# A View From On High: Heinrich Berann's Panoramas and Landscape Visualization Techniques for the U.S. National Park Service

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**The late Heinrich Berann, from Austria, was generally regarded as the most accomplished panoramist of all time. During the decade before his retirement in 1994, Berann painted four panoramas for the U.S. National Park Service (NPS) that demonstrated his genius for landscape visualization. This paper examines the widely admired, but little understood, vocation of panorama making, with emphasis on Berann's NPS pieces, concepts, and techniques. Explanation is offered about how the panorama for Denali National Park, Alaska, was planned, compiled, sketched, and painted—starting from a blank sheet of paper. Berann's techniques for landscape manipulation are then analyzed, including his unorthodox habit of rotating mountains and widening valleys, and his unique interpretations of vertical exaggeration. His graphical special effects used for portraying realistic environments are reviewed. The paper finishes with illustrations that compare Berann's panoramas to digitally-generated landscapes.**

## INTRODUCTION

The world lost one of its most gifted and prolific mapmakers when Heinrich Berann, the renowned Austrian panoramist, passed away December 4, 1999, at the age of 83. Intended as a tribute to Berann, this article discusses his work for the U.S. National Park Service (NPS), emphasizing in particular his artistic techniques and contributions to three-dimensional (3D) landscape visualization.

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### A rich partnership

Artists and the lands under NPS stewardship have had a long association. During the nineteenth century, Albert Bierstadt and Thomas Moran heightened public awareness about the landscapes of the American West with paintings that portrayed nature in an exalted and romantic light. The interest generated by their art and other influences eventually led to land-protection legislation and then to the formation of the NPS. A century later, the panoramas of Heinrich Berann harken back to the era of Bierstadt and Moran by depicting the park landscapes in an idealized manner.

After first contacting Heinrich Berann in 1972 to explore the possibility of creating park panoramas, the NPS began its formal association with him in 1987 with the publication of the North Cascades panorama. This was followed by panoramas of Yosemite (1989), Yellowstone (1991), and Denali (1994). During his 50-year career, Berann painted more than 500 panoramas. However, his NPS panoramas are noteworthy for their exceptional quality. Berann, the world's foremost panoramic artist, was near the end of his career and at the height of his artistic prowess when he painted the world-class landscapes of these four U.S. National Parks. He retired in 1994 after painting Denali's Mount McKinley, the highest peak in North America—a fitting magnum opus to cap a brilliant career.

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**Panoramas and cartography**

Panoramas are a unique variety of map that transcends the boundary between cartography and art. They are beautiful, enjoy widespread popularity with the public, and are excellent pictorial devices for visualizing landscapes—especially ski areas, for which the panorama has become the de facto cartographic standard. Despite this, the creation of panoramas has been eschewed by the mainstream cartographic community because of the highly specialized skills needed for their production and, to a lesser extent, concerns about their relaxed accuracy. Cartography's lack of interest in panoramas is hardly surprising considering the discipline's emphasis during the last several decades on the quantitative and theoretical aspects of map making. There simply has been a dearth of cartographers with the needed artistic skills and temperament to create panoramas. Thus, the business of panorama creation has been largely relegated to artists who have an affinity for landscapes, such as Berann. Ironically, the artists who create panoramas tend not to consider themselves cartographers—they prefer to be called panoramists instead—despite the fact that they graphically portray spatial relationships on the Earth's surface. The number of active panoramists world-wide is rather small. Probably, most panoramists live in Austria, where, as of 1998, seven people painted panoramas on either a full or part-time basis (Vielkind, 1998).

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Cartographers have not been entirely absent from panorama making, however. Hal Shelton, now retired from the U.S. Geological Survey, painted the elegant panorama "Colorado: Ski Country U.S.A." and numerous ski-area maps in the 1960s. Other cartographers studied with Berann himself, including James Robb, University of Colorado at Boulder, and Michael Wood, University of Aberdeen, Scotland. Wood painted the "Whisky Trail" and several other panoramas of the Scottish Highlands. In Switzerland, Arne Rohweder (Karto Atelier) and, in the U.S., Pete Powers (Terragraphics) are among the few trained cartographers who actively produce panoramas today.

The general schism between cartographers and panoramists—exceptional cartographer-panoramists notwithstanding—may be ending thanks to computers. Powerful microprocessors, abundant geo-data, and sophisticated graphical software programs now permit cartographers (and many others) to create 3D landscape visualizations that resemble panoramas. Moreover, interest in 3D mapping is growing rapidly and enjoying a renaissance, apparently because of the rapidly evolving discipline of multimedia cartography. Today's cartographic researchers studying interactive spatial environments assume that 3D presentation is a superior method for visualizing many forms of geographic data, including landscapes. Because 3D landscapes are less abstract than their two dimensional (2D) counterparts, they are thought to be easier to visualize, especially by the growing numbers of people with limited map reading skills or the time needed to study maps.

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As more multimedia cartographers rely on 3D map presentation, questions inevitably arise about optimizing the design of 3D landscapes. Careful examination of Heinrich Berann's work answers or gives insights into some of these questions.

## ABOUT BERANN

Berann's lifestyle, ethos, and artistic training have roots in a former era. To appreciate fully Berann's panoramas—especially amidst a digital revolution and in a new millennium—it behooves cartographers to know something about the man and his traditional qualifications for interpreting landscapes graphically.

## A brief biography

Heinrich Caesar Berann was born in 1915 in Innsbruck, Tyrol, Austria. Living in proximity to inspiring alpine landscapes exerted a lasting influence on his later development as a panoramist (*Figure 1*). All of his panoramas, even of foreign areas, tend to depict mountains in a style reminiscent of the Alps. Berann came from a family of artisans, and his grandfather was an art teacher. In spite of this, Berann's father initially objected to his son's artistic aspirations. This forced Berann to learn painting through self study (Troyer, 1999). From 1930 to 1933 he attended design school in Innsbruck and worked as a graphic illustrator during the economic depression of the 1930s. After World War II army service, Berann continued his art training in Vienna. He studied sculpture with Gustinus Ambrosi and anatomical art with Dr. Wirtingen. He never studied cartography, however.

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From 1952 until his death in 1999 he lived and worked in Lans, Austria, a small village near Innsbruck. Berann was married for 32 years to his first wife, Ludmilla, who died in 1974. In 1991, Berann married his longtime friend, Mathilde, who died unexpectedly in 1993. After this devastating blow Berann lost all desire to continue working as a commercial panoramist, and his health declined. His retirement years were devoted to painting fine art and listening to music (Schutzler, 1999). Berann is survived by daughters Angela and Elisabeth.

Berann's commercial career started with the production of non-panoramic tourist posters of the Tyrol and Grossglockner regions of Austria, and these exhibit the art-deco influences of the period. His first panorama, produced in 1934, commemorated the opening of a mountain pass road near Grossglockner and won first prize in a competition. Winning the prize awakened Berann to the possibility of becoming a career panoramist—despite the vow he made as a youth "never to paint mountains" (Troyer, 2000). In 1937 he painted a panorama showing a tourist railroad in the Jungfrau region of Switzerland. During the next five decades Berann painted hundreds of panoramas, most depicting his native Alps, and he gradually improved his artistic style. His earliest panoramas were highly stylized compared to his later work, especially the distinctive treatment of clouds, which he perfected while on military duty in Norway and north-

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*Figure 1. (left) Heinrich Berann in his studio, Lans, Austria. (right) Berann's emblem: "The Balance."*

ern Finland during WWII (Troyer, 1999). Although Berann did not invent the panorama—bird's eye views of cities and recreational areas have been common since the late eighteenth century—he has set the highest standard to emulate.

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**Fine art**

As his career as a panoramist burgeoned, Berann also pursued his interest in fine art. His artistic expression often touches on religious themes and tends toward the baroque. Many of his pieces revel in the human form, especially female nudes, while other works are more abstract and splashed with vibrant color (see Hörmann, 1995, for examples). A deliberate symmetry exists between Berann's passion for fine art and his pragmatic career as a panoramist, something he acknowledges by his choice of a personal emblem, which he calls "the balance" (Troyer, 1999; *Figure 1)*

Balance emblem or not, Berann's dual career was not an entirely neat and compartmentalized package. His prowess as a panoramist clearly benefitted from his passion and inborn artistic ability: similar skills are required for putting forms to paper, be they nudes or mountains. Cross fertilization occurred between his vocations. Berann's fine art pieces became less impressionistic and more detailed later in his career because of the influence of cartography (Troyer, 2000). In 1963 Berann visited Nepal to prepare for painting the Everest panorama. There he came into contact with Hinduism, which had a profound and lasting influence on his art (Garfield, 1992), although he remained Roman Catholic in his religious beliefs. Conversely, the religious influence in Berann's art is very evident in his distinctive depiction of the sky on panoramas. The arcing cloud formations on panoramas are a manifestation of Berann's fascination with the "circle of life," a theme that pervades his fine art (Troyer, 2000).

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Berann's dichotomous artistic output—commercial panoramas and high-minded fine art—reflects the divisions within the modern art community as a whole. The study, "Most Wanted Paintings," by the Russian emigré art team of Vitaly Komar and Alexander Melamid, helps put Berann's work into a wider context. To date, they have conducted public opinion polls in 14 countries to learn about our likes and dislikes in paintings. Their polls purport to represent about one-third of the Earth's population and all segments of society. Not surprisingly, the picture that emerges from this democratic sampling of humanity contradicts the tastes of the art establishment; abstract art, modernism, nudes, religious themes, and paintings containing messages were least popular. By contrast, there was an overwhelming cross-cultural preference for large-format, tranquil, realistic landscapes dominated by blue (Komar and Melamid, 1999). The world at large, it seems, is predisposed to like panoramas.

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**Selected career milestones**

**1934** Produces his first panorama, of Grossglockner, Austria's highest peak. Painted in sepia tones, it bears little resemblance to his more colorful later work.

**1956** Paints a panorama of Cortina, Italy, for the Winter Olympic Games, the first of his many Olympic panoramas. Berann painted panoramas of his hometown, Innsbruck, Austria, for the 1964 and 1976 Winter Olympics, for which he was awarded the Austrian Olympic Medal.

**1963** Begins a profitable association with the National Geographic Society that yields two exquisitely detailed panoramas of the Mount Everest area.

**1966** Completes his largest map ever, of the ocean floor, for the U.S. Navy and Columbia University in collaboration with Bruce Heezen and Marie Tharp (Lawrence, 1999). Bathymetry is depicted in simulated 3D with cast shadows on a Mercator world map. He also paints ocean-floor maps for the National Geographic Society.

**1967** Completes a panorama spanning the length of the Alps viewed from the north. It is compiled with the help of a Perspektomat, a Swiss-produced mechanical device similar in design to a pantograph. Finding the Perspektomat troublesome to operate and less efficient than compiling by hand, Berann never uses it again. (Vielkind, 1998)

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**1973** The Austrian Ministry of Education and Art bestows on him the title of "Professor."

**1986** Painted a small-scale panorama of Germany requiring 3,000 hours to complete. It is followed by other small-scale panoramas of Europe (1989), North America (1991), and southern Africa (1994). Rollers were used to advance the paper to paint these individual panoramas, which are about two meters in length. Berann claims not to have looked at each completed piece until the end of the roll (Troyer, 2000).

**1987** A panorama of the North Cascades is his first for the U.S. National Park Service.

**1990** The President of Austria presents Berann with the Austrian Cross of Honor for Science and Art.

**1994** Retires after completing the panorama of Denali National Park.

## WHAT IS A PANORAMA?

The term "panorama" was coined in 1792 by Robert Barker, who devised a series of six paintings of the London skyline showing a 360-degree view from the roof of a tall building. The paintings were arranged on a curved surface surrounding the viewer to give the illusion of being immersed within the scene. Barker's display was a success, and similar panoramas quickly became a popular novelty during the early-to-mid nineteenth century throughout Britain and France (Oetterman, 1998). Today, the Cyclorama at Gettysburg National Military Park, Pennsylvania, is one of the last surviving traditional panoramas in the U.S. Created in 1884, it is a 360-foot-long circular oil-on-canvas painting depicting Pickett's Charge, the decisive moment in the Battle of Gettysburg. Barker's original concept for the panorama is also recognizable today in cyberspace. Apple Computer's QuickTime VR and similar applications enable users to navigate cylindrical 360-degree photographs and computer-generated 3D scenes, which are displayed on a flat computer screen instead of an encircling curved surface.

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A Berann panorama, consisting of a single flat image, does not fit the original concept of the panorama developed by Barker. However, over time, the definition of a panorama has broadened.According to *Webster's New World Dictionary*, a panorama is:

1. a) a picture or series of pictures of a landscape, historical event etc., presented on a continuous surface encircling the spectator; cyclorama

> 1. b) a picture unrolled before the spectator in such a way as to give the impression of a continuous view 2. an unlimited view in all directions 3. a comprehensive survey of a subject 4. a continuous series of scenes or events; constantly changing scene.

F.J. Monkhouse's *A Dictionary of Geography* defines the term as:

> An outline sketch of a piece of country as viewed from some prominent point, covering a considerable horizon distance, emphasizing foreground, middle-ground, and background detail. It is an essential part of field sketching. Various geometrical methods can be used. A panorama can be drawn in the field (preferably) from a contour map.

Although the above definitions describe Berann's work, albeit in a limited manner, Berann's panoramas are much more than simple field sketches. They treat the viewer to an "impression of continuous view" and impart a dynamic quality via atmospheric graphical effects that belie the static medium—paint on paper—upon which they are presented. Berann's panoramas defy classification as completely one genre or another. Instead, a hybrid, they occupy the misty borderlands between photographs, fine art, cartography, and the real world observations of viewers—a fact that only adds to their allure. By describing his work as "exact like a map and visual like a photograph" and, "more colorful, clear, and three dimensional than satellite images" (Stern, 1987), Berann supported the analogy of the panorama as a hybrid.

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Sometimes the multi-disciplinary heritage of panoramas creates confusion about their identity. When panoramas are viewed from very low elevations they become less map-like and more characteristic of landscape paintings. Several well-known panoramas by Berann approach this nebulous threshold, including Denali and the Everest panoramas for the National Geographic Society. More problematic still, Berann's panorama of "Reit im Winkl," in the Bavarian Alps, clearly crosses into the realm of landscape painting. It depicts an otherwise typical panorama from a hillside vantage point that includes trees and pathways in the foreground (see Berann and Graefe, 1966, for example). Rather than exclude such low-elevation views from the panorama family, cartography should perhaps follow the example of remote sensing which accepts images taken from all elevated platforms, whether on the Earth's surface or in the sky.

*"The preternatural topography in a panorama, artistically enhanced to minimize the disorder and distractions of nature, permits the reader to understand the land better."*

Each Berann panorama is distinctive, but all share common characteristics. They are framed within a rectangular border, show terrain in perspective with simulated three dimensionality (2.5D), contain a horizon and sky, depict detailed surface features, and give uncommonly strong emphasis to artistic presentation and natural realism. When combined, these characteristics yield a final product that is much more than the sum of its parts. Something truly magical happens. Readers feel drawn into the panorama as if they were flying high above the land. Alpine peaks project skyward, haze veils distant valleys, and storm clouds gather on the horizon, lending energy to the environment. The effect can be mesmerizing. And while a panorama often brings to the viewer intense visual pleasure, it also delivers a subtle yet more valuable gift. The preternatural topography in a panorama, artistically enhanced to minimize the disorder and distractions of nature, permits the reader to understand the land better.

## PRODUCTION OVERVIEW: DENALI

Traditional panorama preparation is undoubtedly one of the most difficult cartographic endeavors. Besides artistic talent, the panoramist must possess the ability to read 2D topographic source materials and translate this information into a graphical 3D representation that a lay audience can understand. That panoramas usually portray the most complex mountain topography only adds to the difficulty. Great amounts of time are required to complete a piece. It took Berann an average of six months to complete a large panorama while he worked concurrently on smaller projects (Vielkind, 1998). His NPS panoramas sometimes took several years to complete because of the time needed for planning and thorough reviews.

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**Planning**

The preparation of a panorama begins modestly enough with paper, pencil, and topographic maps for reference. Then the process becomes much more involved. The following section explains the process for creating the panorama of Denali National Park, Alaska.

Berann held discussions with the NPS about the geographic coverage and best direction from which to view Denali. Herwig Schutzler of R.R. Donnelley Cartographic Services (now MapQuest.com, Inc.), which was then a commercial contractor for the NPS, served as our German-speaking intermediary and project consultant. He also had a central role developing the three other NPS panoramas. Through Schutzler, the NPS told Berann that the panorama had to show: Mt. McKinley (also referred to as Denali) and the other major peaks of the central Alaska Range; the highway and railroad leading to the east entrance of the park (where the visitor center, hotels, and park headquarters are located); and the 137-kilometer-long road leading to Wonder Lake in the interior of the park. Altogether the planned panorama would show nearly the entire 24,000-square-kilometer extent of the park, an area slightly larger than Wales, U.K. The decision was made to view Denali from the southeast up the Susitna River valley to match the view most visitors see on their approach to the park from Anchorage. The southern flank of the Alaska Range contains the longest glaciers, most distinctive topography, and an area greater than the abrupt northern side. Also, the relatively narrow (but quite high) Alaska Range trends in an arc that opens to the southeast and forms a natural amphitheater for framing a northwest-oriented panorama.

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**Initial sketch**

Berann next went to work on the initial pencil sketch that he would submit to the NPS for approval before he began painting. Referring primarily to contour maps, he sketched the terrain of the park to appear in 3D. He did this without the aid of computers or mechanical devices. On a sheet of paper he lightly drew radiating lines from a central observation point high above the Susitna River. These lines establish the field of view and serve as guides for sketching the terrain in perspective.

In drawing the initial sketch, Berann also referred to oblique aerial photographs, which were essential for the accurate depiction of vegetation, mountain textures, cultural features, and other surface details. While he sometimes drew field sketches from a helicopter, this was not possible for the Denali project because of Berann's advanced age, the remoteness of the park, and prohibitively expensive travel costs. Instead, Berann relied heavily on oblique aerial photographs taken by Bradford Washburn, honorary director of the Boston Museum of Science, who has dedicated much of his career to mapping and photographing Mt. McKinley (Washburn and Roberts, 1991). Ironically, the exceptional clarity of Washburn's photographs, which lacked normal amounts of atmospheric haze because of the extreme altitude, made it difficult for Berann to gauge distances when compiling the panorama (Troyer, 2000). Berann also referred to Washburn's superbly detailed topographic map of Mt. McKinley, produced in a collaboration with the National Geographic Society, Swiss Foundation For Alpine Research, and the Swiss Federal Office of Topography, that featured realistic depictions of cliffs, scree slopes, and glacial moraines.

The initial pencil sketch of Denali, when it arrived, was not what the NPS had envisioned, even though it was well crafted and drawn exactly according to our instructions *(Figure 2).* The Alaska Range itself occupied only 35 percent of the total area and, worse still, the entire foreground of the panorama was occupied by flat uninteresting land not even inside the park boundary. Vincent Gleason, then chief of the NPS Division of Publications, made a wise decision that salvaged the project: he asked Berann to crop away two thirds of the sketch, thereby focusing the scene on Mt. McKinley

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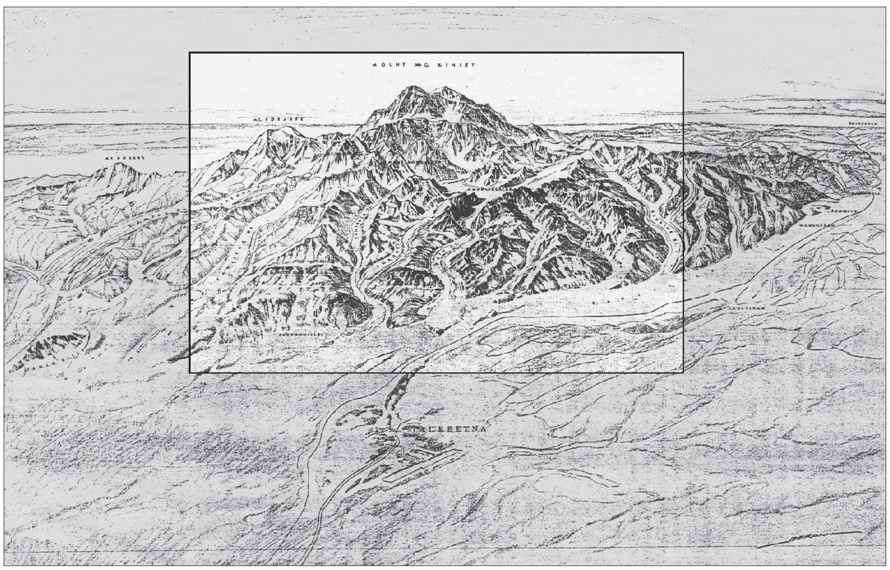

*Figure 2. The initial pencil sketch showed nearly all of the Alaska Range and Denali National Park. The NPS asked Berann to crop the sketch to include only the area within the highlighted box.*

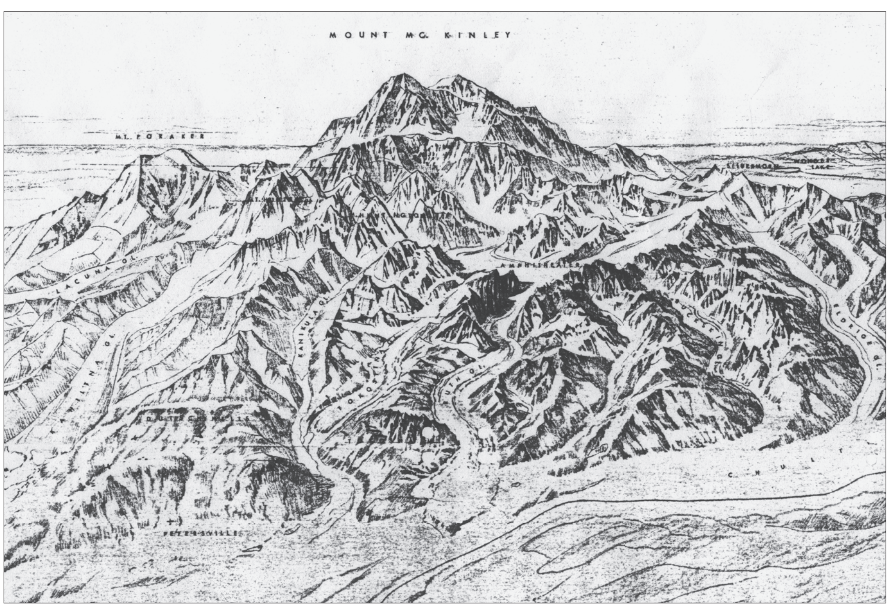


*Figure 3. Detail from the cropped initial sketch centered on Mt. McKinley.*

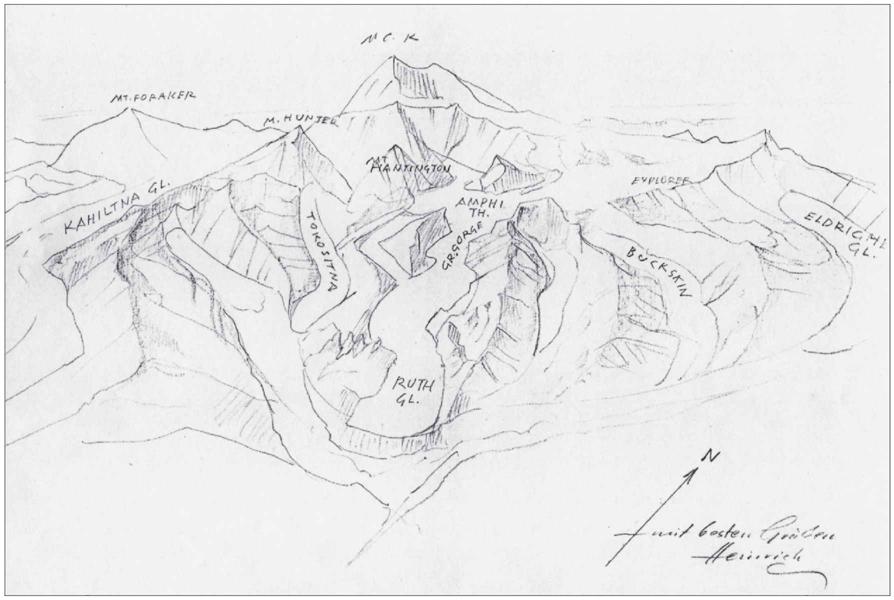


*Figure 4. Berann altered the alignment of Kahiltna Glacier (left side) in the rough final sketch. (See Figure 3 for comparison.)*

and its immediate environs *(Figure 3).* Berann then produced another quick sketch to confirm the new viewing parameters—and reconfigured selected topographic features along the western (left) margin *(Figure 4).*

**Painting**

Painting metamorphosed Denali from a mechanical drawing into a beautiful landscape. Berann painted the final panorama on a fresh sheet of heavy, coarse-grained white paper. First, he re-sketched the terrain for the entire panorama lightly in pencil with less detail than the initial pencil sketch. Painting was mostly done in gouache and tempera, which are opaque water-soluble paints, and generally progressed from top to bottom (background to foreground) in a patchwork fashion. Berann would complete one section of terrain, for example, a ridge between two glaciers, before proceeding to the next. This production approach allowed Berann to make localized tonal adjustments on-the-fly as the entire panorama progressed. Also, a section-by-section approach to production undoubtedly gave him a gratifying series of minor accomplishments during the arduous months of painting *(Figure 5).* Tissue paper, with a hole cut out of the center for access, was used to protect the panorama surface while he painted other sections (Wood, 2000).

> *"The color of the land and sky are complementary and were chosen carefully to create a sense of depth."*

The application of Denali's colors occurred in four general stages. In the first stage, light washes were applied over the penciled line work to give basic color and shape to landforms. An airbrush was used to fill in the unadorned blue sky, which appears abruptly lighter near the horizon and becomes gradually lighter in value from right to left. The color of the land and sky are complementary and were chosen carefully to create a sense of depth. Clouds are nearly absent from Denali's sky because of the prevalence of white already on McKinley's snow-crowned summit. In the second stage, dark colors were applied to shadowed slopes with broad brush strokes to develop further the structure of landforms. Next, lighter pigments were used to paint highlights and surface details, and greens were used to depict forest and tundra vegetation. In a surprising touch, some highlights were lightly applied with a large, dry brush, with the stroke trending perpendicular to the slope of the land. This emphasized the fractured alpine texture. For the final stage, the difference between dark mood colors (shadows and forests) and light mood colors (clouds, atmospheric haze, and water glints) was stressed. Rivers and the few roads that existed were painted in last with a fine brush. The Denali panorama reveals no trace of its underlying pencil compilation. It was printed in process color at 100 percent of original size and measures 74 x 99 cm.

## LANDSCAPE MANIPULATION

This section describes the techniques Berann used to manipulate landscapes. To most readers, the process of viewing a Berann panorama seems like a random series of happy discoveries. Your eyes move from one feature to another, lingering occasionally in places that attract your interest, and then, perhaps, your focus widens to regard the sweep of the entire landscape. However, your visual journey through a Berann panorama is not entirely a matter of choice and chance. The physical structure of the landscape has been altered to create pathways that subtly guide you to selected features of significance.

Many of Berann's techniques for manipulating landscapes were unorthodox. He often would take questionable liberties (at least from a cartographic perspective) with geographic reality for the convenience of telling a panorama's story. Whether or not you agree with his techniques, knowing what can be done is valuable for understanding the problems associated with 3D landscape presentation in general.

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**Perspective**

Perspective provides the framework for building a panorama and governs how much of the world the viewer will see *(Figure 6).* In general, Berann used more perspective on small-scale scenes than on large-scale scenes. Increasing the amount of perspective increases the field of view, thereby compressing more background information into the finite width of the panorama. Use of perspective enhances realism, unless applied excessively, in which case it tends to pinch background areas unnaturally. Large-scale panoramas employ very little perspective, for the purpose of moving background features closer to the viewer (Garfield, 1992). For example, Berann minimized perspective on the Yosemite panorama to accentuate the lofty peaks along the Sierra Nevada crest, which would be indistinguishable if greater amounts of perspective were used. He compensated for the lack of optical perspective by exaggerating other graphical cues—cloud formations converge toward a false vanishing point, and the differing foreground and background colors enhance aerial perspective. On the North Cascades panorama, on the other hand, Berann used more perspective to pull peripheral landmarks, such as Mt. Rainier, the city of Seattle, and Vancouver Island, into the scene.

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**Orientation**

The cartographic convention of north orientation is not a major factor for determining the orientation (or viewing direction) of large-scale panoramas. None of Berann's NPS panoramas is oriented due north: North Cascades is oriented to the southwest, Yosemite to the east, Yellowstone to the south, and Denali to the northwest. Berann's goals when selecting orientation were to maximize the visibility of important local features and to show the broader geographic context. When depicting alpine mountains in the northern hemisphere, such as the Alps or North Cascades, he often used southwest orientation. Looking southwest reveals northeast mountain faces, which tend to be steeper, more distinctive, and more glaciated. Prevailing southwest winds transport summit snows to these lee slopes, which also get less direct sunlight.

Berann preferred the view from lowlands toward highlands. In fact, most of his panoramas have a lofty mountain range as the backdrop. On large-scale panoramas, viewers tend to become disoriented when looking from highlands toward lowlands, despite our real-world familiarity with downhill vistas from mountain peaks. This phenomenon received prominent attention during the controversial court martial of the U.S. pilot who clipped the cable of a ski gondola in the Italian Alps in 1998, tragically killing 20 people. The legal defense team for the pilot presented a digital fly-through animation, which was shown on CBS national television news in the U.S., to demonstrate the difficulties of judging elevation when traveling downhill through a narrow mountain valley (Visual Forensics, 1999).

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Berann sometimes added twist (skewed orientation) to his scenes to show topographic features with cultural importance that otherwise would be outside the field of view. This is evident in two NPS panoramas: Yosemite was skewed to the north to include Hetch Hetchy Reservoir, the site of a landmark conservation-versus-development battle in the early nineteen hundreds; and the North Cascades was skewed to the south to include Mt. Rainier—the defining landmark for the millions of people who live in Seattle and the Puget Sound lowlands (see Appendix A for illustration).

**Projection plane**

Cartographically speaking, Berann did not accept that the Earth is flat, even on large-scale panoramas. He added curvature to the projection plane (the theoretical flat base upon which 3D terrain projects upwards) to enhance viewing. On a typical 3D scene with a low-elevation view, the horizon is visible, and the landscape looks realistic, but tall features in the foreground obscure the background. Conversely, high elevation views show background terrain better, but, without the horizon, they look too much like conventional maps.

*"The end result is a panorama that combines the best of both worlds: the foreground and middleground appear map-like while the background appears realistic, complete with a horizon and sky."*

To solve this problem Berann emulated the view as seen from an airplane *(Figure 7).* From high above the Earth, the horizon is always visible, yet when you shift your eyes downward the view gradually becomes less oblique and more planimetric. To bring this effect to a panorama, Berann tilted the projection plane toward the viewer and, from a point about two thirds of the way into the scene, added convex curvature to flatten the horizon. The end result is a panorama that combines the best of both worlds: the foreground and middleground (where the important information resides) appear map-like while the background appears realistic, complete with a horizon and sky (Patterson, 1999).

Berann's manipulation of the projection plane is most evident on small-scale panoramas, such as his 1986 view of Germany, in which the relatively low relief tends not to obscure the base. In fact, on small-scale panoramas Berann compiled all foreground and middleground information directly from printed maps, drawing topography in an axonometric fashion that transitions to true perspective deeper in the scene. The dual compilation method, although much easier to execute than a panorama based entirely on true perspective, sometimes appears unrealistic and forced where the axonometric map abruptly changes to the perspective background. The problem is most pronounced on continental panoramas that show the Earth's curved horizon.

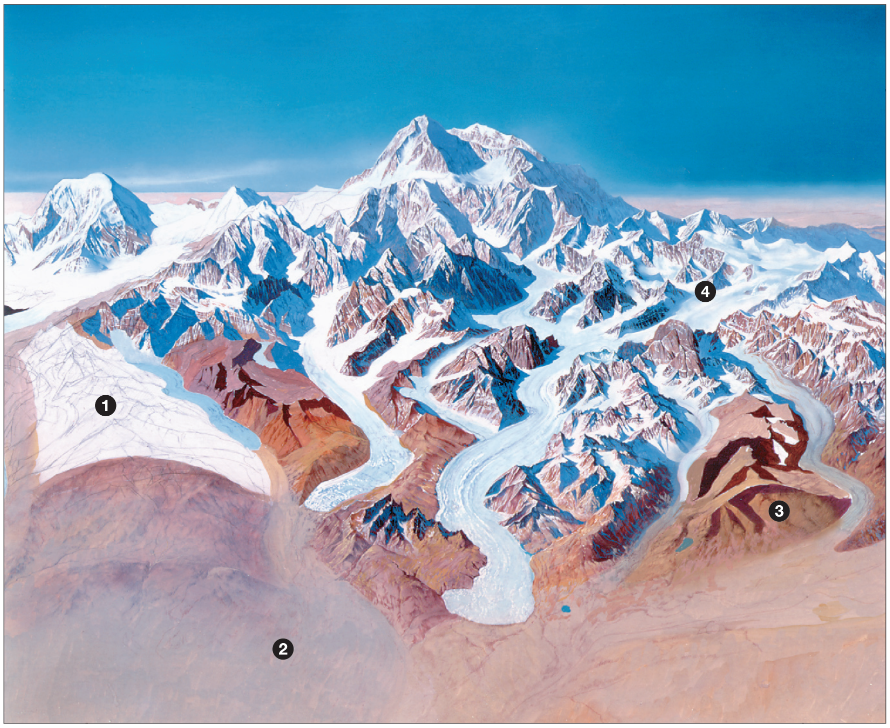



*Figure 5. Denali painting in progress: 1) Rough pencil sketch, 2) Light base colors, 3) Shadows, and 4) Final details.*

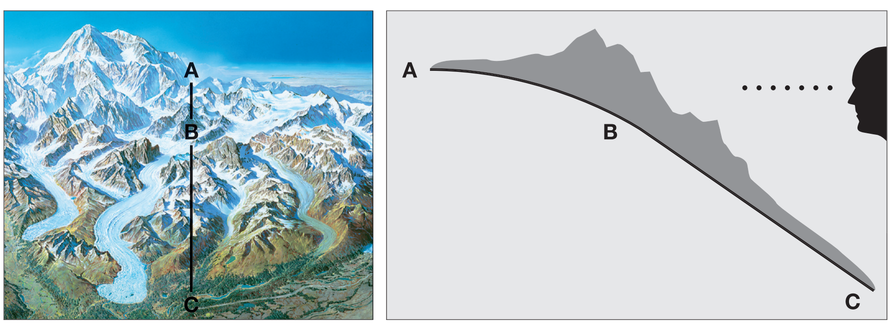



*Figure 7. (left) Looking directly into a panorama. (right) The profiled illustration shows how Berann tilted and curved the projection plane, depicted by line ABC.*

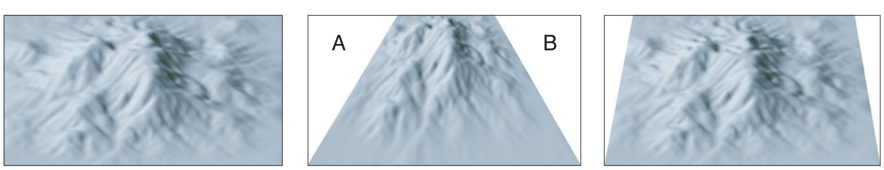



*Figure 6. Perspective—finding the perfect fit (Illustration on the left). A hypothetical landscape shown without perspective. It fits nicely into a rectangular format, but looks somewhat artificial. Background features appear too large (Middle illustration). Excessive perspective convergence requires additional terrain to be shown in the empty corners, shown at A and B, thus increasing the amount of work and possibly including distracting or competing area. Background features are compressed (Illustration on the right). Berann typically used modest amounts of perspective, especially on large-scale scenes.*

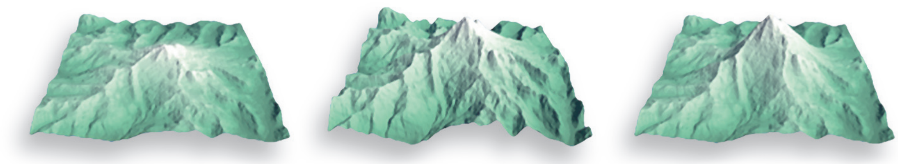


*Figure 8. Selective vertical exaggeration. (left) A computer-generated view of Mt. Baker, Washington, shown with about 2:1 vertical exaggeration. The summit appears somewhat flat. (middle) Vertical exaggeration increased to about 4:1, but now Mt. Baker appears indistinct because of visual competition from the surrounding terrain. (right) Mt. Baker with 4:1 vertical exaggeration applied only to the summit. The surrounding terrain is shown with 2:1 vertical exaggeration.*

**Vertical exaggeration**

*"Berann departed from mapping tradition in his use of selective vertical exaggeration and/or resizing to accentuate important landmarks."*

Panoramas need vertical exaggeration to depict terrain so it approximates our anthropocentric expectations. For example, because an upright human's vantage point is about 2 meters above the Earth's surface, even a 100-meter high hill appears significant to us. However, on many small and medium-scale 3D maps, without vertical exaggeration that same 100 meter high hill would barely appear. On Berann's panoramas, vertical exaggeration typically ranges from 1.5:1 to 4:1, depending on the scale and local relief. Small-scale panoramas with low local relief generally display more vertical exaggeration than large-scale panoramas with high local relief.

Berann departed from mapping tradition in his use of selective vertical exaggeration and/or resizing to accentuate important landmarks *(Figure 8).* For example, the Denali panorama uses about 2:1 vertical exaggeration throughout the scene, with additional exaggeration applied to the summit of Mt. McKinley. The summit is shown about two times larger in all dimensions (x,y, and z) than the surrounding terrain. By increasing the overall size of Mt. McKinley, Berann avoided the problem of "spiking" that results when too much vertical exaggeration alone is applied to exceptionally tall summits with limited surface area—the Matterhorn would typify this type of mountain.

*"On a summer panorama more exaggeration would be applied to crags to emphasize the scenery that presumably attracts summer visitors."*

Carrying the concept of selective vertical exaggeration still further, Berann sometimes varied the vertical exaggeration between elevation zones, depending on the purpose of the panorama and the season of the year *(Figure 9).* For example, on a winter ski area map, more vertical exaggeration would be applied to the sloping base (where chair lifts and lodges are located) than to the craggy precipices above. On a summer panorama more exaggeration would be applied to crags to emphasize the scenery that presumably attracts summer visitors (Garfield, 1992).

Berann also liked to emphasize background features in a panorama to show terrain that would normally be too small and distant to comprehend.

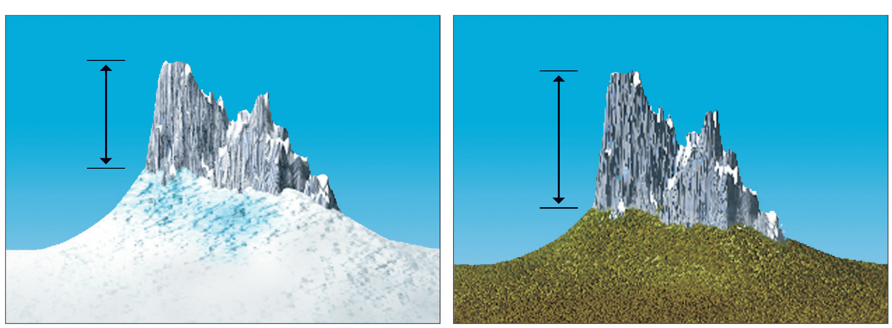


*Figure 9. Seasonally-adjusted vertical exaggeration. (left) The winter image emphasizes the gentle lower slopes. (right) The summer image emphasizes cliffs at the expense of lowlands. Both images are computer generated.*

The Yellowstone panorama is a good example. It shows the greatly enlarged Teton Range along the southern horizon, establishing a familiar geographic context and adding graphical interest to the otherwise flat horizon.

**Rotating reality**

The Teton Range also illustrates Berann's very controversial technique of selectively rotating the orientation of mountains and other topographic features within a panorama. Cartographic standards aside, there are compelling reasons for such adjustments. Regardless of how carefully a panoramist chooses the orientation, perspective, and vertical exaggeration, usually a few important landmarks will not appear as clearly as they should. In the southward looking Yellowstone panorama, for example, the north-south trending Teton Range appears as an insignificant nub on the horizon. To make the panorama more meaningful, Berann turned the entire Teton range 55 degrees to show the familiar east face that has appeared in countless photographs *(Figure 10).* Because the distant Tetons are used merely as a

*"Regardless of how carefully a panoramist chooses the orientation, perspective, and vertical exaggeration, usually a few important landmarks will not appear as clearly as they should."*

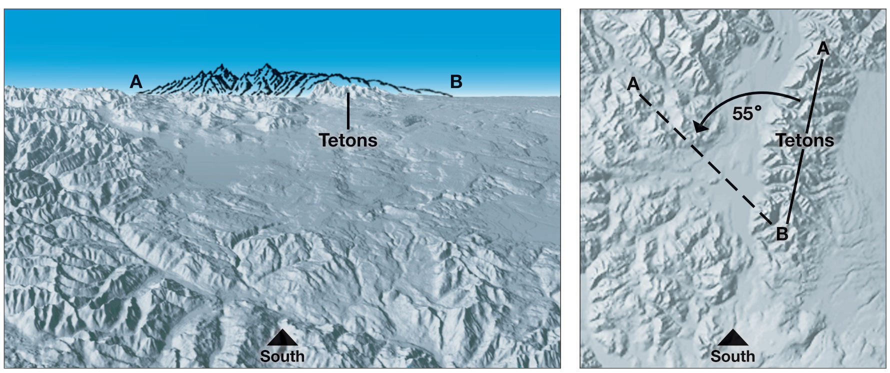



*Figure 10. (left) A digital representation of Berann's Yellowstone panorama. In this south-oriented view, the north-south trending Teton Range appears insignificant. (right) The map shows how Berann rotated the Tetons, shown by line AB, 55 degrees to present a more recognizable portrayal of the range on the panorama.*

reference landmark, not unlike a north arrow on a conventional map, their rotation may not be the breach of cartographic ethics it otherwise would seem. Berann wisely applied selective rotation with greater discretion for primary landmarks. For example, in the Denali panorama the summit of Mt. McKinley has been rotated approximately 20 degrees to the east to distinguish between Mt. McKinley's hard-to-discern North and South Peaks.

**Moving mountains**

Berann would rearrange and reposition terrain to improve legibility, especially in areas with a concentration of human-made features. One favored technique was to widen narrow mountain valleys notorious for obscuring details within their innermost recesses. Compared to the area shown on a map, Berann widened Yosemite Valley by 220 percent to portray a clearer view of the roads, campgrounds, lodges, and famous landmarks confined to the limited space. Berann also applied a slight straightening to the bends in Yosemite Valley—to look past El Capitan and the other monoliths otherwise obscuring the valley floor. Other terrain movements are done only to improve the graphic composition. In the North Cascades panorama, for instance, the distant Olympic Mountains were dragged about

*"One favored technique was to widen narrow mountain valleys notorious for obscuring details within their innermost recesses."*

80 kilometers to the south (left) to align with the upper Skagit River valley, thus creating a visual axis through the center of the scene (see Appendix A for illustration).

**Generalization**

Considering how much time is spent making a panorama appear realistic, an inevitable question arises: why not just use an oblique aerial photograph instead? The answer is "generalization." Aerial photographs typically show too much and/or inappropriate detail. How many tourist map sponsors would agree to show unsightly clearcut forests, power lines, or landfills? Oblique aerial photographs also have visibility limits. For example, Berann's 1986 panorama of Germany depicts an area more than 800 kilometers in length, well beyond the range of low-altitude aerial photographs. (The maximum line of sight ever observed on the Earth's surface is 370 kilometers.) Moreover, high-altitude aerial photographs and oblique satellite images are inadequate for depicting regions with low relative relief, such as in Germany, without vertical exaggeration.

*"Although one distant mountain range may look like another, Berann went to great efforts to capture their signature characteristics."*

Panorama generalization is accomplished by manipulating the complexity of the underlying topography and/or surface textures representing vegetation, rocks, etc. Much to Berann's credit, it is very difficult to detect generalization by comparing his panoramas to topographic maps and 3D computer models—at least for terrain in the foreground and middle ground. In the background areas Berann was selective in the quantity and quality of terrain that is shown. Although one distant mountain range may look like another, Berann went to great efforts to capture their signature characteristics. For example, on the Yellowstone panorama, individual peaks in the far-away Tetons are recognizable despite their stylized depiction and the liberal use of atmospheric haze.

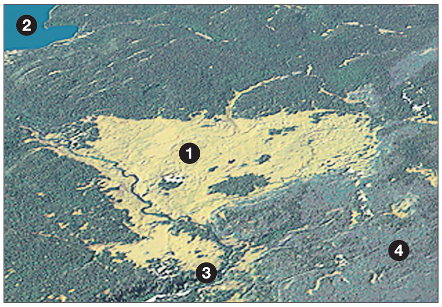
*"Berann lavished attention on the smallest features in a landscape."*

As discussed earlier, Berann sometimes selectively exaggerated the size of important landmarks. This creative license was done at the expense of adjacent or intervening terrain because only a finite space exists on a printed sheet. The sacrificed terrain is usually not omitted but minimized in its extent and functions to bond or connect the more important components of the landscape. On landscapes lacking distinctive topographic features, such as Yellowstone's Central Plateau, Berann had a particularly difficult time selecting which features to emphasize (Troyer, 2000).

*"Foreground generalization tends to direct the viewer's eye slightly deeper into the scene, where the most important information can be found."*

Much of the apparent detail in a Berann panorama derives from the surface texture and detail that is painted on top of the structural landscape itself. The base topography, derived from topographic maps, is often rather generalized. Berann painted subordinate topographic details (microforms), such as the clefts on a cliff face, by referring to oblique aerial photographs. Detail accentuates a scene's important foreground features and diminishes gradually toward the background. Additional detail applied to well-known landmarks alerts the reader to their importance. Berann lavished attention on the smallest features in a landscape. Cultural features such as roads, dams, and buildings are exaggerated in scale and painted so as to be recognizable. On the Yellowstone panorama, for example, the Old Faithful Lodge, as shown, would be 1.2 kilometers long when compared to a map. Berann also greatly exaggerated the size of waterfalls and Yellowstone's famous geysers by emphasizing their billowing plumes of mist and steam *(Figure 11).*

The intuitive progression of less detail to more detail from background to foreground does not always apply. Careful inspection of the Yellowstone and Denali panoramas reveals that the level of detail increases normally from background to foreground, except in the very closest areas (the



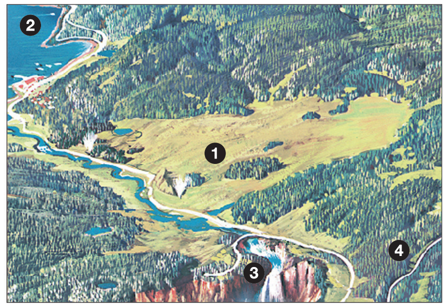




*Figure 11. Surface detail comparison, Hayden Valley, Yellowstone National Park. (left) A color-enhanced Landsat satellite image draped onto a DEM. (right) Detail from Berann's panorama. The numbered features are: 1) Hayden Valley, a large meadow dotted with trees and geysers; 2) Yellowstone Lake; 3) Lower Yellowstone Falls; and, 4) Damage from a 1988 forest fire is visible only on the more recent Landsat image.*

bottom edge), which are more generalized. On Denali, foreground generalization is most pronounced in the left and right corners. Foreground generalization tends to direct the viewer's eye slightly deeper into the scene, where the most important information can be found. It also accentuates perspective by suggesting motion blur, the same effect one would experience by flying into the scene in a high-speed aircraft.

Berann's NPS panoramas are noteworthy for their apparent lack of generalization on the vertical axis between elevation zones. For the preparation of map shaded relief, Eduard Imhof noted how the aerial perspective effect could enhance three-dimensionality by portraying lowlands softer and with slightly less detail than highlands (Imhof, 1982). Aerial perspective is a graphical technique based on the real-world observation that landscape features farther away from the viewer appear less distinct than those in the foreground. The aerial-perspective effect is evident on many of Berann's early panoramas, which show valleys with minimal detail compared to the richly textured mountain peaks above. Later in his career, however, as his artistic skills became more sophisticated and his topographic depictions more realistic, Berann became less reliant on aerial perspective. By the time the NPS panoramas were created he was able to apply equal amounts of detail in lowland and highland areas without compromising three-dimensionality.

*"The aerial-perspective effect is evident on many of Berann's early panoramas, which show valleys with minimal detail compared to the richly textured mountain peaks above."*

## ENVIRONMENT

Much of the visual appeal of a panorama derives from the carefully crafted environment that interacts with the structural landscape. This section outlines some of Berann's preferred special effects and graphical flourishes.

### Color

Berann loved color and used it abundantly and with casual confidence. In 1991, Berann spoke about his work at the "Mapping for Parklands" symposium sponsored by the NPS. To paraphrase him: "I make a beautiful panorama by adding a little bit of color here, another bit of color there . . . dah-da, dah-da, dah-da." That easy. Surprisingly, he relied heavily on saturated primary colors. Fiery oranges illuminate mountain peaks, cliff faces glow in shocking pink, and deep blue shadows etch the slopes, occasionally accented with bright red (Wood, 2000). Amazingly, they all come together to form a harmonious natural landscape. The key to Berann's success, of course, is his use of complementary colors, applied with small loose brush strokes, sometimes pointillistically in forested areas.

*"Surprisingly, he relied heavily on saturated primary colors."*

Two standardized color palettes were used, one for winter scenes and the other for summer. The winter palette relied on a limited range of colors—the grays, whites, blues, and deep forest greens that characterize high mountain areas worldwide. Berann used it mostly to paint winter sports areas. He used the richer and more vital summer palette for the NPS panoramas—except for the high-elevation areas of Denali, which exhibit the winter palette. Within the summer palette, color would be selected according to real-world conditions and to achieve graphical effect. For example, the highest peaks within a scene were generally the lightest, often because of snow, and were highlighted with reds and oranges reminiscent of alpenglow. By contrast, the lowlands, which are warmer climatically, were dominated by forests depicted in dark greens, a visually recessive color. Depth within a scene was enhanced by using cool blues to portray background terrain and warmer hues for foreground features (Garfield, 1992). This is another example of the aerial perspective effect applied to the horizontal plane, which mimics the view one sees from a high peak in which blue haze veils distant features and more saturated hues gradually become evident in the foreground.

*"Depth within a scene was enhanced by using cool blues to portray background terrain and warmer hues for foreground features."*

The summer palette did not always work successfully. Berann developed it for portraying the well-watered and manicured landscapes of his native Alps in early summer. It translates poorly to semi-arid environments, such as Yellowstone. The garish yellow-green Berann used for the meadows, while perhaps characteristic of the Alps, is incongruous in the Yellowstone region. Berann's earliest panoramas made abundant use of yellow-green for depicting meadows (a color choice that was hampered by the poor color reproduction technology of the day, a situation that often frustrated Berann), but it is less apparent on his later work and does not appear at all on Denali, even though vast tracts of grassy tundra spread before the mountain.

*"Front-left illumination more closely approximates cartographic conventions and, therefore, would seem to be the preferred illumination source for panoramas."*

**Illumination**

Panorama illumination differs from the conventions used for cartographic relief shading. In cartography, the preferred light source usually originates in the northwest or upper left when the map is north oriented. This selection helps to minimize relief inversion, an optical illusion that causes mountains to look like valleys and vice versa. However, when upper-left illumination is used on a panorama, the slopes facing the viewer are cloaked by shadows obscuring foreground detail.

Illumination from the front left or right usually works best for panoramas. Front-left illumination more closely approximates cartographic conventions and, therefore, would seem to be the preferred illumination source for panoramas. Berann's NPS panoramas generally support this idea, except that Yosemite is illuminated from the front-right. Berann's preference for front-left illumination is not as evident in his non NPS work, however, which seems just as apt to use illumination coming from the front and right. Front-right illumination is especially prevalent in small-scale continental panoramas and ocean bottom maps, the most map-like work of all Berann's productions. Curiously, these maps look splendid and do not suffer from relief inversion despite the use of illumination that usually dooms 2D shaded relief. Apparently 3D landscape maps are more tolerant of variable illumination sources than conventional 2D relief maps—a subject deserving more attention from cartographic researchers.

*"To select the illumination direction, Berann would consider several factors and judge their interaction with the topographic characteristics of a panorama."*

To select the illumination direction, Berann would consider several factors and judge their interaction with the topographic characteristics of a panorama. His foremost consideration was to position the light source as perpendicular as possible to major trends in the topography because this would emphasize the contrast between illuminated and shadowed slopes, thus enhancing three-dimensionality. He would also study slope and aspect for the purpose of bathing gentle slopes in illumination and limiting dark shadows to abrupt slopes with limited area. These effects maximized legibility throughout the panorama. For panoramas containing a sizable water body, Berann preferred that the light originate from the direction of the sea (Garfield, 1970). Pragmatism may have also influenced how Berann chose the illumination direction. For example, reconnaissance flights are usually scheduled for cloud-free mornings when light originates from the southeast, so it was much easier for Berann to use the southeast illumination imbedded in the aerial photographs, if these were his references, than to recalculate illumination from another direction. Also, illumination within a panorama is not rigidly constant. Sometimes it appears that Berann uses secondary illumination sources to give local units of terrain better definition, or perhaps he was accounting for reflections from adjacent slopes or ambient light. In general, the lighting within his scenes suggests sun elevations typically encountered during early to midmorning or mid- to late-afternoon.

*"Berann's penchant for selecting an illumination source based primarily on graphical considerations sometimes resulted in lighting seldom if ever encountered in the natural world."*

Berann's penchant for selecting an illumination source based primarily on graphical considerations sometimes resulted in lighting seldom if ever encountered in the natural world. For example, some of his panoramas of the Alps look from northwest to southeast and use illumination coming from the front and left. This azimuth places the midmorning sun in the northeast quadrant of the sky—a geographic impossibility even during the summer solstice. Moreover, some of his panoramas contain morning sun (judging by the light direction) that casts golden illumination across the landscape while convective cumulus clouds form on the horizon, creating an ambience more typical of late afternoon lighting. Nevertheless, these panoramas look convincingly normal, and few viewers would notice or even care about the meteorological discrepancies.

*"Berann used cast shadows liberally to enhance natural realism, with minimal detrimental effect, although some detail is sacrificed."*

**Cast shadows**

Cast shadows—the shadows thrown by high topographic features across lower areas—are steadfastly avoided in 2D shaded relief to lessen confusion in narrow valleys (Imhof, 1982). Otherwise, the shadows project onto illuminated slopes and make the drainage lines appear out of register with the shaded relief. Once again, however, the rules of conventional cartography do not apply to panoramas. Berann used cast shadows liberally to enhance natural realism, with minimal detrimental effect, although some detail is sacrificed.

To place cast shadows, Berann had to calculate how irregular shadow profiles would project on irregular adjacent slopes. This is an amazing visualization feat. Some cast shadows are shown with crisp edges while others merge diffusely with their surroundings to create a somber mood. The shadows typically result from a relatively low-altitude illumination source to heighten the overall dramatic effect. As with illumination, Berann varied slightly the placement, length, orientation, and intensity of cast shadows within a panorama, depending on the presentation requirements of localized terrain *(Figure 12).* Despite the small variations, all cast shadows appear natural and consistent within the scene, probably because complex terrain makes light and shadow patterns difficult to gauge. Berann painted the cast shadows with dense neutral or cool colors that serve to balance the warm colors on illuminated slopes.

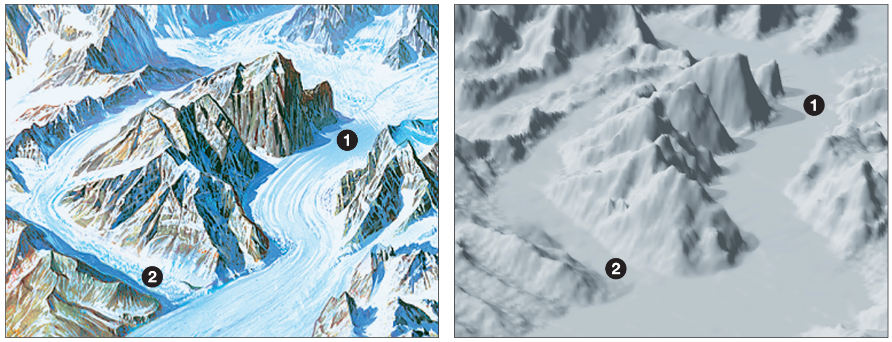



*Figure 12. Cast shadow comparison, Ruth Glacier, Denali National Park. (left) Detail from Berann's panorama of Denali. (right) A computer-generated scene using approximately the same lighting as Berann's panorama. At (1) the size and orientation of the cast shadows are similar, but at (2) the cast shadow appears on the panorama, but not on the computer image. Berann probably shifted the light source locally at (2) toward the front and left.*

**Water surfaces**

*"Berann's water surfaces are always tranquil, interrupted occasionally by rippling zephyrs and the wakes from boats."*

Shimmering water bodies are a hallmark of Berann's panoramas. Believing that water bodies are a significant component of the landscape, he typically exaggerated their size (Wood, 2000). The appearance of water surfaces is determined by sun elevation and azimuth, clouds, wind gusts, adjacent terrain, and depths. Berann's water surfaces are always tranquil, interrupted occasionally by rippling zephyrs and the wakes from boats (Troyer, 2000). Colors range from dark blues in narrow mountain-surrounded bays to light blues in open water. On top of the blue, Berann airbrushed white sun glints, in places with an intensity that suggests radiating energy. The effect is to highlight selected lakes, bays, and other water surfaces in a highly individualistic fashion. (Oblique satellite images and aerial photographs show sun reflections to be much more uniform.) In general, his depiction of water surfaces tends to minimize the influence of surrounding terrain. Cast shadows rarely mar the water surface, even within fiord-like embayments, and reflected mountain sides appear only as subtle hints. Rivers are depicted in dark blue, while rapids and waterfalls are shown in bluish white.

**Atmosphere and clouds**

*"When traveling with Herwig Schutzler, he would occasionally stop, point at the sky, and exclaim: 'there are Berann clouds.'"*

Clouds distinguish Berann's panoramas from all imitators. Paradoxically, they add natural realism to scenes, yet from nowhere on Earth do clouds appear quite as they do in Berann's work. Their ethereal perfectionism almost certainly derives from his background as a painter of religious art. According to Berann, the sky gives a panorama its "voice" (Stern, 1987). Berann also found inspiration for cloud depictions in his everyday observations of nature. When traveling with Herwig Schutzler, he would occasionally stop, point at the sky, and exclaim: "there are Berann clouds" (Schutzler, 1999).

Although related stylistically, Berann's cloudscapes all appear different from one another *(Figure 13).* Yellowstone features backlit storm clouds emerging through the western haze. Yosemite shows a tempest clinging to its northern peaks and high altitude cirrus clouds converging toward an unseen vanishing point, suggesting motion. Because clouds occupy the most distant areas, cloud shadows tend to interact only with landforms near the horizon. Sky and clouds occupy the top one-third of Berann's panoramas, which conforms to the sky-to-land ratio of classic European landscape photography and is commonly used for postcards and calendars. Within a pan-


*Figure 13. Sky comparison.*

orama, however, this is a generous allocation of space devoted to a feature whose primary function is ornamental. To place greater emphasis on the landscape itself, the sky in the printed NPS panoramas has been cropped so that it occupies 20 to 25 percent of its total visible area.

The shades of blue in the sky determine the color of background haze, which in turn determines the depth of a scene. Extra haze sometimes fills the deepest valleys, enhancing the aerial-perspective effect. On the North Cascades panorama, the discerning viewer will notice an unusual atmospheric phenomena, similar to a rainbow, where the sun strikes morning valley haze over Lake Chelan (see Appendix A for illustration). Berann used greater amounts of mist and haze in middleground areas on his panoramas of the Alps, a humid environment, compared to his NPS pieces of the drier western United States. His panorama of Cortina d'Ampezzo in the Dolomites of Italy shows a towering thunderstorm with an anvil-shaped crown, arguably the most distinctive and imposing of all cloud types, but one seldom depicted by Berann (see Berann and Graefe, 1966, for example). Moreover, the fluffy cumulus clouds so typical of summer skies are conspicuously absent from Berann's panoramas, perhaps because

*"The shades of blue in the sky determine the color of background haze, which in turn determines the depth of a scene."*

their languid appearance would contribute minimal dynamic energy to a scene.

Berann's most memorable panoramic sky was painted for the Valais Water Authority, a region in Switzerland including the Matterhorn. On this project Berann was free for once from the dictates of the tourist industry, which invariably insisted on showing sunny skies to attract visitors. Left to his own devices, he painted a melancholy sky with ragged dark clouds and thunderbolts, giving the scene a sense of apocalyptic foreboding (see Garfield, 1992, cover illustration, for example).

*"Within a typical Berann panorama, the color of the sky varies in value from top (darker) to bottom (lighter) and from left to right depending on the illumination source."*

Within a typical Berann panorama, the color of the sky varies in value from top (darker) to bottom (lighter) and from left to right depending on the illumination source. Clouds are absent or rare on snow-covered winter panoramas to minimize the dominance of white. The Denali panorama shows this preference, although a careful inspection will reveal a few wispy clouds emerging from behind the flanks of Mt. McKinley. On most panoramas, clouds are placed at varying altitudes, ranging from fogs, mists, and storm clouds that brush the Earth's surface to streaks of cirrus high overhead. With theatrical drama, Berann typically placed roiling storm clouds along the margins, where they appear to be moving away from the center of the panorama. The effect is to reveal a landscape to the audience the way opening curtains reveal a stage *(Figure 14).*

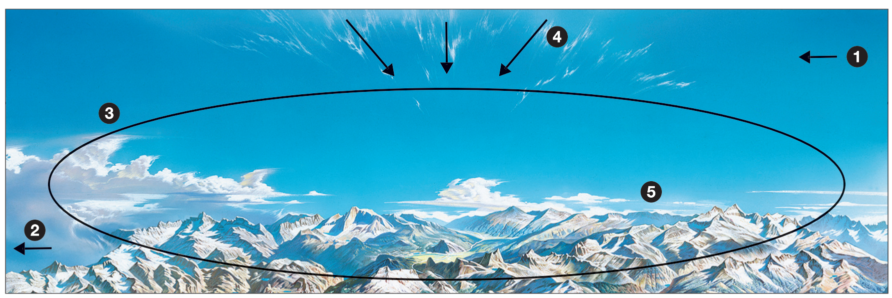



*Figure 14. Berann's skies are more than just a pretty picture. 1) Illumination originating from the right directs the viewers eyes to the left as the sky dome becomes progressively darker. 2) The closest and lowest clouds are placed at the left margin, creating a frame for the scene. They are moving away from the source of illumination, a typical characteristic of Berann's skies. 3) Uplifting storm clouds dissipate into arcing tendrils, suggesting an oval that focuses the viewer's eyes toward the center. 4) Cirrus clouds converge toward a distant vanishing point to reinforce perspective. 5) The horizon usually contains the most distant clouds, if any are shown at all.*

## CONCLUSION

The National Park Service has not published a panorama since Berann's retirement in 1994. Berann's absence is only one factor. Vincent Gleason, who initiated the NPS panorama program, retired shortly after Berann, and since then limited resources have all but eliminated new panorama projects from consideration. This is a pity considering the wealth of exceptional NPS landscapes that could benefit from panoramic depiction. Canyonlands, Glacier Bay, Grand Canyon, Rocky Mountain, and Waterton/Glacier are just a few of the excellent candidates. Vincent Gleason had hoped that Wrangell/St. Elias National Park would become the next NPS/Berann collaboration (Schutzler, 1999). Geographically spectacular, as big as Switzerland, and straddling the roadless mountains along the Alaska/Canada border—the park is quite difficult for the public to visit.

*"For more than 40 years Heinz Vielkind served as Berann's apprentice, gradually honing his panoramic skills until his work can barely be differentiated from the work of the master himself."*

Berann's departure from panorama production is sorely missed. However, he made careful preparations to ensure that his legacy endures. For more than 40 years Heinz Vielkind served as Berann's apprentice, gradually honing his panoramic skills until his work can barely be differentiated from the work of the master himself. When it comes to panorama production, Heinz

Vielkind is a talented disciple of Heinrich Berann. Furthermore, Berann's legacy is likely to continue beyond Vielkind, who for the last seven years has been training his own apprentice. Vielkind has licensed the Berann name and trademark signature, which he modified *(Figure 15).* His business, Panoramastudio Vielkind, operates from a spacious studio in the university district of Innsbruck and appears to be flourishing. New varieties of projects undertaken include a panorama of Russia spanning 11 time zones that simultaneously shows the Sun rising in the east and setting in the west, and a bird's-eye view of a palace complex and zoo in Vienna.

In keeping with the master/apprentice tradition, Vielkind produces his panoramas in exactly the same manner as Berann—entirely by hand. How much longer this tradition will continue remains to be seen, especially now that 3D software and digital terrain models allow landscapes to be modeled with relative ease. Heinz Vielkind is in an excellent position to make the switch to digital panorama production. Next door to his panorama studio he operates a digital video editing business equipped with the latest technology. For now, his panorama and video businesses are completely separate, but it would seem to be only a matter of time before Heinz melds his operations to create an innovative new class of panoramas.


*Figure 15. Heinz Vielkind now uses Berann's signature, but with a tiny "NF" (nachfolger—"successor" in English) added to the trailing swoosh.*

## Digital applications

In the meantime, the NPS has begun producing 3D landscape visualizations in-house using graphical software applications. These 3D products include geologic diagrams, large-scale views of historical sites depicting buildings and vegetation, globes, and perspective maps derived from Digital Elevation Models (DEMs). Digital landscape visualizations, although not nearly as beautiful as Berann's panoramas, meet or surpass most publication standards, and can be produced quickly and inexpensively when compared to traditional production. In addition, digital products can be easily reused for multimedia applications, thereby amortizing production costs over several projects.

*"Besides his prolific legacy of panoramic art, Berann's other gift to the cartographic community is a better understanding of 3D landscape visualization, seen through the eyes of an accomplished traditional artist."*

Besides his prolific legacy of panoramic art, Berann's other gift to the cartographic community is a better understanding of 3D landscape visualization, seen through the eyes of an accomplished traditional artist. Some of Berann's 3D visualization techniques are used by the NPS for digital

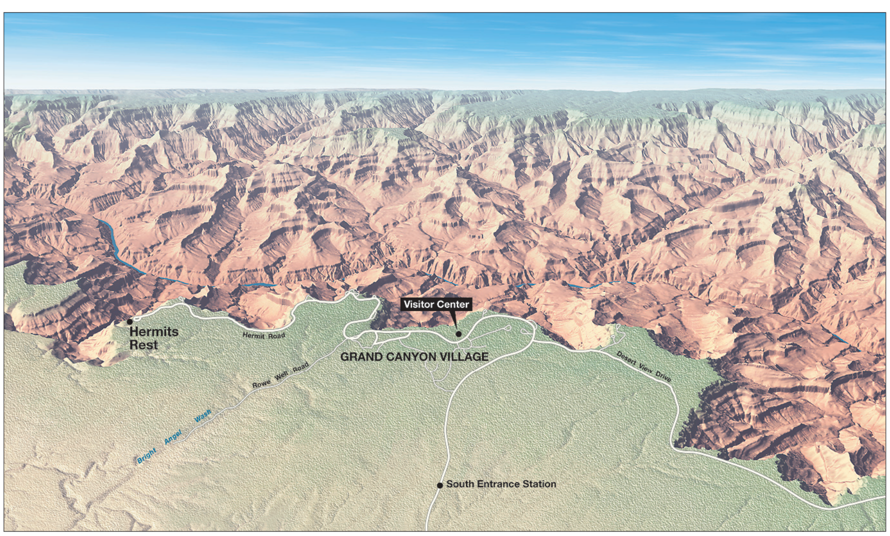



*Figure 16. The receding horizon in this digital view of the Grand Canyon was created by curving the projection plane from front to back—a visualization technique pioneered by Heinrich Berann.*

production. For example, Berann's idea about modifying the projection plane of a panorama—tilting the foreground closer to the viewer and curving the background to disappear over the horizon—can be accomplished with digital tools, yielding scenes that are more legible and natural looking than default "flat world" output from 3D applications. *(Figure 16)* Even Berann's meticulous attention to land-surface detail is digitally emulated by combining DEMs, draped imagery, bump-mapped textures, and ray-traced rendering.

Today's 3D software applications have diminished the requirement that an aspiring cartographer/panoramist possess manual artistic skills. Nevertheless, the success of a 3D landscape visualization still rests on design choices made by the cartographer, which, unlike inborn artistic ability, can be learned. As cartography continues to be transformed by the digital revolution, we are fortunate to have Heinrich Berann's panoramas as an inspiring lesson.

## ACKNOWLEDGMENTS

I am very grateful to the many people who provided advice and assistance. I owe special thanks to Herwig Schutzler, who was Berann's friend, for sharing his personal insights, contacts, and large collection of Berann memorabilia with me. Schutzler was the source for the images showing the progressive work on Denali. The photograph of Berann wearing his special vest and the illustration of his balance emblem were used with the permission of Elisabeth Troyer, Berann's daughter. Shoko Fujita-Ehrlich translated a portion of Garfield's text from Japanese to English, text which, ironically, was originally written in English.

## OBTAINING BERANN'S NPS PANORAMAS

For information about ordering National Park Service publications, please visit our website at: www.nps.gov/hfc/salespubs/orderinfo.htm, or contact:

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Fax: 304-535-6144

## REFERENCES

Berann, Heinrich C. 1991. Mapping for Parklands Symposium. National Park Service. Harpers Ferry, W.Va., (oral translation by Herwig Schutzler).

Berann, H.C. and Graefe, H.A. 1966. *Die Alpen im Panorama.* Verlag Wolfgang Weidlich, Frankfurt, 205 p.

Garfield, Terry. 1970. The Panorama and Reliefkarte of Heinrich Berann. *Bulletin of the Society of University Cartographers.* Vol. 4, No. 2, Liverpool, pp. 52-61.

Garfield, Terry. 1992. *Panoramas Berann's World: From the European Alps to the Himalayas* (text in Japanese). Jitsugyo no Nihon sha (publisher), pp. 104-111.

Hörmann, Lia. April-May, 1995. Die Welt Des H.C. Berann. *Die Tirolerin.* Innsbruck, pp. 188-195.

Imhof, Eduard. 1982. *Cartographic Relief Presentation.* de Gruyter, Berlin, New York, H.J. Steward (edited by), 389 p.

Komar, V. and Melamid, A. 1999. *Komar & Melamid: The Most Wanted Paintings on the Web.* (website) http://diacenter.org/km/index.html

Lawrence, David. 1999. Mountains Under the Sea. *Mercator's World.* Vol. 4, No. 6.

Monkhouse, F.J. 1965. *A Dictionary of Geography.* Edward Arnold, London, 334 p.

Oetterman, Stephan. 1998. *The History of the Panorama: History of a Mass Medium.* Zone Books, New York, 497 p.

Patterson, Tom. 1999. Designing 3D Landscapes. *Multimedia Cartography.* Springer-Verlag, Berlin, W. Cartwright, G. Gartner, M. Peterson (edited by), pp. 217-229.

Schutzler, Herwig. 1999. MapQuest.com. (personal communication).

Stern Magazine TV Guide, Childrens Supplement. December, 1987. Neue Perspektiven.

Troyer, Matthias. 1999. The World of H.C. Berann. (website) http://www.berann.com

Troyer, Elisabeth and Gerhard. 2000. (personal interview with Berann's daughter and son-in-law)

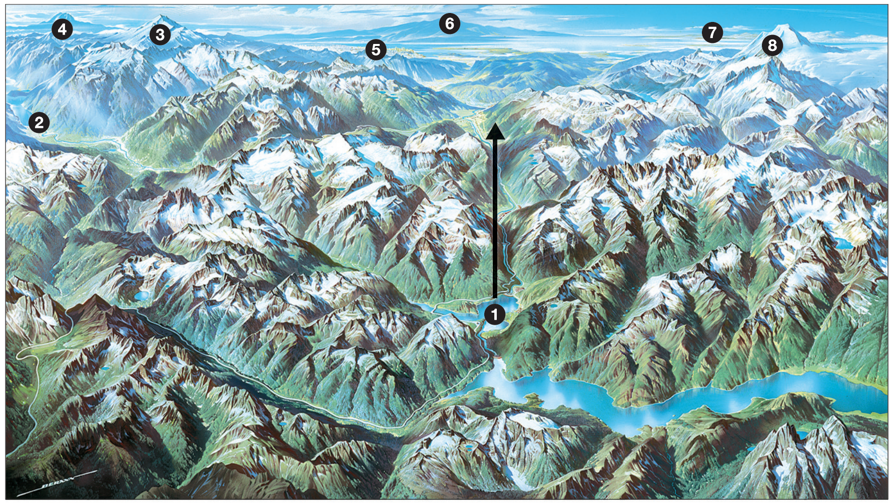
Vielkind, Heinz. 1998. Panoramastudio Vielkind. Innsbruck. (personal interview)

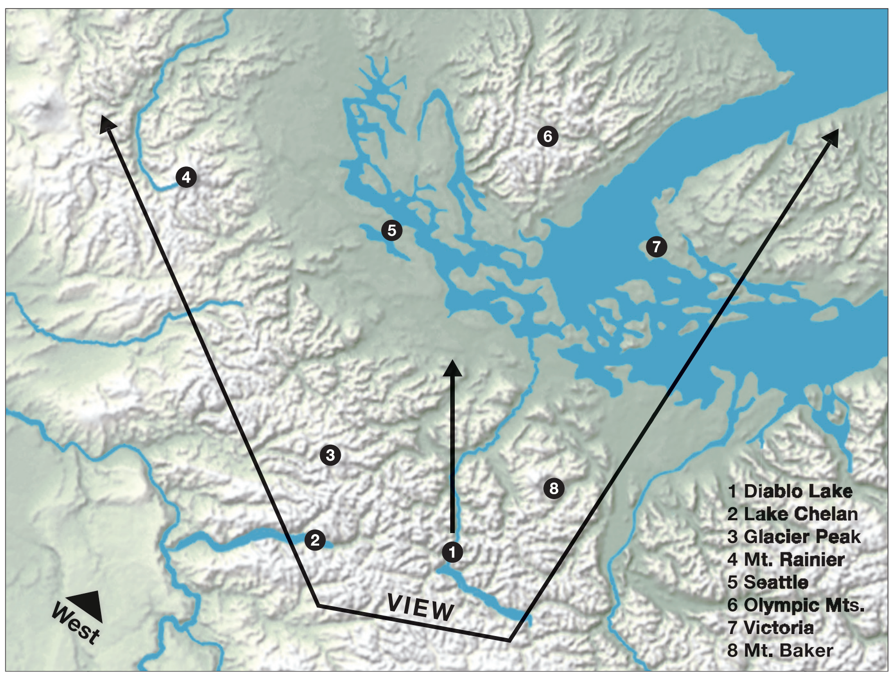
Visual Forensics. 1999. (Website) http://visualforensics.com/Current_Work/Aviation_Law/aviation_law.html

Washburn, B. and Roberts, D. 1991. *Mount McKinley: The Conquest of Denali.* Abrams, New York, 206 p.

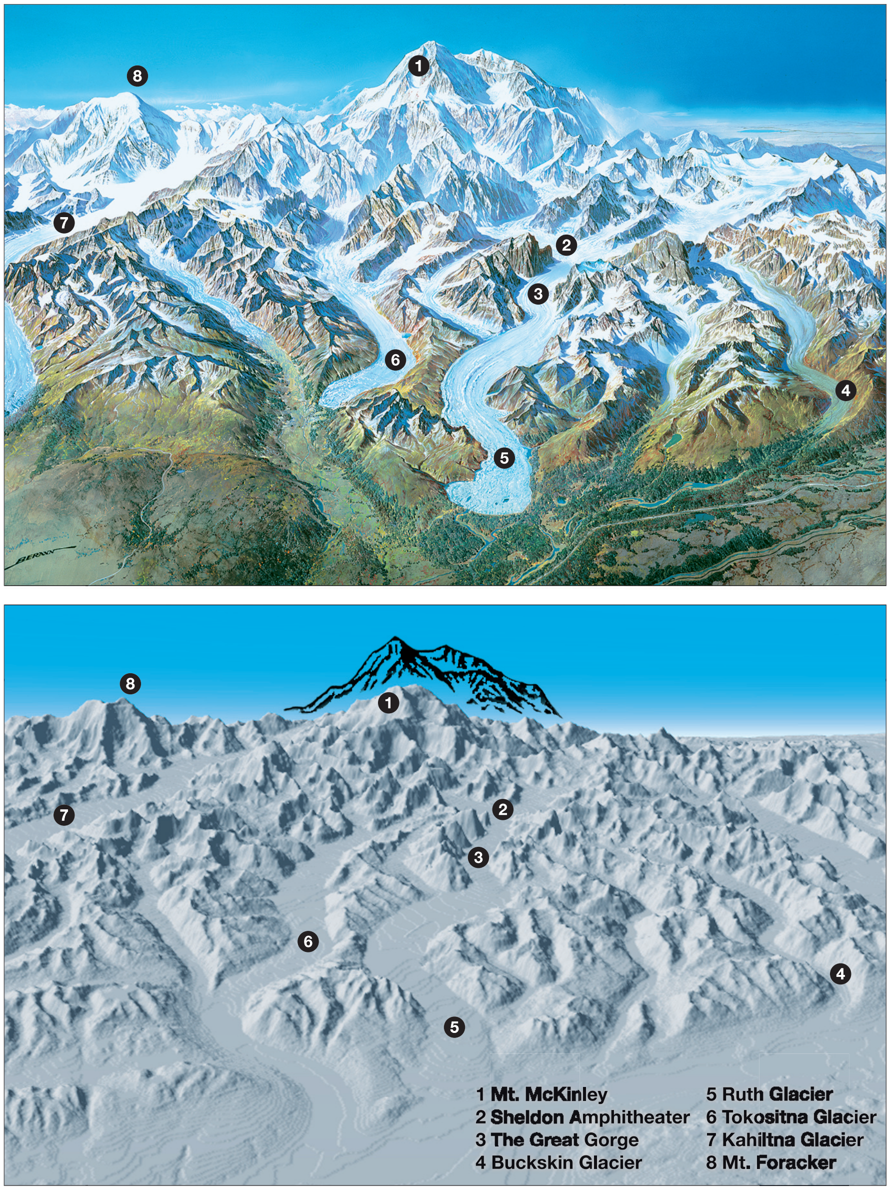
Wood, Michael. 2000. Heinrich Berann and his Methods—A Past Student's Reflections. *ICA Mountain Cartography 2000 Workshop.* Rudolfshütte, Austria.

# APPENDIX A
# BERANN'S PANORAMAS COMPARED TO DIGITAL LANDSCAPES

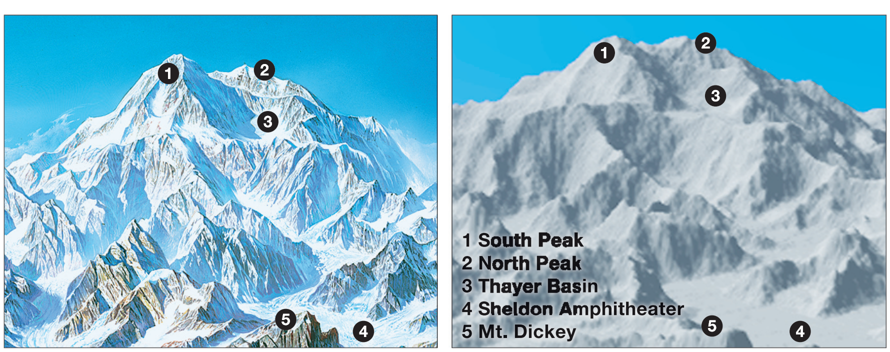


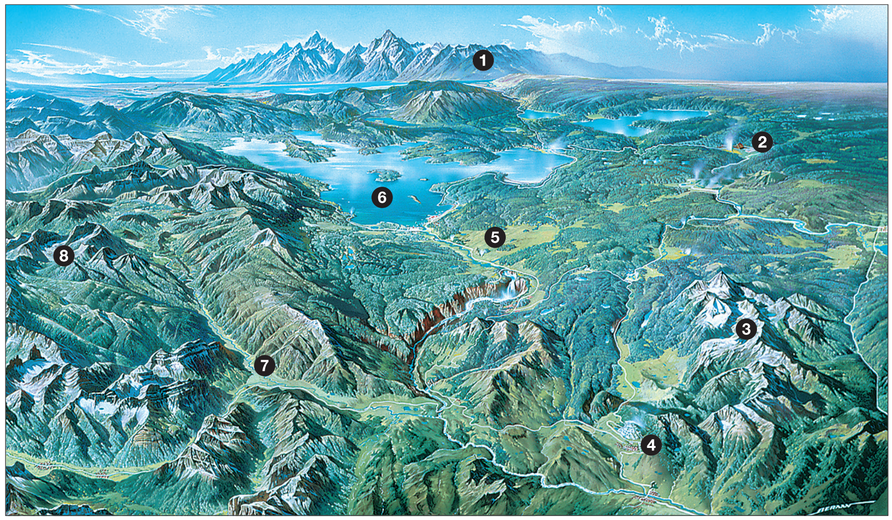

*North Cascades National Park*
*Digital source: GTOPO30*

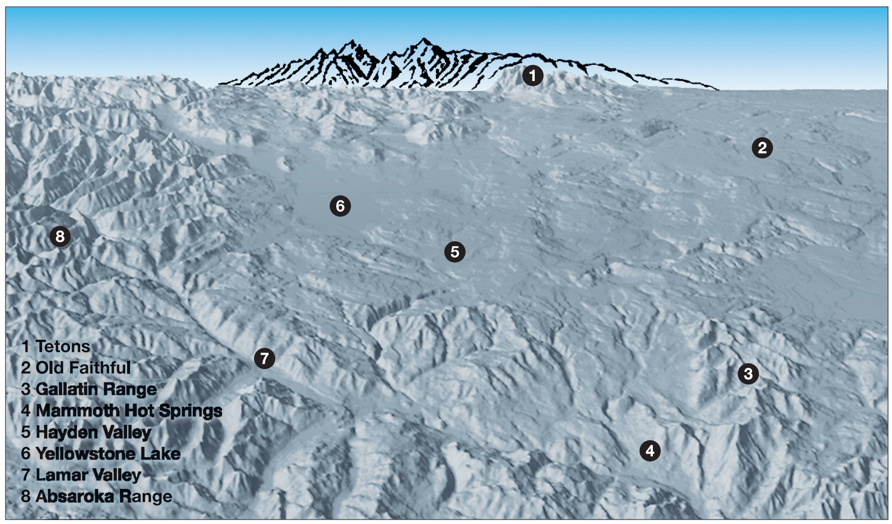



*Denali National Park*
*Digital source: 1:63,360-scale USGS DEMs*

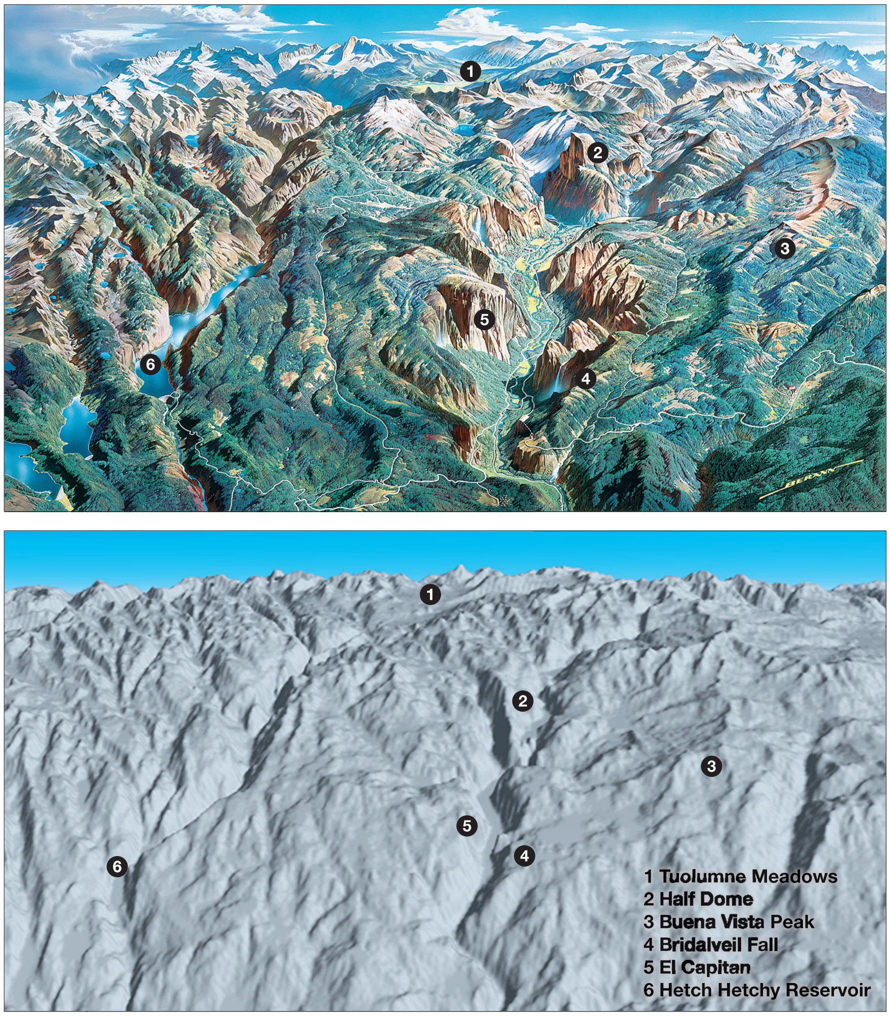



*Mount McKinley summit detail, Denali National Park*
*Digital source: 1:63,360-scale USGS DEMs*

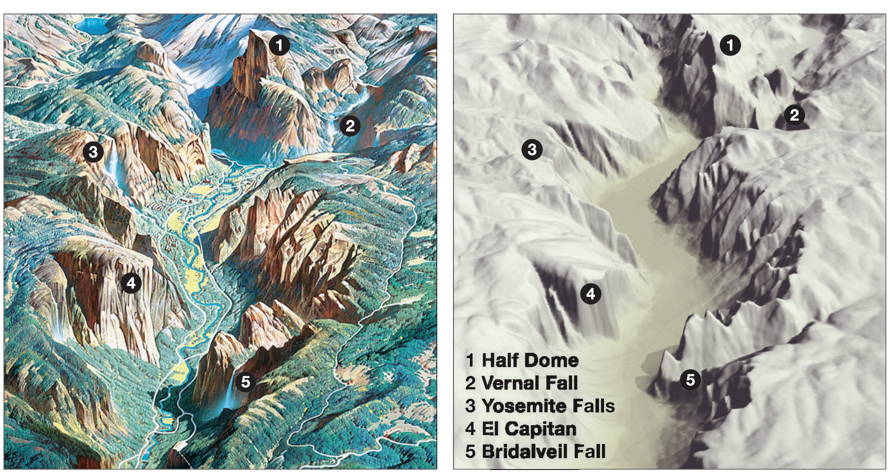





*Yellowstone National Park*
*Digital source: Downsampled 1:24,000-scale USGS DEMs*




*Yosemite National Park*
*Digital source: 1:250,000-scale 90 meter USGS DEMs*




*Yosemite Valley detail, Yosemite National Park*
*Digital source: 1:24,000-scale 30 meter USGS DEMs*