how the results of a similar combining of archaeological data can be presented in a single reconstruction image.

The idea of Cubist multi-perspective imagery and interpretation in reconstruction illustrations is further illustrated by a recent project that integrated two very different views of the past into

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FIGURE 12. Multiple-viewpoint illustration of Petroglyph 32-1 at site XHP-00017, Desperation Lake. (illustration by Eric S. Carlson; image used with permission from the National Park Service).

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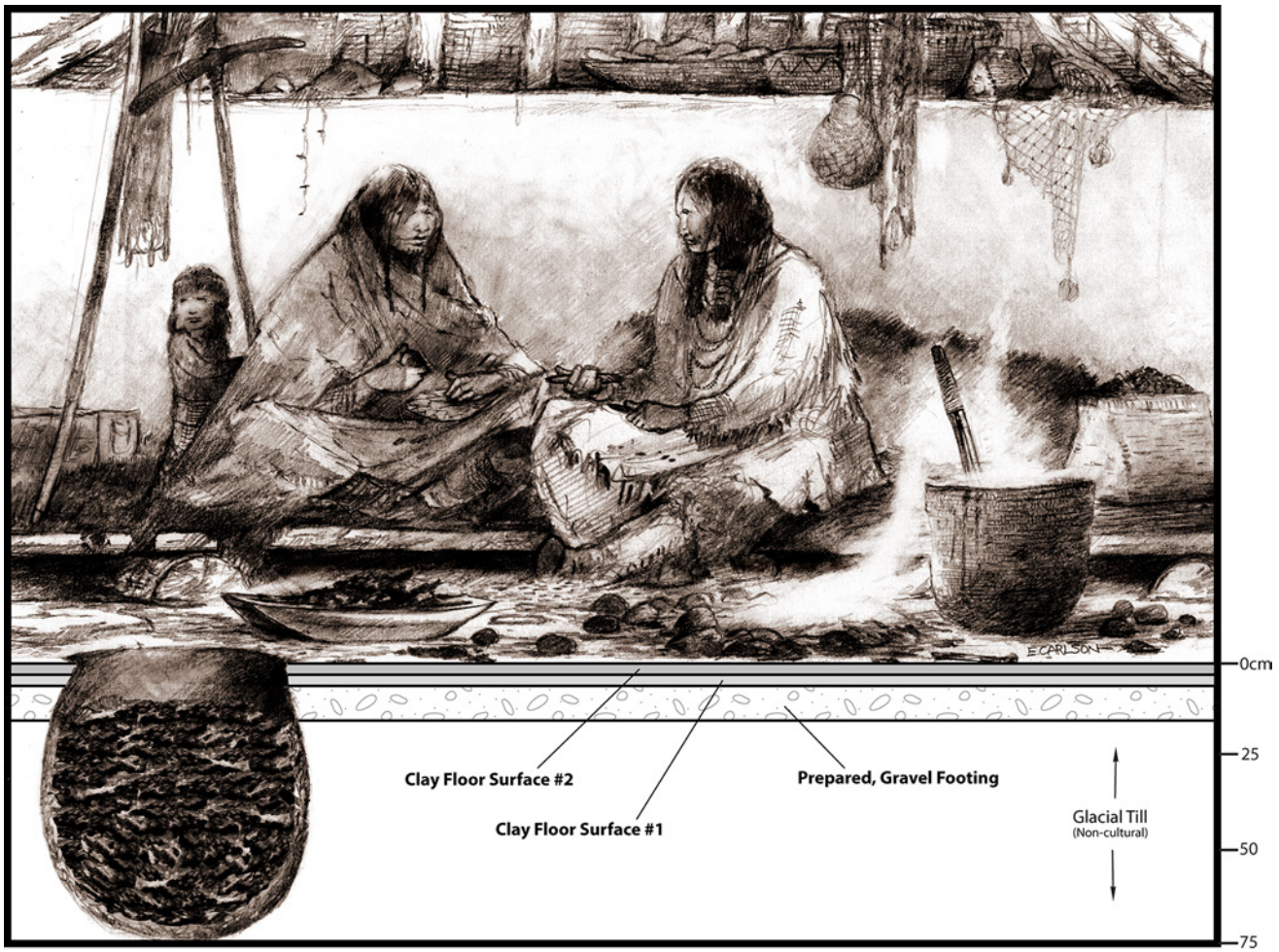

FIGURE 13. Reconstruction illustration of a pithouse interior, Mid-Fraser Region, British Columbia, by Eric S. Carlson. In Prentiss and Kuijt (2012). Used with permission of the publisher. Note: illustration has been altered for use in this article.

a single image. Archaeologists from Simon Fraser University worked in collaboration with members of the Xaxli'p Band of the St'at'imc Nation to excavate a small site that was eroding out of the embankment near Fountain Rapids, an important fishing location in the Middle-Fraser River Region in southern British Columbia, Canada (Villeneuve and Billy 2008; Villeneuve et al. 2011a; Villeneuve et al. 2011b).

In addition to excavating together, both groups decided to have a reconstruction illustration commissioned for the site that would "people" the site and show fishing and fish-processing activities occurring at that location. Careful excavation techniques, field documentation, and the later analysis of the contents of a buried bark storage container at the site were critical for completing the illustration.

As the illustrator in this process, I had access to the archaeologists and members of the Xaxli'p community through a website developed specifically for the project. An evolving succession of draft images was posted on the website, and collaborators were encouraged to post comments about the images. Through the process, we realized that two very different views of the past were at work, and the illustration became a vehicle to present the two perspectives simultaneously. It turns out that the fishing location figures prominently in a St'at'imc Coyote story. In the story, Coyote leads the first spawning salmon from the ocean up the Fraser River and steps out of the water at the rapids near the site, leaving a deep footprint in one of the large fishing rocks. In the drawing, the importance of the place as a fishing location linked to a Coyote story from the deep past is represented simultaneously with an archaeological perspective (Figure 14). The process and presentation opens up possibilities for a shared past and may potentially bridge gaps between archaeological and indigenous viewpoints by presenting them together as one image.

CONCLUSION

In the following discussion I have suggested that new digital imaging technologies, such as digital cameras and 3D scanners, produce distorted and incomplete representations of archaeological artifacts, rock art, and other archaeological items. The reason, as simply stated by Kahnweiler (1949) and borrowed for the title of this article, is that structure and representation conflict: the form of a bowl or the lenticular curve of a flaked stone tool, will always distort or visually impair the viewing of

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FIGURE 14. Reconstruction illustration showing the excavated birch-bark container above the Fraser River, and a depiction from a Coyote story (illustration by Eric S. Carlson, 2011).

the complete artifact from a single perspective. The conflict was reconciled by the Cubists, who challenged traditional concepts of space and time and liberated the representation of the object from both a single-perspective viewpoint, and from a single moment of time. They painted around an object to present not just what they saw but also what they knew about an object, and extended time to a duration in which movement, multiple light sources, and multiple angles were presented as a unified whole. As Miller (2001:10405) notes, an observer of a Picasso painting "stands in one place while watching many different representations of an object unfold in time."

Traditional archaeological illustrators utilize similar principles involving spatial simultaneity and multiple perspectives to visually communicate to the viewer a complete, accurate, and undistorted package of information about an artifact, while adhering to measured, illustrative conventions. By freeing the image from a single, static perspective, the illustrator is able to separate certain attributes of the artifact from its form and present a complete representation that is, in essence, a unification of various viewpoints representing a duration of time and not just a snapshot of it. Split representation is a similar technique utilized by Northwest Coast cultures and the Maori, among others, in which 3D designs carved on wooden masks and figurines are converted onto a 2D plane.

The supplanting of hand-drawn illustrations by digital images in today's archaeological publications threatens to revert the visual representation of data back to uninformed "snapshots" of incomplete objects. Used creatively, however, digital imaging technologies can be an unbelievably useful tool that traditional illustrators can utilize to enhance the accuracy and detail of their hand-drawn images (and to speed up the illustrative process). For example, the painted designs on ceramic vessels can be photographed at various angles and then printed. From the prints, the illustrator then selects undistorted portions of the design to trace and combines them with other views to form a collage that is redrawn as a unified whole. Often the painted design at the base of a bowl remains fairly undistorted when photographed from above, and a print of this can be used as the foundational center of a 2D illustration. Similarly, the central vertical portion of flaked stone tools can be photographed with little distortion. A printed image of this narrow part of the artifact can serve as a foundation for the illustration, with the obscured portions of the outer edge of the artifact being unfolded and pulled up to the foreground through the illustrative process, so that they can be integrated with the photographed portion.

Digital photography and 3D scanning technologies are also useful in capturing the character and contextual nature of objects and rock art—for example, how were these objects intended to be viewed by people in the past and how do *all* of the qualities inherent in the objects together form a whole? Such realist representations should ideally be presented in publications beside the illustration that is rendered for a very different purpose, that is to highlight only certain characteristics of the object and to present them completely and undistorted.

Recognizing that archaeological illustration is a conceptual process, and not simply a process of rendering a realistic snapshot of an artifact, frees the illustrator to utilize techniques that "liberate" the artifact from a single-perspective representation. By practicing a free, variable system of perspective the illustra-

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tor can present an object as a fusion of multiple viewpoints, stretched beyond a single moment of time. In so doing, the illustrator is more effectively able to convey a complete package of information about an artifact to the viewer. Limiting ourselves solely to digital imagery and photographic representations of artifacts constrains what can be communicated visually about them and greatly hinders the potential for innovation in the future, especially as illustrators *unlearn* the potentials of the illustrative process.

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No original data were developed or used in this article.

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NOTES

1 Most traditional archaeological illustrators who once used pen and ink to depict artifacts, maps, and images of the past (reconstruction illustrations) have moved into the digital realm, while a new generation of graphic artists is entering the discipline with limited knowledge of hand-drawn techniques. Artifacts (including stone tools, painted ceramics, and rock art) are now often drawn digitally by simply tracing over high-resolution, enhanced photographs or scans.

2 This process is not to be confused with the common practice of presenting a succession of *separate* illustrations of a single artifact, each drawn from a different angle (e.g., planview and profile).

3 The bowl is one of many 3D scanned/photographed ceramic vessels available online at the Arizona State Museum's 3-D Pottery Storeroom.

4 See Clifford (1988) for further reading.

5 The illustrations and photos are taken of a Mesa Point cast (KIR02-85), Cast #P4 (www.lithiccastinglab.com).

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