COINCIDENCE AND ALIGNMENT: EXAMINING AN ALTERNATE HYPOTHESIS TO EXPLAIN INTERACTIVE PANELS

by

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Those who have seen only a photo or two of shadow template-element alignments on interactive rock art panels often wonder if the alignments are coincidental. While chance correlation of shadow and element shape is possible, the chance of a significant interaction (a series of sequential alignments) occurring coincidentally is minuscule. Because of daily changes in the declination of the sun, any given shadow-element relationship occurs only twice yearly, once as the sun moves north, and again on the complementary date as the sun moves south. An exception is at each solstice (northern and southern extremes of the sun's path), when shadow shape and position are essentially identical for two or three days. Makers of interactive rock art in Utah typically used the shadows as templates on five key days during the half year: Winter Solstice, Winter Crossquarter, Equinox, Summer Crossquarter, and Summer Solstice.

A given template achieves perfect alignment with a target rock art element only once in that 183 day period. Therefore, the odds of one such template-element alignment occurring by chance on one of the five key dates is approximately 5/180. Significant interactions are by definition a series of alignments (a minimum of three alignments during the interaction). The chance of three coincidental alignments during the same interaction on the same day, which also is by chance one of the five key days, should then be 5/180 X 1/180 X 1/180, or 1/1,166,400. Since hundreds of such interactions have been documented, coincidence is not a tenable hypothesis.

However, interactive rock art should not be uncritically accepted as an adjunct to the archaeological tool kit without more direct testing of the coincidence hypothesis. There are ways to directly assess the role of coincidence in interactive alignments. First, by examining documented interactive panels for alignments on other than key days. This approach fails because there may be regional, cultural, or site specific key days other than the ones so far identified. Therefore a day chosen at random might actually be a key day at a given site. Further, panel design uses naturally occurring shadow templates, and given rock formations tend to weather or fracture in fairly uniform ways. Thus an element designed on a key day may show some correspondence (a decayed alignment) with shadows on other days. Additionally, some pecking techniques can (to some degree) force shadow alignments. Second, one could construct a number of rock art panels without observing the shadows, then search for coincidental shadow alignments on key days. This test is impractical unless one owns a cliff and desires to have it decorated with modern rock art. Third, one could assess alignments on a panel previously photo-documented as interactive, *after the gnomon creating the templates had been removed.* Removal of the original gnomon results in new, coincidental shadow templates cast by other rock surfaces. When comparing the original, designed shadow template-element alignments with the new, coincidental alignments, we still would need to consider the tendency of rock formations to fracture or weather in typical ways, and the possibility of forced alignments.

This third test became possible at Panel 6 at McKee Spring in 1992, when a large stone pillar forming the gnomon for afternoon interactions on key dates throughout the year became

dislodged and fell down the slope. Figure 1 illustrates the physical situation for the panel and gnomon before the rock fall.

Before examining the potential for coincidental interactions on key days, I must review the characteristics of interactive rock art panels. I classify interactions as Type A, B, or C. Type A interactions use (typically) alignments involving a wedge (arrow), box, or cup shaped shadow template. Due to declination change, path of a given shadow template (in relation to panel elements) tends to vary vertically each day from the path on previous days. For example, if the sun cup shown in Figure 2 is slightly displaced vertically, it no longer aligns with the element. If either the element or the template were a different size, the element would not fit the template. Even one Type A alignment is thus unlikely to be coincidental. Type B interactions reflect the makers' seasonal concerns through emphasis on alignments with seasonally important rock art elements. These alignments utilize season-specific template-element patterns and relationships, which do not occur on other key days. Data from multiple panels and sites statistically support the correlation between template-element relationship and season. Type C interactions (Figure 3) are composed only of sequential linear alignments (with no emphasis on seasonal elements). A series of such alignments on a row of simple, similar figures or geometric designs could be entirely coincidental. Type C alignments are by their nature less prone to obvious misalignment before or after a key day. Shift the shadow template shown in Figure 3 upward or downward a few millimeters, and the alignment appears the same (but occurs slightly earlier or later in the interaction). Short, parallel element lines and long uniform shadow lines increase the chance one coincidental alignment might become a series. Rock art makers also used forced Type C alignments on panels chosen for more dramatic shadow templates on other key days. Therefore coincidence is more difficult to dismiss for Type C interactions generally (and Type C alignments specifically). The Uinta Fremont employed certain conventions in interactive panel design. They used specific shadow templates in specific ways with specific elements, and multiple templates for the same element. They used Type A shadow templates whenever possible. They designed for shadow connections between figures on the panel. They designed alignments during the entire duration of the active event. They designed alignments at the boundaries of the panel during an interactive event. They normally drew linear rock art elements as short (or shorter than) the linear shadow templates they matched.

Having reviewed the definitive characteristics of designed alignments and interactions, we can compare the original and the new, coincidental shadows on Panel 6 at McKee Spring for those characteristics. We will examine afternoon interactions for Panel 6 at Summer Crossquarter, Summer Solstice, and Equinox, before and after loss of the original gnomon.

The original Summer Crossquarter active event (Figure 4) went from lit to dark from left to right in a Type A and B significant interaction beginning at 1345 hours, and lasting 1 1/2 hours. The gnomon for this interaction was the south face of the rock pillar (now missing). Beginning as a sun arrow on the pecked dot at extreme left, alignments stressed the dot, the snake element, the rake elements on the male anthropomorph headdress (in conjunction with the fringe between the legs of the female anthropomorph), and the tear element below the female anthropomorph eye (panel right). The dot, snake, rakes, and head of the male anthropomorph used sun arrow templates. Alignments occurred during the entire event and all across the panel. A series of alignments connected the two large anthropomorphs. The interaction involved all main figures on the panel, and explored the boundaries of the figures.

After loss of the original gnomon, Panel 6 at Summer Crossquarter (Figure 5) goes from lit to dark from left to right beginning at 1515 hours in an active event lasting approximately 1 1\4 hours. The shadow edge is less well defined because the new gnomon is farther from the panel than the original, and because there is increased ambient light in the alcove. Coincidental alignments show no emphasis on seasonal elements. Arm and body alignments for the male anthropomorph are forced by encounter of deeply pecked element lines. Only two parallel elements in near proximity are subject to alignment. Boundaries are not explored, only a portion of one anthropomorph is involved, and there are no alignments connecting the figures. This active event no longer classifies as a significant interaction. The two coincidental alignments may occur partially because any given sandstone tends to fracture and weather in uniform ways (overall slope of the original gnomon was similar to slope of the cliff face that forms the coincidental gnomon). A newly formed Type A (sun cup) template (not shown) is not utilized by panel elements. Sun cup templates normally result in design of circular or shield elements. An unused sun cup template on a key day suggests either this panel is not designed as interactive, or that the rock art predates the template (the panel is still identifiably an interactive panel because of its unaffected morning interactions).

The original Summer Solstice afternoon interaction (Figure 6) went from lit to dark from left to right in an active event beginning at 1345 hours and lasting 2 3/4 hours. Alignments first used the south face of the pillar as a gnomon. Later in the interaction direct sunlight came through the gap between the pillar and the main cliff face, which together formed the gnomon for the last half of the interactive event. The Type A interaction utilized a large vertical sun arrow moving horizontally across the panel. This interaction also classified as Type B due to emphasis on the snake and rake elements. Specific alignments emphasized pecked dot, the snake, the rake elements, the male anthropomorph and the object in his hand, the female anthropomorph body, tunic, eyes, and tear element below her eye (panel right). Sculpting created a dramatic textured effect on the tunic of the female anthropomorph. Stacked alignments (depicted for clarity in the figures by two parallel lines), resulted from placing elements at the intersections of two different shadow templates. The original interaction featured alignments with all of the figures, boundaries were explored, and alignments occurred during the entire active event and across the entire panel.

After loss of the original gnomon, the active event on Summer Solstice (Figure 7) goes from lit to dark from left to right, beginning at 1500 hours and lasting 1 1/2 hours. There are no coincidental alignments. The alignments using the left side of the vertical sun arrow that crossed the panel between 1500 and 1630 are unchanged, because the left side of the template was cast by a part of the cliff that remains intact. Original gnomon for the right side of the sun arrow template was the north side of the rock pillar (now missing). Thus, the Type C linear alignments shown are the degraded remains of a Type A sun arrow interaction. The dramatic textured effect on the female tunic is reduced. Sun arrow alignments with female anthropomorph eye and tear (formed by a gnomon on the panel itself) are unchanged. There is no seasonal emphasis on the phallus, rake elements, or snake element. Alignments do not explore the panel boundaries, entire areas of the panel are not utilized, and there are no stacked alignments. Remaining portions of the original shadow template are less distinct than before due to more ambient light in the alcove. This interaction still classifies as Type A because the sun arrow to the female anthropomorph eye and tear remains. It no longer classifies as a Type B interaction because there is no emphasis on seasonal elements.

The original documented Equinox afternoon interaction (Figure 8) went from lit to dark from left to right in a Type A and Type B significant interaction beginning at 1300 hours and lasting 1 1/2 hours. The gnomon for the entire interaction was the south face of the rock pillar (now missing). Alignments involved the snake, the body, head, shoulder straps, and phallus of the male anthropomorph, the keyhole shaped element, and the body, head and fringe of the female anthropomorph. Type A shadow and sun arrows moved along the diagonal slash on the small anthropomorph, and a sun arrow moved across the belt-belly area of the female anthropomorph. Snake alignments and sun arrows to female belly or groin are both conventional seasonal (Type B) components of equinox interactions. The original interaction explored the boundaries of the panel, utilized all the main figures, and had alignments all across the panel and during the entire active event. The seasonal elements emphasized are those to be expected in Uinta Fremont equinox interactions, as supported by data from multiple panels and sites.

After loss of the original gnomon, at Equinox Panel 6 goes from lit to dark from left to right in an entirely coincidental afternoon active event beginning at 1530 hours and lasting approximately 1 1/2 hours (Figure 9). Coincidental alignments include a portion of the snake, a portion of the male anthropomorph arm and top of the left foot, and a series of short linear alignments with the shoulder-shoulder strap area. A portion of the diagonal slash on the small anthropomorph receives a linear alignment, as does a portion of the unidentified shape near the shoulder of the female anthropomorph. There is an alignment with the tear element of the female anthropomorph. There is no emphasis of known seasonal elements. Coincidental alignments seem to emphasize the shoulders and shoulder straps of the male anthropomorph. This does not classify the event as a Type B interaction because acceptance of elements as seasonal relies on emphasis at more than one panel and/or site.

These coincidental Equinox alignments are all native rather than forced, and taken out of context, convincing. All of the major figures are involved (to a small extent), boundaries are somewhat explored, and there are at least occasional alignments all across the panel. Observing this event without any knowledge of its coincidental nature one might rate it as a Type C interaction. However,- two diagnostic factors characteristic of Type C interactions are not present. First, as on Summer Crossquarter, there is an non-utilized Type A shadow template. A horizontal sun box (not shown) crosses the chest of the male anthropomorph during the event. Portions of the sun box align with the shoulder straps. However, sun boxes are conventionally used to cup circular elements, rather than for linear alignments. The second factor is subtle, but also diagnostic. Figures 4, 6, and 8 (the original, designed interactions) show that purposeful linear alignments strongly tend to utilize the entire length of element line segments. As can be seen in Figures 5, 7, and 9, for coincidental alignments templates do not tend to use the entire length of element line segments.

To summarize the results of this investigation, after loss of the gnomon for panel 6 at McKee Spring, coincidental shadows resulted in occasional Type C alignments. Coincidental Type C interactions are represented by one marginal example. That example violates Uinta Fremont convention by non-use of a Type A shadow template, and by incomplete shadow coverage of element line segments. No coincidental Type B (seasonal) interactions resulted. No coincidental Type A interactions resulted. Two Type A templates (a sun cup and a sun box) were created by the gnomon loss (not surprising given the natural prevalence of both shapes already at McKee Spring). The two newly created coincidental Type A templates exhibit no conventional

congruence with panel elements. Unused Type A templates on a panel known (from other active events) to be of interactive design suggest possible gnomon damage.

This test supports the following conclusions. The statistical universe is a large place. Coincidental correlation between shadows and rock art elements indistinguishable from an intentionally designed interaction is possible. However, scientific studies do not depend on data from one example of any artifact or feature. The chance that a coincidental Type A template might form an alignment on one of the five key dates of the year is small. There is no reasonable chance of a coincidental Type A interaction involving a series of such alignments. Seasonal emphasis in Type B interactions is defined on the basis of repeated emphasis at multiple panels and sites. Therefore, an instance of coincidental seasonal emphasis would (if it matched identified designed seasonal patterns) be lost in the volume of valid instances, or (if the emphasis was contrary to identified design conventions) be ignored. A series of coincidental Type C alignments resembling a designed Type C interaction is highly probable. In fact, for any significant interaction designed in the past it is not possible to know if every small congruence with linear elements is intentional. However, the potential archaeological information in interactive rock art depends on support from multiple panels and sites, and resides in Type A and B interactions. Type A shadow templates are the reason given surfaces were selected for use as rock art panels. Type A interactions are the most dramatic (and the most specific) pointers to the intentions of the panel makers. Type B interactions are excellent potential sources of specific seasonal information. Type C interactions may hold no potential information other than to indicate someone was present to utilize shadows during an active event.

The chance that coincidental interactions might confuse archaeological interpretation of a panel is slight. The possibility that they might affect understanding of a site or culture area is non-existent. Coincidental alignments do not display the same characteristics as designed alignments during an interaction. This may aid in identification of gnomon damage or loss. Gnomon damage to an interactive panel is likely to result in a depleted sequence of alignments and downgrading of interactive classification. The coincidence hypothesis is an unlikely explanation for Type C interactions, and is indefensible as an explanation for interactive panels.

not to scale

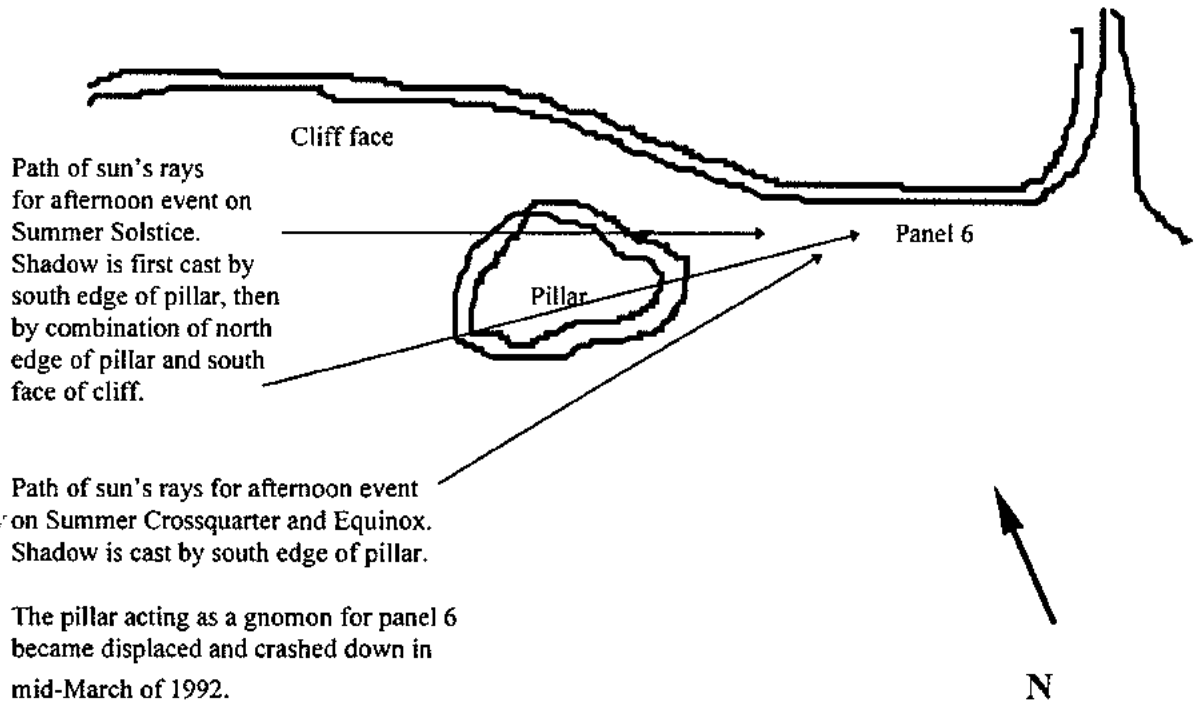
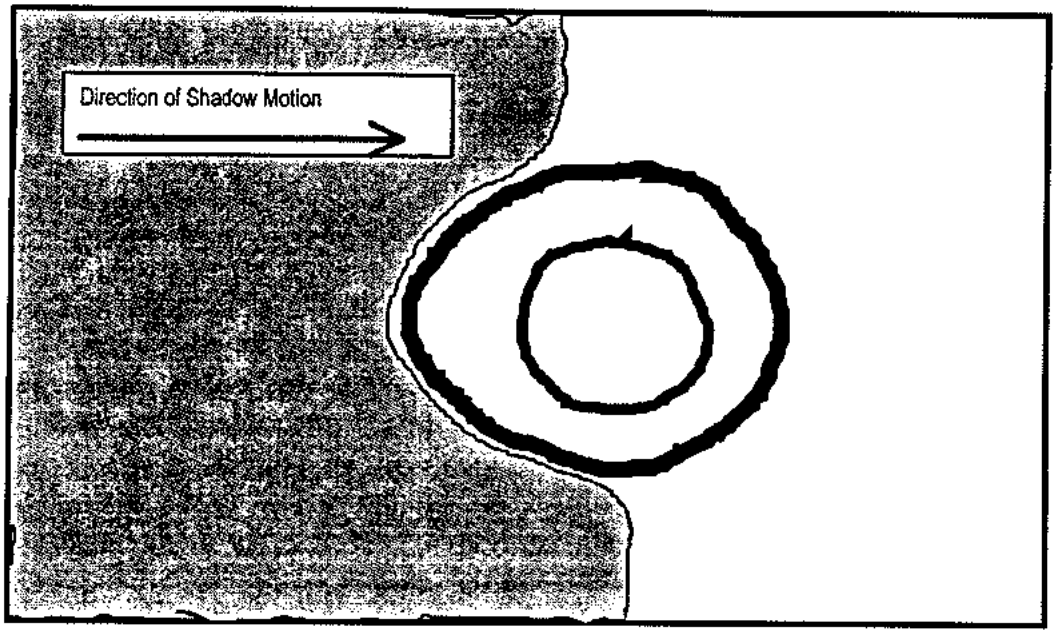
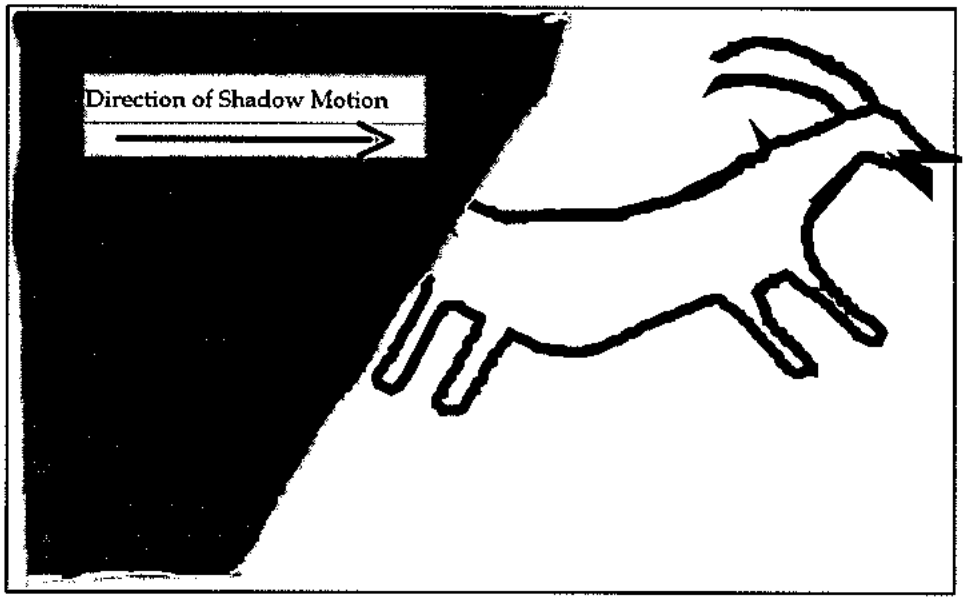


Figure 1. Physical situation of original gnomon for panel 6: McKee Spring.



A sun cup moving from left to right cups the concentric circular elements on a key day. One day before or after the key day, the sun cup would be misaligned upward or downward from the concentric circles.

Figure 2. Type A shadow shape and element alignment.



A shadow line moving from left to right aligns with each rear leg, then the front of the neck of the zoomorph. Displaced slightly upward or downward, the shadow would still align with those elements.

Figure 3. Type C shadow shape and element alignment.

Dotted lines delineate panel elements

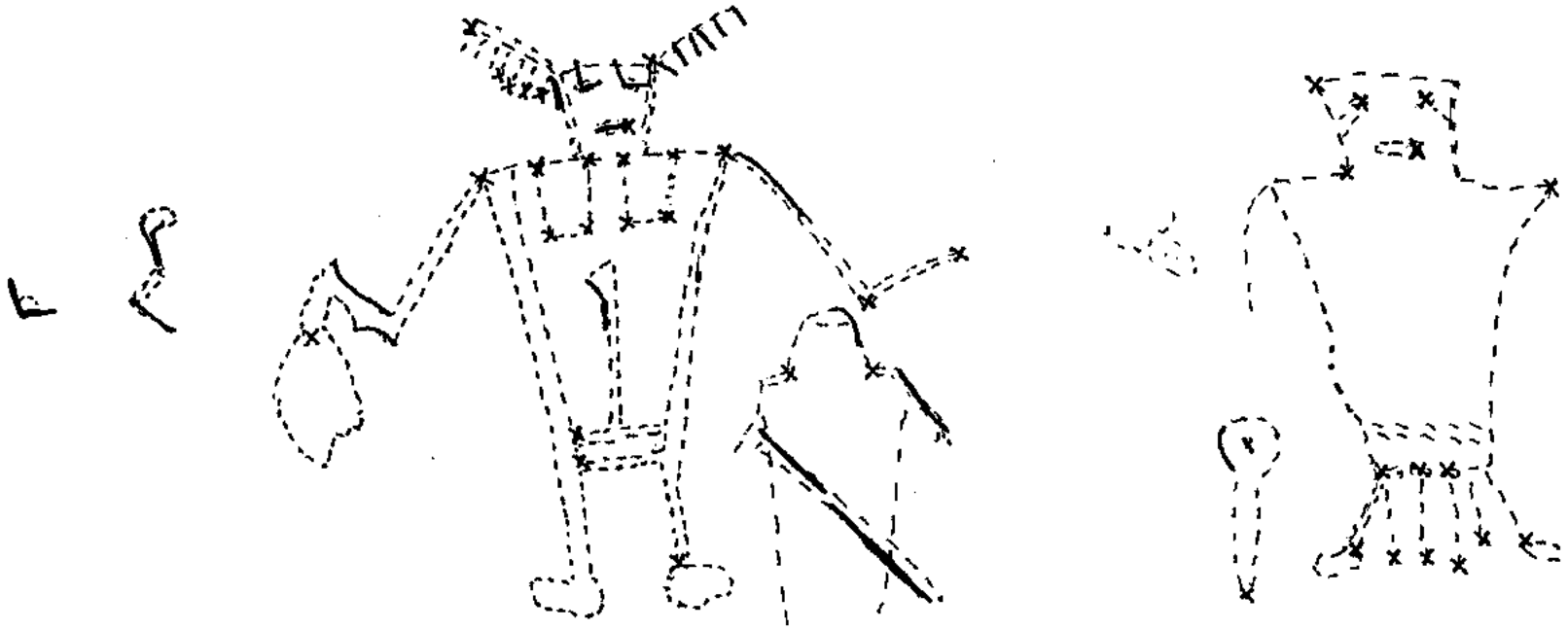


Figure 4. Original afternoon Summer Crossquarter alignments on panel 6.

Dotted lines delineate panel elements

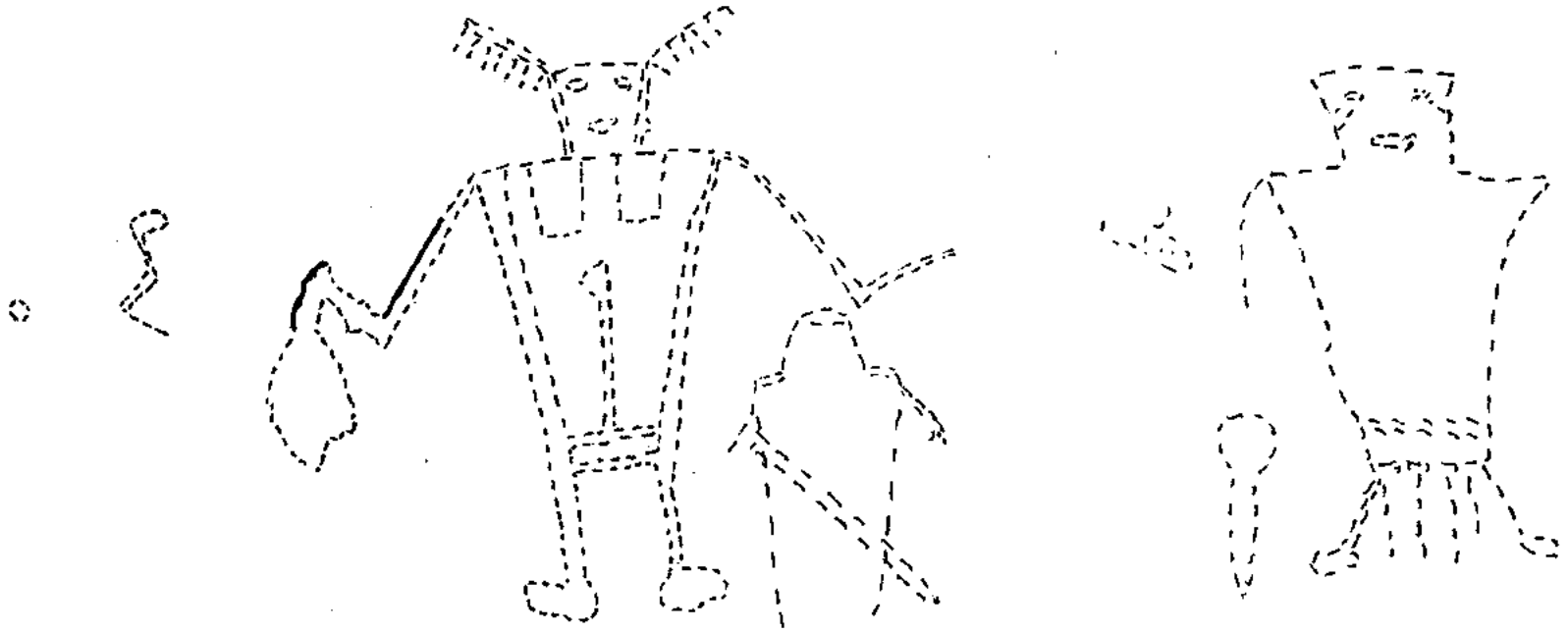


Figure 5. New afternoon Summer Crossquarter alignments on panel 6.

Dotted lines delineate panel elements

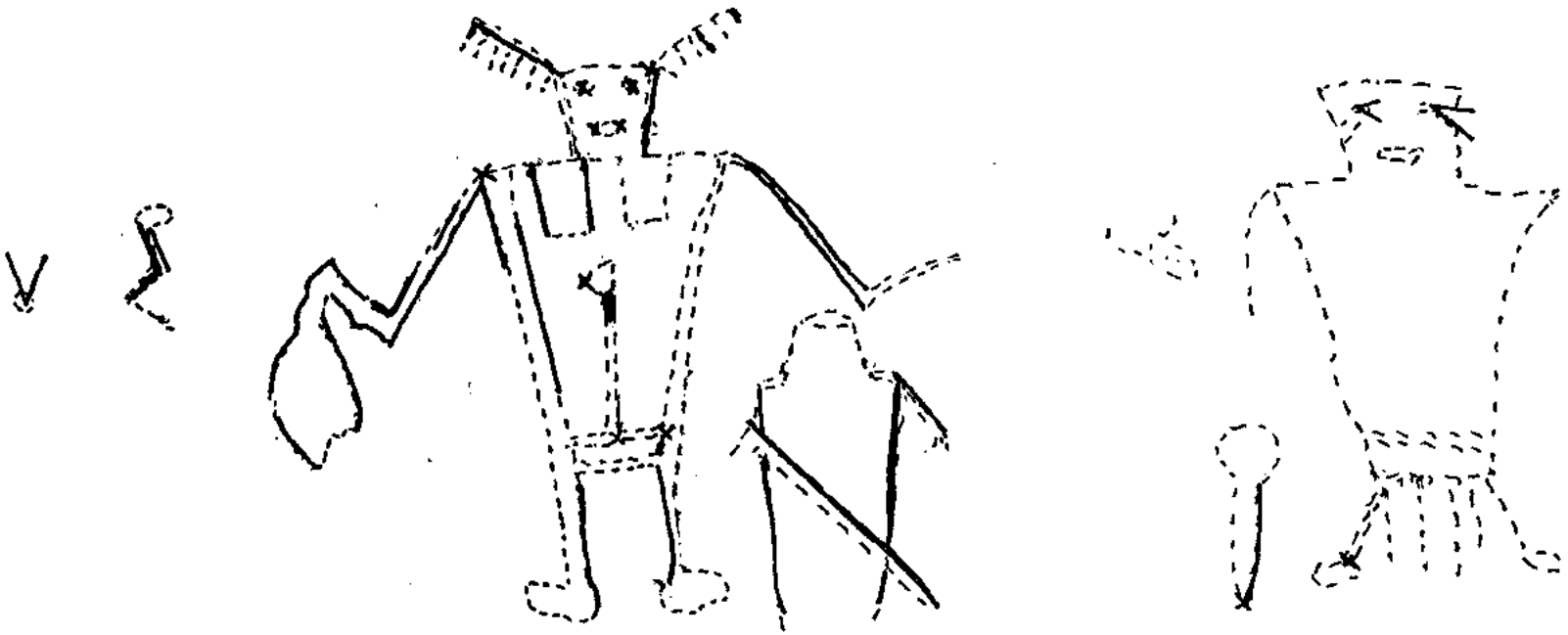


Figure 6. Original afternoon Summer Solstice alignments on panel 6.

Dotted lines delineate panel elements

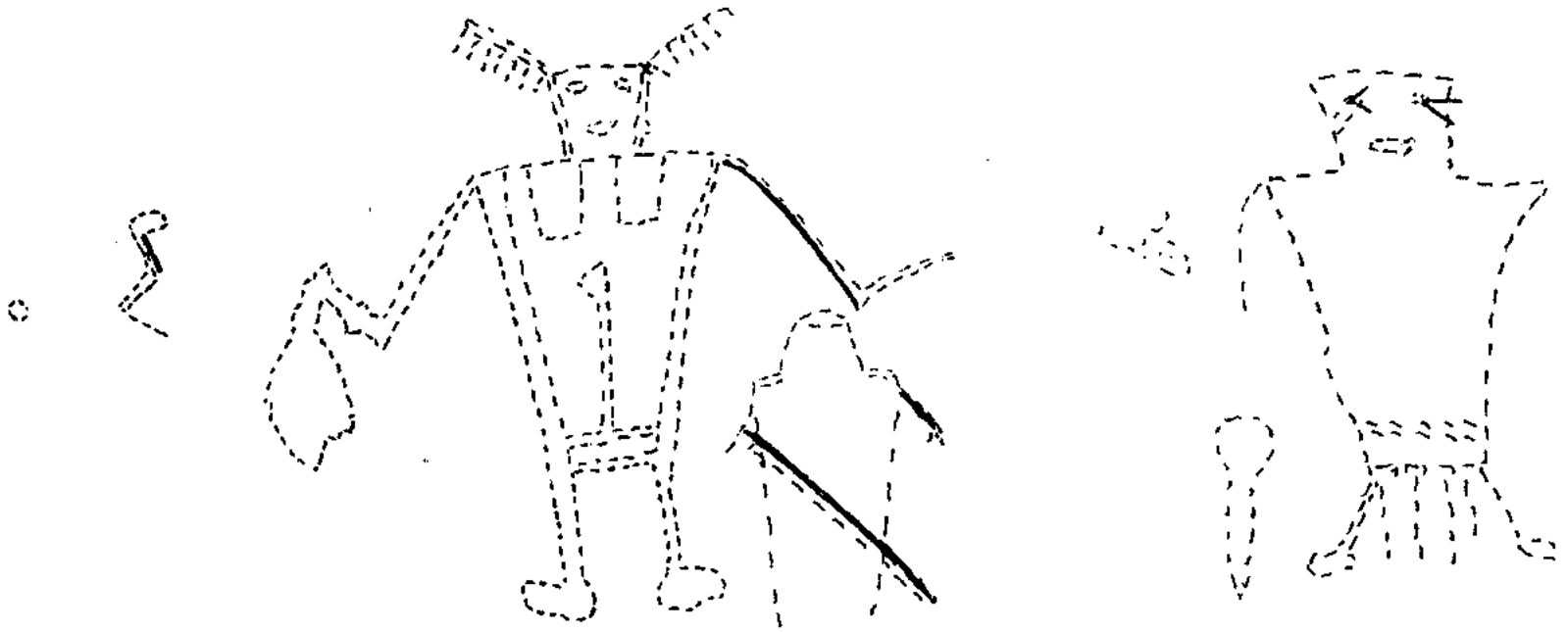


Figure 7. New afternoon Summer Solstice alignments on panel 6.

Dotted lines delineate panel elements

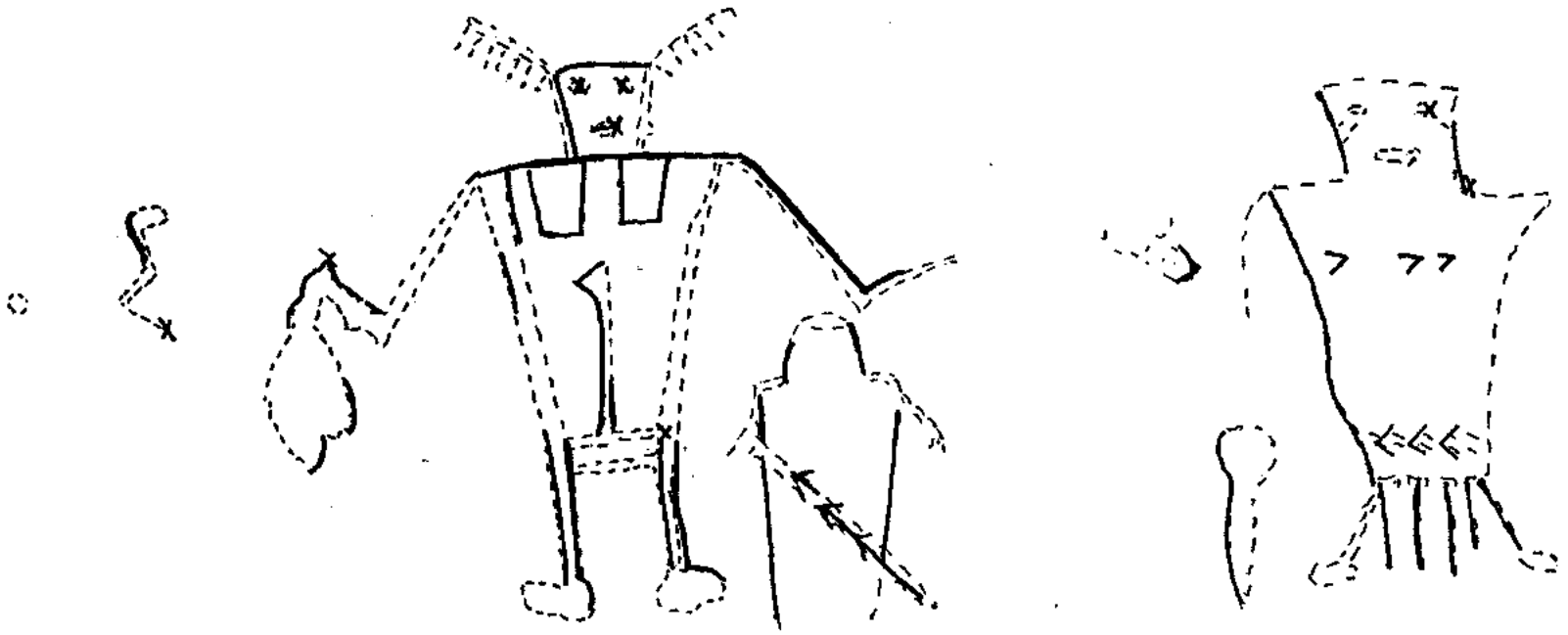


Figure 8. Original afternoon Equinox alignments on panel 6.

Dotted lines delineate panel elements

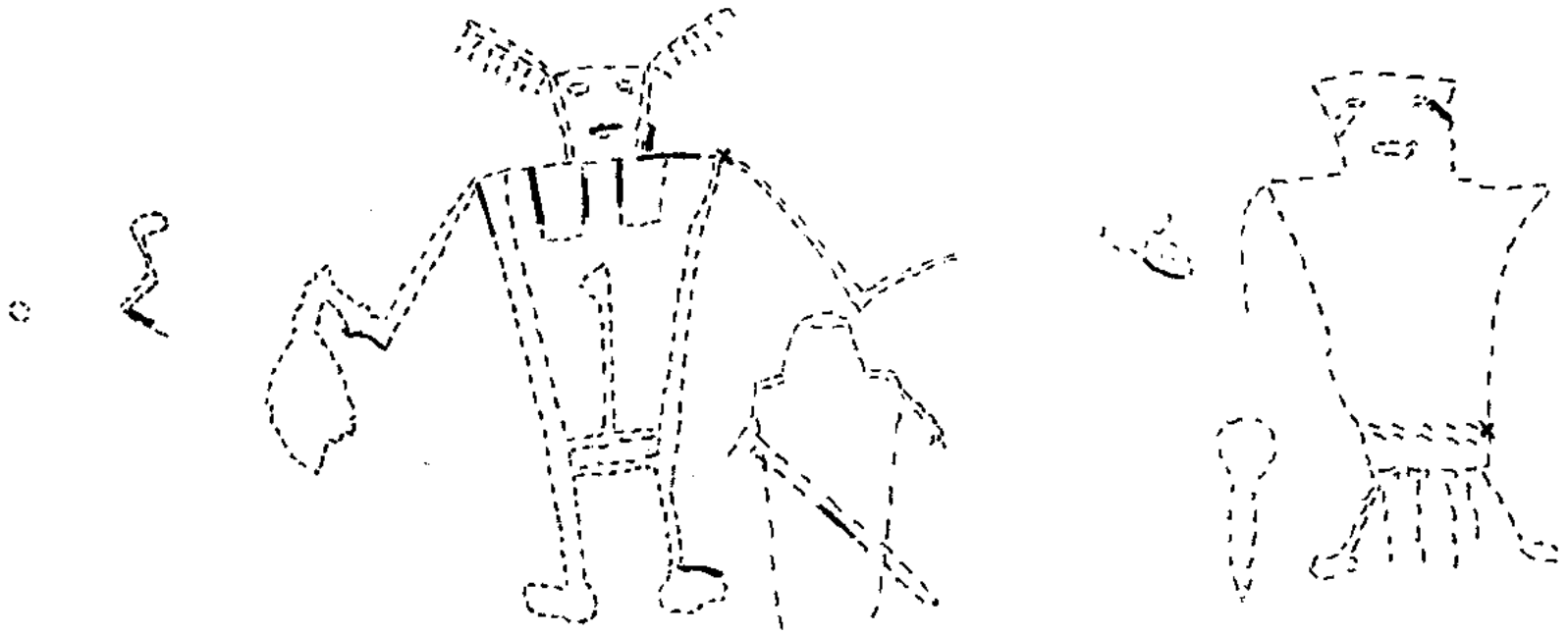


Figure 9. New afternoon Equinox alignments on panel 6.