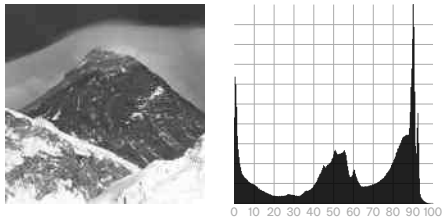
Technical notes

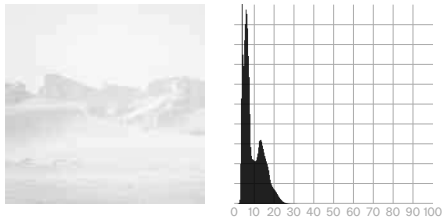
In computer imaging software a histogram is a graph representing the distribution of colour values in an image. The histogram plots colour values on its X-axis, and the frequency of their occurrence in the pixels that comprise the image on its Y-axis (figure 1).[1]

FIG.1



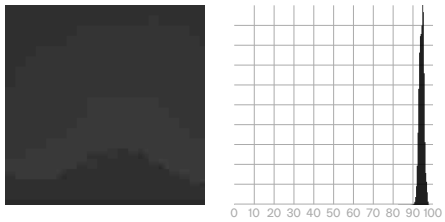
In a multi-channel colour photograph interactions between these values are potentially complex. But in a grayscale photograph — comprised only of pixels on a 100-point scale of values between white and black — the histogram is a legible graph that an experienced software operator can readily correlate with a visual inspection of the image.

FIG.2



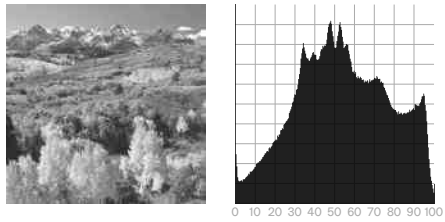
If the histogram registers only pixels with grayscale values tending to the left of its range (figure 2), the photograph it represents will be visually light.

FIG.3



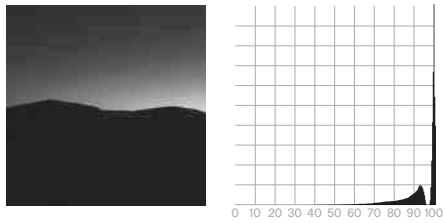
If it registers only pixels with grayscale values tending to the right of its range (figure 3), the photograph will be visually dark.

FIG.4



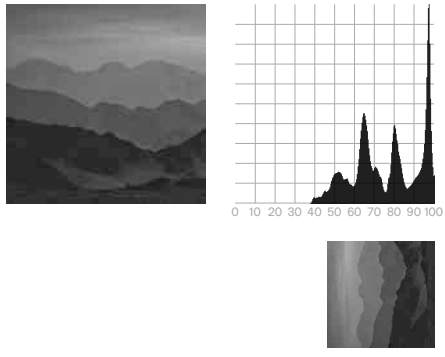
The filled area of the histogram conveys the tonal diversity in the photograph. The broader and deeper this area, the more various the grayscale values in the image, and the more visually complex it is likely to be (figure 4).

FIG.5



Contrasting ranges of grayscale values register distinctly in the histogram. In figure 5 the silhouetted landscape is represented by the spike in the histogram's 95–100% range, and the tonal gradation in the sky by the wedge in its 20–95% range.

FIG.6



In figure 6 the four ranges of grayscale values in the receding landscape and sky are distinctly legible in the histogram. The photograph is also shown scaled down and rotated 90° counter-clockwise to directly correlate these ranges with the histogram.

1 Here the X-axis is labeled 0–100, representing grayscale values. The Y-axis is not labeled as the values it represents are relative and depend on the content of an individual image.

One of Adobe Photoshop's primary interfaces for adjusting tonal values in an image, "Curves", is displayed as a histogram with a linear vector overlay. Adjustments are made by placing control points on this vector and manipulating them to create a simple Bézier curve. Each manipulated control point establishes a new position for a particular grayscale value. The curve arcs between these points, tapering surrounding grayscale values toward the newly established value, and so minimising the potential for sudden disparities to visually degrade the image.

Interaction with the characteristic S-curve of the Bézier also signals the relativity of the underlying histogram. If grayscale values in the 60–70% range of an image are adjusted into the 50–60% range by repositioning a control point on the curve, the resulting histogram will reflect the decrease of pixels in the upper range *and* the consequent increase of pixels in the lower range. The Bézier is a visual metaphor for the optimal, smooth adjustment of tonal values that the Curves interface mediates.

The visual optimisation of an image by its metadata is not a digital concept. In the 1930s and 1940s American artist Ansel Adams developed a system for black and white photography in which the exposure of a negative, its chemical processing in the darkroom, and its final printing are calibrated. In Adams's system, narrow ranges of grayscale values are identified as "zones". Zone 0 is pure black and zone X is pure white. Zone V is mid-gray, as determined by a ubiquitous piece of photographic equipment from the era, the Kodak 18% reflectance neutral gray card. For Adams this mid-gray "functions like the 'A' of the musical scale as a universally recognised basic value."[2]

Despite its emphasis on "image management", the Zone System was motivated by Adams's claim that artistic judgement should take priority over technical sophistication in photography: "If we fail to comprehend the medium, or relinquish our control to automation of one kind or another, we allow the system to dictate the results instead of controlling them for our own purposes."[3]

Adams's term for this negotiation between artist and instrument was "visualisation", a practice of "learning to see as the camera sees"[4] and "projecting the final photographic image in the mind before taking the first steps in actually photographing the subject."[5]

In the *Ansel Adams Photography Series*, a three-volume set of technical manuals for *The Camera*, *The Negative*, and *The Print*, Adams gives notes on the making of many of his images. Photographs of the granite escarpment of Yosemite Valley, the stratified towers of the Grand Canyon, and the lush and intricate surfaces of the Rocky Mountains are shown alongside charts of the ten grayscale zones. Diagrams correlate areas of the photographs with the charts. These explications reveal unseen reciprocities between Adams's images and their metadata. The landscapes of the American west are at once prompts for, and ideal receptacles of, Adams's union of artistic imagination and technical constraint. It is as if Adams was drawn to landscapes from which he could produce photographs that fully express the Zone System.

On page 132 of the first volume, *The Camera*, is an archetypal example. The photograph, titled *Rocks, Alabama Hills, California*, shows a cluster of heavily eroded granite boulders. The composition is tightly cropped around their four rounded forms, aligned to appear as a single mound that fills the frame like a bell curve. Low in the foreground, some dark, almost black shadows. In the patchy clouds above some highlights. In the centre, in the boulders, some midtone texture. All ten zones of grayscale values seem to be so well represented that a digital scan from Adams's original negative — without any distortion from the remediations of printing and re-scanning — might even produce a histogram with a similar bell curve. A rounded pile of pixels. This is a photograph whose composition and metadata have an inextricable sympathy: an image that *looks like itself in the abstract*.

2 Adams, Ansel, *The Negative*, New York: Little, Brown and Company, 1981/2001, p. 33.
3 Adams, Ansel, *The Camera*, New York: Little, Brown and Company, 1980/2003, p. 2.
4 Adams, *The Camera*, ibid., p. 95.
5 Adams, *The Negative*, ibid., p. 1.

This publication presents offset lithographic prints made from 16 digital photographs licensed from the Adobe Stock website. The original RGB image files were converted to grayscale using a generic profile in Adobe Photoshop, and cropped square to enable them ultimately to be inspected in the same aspect ratio as their histograms in the comparative presentation on pages 22–23. Each image was resized to 1652 × 1652 pixels (2,729,104 total pixels per image) and prepared for printing at a resolution of 300 pixels per inch (as shown on pages 1–18).

The images have been processed with a JavaScript application developed for this purpose. The application automatically adjusts grayscale values and adds "noise" — "pixels with randomly distributed colour levels"[6] — to permit a direct intervention in an image's histogram, unmediated by software interfaces designed to maintain the visual integrity of the image within optimal limits.

FIG.7

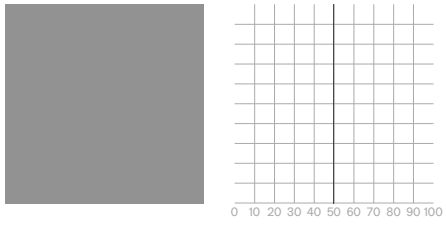
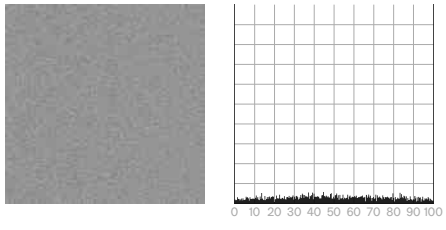


FIG.8



To demonstrate the effect of noise on grayscale values in an image, figure 8 is prepared by applying a 100% noise filter to a solid fill of 50% monotone gray. The histogram of the resulting image reports random variance in all grayscale values from 0–100. (Figure 7 shows the fill before noise is applied.)

Automated in JavaScript, the same 50% monotone gray fill in figure 7 can be processed with a noise filter that applies grayscale values randomised within predefined parameters.

FIG.9

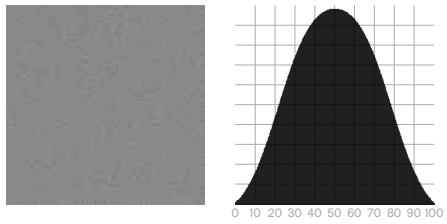
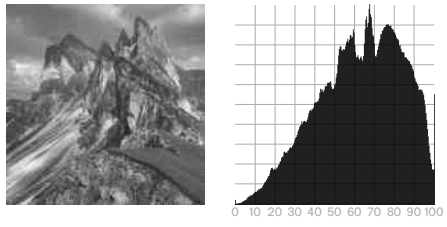


Figure 9 (printed at full resolution on page 24) has been processed with a noise filter that generates a relatively higher number of pixels in the 40–60% grayscale range, and a relatively lower number of pixels in the upper and lower ranges.

The resulting noisy image produces the histogram in the figure and on the cover of this publication. This meta-image inverts the typical relation between an image and its histogram — the image comprises only statistically determined noise, and the histogram is the "visual" output.

Each of the photographs on pages 1–18 has been processed in JavaScript with a custom adjustment and noise filter. Eschewing Adams's artful image craft, this inutilious process computationally forces the aggregate grayscale values in each image to produce a histogram predefined by tracing the composition of the image itself, irrespective of any consequent visual degradation.

FIG.10



In figure 10 (reproduced at full resolution on page 4), the histogram already superficially resembles the composition of the original image. Here little intervention is required to manipulate these grayscale values and produce a histogram that more closely resembles the composition. Compare this to the photograph on page 11, whose dark tones and subtle composition require almost pure noise to reconcile with its histogram.

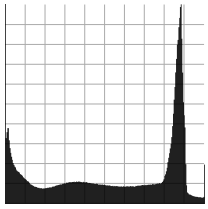
6 Adobe webpage, "Photoshop filter effects reference", retrieved September 2019.

INPUT

OUTPUT

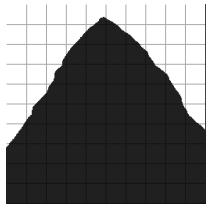
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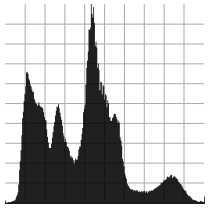
Scripted_190489065.tif





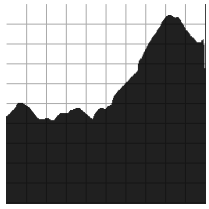
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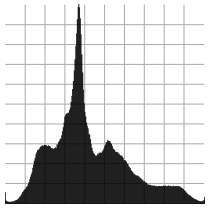
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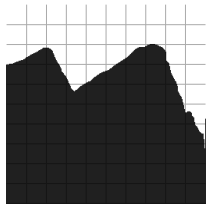
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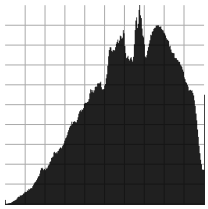
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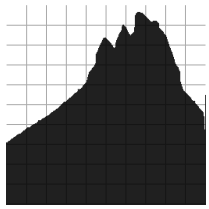
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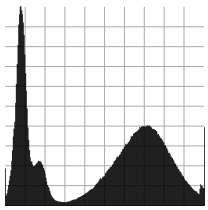
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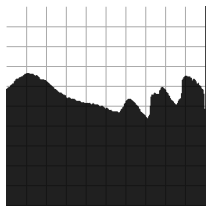
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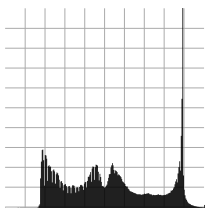
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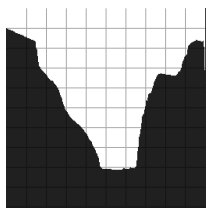
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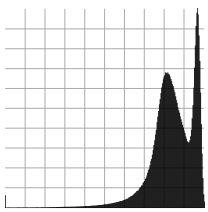
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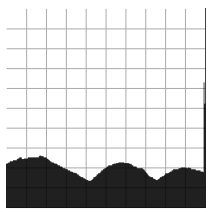
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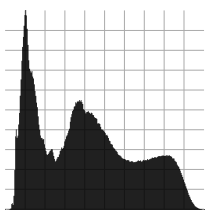
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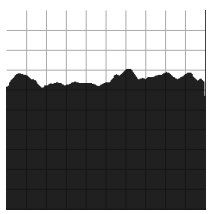
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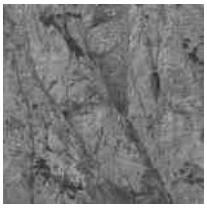


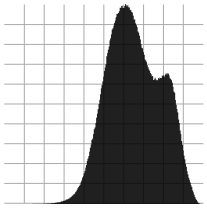


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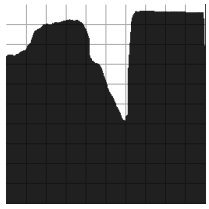
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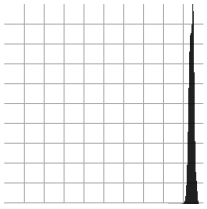
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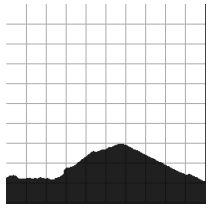
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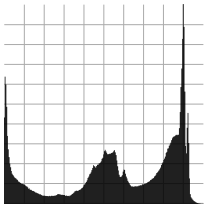
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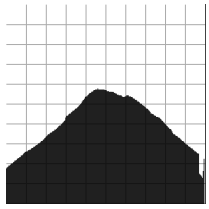
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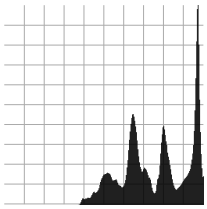
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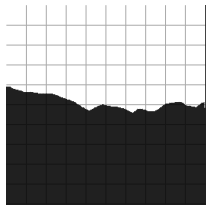
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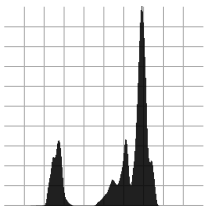
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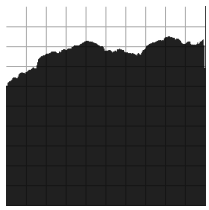
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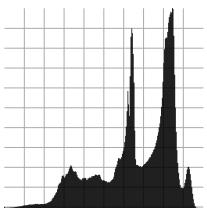
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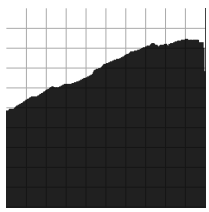
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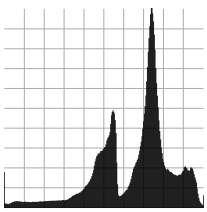
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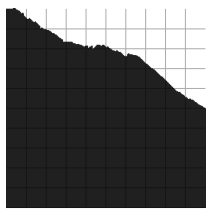
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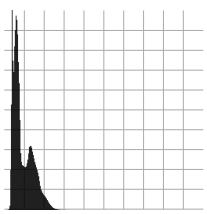
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AdobeStock_139067414.tif





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