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James Turrell—Roden Crater Project

Content

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Describing, analyzing, and interpreting works of fine art before they have even been completed is the exception in our métier. Architecture is more likely to provide examples of designs, plans, and models being dealt with as if they had already been built. This is first and foremost due to the contract situation. Under more rigorous competitive conditions, the methods of representation have become so refined that scale models definitely allow a reliable evaluation of the architectural structure and location within an urban or landscape context of constructions, as well as an estimation of their spatial effect and the distribution of light. Added to this comes knowledge about and the assessment of buildings that have already been realized.

The *Roden Crater Project* by James Turrell has been and still is described, analyzed, and interpreted without there ever having been more to see than the dormant volcano Roden Crater.[1] There are reasons for the anticipation of a work by art critics as well as art historians: For one thing, when his considerations had been brought to an initial conclusion, the artist mounted an exhibition that surprised the art world with the wealth of material it included. On display were models, plans for the construction of individual corridors and chambers, aerial photographs, and aquatints, all of which illustrated certain perceptual phenomena in the planned spaces. At one and the same time, the exhibition communicated that everything had already been built or would, as planned, be completed before long.

One does not have to return to the period of the architecture of the French Revolution to find examples of the amazing phenomenon of a real discussion about fictitious experiences of space and time. Walter de Maria's *Vertical Earth Kilometer,* which was planned for the expanse of rubble at the edge of the Olympic Village in Munich in 1972, was never drilled. Here, too, critics anticipated the work, although they argued against it by claiming that even if the *Vertical*

[1] This also applies to the text presented here, which is largely based on a research sojourn in Flagstaff, Arizona, in the summer of 1995. At the time, the initial planning phase had been completed; however, due

Earth Kilometer were to be realized, there would be nothing more to see than there already is, namely an expanse of rubble. They ignored the effect of the real. The execution of the work in Kassel later showed that a work can be unabatedly discussed even if it is not visible but has an author, has been installed at a site laden with history, and at the same time is associated with an exhibition as well known as the documenta. If this is the case, then a work of art is able to subsist on the power of imagination of those who seek out the place at which a brass rod has been driven one thousand meters into the earth.

This example seems suited to demonstrating the problems related to fictitious art because it depicts the other side of the reception of the *Roden Crater Project.* Except for the plate that covers the borehole, the work cannot be seen in Kassel either; everything is left to the imagination: How long is a kilometer that leads into the depths of the earth? We have no standard for gauging this. What kinds of strata does the borehole penetrate? Does the brass rod conduct geothermal energy? Questions to the point of doubt whether this hole was ever even drilled at all. For such questions and those that ensue, the formal side of the work is relatively secondary. Moreover, the piece of art can be made more precise by providing information about the length and the diameter of the borehole as well as by illustrating the earth kilometer being exhibited.[2] However, when the demonstration, perception, and experience of a work are primary, as is the case for Turrell's work in general, then Roden Crater also has to be able to perceived and experienced, and in order to do this the work first of all has to exist. Craig Adcock, who has dealt with the *Roden Crater Project* on many occasions, identified this deficit and followed the description of the individual perception spaces with references to works in which comparable phenomena are exemplified. However, apart from the fact that Turrell worked exclusively with artificial light in many of these earlier works and only natural light is used for the

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not least to financial reasons, Turrell was not able to begin working at the volcano until later. While the first chambers have been completed in the meantime, they have not yet been released for viewing.

Roden Crater Project, these works were for the most part only temporary and can only be consulted to a limited degree in this current analysis.

Neither Walter de Maria's work nor the *Roden Crater Project* by James Turrell is conceptional. Roden Crater has to be built, because it is only when our perception is guided that we will be able to have that experience in the chambers and corridors that exceeds the observation of the sky, the equinoxes, the phases of the moon, or the light variations already possible from each of the many other volcanoes in the region of the San Francisco Peaks. Roden Crater not only has to be built, it has to be completed before further thought can be given to the effect of the individual observation and perception spaces and of the coming about of guided perception.[3] At the same time, the historico-cultural context shall surely be investigated as there is striking evidence of an Indian culture for whom the measurement of time was a vital matter in the immediate vicinity of the crater. The question regarding the history of the volcano itself seems central to me as well. It is repeatedly pointed out that James Turrell selected Roden Crater out of hundreds of volcanoes, because like no other it fulfilled the formal and geographical conditions that the artist placed on the planned work from the beginning. Besides its relative isolation and the possibility of purchasing the mountain, the decision for Roden Crater was primarily made based on the regular shape of the crater's rim, thus on its form. The decisive prerequisites for a more accurate understanding of the experiences that the project will later make possible are to be sought in both fields—in the cultural history of the Four Corner Land in which Roden Crater is situated and in the geological genesis of the volcanic field. In both areas, in particular those of geology and volcanic research,

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[2] Cf. Ulrike Lehmann and Peter Weibel, eds., *Die Ästhetik der Absenz: Bilder zwischen Anwesenheit und Abwesenheit* (Munich: Klinkhardt & Biermann, 1994).

[3] This criticism is particularly true for the otherwise so commendable, because rigorous, investigation by Craig Adcock. While he provides a detailed description of the *Roden Crater Project,* he also forms conjectures about the possible effect of the projected spaces. This means that the book, which was published in 1990, is in this respect partially outdated, because the artist continued to work on the projection of the chambers and spaces were added—quite apart from the fact that the presumed effects cannot be verified. In the summer of 1995, nothing had yet been built at Roden Crater. Cf. Craig Adcock,

I relied on the firm support of the colleagues I have identified here. Research on the cosmology of the Pueblos has also increased enormously in scope in recent years and has become hardly fathomable, especially for an outsider.

The Volcano

Arizona's extraordinarily diverse landscape relief with its deserts and prairies in the south and southwest, the so-called Transition Zone, which is formed by the mountain range between the Black Mountains and White Mountain and the Colorado Plateau to the north, is the result of a geological development that shaped the entire North American continent. After its separation from the European continent, which coincided with a northward movement, during the mid-Tertiary Period the surface of this massive island changed due to continuous activity in the earth's core. Tension in the earth's crust led to the formation of deep rifts, faults, and clefts; extreme volcanic activity influenced the climate and changed the landscape. At the same time, earthquakes shook the continent, equalizing unstable mountain ranges and accelerating erosion.

The state's profile, rising from the south to the north and characterized by extreme deflection, was primarily formed by the eruption of innumerable volcanoes. This volcanic activity was concentrated on three fields: in the southwestern region of Arizona around the Kofa Mountains, the zone around White Mountain to the east, and the vast region around the San Francisco Peaks. These stratovolcanoes north of Flagstaff are the oldest in the field. Their eruption approximately twenty-eight million years ago and all subsequent eruptions formed the massif into one of the highest mountain ranges in the region.[4]

James Turrell: The Art of Light and Space (Berkeley, Los Angeles, and Oxford: University of California Press, 1990), pp. 154ff.

[4] Geologists consider Arizona's volcanic fields to be the most diverse in the world. Nowhere else have volcanoes been so continuously active over the comprehensible period of time of c. thirty million years. This has resulted in the emergence of a laboratory situation that is ideal for further studies, which will also allow making more precise prognoses about future eruptions. Cf. Michael F. Sheridan, "Volcanic Landforms," in Terah L. Smiley, J. Dale Nations, Troy L. Pew, and John P. Schafer, eds., *Landscapes of*

For a long time this volcano was also the only one on the vast plateau in northwestern Arizona, which at the time already consisted of 250-million-year-old Kaibab sandstone. Brought on by the movement of the North American Plate, which collided with a magma field located just under the earth's surface in the region of what is today the Mogollon Rim, the first volcanic eruptions occurred southwest of the San Francisco Peaks, resulting in extensive changes in the geographic texture. In three consecutive phases, this commencing volcanism in the early Tertiary Period generated the unique landscape around the San Francisco Peaks. Concurrent with the northeastward movement of the North American Plate, the volcanic activity moved from the area around what is today Williams via the former center of the peak into the area east and northeast of Elden Mountain. In this intermediate phase, which occurred approximately four million years ago, San Francisco Peak again became active itself, releasing lava and ash, becoming broader and higher, and forming several secondary craters. Its last eruption more than 400,000 years ago presumably caused its implosion to become an extensive, empty magma chamber.

The vast volcanic field east and northeast of the San Francisco Peaks originated during the third phase of these eruptions. Volcanic activity began here approximately 2.4 million years ago, concurrent with the eruptions of an old stratovolcano, and continued until 1064 AD. The last eruption created Sunset Crater after the earth's crust cracked open, a wide river of lava had flowed in the direction of the Little Colorado River, and considerable amounts of volcanic ash and cinders descended on the entire area.[5] This last phase is divided into four periods, which are named after the types of basalt they are typically composed of: the Woodhouse Period (2.4 million–500,000 years), the Tappan Period (600,000–

Arizona. The Geological Story (Lanham: University Press of America, 1984), pp. 79–109, in particular p. 79.

[5] For this context cf. Dorothy A. House, "Roden Crater," special issue, *Plateau, Magazine of the Museum of Northern Arizona* 59, no. 3 (1988), pp. 8ff.

175,000 years), the Merriam period (100,000–50,000 years), and the Sunset Period (1064–1250 AD).[6]

Due to its form, but also because of the composition of the expelled cinders and the severe erosion, Roden Crater must have originated in the Tappan Period. The crater is situated at the eastern edge of the San Francisco volcanic field, northeast of the much younger Sunder Crater. This topographical relation shows that the volcanism did not necessarily take place from west to east, but that various faults within one area allowed magma to be pushed upwards at different locations. Roden Crater is approximately 500,000 years old and thus originated in a period during which the San Francisco Peaks were still active. The crater's terraced silhouette stems from two eruptions that probably occurred at short intervals. In an initial phase, the volcano threw out cinders and ash and released molten lava, which solidified on the eastern flank into a sharp-edged shield composed of black basalt, while on the southwestern side of the volcano, an evenly formed embankment was created made of black cinders and sand. A later eruption, which sent coarse-grained red cinders to the surface, formed the central cone, which is enclosed by an older cone composed of black rock. The so-called fumarole stems either from a simultaneous or subsequent lava flow on the northeast flank. Today, the main cylinder with the relatively shallow crater floor rises approximately 150 meters above the plateau south of the Little Colorado River. Like most other volcanoes, in particular older ones, Roden Crater was originally much taller. Over the millennia, extreme fluctuations in temperature and harsh west winds wore away the coarse, pyroclastic basalt material meter by meter so that today, Roden Crater appears to be relatively low on its broad base. This base, which lies around the main cylinder like a dyke, in particular in the southwest, is the result of older volcanic activity. The embankment is evenly shaped—in contrast to the eastern boundary, where around Eagle Rock black

[6] Cf. Edward W. Wolf, "The Volcanic Landscape of the San Francisco Volcanic Field," in Smiley et al. 1984 (see note 4), pp. 111–136; with reference to dating cf. pp. 119f.

lava fissures characterize the silhouette.[7] A fumarole made up of several so-called vents, which emerged at intervals, borders the main crater to the north. Lava flowed out of one of these secondary openings down to the Little Colorado River. This fumarole rises to approximately the height of the southwestern embankment, together with which it forms the base. From a certain distance, above all from the east, the viewer has the impression of looking at a leveled-down terraced pyramid.[8] The impression changes as one moves closer or changes one's perspective. Compared with other volcanoes in this region, Roden Crater has a characteristic form which despite its relatively low height distinguishes it from all the others. During his search in 1974 for a suitable volcano for his project, Turrell had specific ideas of how the perception spaces would have to be installed in the volcano, how big the crater opening would have to be, how high the rim of the crater should be in relation to the crater floor, and how far the site of the observatory would have to be from any settlements in the area. The artist's decision in favor of Roden Crater was also based on its unusual form. The crater opening forms a slightly oval, flat basin with a resulting orientation to the east/northeast-west/southwest; the rim of the crater drops away gently to the east.[9] The regular boundary of this crater basin is already suitable for showing the phenomenon of the celestial sphere.

One no doubt could have found other craters with these characteristics (regular crater opening, crater rim at one level, low total height) in Arizona, Colorado or New Mexico. Roden Crater obtains its unique form through the even deposit in the southwest and the slightly staggered fumarole in the northeast.

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[7] This is why for the most part, Turrell and the photographers who worked for the Skystone Foundation took pictures of Roden Crater from the southwest or the west. The few photographs taken from the east mainly show the crater contre-jour and in this way cast a shadow on the sharp-edged crater rim. Most of the pictures that have been published show the crater under conditions of alternating light as a regularly formed—in certain perspectives almost symmetrical—sculpture in the landscape.

[8] Most of the ash cones in this region are symmetrical and give the crater rim a round or slightly oval shape. This can be traced back to the energy with which volcanic ash and cinders were hurled vertically upward and, depending on their size, subsided on the crater rim or the adjoining plateau. Asymmetries resulted when strong winds blew from a certain direction during the eruption phase. The virtually constant thirty-degree angle of inclination can be explained by the weight and size of the falling cinders.

These plastic shapes give the crater an unmistakable profile: Viewed from a distance from the terrace west of the volcano or from the Painted Desert in the east, Roden Crater appears to be a regularly arranged terraced pyramid. Although the crater's main cylinder drops away to the south at an angle of thirty degrees, the distance of the lower deposits to the crater's axis is about the same because there is a greater difference between the run of the crater hill there and the southern embankment than is the case with the corresponding formation in the north. The crater's overall balanced form is to a large extent the result of this exceptional feature. In addition, the rounded, evenly distributed base zone aligns the crater along an east/northeast-west/southwest axis, an alignment that is clearly discernible not only from above, but also from elevated vantage points such as Merriam Crater and certain parts of the Roden Spring Field. From a geological point of view, this orientation is of great significance as it indicates the very direction in which the North American Plate moves four centimeters annually, namely west-southwest.

Despite this special form, which Turrell will also use for his four perception centers, Roden Crater is only one among many volcanoes. This will surprise many of those familiar with Turrell's work from what have in the meantime become countless publications, which include fascinating aerial photographs showing the crater for the most part in isolation and often in oblique light, which emphasizes the enormous plasticity of this volcanic deposit, or from an extremely low perspective just above the round buckwheat shrubs. Although it is located at the periphery, the crater on the northeastern foothills of the San Francisco volcanic field is directly connected with the field. All paths lead past various other volcanoes before one reaches Roden Crater. This will also be the case in the future, as approaching it from the north remains difficult due to the natural boundary created by the Little Colorado River Canyon. Thus the geological context described above can be experienced directly. Roden Crater is part of a

[9] In two separate operations, one in 1981 and the other in 1983, the crater rim was leveled to a height of

comprehensive, extremely complex volcanic region, the genesis of which goes back to the Tertiary Period, which in recent years has been exhaustively researched.[10]

Most researchers assume that the volcanic activity in this region is not over, citing the eruption of Sunset Crater less than one thousand years ago. Measured against the geological time that has passed since the first eruptions of San Francisco Peak twenty-eight million years ago, this period is extremely short. The volcanic field northeast of Flagstaff may be inactive; however, the movement of the earth's crust above a stationary hot spot could reactivate it. Nevertheless, what is reassuring is that potential eruptions would be preceded by earthquakes, which applies for the St. Andreas Fault on the west coast or which was recently the case in Alpine, Texas, near Marfa, where an earthquake occurred with a magnitude of 5.6 on the Richter scale.[11] "The last eruption on the Plateau, that of Sunset Crater, occurred a little more than 900 years ago. In all likelihood, there will be other eruptions; the region is by no means 'dead' volcanically."[12]

To date there have been no volcanic eruptions in the Four Corners area between Utah, Colorado, New Mexico, and Arizona, but there have been numerous earthquakes. "The Grand Canyon area again appeared to be the most seismically active region in the State. Of the 74 earthquakes located within Arizona in 1992, 68 occurred in the South Rim area of Grand Canyon."[13] On March 14, 1992, the most powerful earth tremor reached a magnitude of 4.1 on the Richter scale, as did further tremors on the southern edge of the canyon. The region northeast of Flagstaff continues to be active as well. With a magnitude in the range of 2.0, the generally minor earthquakes measured there occur at

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5,440 feet. Today it is nearly the same height all around.

[10] On the status of research on volcanism on the North American continent cf. Charles A. Wood and Juergen Kienle, eds., *Volcanoes of North America: United States and Canada* (New York: Cambridge University Press, 1990).

[11] Report by the Associated Press on April 14, 1995, on the front page of the *Arizona Daily Sun*.

[12] Halka Chronic, *Pages of Stone: Geology of Western National Parks and Monuments, Grand Canyon and the Plateau* (Seattle: The Mountaineers, 1988), p. 27. Also refer to Edward W. Wolf, "The Volcanic Landscape of the San Francisco Volcanic Field," in Smiley et al. 1984 (see note 4), p. 133.

shallow depths, as did the tremor on March 19, 1992, at Sunset Crater. Roden Crater is located only several kilometers away. One cannot, however, draw conclusions about the location and date of future volcanic eruptions from these earthquake clusters. The available data is still too incomplete to do so—a systematic and coordinated seismography for the Colorado Plateau has only existed for a good twenty years.[14] In contrast, the geological investigation of the plateau began much earlier and has in the meantime produced profoundly precise knowledge about the subterranean tectonics and about the forces that alter them. The forces currently at work, which are caused by the moving layers and bring about the earthquakes cited above, are primarily produced by a the expansion of the Colorado Plateau to the northeast. The expansion is able to occur evenly because the plateau consists of a coherent and relatively cool block that is borne by the warmer layers of adjacent regions such as the southern Rocky Mountains to the east and the mountains of the High Plateau and Wasatch Ranch to the east and the north. This geological balance could, however, change in thousands of years. Precisely because there is a considerable difference between the center of the Colorado Plateau and the adjacent regions extending to the basin and the ranch territory with regard to the degree of heat and the tectonics, stronger earthquakes and possibly volcanic eruptions could occur above all at the rims of the plateau.[15] The entire volcanic field of the San Francisco Peaks northeast of Flagstaff lies in this critical Transition Zone. Its location within the field makes Roden Crater the closest one to the cooling center of the plateau.

The geological conditions of the region surrounding Roden Crater and the estimation of possible developments result in an initial range of parameters within which each artistic project in one of the craters located in the San Francisco

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[13] Doug Bausch and Suzanne Morrison, “Summary of Earthquake Activity in Arizona for 1992,” *Arizona Geology* 23, no. 2 (1993), p. 2.
[14] Ivan G. Wong and James R. Humphrey, “Contemporary Seismicity, Faulting, and the State of Stress in the Colorado Plateau,” *Geological Society of America Bulletin* 101, no. 9 (1989), pp. 1127–1146.

volcanic field moves. The artist has to accept some of these general conditions and can work with others. In projects such as Mendota Hotel or Capp Street, Turrell explored the acceptance of the conditions prescribed by the site or the existing architecture and found surprising solutions. The typology of the perception spaces planned for the *Roden Crater Project* reveals that there are some among them that can only be realized under the unique conditions of this site, but that there are others that serve to perceive the light and are thus not bound to the site. In this phase it is difficult to establish to what extent the works stemming from various contexts will go together with the site-specific spaces or even complement them. For the moment, only the concept for this site shall be discussed. At least one can derive four parameters for the work from the geology of the site: the context, time, form, and materiality of the *Roden Crater Project*.

The Time

Roden Crater is part of an extensive volcanic field northeast and east of the San Francisco Peaks. Visits to the crater will also lead through this field in the future, past other volcanoes, lava fields, and basalt blocks. On the drive to Roden Crater, one can immediately recognize the unique features of the geological relief as the outcome of prehistoric volcanism: the regular cones of the volcanic hills and the partially open crater rims clearly indicate that these were once volcanoes.[16] The road leading to the crater allows two views: on the one hand a view into the earth's layers. We know that erupting volcanoes have altered the surface of the earth and that the ash they have hurled out has blocked the sun and occasionally changed the earth's climate. More recent eruptions such as the well-documented eruption of Particutin in Mexico between 1943 and 1954 are as

[15] Cf. P. Morgan and C. A. Swanberg, "On the Cenozoic Uplift and Tectonic Stability of Colorado Plateau," *Journal of Geodynamics* 3 (1985), pp. 39–63.
[16] Construction of a visitor center is planned at the entrance to Roden Crater twelve kilometers to the south on the road to Leupp. It will also include an introduction into the geological conditions. The Museum

much a part of our cultural experience as the most infamous volcanic eruptions in history. A landscape characterized by dormant volcanoes, such as the landscape surrounding the San Francisco Peaks, reminds us of a time before our time in which entire stretches of land were recreated. Because as in the past, volcanoes still have a connection with the magma zone in the Earth's interior, they relativize and bridge the otherwise unimaginable period of time of 150 million years and remind us of a time when Pangaea broke up into the continents. In this kind of landscape, the past becomes visible in the present. The second view that results from the geological context of the San Francisco Peaks is related to the peripheral location of Roden Crater, which lies on the northeast boundary of the volcanic field, only several miles from the Little Colorado River. The Painted Desert begins east of this canyon. Whereas the other volcanoes rise out of a hilly landscape characterized by volcanic activity, Roden Crater is located on a mesa in a shallow valley on a level with the adjacent desert, which at this point extends out into the volcanic region as a desert prairie. The base zone of the crater links, so to speak, the hostile desert with the distinctly volcanic pastureland. It becomes obvious when approaching Roden Crater from the south that geologically speaking, it is isolated, its location allowing an unobstructed panorama of Colorado Plateau. In order to experience the phenomenon of the celestial sphere, which visitors can already do from the floor of the crater's opening, it was also important that there were no adjacent mountains protruding above the evenly ground-down rim of the crater. Both from a geological as well as from a geographical point of view, Roden Crater is a suitable observation site.

The parameter of time is a category that is central for the *Roden Crater Project* as an observatory. Whenever astronomic occurrences become visible, the factors of time and space are the coordinates that are decisive for determining these occurrences. The project is not conducting an investigation of the orbits of the moon and the stars at present. However, the crater, which has its

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of Northern Arizona in Flagstaff already contains a straightforward presentation on the geology around the

own history within the context of the volcanic field, already exists between geological and cosmic time. When visitors, lying on their backs on the floor of the crater opening, observe the celestial sphere, this connection can be experienced both physically as well as cognitive-psychologically: they lie directly above the closed cylinder of the volcano, through which millions of years ago cinders and ash were thrust from the Earth's interior to the surface, and after sundown see the path of the stars above.[17]

The geological time experience, which will later also become important for other perception spaces in the crater, results from the view. During the drive to the crater, visitors encounter a distinctly volcanic landscape; large cinder cones and countless secondary craters, lava fields, and basalt cliffs determine the geological relief of this region. Even for the layperson, the landscape clearly conveys the impression of having originated millions of years ago due to eruptions from the deeper layers inside Earth. This geological time experience is also supported by a further observation. All over the world, but in particular in regions with severe fluctuations in temperature and extreme climatic changes, erosion is changing the earth's surface. Due to the great differences in altitude, Arizona has various climate zones that differ not only horizontally, but vertically as well. Between Flagstaff and the Little Colorado River, over a distance of hardly more than a hundred kilometers, the climatic conditions change from a highland climate with minimum temperatures of well below zero in the winter to what is first an extreme, then moderate semiarid climate, finally becoming a desert climate, although in the canyon of the Little Colorado River the temperatures can also drop below freezing in the winter.[18] Precipitation also varies throughout the region. While more than seven hundred millimeters of rain may fall annually in the

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San Francisco Peaks.

[17] As is the case for other of Turrell's perception spaces, certain dates and times of day will be recommended for visiting the cosmologically oriented spaces of the *Roden Crater Project*. It is stipulated that one visit *Sky Windows Meeting* und *Blue Blood* in the hours immediately prior to and after sundown.

[18] Meteor Crater, a crater that was caused by the impact of a meteor 50,000 years ago, is located at the eastern edge of this area. The geological formations there are to a large extent similar to those on the moon, which is why it served as a training ground for the Apollo astronauts.

woods of San Francisco Peaks, in the prairie and desert zones there may not even be seventy millimeters of rainfall. Heavy rain often falls on the region in the summer months, which causes serious damage: because the volcanoes support only sparse vegetation, the rain flowing down the slopes washes the ash and fine-grained cinders into the valley, cutting deep channels.[19] It is easy to understand that many of the volcanoes in the region were originally very much taller. Roden Crater's sturdy form cannot completely be attributed to erosion caused by heavy rainfall. Besides water, wind erosion has also altered the volcanoes' profiles. In the spring months, severe storms may carry the loose granules on the slopes of the volcanoes into deeper-lying zones. Fluctuations in temperature, heavy rainfall, and the strong west winds have a determining influence on the geomorphological processes in the region east of the San Francisco Peaks and have led to the visible erosion everywhere of the cinder cones in particular. This is an immutable process. Tectonic displacement, that is shifting caused by earthquakes and volcanic activity, and the effects of climatic parameters therefore enable geological time to become visible. Some basic knowledge of geology is helpful for imagining how volcanism formed this landscape millions of years ago; the impact of erosion is directly experienceable during the drive to Roden Crater. With an idea of a time that is linked to these processes and which extends a long way back in the history of our Earth and therefore relative, we approach a work in which light, space, but above all time are investigated, and presented and illustrated to the viewer.

The Form

Roden Crater's form results from its geographic position, which is exactly 32° 25' 41" north und 111° 15' 25" west. All of the geological landforms in this region are of volcanic origin; all of the mountains here are volcanoes. With the exception of

[19] Cf. Terah L. Smiley "Climatic Change during Landform Development," in Smiley et al. 1984 (see note 4),

the older of the San Francisco Peaks volcanoes, Sunset Crater, Merriam Crater, S. P. Crater, Black Bottom Crater, and all of the other craters are so-called pyroclastic cones. “Turrell’s Roden Crater belongs to the Tappan Age group of cinder cones. It probably is 500.000 years old, erupting while the San Francisco Peaks were being formed. Like other craters of comparable age, Roden shows the effects of erosion. From a distance, it presents a low, weathered profile to the observer.” [20] Part of the described form of Roden Crater on the periphery of the San Francisco volcanic field is its orientation. Because of the fumarole situated to the northeast and the southwestern deposit, the crater is oriented 61° north and thus on an axis along which the sun rises in the northeast during the summer solstice on June 21, and sets in the west/southwest during the winter solstice on December 21. This imaginary axis runs over the deepest point of the crater floor—the original cylinder opening. This orientation will be of considerable importance for the conception of the observation spaces.

These coordinates describe and at the same time fix the position of Roden Crater. The data are set and laid down. At the same time, however, the crater is in motion. As part of the North American Plate it moves four centimeters northeastward per year. This is the speed geologists have based their calculations on up to now. However, more recent investigations have shown that this kind of shifting is generally impeded by local, rotating movement. For this reason, under certain circumstances the northwestward movement of the crater is not maintained. This leads to first uncertainties with respect to the astronomically oriented spaces and tunnels of the *Roden Crater Project:* While the orbit of the moon or the North Star can be calculated with great precision for years to come, one cannot determine the exact position of the place from which observations shall be made in the future. This uncertainty results from the crater’s horizontal movement. It may also possibly move in a vertical direction. At the moment, large amounts of the annual rainfall are caught by the crater’s basin, from where it runs

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pp. 55–77, in particular pp. 60f.

off underground. Augmented by the below-freezing temperatures in the winter, erosion is occurring not only on the crater's surface, but also in its interior. It is caving in; in some places, masses with varying consistencies are shifting against each other. When the project has been completed, the water will be collected in a large tank in the center of the crater's basin and led via channels into individual chambers. At the same time, the crater will be drained—with hardly calculable consequences for the vegetation, above all for the stability of the crater itself. Finally, there is still the risk of renewed activity in the volcanic field, a risk geologists point to again and again. The region east of the San Francisco Peaks appears to be at particular risk. Thus an investigation of the geological conditions of the crater addressing itself to Turrell's planned work produced a first result: As a volcano, Roden Crater is an ideal site for the complex project. However, its suitability from an astronomical point of view is highly uncertain, because it is much more at risk.[21]

The Anasazi

Compared with the geology of the site, the anthropological context is much younger—for the area of the Colorado Plateau, it extends back only to the beginning of our calendar; however, from that point onward it is virtually unbroken. What is decisive for our context is the question of the relation of the project and parts of the work to the anthropological history of the crater. Can proof of an individual history even be established for Roden Crater? Has its exposed peripheral position led in the past to regarding it as a special, as a prominent mountain? And if so, can certain aspects be derived from this for the

[20] House 1988 (see note 5), p. 11.
[21] Another reason Roden Crater is a suitable location for the planned observation of the stars is the low occurrence of light scattering. The area around the crater is only sparsely populated within a radius of c. 70 kilometers. The next larger town is Flagstaff, which has strict regulations with regard to the distribution and intensity of light generated by both private and public lighting facilities. These regulations were

experiences that James Turrell wants to make possible in this crater? The answer is simple: at no time was Roden Crater of any significance. In the past, it was only Sunset Crater that stood out in this volcanic field following its eruption in 1064—Hopi legends have grown up around this mountain that once spewed fire.[22] With the exception of the snow-covered San Francisco Peaks, all of the others were part of a landscape that had to be made fertile enough to allow a limited number of families to live from the land. Because of the scant rainfall, this was not an easy task, which is also why the region was populated later than other parts of Arizona. The southwest, but the northeast as well—the so-called Four Corners area—were discovered very much earlier by the tribes migrating southward from Asia via the Bering Strait.[23]

Since the first century of our calendar, the Anasazi, a seminomadic people of hunters and gatherers, began settling on the Colorado Plateau. They did not permanently settle until about 500 AD after they had learned to cultivate grain and keep domestic animals. It was during this period that the Anasazi, whom the modern Navajo regard as their ancestors, built round pit houses approximately seven meters in diameter with an opening in the roof that served as an entryway and a smoke outlet. There was a sand-filled pit, a so-called *sipapu,* next to the fireplace that represented the symbolic entrance to the underworld. These Anasazi pit houses already exhibited the same structure as the *kivas* still being built by Pueblo Indians today: round, windowless, partially subterranean spaces with an opening in the roof. The height of the Anasazi culture, the so-called Pueblo Period, begins in 1100. It was during this period that the Indians left their pit houses and moved into settlements consisting of multistoried adobe houses, which were more conducive to communication and communality. In order to better protect themselves from attacks, some communities retreated into cliff

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pushed through years ago by the Lowell Observatory, which is located on a hill immediately overlooking Flagstaff.

[22] Ekkehart Malotki and Michael Lomatuway'ma, *Earth Fire. A Hopi Legend of the Sunset Crater Eruption* (Flagstaff: Northland Press, 1987).

dwellings, the ruins of which can still be closely studied today in the Canyon de Chelly.[24]

The rapid development of skills—the production of elaborately painted vessels, jewelry, and weapons—was accompanied by the increased exchange of these articles with other tribes in neighboring areas. At the Little Colorado River to the east, the land of the Kayenta Anasazi and the Windlow Anasazi bordered that of the Sinagua Indians. Roden Crater is located in this frontier area on what was once Sinagua land. There is evidence that human life existed here beginning in about 650 AD. An accumulation of uncut basalt blocks of approximately the same size around the ground plan of huts, clay discs and arrowheads found at the crater, and lines of stones marking the boundaries of fields in the areas surrounding the volcano prove that Roden Crater as well as the remainder of the volcanic field was inhabited by farmers and hunters early on. What is open to question is whether the families also settled on the crater or whether they occupied areas on the periphery or elsewhere on the plateau. In this case the foundations that were found and the huts on the mountain reconstructed based on these foundations are probably field huts that served as storage chambers for seed or as emergency shelter.[25]

The region east of the San Francisco Peaks was only later populated by families from Arizona's southeast. They followed the course of the Little Colorado River and began working the barren ground at the foot of the soaring mountain. The Sinagua benefited from vigorous trade with the Anasazi in the east and the Hohokam in the south, and soon developed their own culture. They laid out terraces to collect rainwater runoff and to use for sowing grain, they built attached pit houses, they had assembly spaces in which the tribe members, who lived scattered over a wide area, would meet, and they designed and built large oval

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[23] Jay J. Wagoner, *Early Arizona: Prehistory to Civil War* (Tucson: University of Arizona Press, 1975), pp. 11ff.
[24] Campbell Grant, *Canyon de Chelly: Its People and Rock Art* (Tucson: University of Arizona Press, 1978).
[25] House 1988 (see note 5), pp. 15f.

playing fields for ceremonial competitions.[26] This development was furthered by a gradually warming climate that (initially) became drier. However, beginning around 1050 annual precipitation rose significantly, and the yields from the cultivation of grain, maize, and beans increased. This prospering culture, which was based as much on the careful observation of natural processes as well as on the rigorous exchange with other tribes, was severely hit by the unexpected eruption of Sunset Crater in 1064. After the first and the subsequent, in part violent, eruptions, which scattered tons of volcanic ash over an area extending more than a thousand square kilometers, any kind of agriculture became temporarily impossible.[27] Although these volcanic eruptions must have seriously unsettled the Sinagua, they nevertheless remained in the area east and south of the San Francisco Peaks. The tribe even continued to grow and organized itself into larger coherent units. The Sinagua built pueblos inhabited by up to a hundred families. Village elders controlled the needs and interests of the tribe members from so-called chief villages. These villages were often located at river crossings along old trade routes or on hills, from where the villagers had an unobstructed view out over the surrounding land. Later, like forts these chief villages were built on hardly accessible mountain ridges or volcanic craters; however, there is no evidence of any fighting over these forts. “Some have suggested that rather than being used for defense or warfare-related functions, the forts served as communal storehouses for food and other commodites, the residences of elite families or individuals, or as astronomical observations.”[28]

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[26] One such ball court has been preserved in Wuptaki Monument in the immediate vicinity of Roden Crater. Cf. Bruce A. Anderson, “Wupatki National Monument: Exploring the Prehistory,” *Exploration, Annual Bulletin of the School of American Research* (1987), pp. 13–19.

[27] This is a relatively young theory. For a long time research assumed that volcanic ash containing nitrate fertilizes the soil. This requires, however, the decomposition of the ash and its combination with the natural soil. This is a gradual erosion process that as a rule does not lead to an improved yield for many decades. For this reason, today it is generally assumed that the Sinagua laid out new fields on the perimeter of the ash-covered region. Cf. Peter J. Pilles, “The Sinagua: Ancient People of the Flagstaff Region,” *Exploration, Annual Bulletin of the School of American Research* (1987), pp. 2–11.

[28] Ibid., p. 9. A fort of this kind has been preserved in the Wuptaki District. Archeologists see a fort in the so-called citadel located on a small volcanic hill. It dates from the Elden Phase (1150–1220). It was not until later that entire villages were built on strategically favorable mountain ridges, such as the Pueblo Tuzigoot on the Verde River in which c. 400 Sinagua lived around 1300. They had left the area east of

Around 1300—in several areas even earlier—the Sinagua began retreating from the area east of the San Francisco Peaks. This exodus from the immediate vicinity of Roden Crater can be explained on the one hand by the recurrent eruption of Sunset Crater, which darkened the sun and made the earth infertile and life unsafe. The decisive factor, however, was the decreasing amount of rainfall. The climate continued to become warmer, and concurrent with it, beginning in around 1220 the annual volume of precipitation began dropping, causing extreme fluctuations in temperature to prevail in the Wupatki village and the adjacent fields. In around 1225 the Sinagua left Wupatki and retreated into Walnut Canyon, only several kilometers southward, to settle there on the protected northern slopes.[29] A sustained drought at the end of the thirteenth century and a certain overpopulation prompted the approximately three hundred families to leave there for the Verde Valley. These southern Sinagua lived in the vast, fertile valley near Montezuma Castle and the mountain village of Tuzigoot until about 1450. For reasons that have still not been researched into, the Sinagua tribe then migrated away, became scattered, and from that point onward all traces of them were lost. Thus a culture ceased to exist that had brought forth magnificent architecture, unique craftwork, but above all skills that allowed a people to survive in this extreme climate in harmony with nature and its strict laws.

The Sinagua culture is part of the general framework of the *Roden Crater Project* and is therefore of primary importance for understanding its conception. An artist's observatory, which will be built in the immediate vicinity of the Sinagua community of Wupatki, cannot be adequately perceived and understood without this historical context. Turrell's inquiry into the Sinagua culture results in three interpretational grids for his project: for the connotation of the volcano's crater, for the relationship between time and space—thus for the astronomical context—and

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Flagstaff three generations prior to that and established a new settlement at this curve in the Verde River (Tuzigoot = crooked water).

for the function of the large *kivas.* Little is known about the religious ideas, about the rites and celebrations of the Sinagua people. But one thing can be said with certainty: for the Sinagua, the gods did not live in the volcanic mountains. With the exception of the often cloud-covered San Francisco Peaks, which the Pueblo Indians honored as the seat of the rain gods, the cinder cones east of Flagstaff were part of a landscape that could be inhabited and cultivated. Economic and ecological necessities determined the relationship the Sinagua had with the dormant volcanoes more than the notion of a mountain as a sacred place. They collected water in the funnel-shaped volcano openings and worked the earth in the same way they farmed all the other suitable land in the barren desert plain west of the Little Colorado River. In the religious beliefs of the Sinagua, Roden Crater was as far away from being a sacred mountain as any other volcano—despite its dangerous connection to the inside of the earth.

It was not until the modern era that mountains, which tower up into the sky, became special places, the home of the *Kachina* and the center of the supreme natural forces. The sacred mountains of the Navajo, Hopi or Apache were located on the edge of the regions they inhabited and represented the four points of the compass: White Mountain in the east, Mount Taylor in the south, San Francisco Peak in the west, and Hesperus Peak in the north. In addition, there are numerous mountains on the Black Mesa and at the San Juan River that are sacred according to the beliefs handed down by the Indians and which can only be visited in connection with certain rites and with a medicine man present.

What is interesting for the connection with James Turrell's work is the concept that the four large mountains not only indicate the four points of the compass, but that at the same time they describe the light and the color of the light: the light appears to be white in the east, blue in the south, yellow in the west, and black in the north. Even today, a Navajo gives reasons for the central meaning of the mountains for the life and the survival of his tribe in the same way:

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[29] For the discussion on these questions refer to Christian E. Zitadelle, "The Sinagua," *Plateau, Magazine*

“These mountains and the land between them are our only protection. We only exist because of the sacred mountains.”[30]

The San Francisco Peaks may be among the four sacred mountains of the Navajo—an old pilgrimage path south of Black Falls ran through the volcanic field via the Little Colorado River and between Wupatki village and Roden Crater further to the west, and medicine men prayed at the foot of the snow-covered mountains for rain, protection from illness, and victory over the enemy. But the mountains, hills, and cliffs before the great mountain under yellow light lay outside the sacred topography of the Navajo. Sunset Crater is the only one around which legends have grown up, such as the one related by Michael Lomatuway’ma: it is the moving story of a couple who prior to their wedding is sent off on a long journey that leads them to the crater. Upon their arrival, the wind god K’anas puts them to a difficult test in which deceit and revenge, desperation and welfare, doubt and hope alternate before they can return to their tribe, happy and in harmony with the gods.[31] An older Navajo legend tells of the emergence of a mountain of fire: After First Man created the mountains at the four borders of their territory to protect them from enemies, Fire Man decided that there should also be a volcano to connect the First World to the Underworld. He went out onto the plain, took an arrow from his quiver, and shot it in the direction of the large hill in the west. The arrow landed in the top of the mountain and penetrated it down to the inside of the Earth. Fire and ash spewed out into the air through the hole. When Fire Man had completed his task and the mountain was finished, the Fire People moved into the mountain and the Earth ceased quaking.[32]

The story comes so close to the actual eruptions of Sunset Crater between 1064 and 1250 that its origin probably goes back to these volcanic eruptions.

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of the Museum of Northern Arizona 63, no. 1 (1992).

[30] Sam Bingham and Janet Bingham, eds., *Between Sacred Mountains: Navajo Stories and Lessons from the Land* (Tucson: University of Arizona Press, 1982), p. 2.

[31] Malotki and Lomatuway‘ma 1987 (see note 22), p. 7.

Either the Sinagua, who were later integrated into the Navajo people, told of the fire mountain, or the direct ancestors of the Navajo, the Anasazi, observed the eruptions from their territory. On a clear day, the San Francisco Peaks are plainly visible from the Canyon de Chelly area. The eruptions of Sunset Crater were recorded, explained, and thus captured in this old Navajo legend. The dormant volcanoes east of the Peaks, which the Navajo later called Testicle Hills, were free of legends, were not the seat of the gods and thus not scared. This is a considerable advantage for the *Roden Crater Project,* because the question regarding to what extent the sacred mountains of the Indians may be used for other purposes continues to be topical. Between 1969 and 1984, Native Americans, environmental groups, and students of North Arizona University went to court against private owners, Summit Properties, and the United State Forest Service over the extension of the ski runs and the setting up of other recreational facilities on the slopes of the San Francisco Peaks. The dispute was taken as far as the United States Circuit Court, where a decision was made in favor of the proponents of the further commercialization of nature.[33] Apache tribe members, local environmentalists, and the National Council of the Churches of Christ continue to fight against the erection of a third large binocular telescope east of Phoenix on Mount Graham, the international observatory of the University of Arizona.[34] This conflict illustrates how precarious the planning and construction of the Roden Crater Observatory could have become.

The use of Testicle Hills east of the San Francisco Peaks, however, appears to be settled: on the one side Sunset Crater, which has been declared a National Monument, which has not been climbed since 1985, and from which not even the smallest stone may be removed, and on the other side the unrestricted exploitation of the volcanic crater. Individual crater cones have been being strip-

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[32] Franc Johnson Newcomb, ed., *Navajo Folk Tales* (Albuquerque: University of New Mexico Press, 1991), pp. 89–107.
[33] Cf. Diana M. Notarianni, “The San Francisco Peaks Controversy; Application of the Segmentary-Opposition Model to an Intercultural Conflict,” (master’s thesis, Northern Arizona University, 1985).
[34] Cf. *The Arizona Republic,* March 28, 1995, p. B2.

mined for decades now—initially to exploit the available ores, and today to use the scoria to manufacture granulate for road construction. This stripping is still going on on a massive scale—some of the cinder cones that have been entered on maps do not even exist any longer, and others are for the most part destroyed. Many of the volcanoes serve as sites for recreational sports. The evenly formed hills are driven over by so-called crater-rated trucks all the way to the crater's edge, digging deep furrows in the sensitive surface and accelerating erosion. Other craters, such as Mirriam Crater, are the preferred take-off stations for paragliders. These recreational athletes use trucks to transport their equipment to the top. James Turrell's *Roden Crater Project* moves somewhere in the space between the rigorous protection and the indifferent exploitation of this geologically unique volcanic field.

The artist already protects the crater from unauthorized intervention and ensures that the land around the mountain is cultivated in the spirit of the indigenous vegetation. When the project is made publicly accessible, as is the case for the Sunset Crater National Monument, visitors will have to adhere to certain rules that not only aid orientation in the various chambers, but also apply to their movement in and on the crater. A visitor center will introduce visitors to the artistic-astronomical concept of the work and prepare them for the anticipated effect of the perception spaces. They will also be made aware of how they are to behave with respect to the crater and to nature. All of this takes place in the spirit of foresighted environmental protection and in this respect cannot be held against the work. For Roden Crater, the rhetorical question raised by John Russell within this context twenty years ago of whether the often enormous technical and thus financial expenditure for realizing such works stands in a justifiable relation to the mostly small number of visitors able to or who want to even view these works can only be answered in the spirit of this work.[35] It has to be clear, however, that the constructional intervention will destroy the crater in its mass, in its geological

composition, and for years to come in its vegetation as well. Against the background of the in part thoughtless exploitation of nature in this region, these measures can only be justified by the work: only at such a site, only from this crater with its evenly ascending flanks, the lower-lying deposits, the almost round crater basin, and the horizontal crater rim, is it possible to observe the stars and explore light in the way envisaged and intended by Turrell.

The Sky

The observation of the sky has a long tradition in the Southwest of the United States. Numerous observatories have been built in Arizona, Nevada, and New Mexico on account of the clean, dry mountain air at high altitudes. One of the oldest, Lowell Observatory—named after the famous astronomer Percival Lowell—is located on Mars Hill in Flagstaff. While modern observatories use complex technology to explore the universe and discover new galaxies, Turrell exclusively investigates phenomena that can be seen with the naked eye. By limiting his observation to, and focusing on, the relation between space and time, he comes very close to the native Sky Watchers in this region. When asked by Julia Brown in 1985 whether he was interested in the functional aspect of the spaces he designs, Turrell replied: “Räume interessieren mich nicht allein in ihrer architektonischen Form, sondern wegen der Gedanken und Erfahrungen, die mit ihnen und in ihnen möglich sind. Und ich liebe Bauten, die ihre Funktion verloren haben, wie die Ruinen der Maya und Ägypter oder Mesa Verde. Die Tatsache, dass an diesen Orten einmal Zeremonien und Rituale stattgefunden haben, macht sie bedeutungsvoll und verleiht ihnen eine Kraft, die physisch erfahrbar

[35] John Russell, “An Earthwork Looks to the Sky,” in *James Turrell: The Roden Crater Project,* exh. cat. Museum of Art (Tucson: University of Arizona, 1986), p. 9.

ist."[36] ((Original?)) The Mayan temples, the Egyptian pyramids, or the Sun Palace on Mesa Verde in Colorado were not only ceremonial sites. In their arrangement and dimension, the pyramids of Gizeh, for example, are the architectural expression of Orion. In this constellation, the Ancient Egyptians worshipped Osiris, god of the dead and brother and husband of Isis.[37] The Sun Palace in Mesa Verde had a position and orientation founded in astronomy: from a specific point on the opposite side of the canyon, on December 21 the Sky Watcher priest of the Anasazi saw the setting sun in the exact center of the Cliff Palace and designated this date, the start of the winter solstice, as the beginning of ceremonies and the time for sowing grain.[38]

The reference to the Mesa Verde Sun Palace and Turrell's plan to illustrate the phenomenon of the celestial sphere from a central kiva on the floor of the crater basin connects the *Roden Crater Project* with prehistoric astronomy in North America's Southwest.[39] The observation of the sun, the moon, and the stars was vital for the Anasazi as well as for the Pueblo Indians: life on this barren land was only possible with the aid of a reliable calendar and precise weather forecasts. The Indians identified their gods with the constellations—their position, course, and ascendant determined the occasion for, and the beginning and course of, their nightly rituals. The Milky Way, for example, represented the omnipotent god of the heavens, who at the same time represented a bridge between the earthly world and the world of the gods and made certain that the forces were balanced. Native American knowledge of the apparent journey of the sun, the phases of the moon, and the course of the stars was collective and existential; above all, however, it was founded in their culture.[40]

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[36] *James Turrell: Occluded Front,* ed. Julia Brown, exh. cat. The Museum of Contemporary Art (Los Angeles: Fellows of Contemporary Art and Lapis Press, 1985), p. 38.
[37] Cf. Robert Bauval and Adrian Gilbert, *The Orion Mystery: Unlocking the Secrets of the Pyramids* (London: William Heinemann Ltd, 1994).
[38] Cf. J. McKim Malville and Claudia Putham, *Prehistoric Astronomy in the Southwest* (Boulder: Johnson Books, 1992), pp. 91f.
[39] For the following accounts refer to ibid.
[40] The religious reference is included in this emphasis on the cultural. When a Hopi child was born, it was kept inside in the dark for nineteen days. On the morning of the twentieth day after its birth, its mother

The prehistoric Sky Watchers had two methods of recording the actual or apparent motion of the stars. Because the change of the seasons was obviously dependent on the changing altitude of the sun, they were primarily interested in determining and recording the winter and summer solstices. In the case of the winter solstice, this could take place in the following way: from a position in the settlement, a prominent point on the horizon above which the sun rose or set was fixed and named after it had previously reached its deepest point and for several days had hardly changed its position.[41] However, it could also be done at places where the horizon was flat and lacking any prominent points: at the equinoxes or the solstices, a beam of light from the rising or setting sun fell through an opening in the outer wall of a house onto the opposite wall and was recorded. An example for this kind of introspective observation and fixing of the solstice, first discovered in 1977, can be found in Hovenweep Castle National Monument in the southwest of Utah. At the winter and summer solstices, openings made in the outer southwest- or northwest-facing walls of the sun chambers guided a beam of light from the setting sun to a point above individual door openings. The special thing about this optical calendar is being able to count the days before the occurrence of the solstices on the same wall on which they have been recorded. This anticipation of the solstices was particularly important for the preparation of the ceremonies that took place at the winter solstice. By way of nocturnal dances, prayers, and sacrifices, the sun god had to be called out of his winter house. The prediction of the spring equinoxes was particularly important for determining the days on which grain had to be planted. The journey of the sunbeam between the winter solstice and the date on which grain was sown has been recorded in so-

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would carry it outside before sunrise. Turned towards the east, when the sun emerged above the horizon, she would hold the child towards the sun and say “Father Sun, this is your child.” Cf. Frank Waters, *The Book of the Hopi* (New York: Penguin Books, 1977), p. 48.

[41] The Anasazi saw great danger in these pauses in the otherwise so constant upward and downward movement of the sun’s altitude. They knew that their grain would only be able to grow when the increasing angle of light coming from the sun in the spring emitted enough warmth. But a constant high altitude of the sun in the summer would endanger their lives. In their winter and summer solstice ceremonies they asked Father Sun to continue his movement. Cf. Michael Zeilik, “The Ethnoastronomy of the Historic Pueblos:

called Rock Art drawings. These are pictures that depict the individual lunar phases as well as pictures of stars. It is not always possible to exactly explain the meaning of the signs that have been found. Many of these signs and images have symbolic meaning and make reference to religious beliefs. The Anasazi from the Canyon de Chelly believed that the stars hold up the canopy of heaven. This is why they drew stars on the underside of the overhanging cliffs below which they had built their dwellings.

The *Roden Crater Project* will demonstrate phenomena that can be observed in the sky during certain times of the day or night, during individual phases of the moon, or during the Earth's orbit around the sun. It will represent them by way of introspective arrangements as well as by directing one's perception towards phenomena outside of the chambers. The phenomenon of precession will be able to be experienced by means of a long corridor with an adjacent chamber. The size, form, and position of this architecture is oriented towards the phenomena being thematicized. The quality of the chambers and tunnels corresponds with the ceremonial centers of the Pueblo Indians, the large kivas, used to observe astronomical events.[42] These structures with a round foundation were common in all Pueblo cultures. The largest have been preserved east of Roden Crater in the territory of the Chaco Anasazi. The layout and instrumentation of the Casa Rinconada as well as other spaces for observing the sun and the planets show that the Anasazi were not only great master builders, but that they had advanced knowledge about astronomy early on.

There is a surprising correspondence between the quality of the chambers with their outlets and openings and the communal spaces of the Pueblo Indians, the kivas. In James Turrell's extension of the *Roden Crater Project,* completed in 1995, he conceived a sunken space for the crater basin to be used for the

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Calendrical Sun Watching," in *Archaeastronomy. Supplement of the Journal for the History of Astronomy* 8 (1985), pp. 1–24.

[42] Ray A. Williamson, "Casa Rinconada: A Twelfth Century Anasazi Kiva" in Anthony F. Aveni, *Archaeoastronomy in the New World: American Primitive Astronomy* (New York: Cambridge University Press, 1982), pp. 205–219, here p. 205.

representation of various heavenly phenomena. The artist calls this space Tso Kiva. The phenomenon of the celestial sphere will be able to be observed from the upper edge of the hemispherically shaped space; on the floor, the hemisphere vaults over a pool, the surface of which generates different refractions. There will be an opening on the south side of the hemisphere to observe the North Star.

As in the other chambers of the *Roden Crater Project,* in the kiva one will be concerned with the observation of cosmological phenomena, the experience of optical sensations, and the play of light and shade in their dependency on refractions created by the surface of the water. Besides having called the space a kiva, at first it is only the opening in the hemisphere that might suggest the kivas of the Anasazi. It orients the space by directing the visitor's glance towards the celestial north pole, thus creating a parallel with the earth's axis. This orientation towards one of the cardinal points provokes the comparison of Turrell's Tso Kiva with the large Casa Rinconada kiva in Chaco Canyon, approximately three hundred kilometers east of Roden Crater.

In all Pueblo cultures of the Southwest, kivas, semiterranean spaces of varying sizes mainly erected on a round foundation, served as a communal space. The male members of one or more tribes assembled there to perform certain rites, to prepare for annual ceremonies, to negotiate tribe-related matters, to exchange experience, and to observe cosmological events. With respect to its location, size, features, and function, the Casa Rinconada is an exception; it is precisely its special qualities that allow comparing it with Turrell's *Roden Crater Project*. The kiva is situated in a central but isolated location within the network of the so-called great houses, which extends over more than twenty kilometers. Casa Rinconada was built on a hill on the south side of the Chaco River only several hundred meters away from the great Pueblo Bonito. This exposed location allows an open view of the settlements on the northern rim of the canyon. With a diameter of about twenty meters, Casa Rinconada is one of the largest

kivas. With a radius of twenty-two meters, Roden Crater's hemispherically shaped Tso Kiva will be nearly twice that size. Both kivas have been let into the earth and are connected with the inside of Earth in different ways. Turrell uses water to create the reference to Earth's molten core. The pool lies directly above the crater's former opening. As is the case in other communal spaces as well as in private houses, hollows, caves, and openings have been let into the floor of the Casa Rinconada, which were covered over and danced upon on the occasion of certain ceremonies. These kinds of openings created a link to the underworld. The functions of both spaces, however, vary. Turrell's Tso Kiva is not a communal space—Roden Crater is culturally, not ritually determined—and the Casa Rinconada was not an observatory. This was pointed out in particular by Ray A. Williamson, who described the Casa Rinconada as a building used for performing rituals, the architectural structure of which characterizes the principal importance of astronomy in the religious practices of the Pueblo Indians. The knowledge of a community for whom the observation of the celestial bodies and the establishment of a calendar derived on these observations were vital culminates, so to speak, in this kiva. Furthermore, the evidence of this culture that has been handed down—for this context it is chiefly the structures—confirm that a large number of the ceremonies that took place in these buildings contained astronomical components, that the motion of the sun and the moon was followed and recorded from certain shrines, and that as a structure, the kiva is aligned relative to the four cardinal points. With Casa Rinconada, a prehistoric building has been preserved at nearly the same geographic latitude that contains several of the phenomena that will be demonstrated or able to be experienced in Tso Kiva. Turrell's kiva will also be oriented astronomically, namely via the opening directed towards the celestial north pole in the kiva wall. In other spaces, for instance the Sun and Moon Space, the fumarole sphere, the architecture will be calculated according to the solstices and the orbit cycle of the moon.

Both orientations were widespread in the Pueblo cultures. In their ceremonies, the tribes along the Rio Grande tended to align themselves according to the four cardinal points; in contrast, the Hopi and Zuni correlated many of their rituals with the winter and summer solstices. Common to both projects is the positioning of the observer. With the Anasazi as well as with later Indian tribes it was the priests, among them those with extensive experience in observing the paths of the sun and the moon, who marked the places that were important for the architectural form of the calendar. There is no evidence of stellar or planetary marks for the Casa Rinconada. This kiva was exclusively conceived to allow a very precise description of the lunar phases and to depict the rising sun.

Beginning clockwise at the entrance aligned with the North Pole, the kiva has twenty-eight niches, which very likely make reference to the 29.5 days of the synodic month.[43] These niches are time markers, so to speak, in the perfectly circular kiva, abstract markings like the 33⅓° segments on our clocks. Calendrical measurements of the orbit of the moon around Earth, which these marks are based on, do not exist in the kiva itself. However, niches 22 and 23 as well as niche E do illustrate the lunar standstill that occurs every 18.61 years.

Regulated by the gravitational effect of the sun, the moon perturbs with an average deviation of five degrees nine minutes from the ecliptic and reaches its turning point every 9.3 years. When the moon reaches its northern- or southernmost celestial latitude, it repeats its path for several days. This apparent orbital standstill of the moon has also been observed in, and recorded by, other cultures. In Europe, prehistoric places of religious worship have been preserved, the layout of which can be traced back to comparable astronomical phenomena: Stonehenge near Salisbury, England, or the megalithic monuments in Brittany, France, served, among other things, to establish the solstices and thus describe

[43] Niche 29 was possibly lost in the course of earlier reconstruction measures. There is an interval for it on the east side of the southern entrance.

the cyclic calendar.[44] Because of their many years of observing the paths of the moon, the Anasazi in Chaco Canyon had very precise knowledge about these phenomena. This is well illustrated by the depiction in the Casa Rinconada of the recurring declination of the moon. Through opening A, every 18.61 years at the summer solstice, the setting moon illuminates niche 23, then niche E, and finally, at the northernmost point of its orbit, niche 22, as does the sun that rises shortly thereafter.

Besides the indications of certain analogies between representations of astronomical phenomena in the Anasazi kivas and Turrell's observation chambers, it seems to be important to also make an essential comparison of these structures. Casa Rinconada in Chaco Canyon is always regarded in connection with the religious beliefs and ceremonies of the Anasazi, and the communal spaces have been described as architectural metaphors for the universe. In this rotund, the varying expanse of the sky and the complicated motions of the stars were converted into human dimensions and thus captured. At the same time, with the kiva, which represented the celestial order and the regularity of stellar movement, the Indian tribes set something against the dangers and rigors of nature. Covered by a copula and oriented towards the four cardinal points of the cosmos, the kiva was a space that called up the harmony of the earthly world with the infinite expanse of the universe. At the same time, the kiva was a place that connected the present with the past and the future. The roof of the kiva was made from branches from the First Trees, trees that were planted in the underworld to enable the ancestors to climb up into this life. The branches in the weave of the roof represent the Milky Way. Besides the cosmological notion that the sky is depicted in the kiva's hemisphere, the kiva symbolizes the cosmogenetic idea of a space in which a human being journeying from the past into the future can linger in order to live with his tribe. This representation based

[44] Ray P. Norris, "Megalithic Observatories in Britain: Real or Imagined," in C. L. N. Ruggles, ed., *Records in Stone, Papers in Memory of Alexander Thorn* (Cambridge: Cambridge University Press, 1988), pp. 262–276.

on the idea of immortality, which was binding and was accepted by every member of the community, is neither aspired to by the *Roden Crater Project,* nor would it be possible. Roden Crater will allow very different experiences to be had—some of them will result from the observation of astronomical phenomena, others from the confrontation with a guided perception of light. But apart from the fact that the observations of solstices, lunar phases, and the paths of stars with the naked eye is prefigured by the practical science of the Native Indian priests of this region, the *Roden Crater Project* will also establish a community. The experiences are too intense and the planned organization too exclusive for uplifting feelings of having been there not to appear. However, members of this community will remain strangers; they will only rarely and more by coincidence be able to exchange the experiences they had while visiting Roden Crater. The community will, so to speak, be conjunctive.

The Project

It will be a long time before visitors to the *Roden Crater Project* will be able to exchange the experiences they have had in its astronomical chambers and perception spaces. Because, after repeated changes and extensions, work on it as a project has been completed, it is now possible to discuss the functions of the planned spaces, the likely interaction between them, and the concept as a whole. This has not yet taken place in American research, which is inclined to limit itself more to an anticipating description of the visual experience that will one day be possible in Roden Crater as an artist's observatory.[45] How temporary and ultimately hopeless such an approach is can be shown by way of an example. In

[45] We expect James Turrell to describe the project, explaining the effects of the individual chambers in the process. He recently did so in a book published by Baile Oakes after comparing the optical sensations of the *Roden Crater Project* with those experienced during flying. In the tradition of Antoine de Saint Exupéry, these texts are in part very poetic; however, they provide no information whatsoever, e.g., about

his monograph on Turrell, Craig Adcock described a pool that is connected to the Fumarole Space via a tunnel. While underwater in this pool, the visitor would be in a position to hear sounds coming out of space such as those made by quasars and Seyfert galaxies. Adcock correctly points out that the sound coming from the Grand Falls of the Little Colorado River only six kilometers to the east would drown any sounds coming out of space, at least during the thaw in spring or after the sometimes torrential rainfall in July and August.[46] In his final version, James Turrell retained this space and described it as an optical and acoustic telescope through which visitors floating in the water will not only be able to perceive celestial events visually, but acoustically as well. At least at certain times of the year, however, the roar of the Grand Falls will make listening to any sounds coming from space impossible. The pool will hardly be able to function all year round as a telescope for the visual and acoustic observation of astronomical phenomena. This uncertainty in the description and interpretation of the published plans suggests attempting to make a more general assessment of the project and its five space clusters than continuing to describe the possible effect of individual spaces.

The plans for the *Roden Crater Project* go a long way back. Turrell was still working on the park group of the *Division Constructions,* in which he materializes light, but had already completed his so-called *Mendota Projects* when he began searching for a place where he could further pursue his investigations under existing geological conditions and with natural light. Volcanic craters with evenly formed ash cones presented themselves for this kind of open-air project because an enormous sky window over the crater's rim opens itself up to anyone standing in the crater basin. However, it does not materialize light, as did *Meeting* at P.S. 1 in New York or *Second Meeting* in Santa Fe—the window is too large to do so, and there is a lack of contact between the cool light from the sky and the warm

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the necessary joining of individual chambers. Cf. Baile Oakes, *Sculpting with the Environment: A Natural Dialogue* (New York: Van Nostrand Reinhold Press, 1997).

[46] Adcock 1990 (see note 3), p. 176.

light in the observation space. By equalizing the horizon and limiting the view, however, the existing crater opening generates the phenomenon of the celestial sphere. This optical sensation can be best experienced from a horizontal position and when the opening is round or only slightly oval and the crater's rim is uniform. The possibility of illustrating the light phenomena of the sky above an evenly shaped volcanic cone at the same time prefigures the directions James Turrell follows in the entire project. Optical phenomena which occur in the sky at different times of the day will be able to be seen in many of the chambers. The north chambers will contain a sky space such as the one the artist last realized in the Israel Museum in Jerusalem and a camera obscura, which will project all of the movements taking place in the sky, above all the drifting clouds, onto the white carpet of sand on the space's floor. The east chamber will have a sky space in which the light in the sky will appear to be dense and solid, especially during twilight. At all times of the day, however, this window will allow light to enter that is intended to mix with the light of another color falling from the east via a ramp on the pool below it. The other chambers also contain spaces that collect, outline or project light. This category of phenomena links the *Roden Crater Project* with Turrell's entire body of work. Turrell has thematicized light as a primary material since his early *Cross Corner* and *Single Wall Projections:* "Light is a powerful substance. We have a primal connection to it. But, for something so powerful, situations for its felt presence are fragile. I form it as much as the material allows. I like to work with it so that you feel it physically, so you feel the presence of light inhabiting a space. I like the quality of feeling that is felt not only with the eyes. It's always a little bit suspect to look at something really beautiful like an experience in nature and want to make it into art. My desire is to set up a situation to which I take you and let you see. It becomes your experience. I am doing that at Roden Crater. It's not taking from nature as much as placing you in contact with it."[47]

Kommentar [R1]: Translate quote into German.

[47] James Turrell, cited in Brown 1984 (see note 36), n.p.

Besides these light spaces, the *Roden Crater Project* contains a proportional number of spaces devoted to the observation of astronomical phenomena. Of the total of fourteen spaces contained in the most recent plan, seven of them are assigned to fixing the solstices, the experience of Earth's rotation, the experience of time, the guided perception of orbits, and astronomical constellations. Because observation and perception spaces were planned in all of the space clusters, the *Roden Crater Project* was more than an artist's observatory from the very beginning. The observation spaces, which serve to examine astronomical phenomena, are geared towards these phenomena, and their architectural form corresponds with the optical depiction of the phenomenon. The shape of the segmented ramp in the east chamber results from the sun's apparent path between its northern- and southernmost turning point. The sun will roam across the northern wall of the spatial segment on the day of the winter solstice, and across the southern wall on June 21. Between these two dates it will rise on different points along the horizon but within the oriented opening of the space. The other astronomical chambers are also developed in exactly the same way—based on the phenomena produced on this side of the volcano. Their positioning is consistent or inevitable and in any case the result of precise calculations. The fumarole chambers on the east-northeastern side of the crater are oriented exactly according to the northernmost turning point of the rising sun at the summer solstice. In the opposite, south-southwest direction, on its southern orbit the moon sets every 18.61 years. The beams of the rising sun are led over the central Fumarole Space into the Sun-and-Moon Space. Shortly before sunrise, the setting full moon appears on the other side in the corridor that leads to the crater basin. The sun and the moon consecutively illuminate an approximately five-meter-high stone wall. Given this dependency between calculable fixed points of the path of the moon and the apparent path of the sun, there is only a single line on the crater on which this dual event can be illustrated. It lies on the east-northeastern side of the crater and runs from the crater rim via

the fumarole until it reaches the plateau. The determination of the absolute height on this calculated line resulted from connecting the Fumarole Space with further space clusters. The Sun-and-Moon Space lies in the hollow between the main crater and the fumarole.

So while there are direction-dependent places on the crater's slope or in the crater basin for the astronomically defined spaces, the perception spaces are neither site- nor direction-dependent. Turrell's previous sky spaces were erected at sites with highly differing topographies: on the one hand in large cities such as Los Angeles, New York or Jerusalem with relatively high levels of light and air pollution, and on the other hand in smaller, higher-lying locations such as Varese in Italy or Santa Fe in New Mexico. The external conditions at Roden Crater for working with light are extremely favorable. There is virtually no light pollution, and in the region south and east of San Francisco Peaks the air is still so clean that the observatories located there continue to work successfully. However, altitude, a clear atmosphere, and low light diffusion are dispensable conditions for sky spaces. There must be reasons for setting them up in such large numbers, and they must adhere to other laws besides those prescribed by the site. Because all of the space clusters contain astronomical observation chambers as well as perception spaces, I will cite an example that can apply for others. The main entrance to the *Roden Crater Project* will lead through the north chambers. As a reference, so to speak, to Turrell's previous work, the visit begins in a sky space in which the artist works with the proven contrast between indirect, warm light in the space itself and the light from the sky in the space's opening. During the day, the light inside will be dominated by the light outside of the space. During twilight there will be a strong interaction between the interior and the exterior light.

When night rises, to apply a formulation often used by Turrell, one will marvel at the soft materiality of the section of sky, follow the path of the stars, and be able to enjoy the sustained silence that prevails at this lonely place. Like all of the spaces in the *Roden Crater Project,* this sky space has been let into the

volcanic mountain; the opening connects with the surface of the fumarole. An underground corridor connects this first pace with a rotund that has been developed into a camera obscura. The dark chamber projects the events in the sky via a short tambour onto a white floor of sand. The visitor will be in the space and be able to observe what this space sees, a space that has been structured like a camera and functions in the same way as the human eye. This part of the North Space also serves to sensitize perception; it illustrates how we see and in doing so works with the optical sensations of the site: light, darkness, the varying brightness of the stars, the movement of the clouds. These spaces are nevertheless not site-specific; they can be set up at any other site, where they then work with the conditions that prevail there. With the aid of the separation of warm and cool light, the sky space in Jerusalem, *Space that sees* (1992), which was also let into a hill, generates the same deep-black material section of sky as the sky space of the Roden Crater Project, and like the Camera obscura, the stoppages of the *Mendota Project* (1970–72) also projected external events onto the walls of the interior spaces.

In the North Space there will also be a space in which the visitor can observe the North Star. It is directly next to the Camera obscura and is connected with the rotund via an opening. From an architectural point of view, this observation station is part of the perception space. One visitor at a time will be oriented via a sight towards Polaris from a seat designed for this purpose. The stargazers eyes will be guided and focused in such a way that he or she will be able to ascertain a movement between his or her position and Polaris. In contrast to the familiar experience of the train arriving on the neighboring track, which one assumes is standing still while the one one is sitting in is moving, the visitor will experience the actual motion of the earth around an axis oriented toward the North Star. Any observation of the starry sky or individual stellar constellations lets us assume that the canopy of the sky wanders from east to west over the earth. With the aid of the North Star Seat it will be possible to see what actually

happens, namely that Earth moves within the universe and not the universe around Earth. Using this instruction in astronomy, Turrell reminds us of both Ptolemy and Copernicus. Ptolemy explained the universe with the aid of a frame of reference that assumed Earth as its center. Copernicus proved that the earth is only part of a very much larger system, the center of which is the sun. Today we know that there exist still other solar systems beyond ours and that everything is in motion. Each of these movements can only be described in relation to movements in other systems. No point of view is absolute or definitive, but always relative. This is exactly what Einstein describes in his theory of general relativity. Turrell makes the relativity of Earth's movement in the universe understandable by allowing us to gaze at Polaris and back at Earth from this star.

For James Turrell, this is the North Space's central configuration; it is site-specific. It is arranged on the exposed Roden Crater in such a way that it enables an unobstructed view of the North Star. The clear air and the frequently cloudless night sky over Arizona prove to be a genius loci for observing this astronomical phenomenon. But what is the purpose of the perception spaces the visitor experienced prior to this? Do they prepare the ground for insight into the relativity of our experience? The optical phenomena in the Camera obscura also cause us to ask what is real. The shadows on the floor of the space are real—or are they really only depictions of a reality that requires sunlight in order to be seen. Outside of the Camera obscura we see clouds and other heavenly bodies in this light. In the dark chamber, the optics of the oculus produce inverse silhouettes. James Turrell associates the beginnings of a depiction of the world from a linear perspective as developed by the universal artists of the early Italian Renaissance Brunelleschi and Alberti with the configuration of this space, which allows assembling celestial phenomena and projecting them onto the visitor's level of experience.[48] In Florence of the fifteenth century it was primarily Leon Battista

[48] In his *Berliner Vorlesungen 1999,* Friedrich Kittler lectures on Shigeru Tsuji's four arguments, which give every reason to believe that Brunelleschi prepared his draft of the *Sacrifice of Isaac* for the bronze doors

Alberti who drew attention to himself as an engineer artist and theorist by way of his inventions, among which was also a camera obscura. Through the opening of the small box "one saw the tallest mountains and vast landscapes around immense lakes and places far away from the eye, so distant that one's vision was not sufficient enough to distinguish between them. He called these things demonstrations, and they were such that both the experienced and the inexperienced did not believe they were seeing paintings, but natural phenomena. There were two kinds of demonstrations: daytime and nighttime. In the latter one saw Arcturus, the Pleiades, Orion, and other shimmering stars; when the evening stars came out the moon rose behind steep cliffs and mountain peaks. In the daytime demonstrations a radiant God—heralded, according to Homer, by Eos, the goddess of the dawn—revealed the vast planet for miles around."[49]

Camera obscura and Sky Space are perception spaces that show us how we see. The artist-scientist Turrell not only shares this interest in perception phenomena, in questions about how our vision functions, with the artists of the early Renaissance, but with the poet-scientist Goethe as well. For Goethe, optical illusions were actually optical truths and as such they were subjective.[50] Despite a configuration that remains the same, for example in the sky space of the north chamber, each visitor will have different experiences with the immaterial image being projected onto the space's ceiling. Everyone will be deluded in a different way. Goethe had understood that optical illusions can show how lively the relationships are between our inner world and nature on the outside. Is that perhaps the link between the perception spaces Sky Space and Camera obscura and the observation space Polaris? Gravity and the atmosphere rotating along

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of the baptistery in Florence with the help of a camera obscura. Cf. Friedrich A. Kittler, *Optische Medien: Berliner Vorlesungen 1999* (Berlin: Merve Verlag, 2002), pp. 67f.

[49] Account by an anonymous biographer cited in Giorgio Vasari, *Leben der ausgezeichnetsten Maler, Bildhauer und Baumeister von Cimabue bis zum Jahr 1567,* ed. Julian Kliemann (Darmstadt: Wernersche Verlagsgesellschaft, 1983), p. 347, note 9.

[50] Arthur Zajonc, *Die gemeinsame Geschichte von Licht und Bewusstsein* (Hamburg: Rowohlt, 1994), p. 230.

with Earth allow us to assume that Earth is standing still and the universe moves above us. We cannot distinguish between the actual movement of the moon around Earth and the apparent movement of the sun around our planet. When we look through the sky window into the cloudless sky during twilight, we believe we are looking at an image on dark blue cloth. We are being fooled in both cases, but in the end light is shed upon the illusion. As soon as stars appear in the opening of the sky space or clouds drift by, as soon as we cease watching the apparently static North Star, we understand what has happened to us: the artist has created a perception and observation situation that deludes us and at the same time (or eventually) sheds light on the illusion.

Sky spaces, of which there are a relative abundance in Turrell's previous work, also play a large part in the *Roden Crater Project*. They occur in the plans for nearly all of the chambers, but have different functions. I would like to report on a further concept in order to make clear that combining sky spaces with the corresponding observation space is not always necessary. In East Space the central space will be a stage oriented eastward, the opening of which will circumscribe the North Star and the southernmost point of the rising sun. At the equinoxes, the sun will rise exactly along the central axis of this stage. In the rear part of this space there will be a pool to reflect and duplicate the sunbeams, above which there will be a sky space. "Because of the opening to the east and the sky space directly overhead, I can take light from different portions of the sky and mix them. Through this simultaneous contrast, I can change your perception of the tangible light. Light inside the space from a red/orange sunrise in the east is going to totally change your perception of the color of the sky above through the sky space. The outdoor sky directly overhead at this time of day would appear as a completely different color."[51] As already explained, observing the rising sun has a long tradition in this region as well as in the entire Southwest of North America. For the Anasazi in particular it was of major importance for determining

[51] Oakes 1997 (see note 45), p. 70.

the calendar. But Turrell is not interested in the calendar. East Space may mark that part of the horizon at which the sun rises between December 21 and June 21, but there are no provisions for dividing up time on the rear concave wall. Turrell wants to use the light of the rising sun as colored light in the first open space and produce a simultaneous contrast with the color of the sky's light above the viewer. Simultaneous contrast and thus mixtures of color or light are only possible when different fields of color lie directly beside each other; only then are they able to be perceived simultaneously. It remains to be seen whether this will occur on the water's surface, where the different colored lights meet. In any case, the gray light of the still dark sky will fall with much less intensity. Simultaneous contrasts can only result through the juxtaposition of colors with the same intensity.

A different effect will probably occur on the pool, the result of the mirror-like reflection from the water's surface. Like sunrise over the sea, the surface of the water will be dark because the sky being reflected from the water is still dark. The rays of the rising sun are reflected from this film. It is possible that this will be the actual sensation in the east chamber. The visitor, whose gaze is directed towards the Painted Desert, experiences the sun rising over water. It is especially the concept of the east chamber that makes clear to us that Turrell works with open systems. The overall space my be oriented towards the equinoxes and its floor plan determined by the northern- and southernmost turning points of the sun; however, the astronomical references are not pursued any further in the inside of the space. In correspondence with the solstices, the exact circumscription of the horizontal opening will have no consequences. The orientation towards the east, one of the parameters in Anasazi architecture and their culture, has been secularized, as it were, and reduced to the fact that the sun rising in the east generates a red light with a low angle of incidence that is reflected from the dark surface of the water. A comparable effect becomes apparent when the sun sets over the water. Thus a quality is relativized that largely determines the

arrangement and the orientation of the other chambers: the reference to the site, i.e. an examination and representation of astronomical events and/or light phenomena which only occur at this site. Turrell's openness when dealing with existing systems applies to astronomic constellations in the same way it does to his own work. He neither further pursues the fixing of the solstices by means of architecture, nor does he use the sky space with the same precision we are familiar with from his group of sky spaces, in which the size of the opening is placed in a specific relation to the size of the space because an image is supposed to be produced in the open ceiling towards which we move at a predetermined distance. In the east chamber, the sky space has the function of letting in the dark light of the setting nighttime sky with enough intensity.

The observation of the east chamber being conceived as a relatively open system leads to the general question regarding the project character of the work. The *Roden Crater Project* consists of the *North Space, East Space*, *Fumarole Space*, *Tso Kiva*, *South Space,* and *West Space*. A comparison of the six space clusters shows that all of them contain complex astronomical observation spaces and perception spaces. The spaces for observing astronomical phenomena such as solstices, the moon's orbit, precession, or the celestial sphere have been set up in places where these events can be observed. The location and orientation of the spaces have been derived from the qualities of the phenomena to be depicted. The Fumarole Space, for example, will contain a Sun-and-Moon Space in which on June 21, the light of the setting full moon during its southernmost orbit, which the satellite reaches only every 18.61 years, will meet the rays of the rising sun. In order to illustrate this event, a site had to be found on the crater which allows this orientation of the chamber and the tunnel connected with it. Only the northeastern slopes of the crater, of which there are three, are suitable for the northernmost sunrise: the slope of the fumarole dropping away to the plateau, the northeastern outer side of the main crater, and the northeastern slope of the crater opening. Because both the sun and the moon rise over a

horizon and at the same time the light of the sun and the moon coming from opposite directions are supposed to meet, the moon had to set over the crater rim. In the course of this, it is supposed to fully stand in the tunnel opening, i.e., in the case of a certain diameter the tunnel had to have a corresponding length. This means that the chamber could only lie on the northeastern slope of the fumarole, from where there is an unobstructed view of the Painted Desert with the Black Mesa; that is where the sun rises. The view over the crater rim at the setting full moon will be led along a long, slightly ascending corridor that has been calculated so that it encloses the moon at its end. The Sun-and-Moon Space is site-specific in a very literal sense. It was solely at this place on the crater that the phenomena to be generated in the chamber could be illustrated. Turrell uses the complex form of the crater for a guided astronomical observation. The rays of the rising sun meet the light of the moon created by the sun not in the vastness of the universe, but in a walkable space.[52]

Site-specificity is not in place in the same way for all of the space clusters, except for the spaces in the crater basin and at the fumarole named for the four cardinal points of the compass. The observation of the phenomenon of precession with the aid of the North Star can be done from the north chamber, but would also be possible from the east chamber. A camera obscura meant for representing the motion of the clouds functions wherever the sky can be clearly seen above the oculus. Even in the case of the astronomical observation spaces, the orientation towards the cardinal points of the compass with reference to a specific topographic situation is relative. The event being observed in the corresponding direction more or less determines the central function of the respective space cluster. In contrast, the surface-geological reference, i.e. the arrangement and coordination of each group of spaces, to the special, individual form of the crater is a close one, but so is the reference of the spatial clusters to

[52] To be precise, they will not meet the moonlight, which they will diminish, but rather a c. four-meter-high disc, which on one side stops the rays of sun and on its southwest side reflects the moonlight. Visitors will go around this disc and be able to look at the celestial bodies through the corridors.

one another. The multishaped relief of the crater and its location on the northeastern edge of the volcanic field of the San Francisco Peaks once more prove to be favorable conditions for the arrangement of the observation and perception chamber.

Just as little as the individual observation spaces are necessarily geared towards specific astronomical events do all spaces in a space cluster connect to an experience field. As a perception space, the sky space of the north chamber neither directly nor indirectly supports observation of Polaris or observation of Earth rotating and moving in the universe. The concept of the *Roden Crater Project* does not consist in the bringing together of experiences of time that result from the observation of astronomical events and on the other hand from a sensitization of perception. The *Roden Crater Project* consists more of patterns that make proposals for observation and perception. The *Roden Crater Project* is therefore not a project. It becomes especially clear how extensive and complex Turrell's concept for Roden Crater is when one compares it with other Land Art projects. Walter De Maria's *Lightning Field* is a work that allows having highly diverse experiences, but it remains a supposition. Nancy Holt's *Sun Tunnels* are site-specific and oriented toward one place. Thus they fulfill the criteria placed on landscape projects: "The center of the work becomes the center of the world."[53]

Artistically speaking, the *Sun Tunnels* are a concrete examination of specific constellations that we are able to see because they shine; but they only shine because the sun illuminates them. This phenomenon is reversed in the tubes. We see the constellations because a negative cut into the tunnel wall is illuminated, in this way enabling the constellations to appear as sunspots on the opposite side.

In a narrower sense, Roden Crater could not become a project because from the very beginning it was planned that highly diverse and, temporally

[53] Nancy Holt, cited in Patrick Werkner, *Land Art USA: Von den Ursprüngen zu den Großraumprojekten in der Wüste* (Munich: Prestel Verlag, 1992), p. 116.

speaking, significantly distant events were to be illustrated—daily events such as sunrise and sunset, annual events such as a solstice, but also events that only occur every 18.61 years. Turrell himself justified the large number of spaces by pointing out the limited scope of experience allowed by each individual space. However, because very diverse ways of observing light and the heavenly bodies were meant to be possible at this site, fourteen spaces were planned. Individual chambers, but individual space clusters as well, will function in the same way as other large-scale astronomical projects, for instance Tso Kiva. In their union of time and space, the observation of changes in light and shade during the day, the experience of the phenomenon of the celestial sphere at twilight, and the gaze directed toward the North Star at nightfall will enable having comprehensive experiences. However, if each space is in principle directed toward a single phenomenon in the sky, thus allowing only a limited number of events, the concept for Roden Crater must be described in a different way than has been the case up to now. It was just recently that the American mediatician David Ross recalled that one of the really great innovations in art in the twentieth century is the collage.

As a principle, the collage is not only limited to the picture. As an assemblage it thematicized the space between the parts very early on and thus provided the decisive stimulus for deconstructivist architecture. Even the movements in the Internet can be described using criteria developed for the collage: interface, diversification, change of perspective, multilingualism. Some of these terms can be effortlessly transferred to the concept for Roden Crater. We have seen that the chambers serve to observe individual celestial phenomena but that they cannot be subsumed under a common astronomical program. We have also seen that the perception spaces only prepare the ground for the observation chambers in a very general sense in that they sharpen the perception of different light phenomena. In this respect, all of the spaces are necessary for a comprehensive understanding and comprehensive experience of the

astronomical events and light phenomena. All of the phenomena that can be observed are connected with each other, but according to the principle of the collage and not according to the strict rules of a project. When two observation chambers each make a connection to the North Star in a different way, then I call that bilingual. When there is a combined experience on the subject of movement between the observation space North Star Seat and the perception space Camera obscura, than I call that diversified. And when two components of the solar system meet in the Sun-and-Moon Space, then an interface emerges there. The principle of the collage is the only valid artistic principle with and through which the current concept of Roden Crater can be adequately described.

Hier folgen noch etwa 2 Seiten mit 3-4 Anmerkungen