A Creek is a Creek . . . or is it?

DON W. DUCKSON, JR.

In a recent article it was shown that in western Maryland the generics, *creeks, runs,* and *hollows* were drawn from different statistical populations and therefore had different morphometric (form) properties.[1] It was suggested further that such properties might be useful in identifying or assessing toponymic hierarchies. The purpose of this paper is to demonstrate that perceptions in the rendering of geographical names were applied consistently but at differing scales within the United States. Thus *creeks* may share a common niche in a hierarchy of generics but will exhibit different form properties as a function of regional scale.

TOPONYMIC HIERARCHIES

The spatial distribution, diffusion, and transformation of topographic terms in the United States reveal patterns of word use, reflect historical migration of settlers, and provide colorful descriptions. Relevant literature suggests that no two generics have identical distributions.[2] Diffusion studies have employed toponymy as a tool, despite some physical nonequivalence and language diversity among generic terms.[3] Perhaps physical diversity of the landscape and, certainly, the rich diversity of

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[1] Don W. Duckson, Jr., "Toponymic Generics in Maryland," *Names,* 28 (1981), 163–169.

[2] For example, maps of toponymic generics have been compiled by Hans Kurath, *A Word Geography of the Eastern United States* (Ann Arbor: University of Michigan Press, 1942), Wilbur Zelinsky, "Some Problems in the Distribution of Generic Terms in the Place Names of the Northeastern United States," *Annals of the Association of American Geographers,* 45 (1955), 319–349, and E. S. Bright, *A Word Geography of California and Nevada* (Berkeley: University of California Publications in Linguistics No. 69, 1971).

[3] Jean Poirier, *Toponymie: Méthode d'enquête* (Québec: Les Presses de L'Université Laval, 1965). For a more specific use, see H. F. Raup and W. B. Pounds, Jr., "Northernmost Spanish Frontier in California as Shown by the Distribution of Place Names," *California Historical Society Quarterly,* (32 (1953), 43–48. Although focused more on formal settlements than topographic place-names, some authors have made historical linkages which overcome transformation. See, for example George R. Stewart, *American Place Names* (New York: Oxford University Press, 1970) or, by the same author, *Names on the Land* (Boston: Houghton-Mifflin, 1958).

language resulted in place-name rendering with sometimes purposeful, sometimes inadvertent color.[4]

Descriptive color notwithstanding, generics carry an information function as part of a place name. As elements of language generics are expressions of culture and are subject to changes in meaning (or loss of meaning) the same as other words.[5] Through time, connotations become vague, and definitions do not clearly distinguish between entities. For example, *creek* is defined as ''a small stream of water that serves as the natural drainage course for a drainage basin of nominal size,''[6] ''a stream of less volume than a river,''[7] ''a natural stream of water smaller than and often tributary to a river,''[8] and as a flow of water ''smaller than a river but bigger than a brook.''[9] *Run* is defined as ''a brook or creek,''[10] ''a creek,''[11] ''a natural channel of water,''[12] and ''a generic for a small stream.''[13] *Hollow* is defined as ''a small ravine,''[14] ''a depressed or low part of a surface, especially a small valley or basin,''[15] and ''a tract of land encompassed by hills or mountains.''[16]

Hierarchies of size or velocity in the rendering of stream names have

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[4] Translation or transliteration into English from various Indian dialects frequently described an event or a setting, as in J. G. E. Heckwelder, ''Names Given by the Lenni Lenape or Delaware Indians to Rivers, Streams, and Places Now in New Jersey, Pennsylvania, Maryland, and Virginia,'' *Pennsylvania German Folklore Society,* 5 (1940), 1–41. Simple compilation with little interpretation or evaluation is provided in G. D. McJimsey, ''Topographic Terms in Virginia,'' *American Speech,* 15 (1940), 3–38. More useful examples of derivations and transfers include R. E. Matthews, ''A Study of Colorado Place Names,'' (Stanford University M. A. Thesis, 1940) and E. W. McMullen, Jr., *English Topographic Terms in Florida,* 1563–1874 (Gainesville: University of Florida Press, 1953).

[5] J. H. Gritzner, ''Seventeenth Century Generic Place-Names: Culture and Process on the Eastern Shore,'' *Names,* 20 (1972), p. 233.

[6] R. A. Durrenberger, *Dictionary of the Environmental Sciences* (Palo Alto: National Press Books, 1973), p. 56.

[7] American Geological Institute, *Dictionary of Geological Terms* (New York: Anchor/Doubleday, 1976), p. 99. The same definition is also the ''standardized'' one used in mapping efforts; see H. M. Wilson, ''A Dictionary of Topographic Forms,'' *Journal of the American Geographical Society,* 32 (1900), p. 35.

[8] *Webster's New Collegiate Dictionary* (Springfield, Mass.: G. C. Merrian Company, 1966), p. 268.

[9] Dudley Stamp (ed.), *Dictionary of Geography* (New York: Wiley, 1966), p. 103.

[10] AGI, p. 372, and Wilson, p. 39.

[11] *Webster,* p. 1013.

[12] Durrenberger, p. 204.

[13] Stewart, *Names,* p. 413.

[14] AGI, p. 208.

[15] *Webster,* p. 545.

[16] *Wilson,* p. 37.

been mentioned by others.[17] Verification of such hierarchies among generics in Maryland was demonstrated by Duckson,[18] and hierarchies based on economic or navigational criteria have been described by Gritzner.[19] It has even been suggested in Canada that all fluvial generics be standardized according to specific criteria (length, width, depth, and slope) into categories: *ruisseau, ru, rivière, torrent,* and *fleuve*.[20] Differing views as to the role of geographical names and political tensions within Canada have resulted in only limited changes in nomenclature under the Canadian Board of Geographic Names.[21]

Because it is one characteristic of language to arrange words into a hierarchy, and because the existence of hierarchies has been demonstrated for fluvial generics, it is not surprising that similar ordering exists for land generics. Gritzner developed a taxonomy for land-related features of the Delmarva peninsula.[22] References to *glades, meadows,* and *islands* connoted ecologically different entities, some of which were scaled also.

In the west and southwest other land-related features are used with little connotative distinction. Among these features are *canyon,* defined as "a steep-walled chasm, gorge, or ravine . . . the sides of which are composed of cliffs or series of cliffs,"[23] "a gorge or ravine of considerable dimension; a channel cut by running water in the surface of the earth, the sides of which are composed of cliffs or a series of cliffs rising from its bed";[24] and "a deep narrow valley with precipitous sides often with a stream flowing through it";[25] and *gulch,* which is defined as "a small

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[17] Most references to hierarchies among fluvial generics were concerned with distributions, not functions. For example, J. L. Kuethe, "Runs, Creeks, and Branches in Maryland," *American Speech,* 10 (1935), p. 258; Kurath, p. 32; McJimsey, p. 27; and Zelinsky, p. 324, all mention but do not assess the nature of a hierarchy.

[18] Don W. Duckson, Jr., "Creeks, Runs, and Hollows," *The Professional Geographer,* 33 (1981), 361–365.

[19] Gritzner, 1972, p. 236.

[20] Michel Brochu, *Normes et Principes Généraux de Toponymie* (Québec: Les Editions Ferland, 1962), 16 pp.

[21] Alan Rayburn, "Some Problems Relating to English and French Hydronymy" in Henri Dorion (ed.), *Les Noms de Lieux et le Contact des Langes* (Québec: Les Presses de L'Université Laval, 1972), 356–374.

[22] J. H. Gritzner, "Perception of Landscape Through the Medium of Language: Seventeenth Century Toponymy of the Eastern Shore," in R. D. Mitchell and E. K. Muller (eds.), *Geographical Perspectives on Maryland's Past* (College Park: University of Maryland Occasional Papers in Geography, No. 4, 1979), 51–70.

[23] AGI, p. 62.

[24] Wilson, p. 34.

[25] *Webster,* p. 163.

ravine, a small, shallow canyon with smooth inclined slopes;''[26] and ''a deep or precipitous cleft: ravine, especially one occupied by a torrent.''[27] It may be noted that land-related terms, such as *canyons, gulches,* and *hollows* frequently assume water-related characteristics. If such generics were perceived to demonstrate water-related characteristics, then perhaps *canyons* and *gulches* hold hierarchical niches comparable to *runs* and *hollows*.

FUNCTIONAL HIERARCHIES

R. E. Horton's now classic paper in 1945 provided the focus for considerable research into basin mechanics.[28] Fluvial systems and resulting forms were investigated with regard to channel geometry and the development of drainage nets, including topology. From the rather considerable literature on these subjects, a few salient points are worth noting.

First, the fluvial landscape is highly structured. Horton's system of stream ordering has been supplanted by that of Strahler,[29] Shreve,[30] Scheidegger,[31] Graf,[32] and others. Ordering of a stream basin reveals a geometric progression between stream segments. The realization follows that stream order must be related to other basin properties, such as stream numbers, channel length, basin area, and slope, by simple geometric relationships or power functions. Drainage basins are allometric.

Second, attempts to identify structural (morphologic) relationships have not been totally successful. Small (Strahler first-order) basins comprise about half the cells of a large basin.[33] Because these small basins are perceived as the fundamental units of larger drainage systems, it is understandable that data collected in the former are extrapolated to the latter. Geometric basin properties appear to extrapolate well because the

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[26] AGI, p. 199, and Wilson, p. 36.

[27] *Webster,* p. 511.

[28] R. E. Horton, ''Erosional Development of Streams and Their Drainage Basins,'' *Bulletin of the Geological Society of America,* 56 (1945), 275–370.

[29] A. N. Strahler, ''Hypsometric (Area-Altitude) Analysis of Erosional Topography,'' *Bulletin of the Geological Society of America,* 63 (1952), 1117–1142.

[30] R. L. Shreve, ''Statistical Law of Stream Numbers,'' *Journal of Geology,* 74 (1966), 17–37.

[31] A. E. Scheidegger, ''Stochastic Branching Processes and the Law of Stream Orders,'' *Water Resources Research,* 2 (1966), 199–203.

[32] W. L. Graf, ''A Cumulative Stream-Ordering System,'' *Geographical Analysis,* 7 (1975), 335-340.

[33] L. B. Leopold, M. G. Wolman, and J. P. Miller, *Fluvial Processes in Geomorphology* (San Francisco: W. H. Freeman and Company, 1964), p. 142.

numbers of basins by order "behave as though a hexagonal determinism were at work."[34] Drainage basins assume nested hierarchies of hexagonal basin areas. Klein, however, showed that processes and process-intensities operating in small basins vary from those in large basins.[35] Subsequent investigations on thresholds, complex response, and feedback mechanisms suggest both spatial and temporal variation in drainage basin form and process. Thus, while form and process are intuitively interrelated, form is more easily perceived, measured, and "ordered."

Finally, it is the visibility of form and the perception of order that relates to toponymy. That perceived arrangements relate also to functional hierarchies, especially for small-sized basins, confirms the shrewdness of observation and the subsequent rendering of geographical names.

As a descriptive toponym, *creek* is the most commonly occurring term for a small stream in the United States. Through time, habit, and migration, settlers transferred their perceptions of the Atlantic seaboard fluvial landscape to other environments. Modifications took place so that hierarchical positions and, perhaps, generic terms among water-related toponyms came to refer to different entities. When is a *creek* a *creek*?

DATA AND METHODS

Morphometric properties are form variables. Organization internal to drainage basins may be portrayed by form variables which tend to be interrelated, yet proportionally scaled according to the size of the basin. It is hypothesized that *creeks* regionally will display different morphometric properties because the rendering of geographical names involved not only differing environments, but differing environmental perceptions as well.

Four samples of twenty basins were selected for analysis. Basins are located in western Maryland, the San Juan and Elk Mountains of Colorado, the central hill district of Texas, and the coast ranges of central California. Data were derived from U.S.G.S. topographic quadrangles scaled at 1:24,000, which were compiled or revised using photogrammetric techniques. Catchments had to carry the term, *creek,* as a geographic name on a published sheet. Drainage had to be well-defined, and artificial constraints to basin form, such as impoundments or diversions,

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[34] M. J. Woldenberg, "Spatial Order in Fluvial Systems: Horton's Laws Derived from Mixed Hexagon Hierarchies of Drainage Basin Areas," *Bulletin of the Geological Society of America,* 80 (1969), p. 99.

[35] Micha Klein, *The Influence of Drainage Area in Producing Thresholds for the Hydrological Regime and Channel Characteristics of Natural Rivers* (Leeds: University of Leeds, School of Geography Working Paper No. 147, 1976), p. 86.

eliminated a basin from consideration. Basin and drainage delimitation followed the blue-line extension method outlined by Morisawa.[36]

Properties derived do not represent a comprehensive list of form attributes, but essentially measure size, slope, and drainage texture. Basin area in square miles was measured by polar planimeter; perimeter and length were determined by a map measurer. Relief ratio (the product of the absolute relief times 100 divided the perimeter in feet) and drainage density (ratio of total length of all streams to the area of a basin) are indices derived from other characteristics. Summary statistics are provided in Table 1.

To test the hypothesis that *creeks* from the four study areas connote streams of different size, basin area was isolated for further examination. Analysis of variance is a test for significant differences between sample means. However, it was necessary to transform basin areas to common logarithms because most morphometric properties seem to have positive skew and because analysis of variance assumes normal distributions and homogeneous variances. When analysis of variance was employed using transformed data, the null hypothesis could be rejected ($F_{.95}$, $df_{3,76} = 12.3141$; tabled value of $F_{.95} = 2.75$).

By acknowledging that variations in scale exist and by allowing for perceptual error in the rendering of generic terms, is it possible that the significant difference in basin areas among *creeks* in California, Colorado, Maryland, and Texas appears to result from scale-changes, or orders of magnitude? Is a Colorado *creek* non-equivalent to a Maryland *creek*; or is it that a Colorado *creek* is really the equivalent of a Maryland *run*?

To assess comparatively the non-equivalence of generic hierarchies, two sets of relationships were examined. *Creeks, runs,* and *hollows* form a hierarchy, both toponymically and functionally, in western Maryland.[37] In western Colorado *creeks, canyons,* and *gulches* appear to hold the same relationship.

Morphometric properties were derived for two additional data-sets, *canyons* and *gulches*. Comparison is possible by consulting the summary statistics provided in Table 2. Areas, lengths, and slopes show consistent hierarchial patterns within regions, but data from Colorado *creeks* compare favorably — except for slope — with Maryland *runs*. For that matter, several properties appear to be similar between both regions and

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[36] M. E. Morisawa, "Accuracy of Determination of Stream Lengths from Topographical Maps," *Transactions of the American Geophysical Union*, 38 (1957), 86–88.

[37] Duckson, "Generics," p. 68.

sets. For example, drainage density means for *runs* and *gulches* are similar.

Analysis of the morphometric hierarchies from Maryland and Colorado also included analysis of variance to ascertain whether perceived differences among sample means were significant. Summaries are presented in Table 3.

It is rather amazing that so many perceptions held by many people who lived at different times could have been so consistently correct in their description. *Creeks, runs,* and *hollows* in Maryland form a scale of decreasing size. So, too, do *creeks, canyons,* and *gulches* in western Colorado. Without a clear understanding of hydraulic function, or geomorphologic interrelationships, the people — miners, settlers, explorers, or whatever — who were responsible for the rendering of geographic names must have had an intuitive ability to perceive the correct scalar series. Perhaps because humankind was more directly dependent upon its physical environment in the past, perhaps because in a smaller population there is a heavier dependence upon the common interpretation of meaning of the signals used in communication, the environmental analysis implicit in toponymic generics of selected water-related features is remarkable.

It is also amazing to realize that the generics, internal process similarities notwithstanding, represent different statistical populations. A *creek* in Colorado is not the same entity as a *creek* in Maryland, but neither is it the equivalent of a *run, hollow, canyon, gulch* or *creek* in either California or Texas. Admitted differences of geology and climate exist between Maryland and Colorado. Certainly the absolute values of slope (Table 2) are strikingly different between the two locations. Yet geological processes are in operation in both environments, and morphometric mean values for some properties, such as area and drainage density appear to be similar. They are not. Process intensities and interrelationships are complex, not totally measurable, and are not fully understood. Some toponyms apparently are already scaled into language which has inadvertently accommodated internal process variations.

Burrill wrote:[38]

> In standardizing geographic names we must identify what kind of entity it is that bears each name. . . . In attempting to identify and isolate . . . we [Board of Geographic Names] were including too few attributes because we did not at first visualize an entity having in combination attributes that we customarily use as a basis for assigning entities to *different* categories.

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[38] M. F. Burrill, "The Language of Geography," *Annals of the Association of American Geographers*, 58 (1968), pp. 3–4.

The decreasing discriminator value of most toponymic generics is not the result of differing connotations produced by physical changes over time,[39] but rather an incomplete understanding (and appreciation) of the perceptions operating when the name was rendered. Morphometric properties are clearly different in value between steps in hierarchical scales. Perhaps current evaluation may allow a more complete discernment of past perception.

A FINAL NOTE

Interest in toponyms has not been as widespread among professional geographers as it has in other disciplines. Particularly among physical geographers there is a focus toward geology and hydrology rather than upon the rendering of names.

A recent event in Montana is of interest. A logger near Missoula was cited under Montana's Stream Preservation Act for altering a stream without having secured an appropriate permit. During the trial, the defendant argued that the Act was not applicable to his case because the stream in question did not constitute a perennial flowing stream as defined by the Act. Testimony was presented to the effect that the stream had, on occasion, ceased to flow in the past. The court agreed with this defense and the case was dismissed.[40] It would seem that connotative distinctions, even when terms are defined, continue to be less clear with time.

Frostburg State College

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[39] M. F. Burrill, "Toponymic Generics," *Names,* 4 (1956), p. 228.

[40] J. S. Rankin and G. T. Foggin, *When is a Stream a Stream? Some Geomorphic, Hydrologic and Legal Considerations* (Bozeman: Montana Water Resources Research Center Report No. 104, 1980), p. 5.

Table 1. Summary Statistics for *Creeks*

Variate	California		Colorado		Maryland		Texas	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Area (mi^2)	3.02	1.83	4.41	2.68	10.27	6.88	6.87	4.83
Perimeter (mi)	8.76	4.39	10.68	4.21	15.50	5.88	11.85	5.15
Relief Ratio	4.13	1.74	7.51	3.39	1.65	0.66	1.64	1.70
Cum. Stream Length (mi)	33.82	19.49	39.13	24.10	85.79	63.30	59.58	39.09
Drainage Density	12.44	3.74	8.97	1.87	8.52	1.44	9.01	1.31
Slope (ft/mi)	547	281	846	403	208	101	105	31

Table 2. Summary Statistics for
Two Generic Hierarchies

Variate	Maryland Creeks Mean	SD	Runs Mean	SD	Hollows Mean	SD
Area	10.27	6.88	3.44	1.78	1.55	1.03
Cum. Stream Length	85.79	63.30	32.87	21.20	19.71	13.20
Perimeter	15.50	5.88	8.60	3.29	6.01	1.58
Drainage Density	8.52	1.44	9.63	2.78	12.94	2.61
Slope	208	101	285	136	441	223

Variate	Colorado Creeks Mean	SD	Canyons Mean	SD	Gulches Mean	SD
Area	4.41	2.68	2.47	2.26	1.12	0.95
Cum. Stream Length	39.13	24.10	29.24	33.72	10.76	9.97
Perimeter	10.68	4.21	7.34	3.18	4.59	1.73
Drainage Density	8.97	1.87	11.39	3.00	9.87	2.26
Slope	846	403	1043	369	1280	628

Note: Each set contains twenty basins.

Table 3. Analysis of Variance for Drainage Hierarchies in Colorado and Maryland

Variate	Data Sets	F-Ratios	
		Calculated	Tabled[a]
Area	creeks, runs, hollows	24.51	3.15
Area	creeks, canyons, gulches	22.52	3.15
Area	Colorado creeks, runs, canyons	9.24	3.15
Area	gulches, hollows	4.14	4.08
Length	canyons, runs	1.79	4.08
Drainage Density	runs, gulches	5.47	4.08

[a] Tabled values for significance at the .05 level.

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GUM, *n*. the large state-owned department in Moscow. GUM is an acronym of Russian *Gosudarstvennyi Universalnyi Magazin* State General Store.

—*The Barnhart Dictionary Companion*, Vol. 1, no. 2, p. 21.

ZHIGULI, *n*. the name of a Soviet-made Fiat automobile. Soviet cars—Zhigulis and other models designed, wholly or in part, at home—are made without pollution controls of any kind, and with little concern for safety devices. The first seat belts began to appear in 1975. Kaiser, 1976, p. 330.

—*The Barnhart Dictionary Companion,* Vol. 1, no. 2, p. 22.