Automating the Local Adaptation of Illumination in Analytical Relief Shading

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Current analytical relief shading, the computer-based process of deriving a shaded relief from a digital elevation model (DEM), largely ignores traditional cartographic principles employed in manual relief shading. Due to the characteristics of certain geomorphic features and their spatial orientation, a single standard direction of illumination may not be ideal for adequately portraying terrain in an appealing and descriptive manner. To emphasize important topographic features, such as mountain ridges and valleys, the direction of illumination must be adjusted locally by the cartographer to highlight the characteristics of discrete landforms within the terrain. Locally shaded and illuminated slopes improve aesthetic quality and help readers better perceive major landforms.

The superior quality of manual relief shading techniques, exemplified in Eduard Imhof's work, is often preferred over analytical relief shading (Figure 1). Unlike manual relief shading, current analytical relief shading does not adjust the direction of illumination locally to structure the terrain into discrete landforms. Previously developed analytical shaded relief algorithms are not completely automated. Instead, digital tools are used to mimic the manual workflow but the cartographer is still required to do a considerable amount of work in order to produce desirable results. My project simulates and automates the techniques and cartographic principles associated with manual relief shading.