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From Legal Theory to Practical Application: A How-To for Performing Vote Dilution Analyses*

M. V. Hood III, *University of Georgia*

Peter A. Morrison, *Morrison & Associates*

Thomas M. Bryan, *Bryan GeoDemographics*

Objectives. The Supreme Court opinion in *Thornburg v. Gingles* three decades ago established a three-prong test whereby a vote dilution claim can be substantiated. This article provides practitioners and social scientists with a working understanding of the operational steps involved in analyzing a vote dilution claim. *Methods.* A brief primer is offered on how to translate the *Gingles* preconditions into a set of practical, real-world tests. At each stage, we buttress these explanations with examples from actual court proceedings. *Results.* This primer furnishes readers with the basic knowledge necessary to carry out a vote dilution analysis under the current legal standard. *Conclusion.* While the generic process for conducting a test of vote dilution has been well-defined by decades of case law, practitioners should be mindful that some aspects of these procedures will continue to be affected by future court proceedings.

The 1965 Voting Rights Act has profoundly altered the American political landscape (see Berman, 2015). The challenges to election procedures and practices it prompted now hinge centrally on successfully prosecuting a claim under Section 2 of the Act.¹ The Supreme Court opinion in *Thornburg v. Gingles* three decades ago established a three-prong test whereby a vote dilution claim can be substantiated. Translating judicial guidance into real-world empirical analysis, however, is not always a straightforward process.

To fill this gap, we present a primer on how to transform the three *Gingles* preconditions into a set of practical real-world tests. Our aim is to provide a working understanding of the operational steps involved in analyzing a vote dilution claim. This *how-to* practicum will illustrate the uses of demographic and statistical analyses to inform legal proceedings. We begin by providing the necessary legal background for experts undertaking a vote dilution analysis. We then consider each of the three necessary preconditions, termed the *Gingles* prongs, which a plaintiff must satisfy to sustain a vote dilution claim. In describing the

*Direct correspondence to M. V. Hood III, Department of Political Science, University of Georgia, 104 Baldwin Hall, Athens, GA 30602 (th@uga.edu). M. V. Hood III and Peter A. Morrison served as expert witnesses in *Rios-Andino v. Orange County*.

¹In 2013, the U.S. Supreme Court in *Shelby County v. Holder* declared the coverage formula in Section 4 of the Voting Rights Act unconstitutional. These formulas determine, in turn, which jurisdictions are subject to Section 5. Until Congress revises Section 4, Section 5 will continue to be unenforceable. As of this writing, it is unlikely that Congress will soon amend the coverage formulas in Section 4. There is both an interparty disagreement over what form a new coverage formula might take and intraparty dissension given that different formulas will produce a varying mix of covered jurisdictions. For an introduction to the previous Section 4 formulas and an interactive look at what jurisdictions would be covered under potential formulas, see "The Formula Behind the Voting Rights Act." *New York Times* June 22, 2013.

process for evaluating each prong, we draw on actual cases to illustrate accepted techniques experts typically employ.²

Legal Background

Largely as a consequence of the 1965 Voting Rights Act, the reenfranchisement of black Americans in the South resulted in substantial increases in black registration and turnout in the region (Bullock and Gaddie, 2009; Hood et al., 2012). Subsequent to these numerical gains following removal of formal barriers to the ballot box, a new issue surfaced: minority vote dilution. Davidson makes a clear distinction between *disenfranchisement* and *dilution*: the later can take place even if the former is not present. He defines vote dilution as “a process whereby election laws or practices, either singly or in concert, combine with systematic bloc voting among an identifiable group to diminish the voting strength of at least one other group” (Davidson, 1994:22).

Section 2 of the Voting Rights Act anticipated the potential for minority vote dilution in 1965:

No voting qualification or prerequisite to voting, or standard, practice, or procedure shall be imposed or applied by any State or political subdivision to deny or abridge the right of any citizen of the United States to vote on account of race or color.³

Vote dilution has a multitude of potential causes, both blatant and subtle. They include electoral systems (at-large or multimember districts), how election districts are drawn (redistricting), the structure of elections (majority-vote requirements), voter requirements (presentation of government-issued photo identification), or how elections are administered (constraints on would-be voters, such as the length of the early in-person voting period). Each can abridge the right to vote specifically among members of certain groups.

Section 2 of the Voting Rights Act (unlike Section 5) applies to jurisdictions nationwide and can be used to challenge existing electoral systems.⁴ Section 2, however, was viewed as little more than a redundancy to guarantees provided in the U.S. Constitution (14th and 15th Amendments) prior to actions on the part of Congress in 1982 (Lowenstein et al., 2012). In 1980, the Court ruled in *City of Mobile v. Bolden* that it was necessary to prove that a jurisdiction had *intentionally* erected an electoral system designed to dilute minority voting strength in order for a cause on the part of a plaintiff to be upheld.⁵ Two years later Congress responded to the Court’s interpretation of Section 2 by amending the law, supplanting the *intent* standard with one based solely on *effects*. The 1982 amendment to Section 2 of the VRA allowed both the Department of Justice and private plaintiffs to challenge a host of election devices as having the effect of diluting minority voting strength.

Following the 1982 amendments to Section 2, the Supreme Court clarified its interpretation of this component of the Voting Rights Act as it applies to vote dilution involving election districts.⁶ In doing so, the Court also articulated a three-part test that plaintiffs must meet to sustain a vote dilution claim (see Bullock, 2010):

²Detailed applications of these methodologies are provided in a separate electronic appendix to this article. See also Morrison (1994).

³Amendments to the Voting Rights Act in 1975 added language defining minorities as a protected class (Bullock and Gaddie, 2009). Statute text from the Office of the Clerk, U.S. House of Representatives at (<http://library.clerk.house.gov>).

⁴Note that unlike Section 5 litigation, the burden of proof falls on the plaintiff in a Section 2 claim.

⁵*City of Mobile v. Bolden*, 446 U.S. 55 (1980).

⁶See *Thornburg v. Gingles*, 478 U.S. 30 (1986).

1. The minority group must be of sufficient size and geographically compact enough to allow for the creation of a single-member district for the group in question.
2. It must be demonstrated that the minority group is politically cohesive.
3. It must further be demonstrated that the candidate of choice for the minority group is typically defeated by the majority voting bloc.

To prevail on a vote dilution claim, plaintiffs must present convincing evidence for all three preconditions. If, for example, the racial minority were not sufficiently numerous to constitute the majority in a single-member district for the jurisdiction in question, then the Court would be unable to grant relief. Likewise, proving the existence of racially polarized voting would not, of itself, constitute vote dilution. It must also be demonstrated that such bloc voting typically results in the defeat of the minority group's preferred candidate of choice.⁷

The 1982 VRA amendments and subsequent Supreme Court interpretations led to a torrent of challenges nationwide in jurisdictions with a sizable proportion of minority residents. These initial challenges targeted multimember, at-large, and mixed election systems. Legal challenges have ranged across all manner of office holding, from city council, school board, county commission, and judicial offices to state legislator. Section 2 vote dilution cases have challenged district compositions under single-member plans as well. For example, although most state legislative plans have shifted from using multimember districts to reliance on the single-member variety, such plans nevertheless have also been challenged under Section 2 (Weber, 2012).

Establishing the three *Gingles* prongs is the primary path to sustain a vote dilution claim. More often than not, meeting these three prongs will likely enable a plaintiff to prevail at trial. Practitioners must understand both the legal foundation underlying each precondition and accepted measurement approaches for establishing it. Accordingly, we now turn to a primer on how to translate these legal preconditions into a set of practical tests.

The First *Gingles* Precondition

The first prong poses the question: Can the minority group in question constitute the majority of eligible voters in a hypothetical *demonstration* district? A *demonstration* district merely establishes the possibility of forming an aggregation of contiguous territory that would encompass the necessary number of total residents (e.g., one-fifth of a city's population with a five-member elected city council) and would sufficiently concentrate the minority group to comprise the majority of that territory's eligible voters.⁸ The two relevant *populations* here are (1) all residents irrespective of age, citizenship, and felony status and (2) all eligible voters.

Can a Majority-Minority District be Drawn?

We begin with a simple illustration. Historically, minorities and immigrants have established recognizable local neighborhoods in American cities (Logan and Zhang, 2004).

⁷Additional evidence of lingering effects of previous discrimination, known as a *totality-of-the-circumstances test*, also can be used by the Court upon meeting the requirements as laid out by *Gingles* (see Bullock, 2010).

⁸Contiguous territory means that a pedestrian within the district could walk to any other point within the district without leaving the district.

These racial/ethnic neighborhoods typically emerge where people of the same background cluster and live together. The City of Gainesville, Georgia exemplifies this coalescence of an immigrant group. Gainesville has registered a sharp increase in Hispanics, altering the city's demographic landscape and buttressing Hispanics' presence among its residents. The impetus behind that increase—employment opportunities in local poultry processing—drew adult Hispanic workers who are not yet citizens and therefore ineligible to vote. As a consequence, Hispanics by 2010 comprised 42 percent of Gainesville's residents, but a mere 12 percent of those eligible to vote (citizens 18 and older).

Gainesville's voters elect its five city council members at-large. A potential plaintiff demanded replacement with a single-member election system, claiming that the existing system prevents the Hispanic community from electing candidates of its choice. The city's initial line of defense centered on the first *Gingles* precondition: Are Hispanic eligible voters sufficiently numerous and geographically compact to constitute a majority of eligible voters within a hypothetical single-member election district encompassing one-fifth of the city's population? The stark disparity between Hispanics' *demographic* presence (among all residents) and their *electoral* presence among adult citizens cast doubt on that likelihood.

A useful starting point is simply to gauge the mathematical possibility of meeting this first precondition (see Table 1):

1. For each census block in the jurisdiction, we calculate the percentage of the citizen voting-age population (CVAP) who are Hispanic (or the subject minority).
2. Next, we rank all census blocks in descending order of that percentage, starting with the highest percentage Hispanic.
3. Next, we calculate the cumulative percentage of the jurisdiction's *total* population, *citizen voting-age* population, *Hispanic citizen voting-age* population, and the *Hispanic share* of CVAP.
4. Note the row at which the cumulative *total* population approaches 20 percent of the city's 35,446 residents (19.2 percent in Table 1).
5. For this row, we note that the Hispanic share of CVAP (46.3 percent) defines the arithmetic upper limit of Hispanics' share of CVAP in *any potential* district drawn to encompass nearly 20 percent of the total resident population. As seen here, that upper limit is well below 50 percent, proving that it is arithmetically impossible to form *any* district (regardless of the contiguity of its blocks) affording Hispanics a majority of a district's eligible voters.

In rare instances such as this, the first *Gingles* precondition can be proven arithmetically impossible. Oftentimes, though, a majority-minority district is numerically possible. In that case, other geographic concerns enter the equation, such as whether these census blocks and block groups could be aligned so as to create a *contiguous* district (Butler and Cain, 1992). In addition to geographic contiguity, a court takes into account numerous other "traditional districting criteria" relevant when considering a district's constitutionality (see Bullock, 2010 and Butler and Cain, 1992 for a discussion of these criteria).

One such criteria is a district's geographic *compactness*. A compact district *minimizes the distance between all the parts of a constituency* (Butler and Cain, 1992:157).⁹ Where race is an important consideration, the courts have viewed bizarrely shaped districts with low levels of compactness as a warning sign that the district may be an unconstitutional

⁹For an introduction to district compactness and its measurement, see Butler and Cain (1992).

TABLE 1
Evaluating the Arithmetic Possibility of Forming One Majority-Hispanic District in a Five-District Plan

Census Block	Total Population			CVAP (2009–2013)			Cumulative CVAP (2009–2013)		
	Number	Cumulative Percentage	Hispanic	Number	Hispanic	Percentage of Hispanic	Number	Hispanic	Percentage of Hispanic
131390011012000	12	0.0	2	2	100.0	2	2	100.0	
131390011013027	9	0.1	1	1	100.0	3	3	100.0	
131390010031008	9	0.1	2	2	100.0	5	5	100.0	
131390011012006	21	0.1	3	3	100.0	8	8	100.0	
131390010031014	6	0.2	1	1	100.0	9	9	100.0	
131390011012023	7	0.2	1	1	100.0	10	10	100.0	
131390011012061	5	0.2	1	1	100.0	11	11	100.0	
131390011013028	41	0.3	6	6	100.0	17	17	100.0	
131390012012046	17	0.4	2	2	100.0	19	19	100.0	
131390010032033	12	0.4	4	4	100.0	23	23	100.0	
131390011021004	7	0.4	2	2	100.0	25	25	100.0	
131390008003041	14	0.5	6	6	100.0	31	31	100.0	
131390010023015	5	0.5	2	2	100.0	33	33	100.0	
131390011013002	13	0.5	2	2	100.0	35	35	100.0	
131390012013029	3	0.5	2	2	100.0	37	37	100.0	
131390011013024	6	0.5	1	1	100.0	38	38	100.0	
131390011013062	7	0.5	1	1	100.0	39	39	100.0	
131390011011047	57	0.7	4	4	100.0	43	43	100.0	
131390005002039	8	0.7	2	2	100.0	45	45	100.0	
131390011013068	3	0.7	1	1	100.0	45	45	100.0	
131390011013030	6	0.8	1	1	100.0	46	46	100.0	
131390011013000	5	0.8	1	1	100.0	47	47	100.0	
131390010032010	2	0.8	0	0	100.0	47	47	100.0	
131390011011032	8	0.8	0	0	100.0	47	47	100.0	
131390011011031	5	0.8	0	0	100.0	48	48	100.0	
131390011013010	69	1.0	7	7	99.0	55	55	99.9	
131390011013008	104	1.3	12	11	97.7	67	67	99.5	
131390011013070	26	1.4	3	3	97.3	70	69	99.4	

continued

TABLE 1
Continued

Census Block	Total Population		CVAP (2009–2013)		Cumulative CVAP (2009–2013)		Percentage of Hispanic
	Number	Cumulative Percentage	Number	Hispanic	Number	Hispanic	
131390007011012	104	1.7	39	33	108	102	94.1
131390013013026	47	1.8	27	19	135	121	89.7
131390011021024	476	3.1	146	100	281	222	78.9
131390014031030	20	3.2	5	4	286	225	78.7
131390011012035	22	3.3	2	1	288	227	78.6
131390009003027	24	3.3	10	6	298	233	78.2
131390010022029	57	3.	29	16	326	249	76.2
131390014031003	7	3.5	3	1	329	250	76.0
131390007012033	1357	7.3	546	281	875	531	60.7
131390010023021	298	8.2	130	65	1,005	596	59.3
131390004001010	2	8.2	2	1	1,007	597	59.3
131390009003029	105	8.5	44	22	1,051	618	58.8
131390007012011	126	8.8	55	26	1,106	644	58.2
131390011021023	1252	12.4	406	187	1,513	831	55.0
131390009004007	81	12.6	53	24	1,565	856	54.7
131390010041026	86	12.8	47	20	1,613	875	54.3
131390007011014	199	13.4	69	28	1,682	903	53.7
131390010041024	67	13.6	41	15	1,723	918	53.3
131390009003030	115	13.9	48	17	1,771	935	52.8
131390013013064	205	14.5	117	40	1,888	975	51.7
131390013013066	7	14.5	6	2	1,894	977	51.6
131390004004049	190	15.0	91	30	1,985	1,008	50.8
131390011021000	442	16.3	141	46	2,126	1,054	49.6
131390012012003	17	16.3	5	2	2,130	1,055	49.5
131390010022001	307	17.2	141	44	2,272	1,099	48.4
131390014031011	45	17.3	13	4	2,284	1,103	48.3

←15.0% of Total Population

continued

TABLE 1
Continued

Census Block	Total Population		CVAP (2009–2013)		Cumulative CVAP (2009–2013)		Percentage of Hispanic
	Number	Cumulative Percentage	Number	Hispanic	Number	Hispanic	
131390009003026	57	17.5	27	8	2,311	1,111	48.1
131390011011061	59	17.7	6	2	2,317	1,113	48.0
131390011013012	57	17.8	8	2	2,325	1,115	48.0
131390008002005	55	18.0	19	5	2,344	1,120	47.8
131390008002012	169	18.5	54	14	2,398	1,134	47.3
131390009004008	67	18.6	38	10	2,437	1,144	47.0
131390006002085	73	18.9	8	2	2,445	1,146	46.9
131390009004013	123	19.2	67	16	2,511	1,163	46.3
131390010023020	709	21.2	316	77	2,827	1,239	43.8
131390007012018	236	21.9	75	18	2,902	1,257	43.3
131390004004046	115	22.2	49	12	2,951	1,269	43.0
131390011011064	86	22.4	10	2	2,961	1,271	42.9
131390011013052	73	22.6	10	2	2,971	1,274	42.9
Total, City of Gainesville	35,446	100.0	17,940	2,066	17,940	2,066	11.5

←19.2% of Total Population

SOURCES: U.S. Census Bureau, 2010 Census PL94-191 block data (using post-2010 city boundaries); 2013 American Community Survey five-year file, Tables 05003 and 050031; allocating block group data to individual blocks based on 2010 block-level VAP full-count data.

racial gerrymander.¹⁰ Even a majority-minority district that is mathematically possible may be viewed as constitutionally questionable if it is noncontiguous and/or is not compact.

Evaluating a Demonstration District

Only rarely can a defendant rule out the mathematical possibility of forming a majority-minority district. Typically, the plaintiff will have crafted an illustrative majority-minority district, which can then be evaluated by experts on behalf of the defendant governmental entity. While district apportionment is based on the official decennial census count of total population, it may be necessary in a Section 2 claim to evaluate a hypothetical district based on additional criteria. Among such criteria might be the actual voting strength of a minority group, based on its share of the voting-age population (VAP) or the citizen voting-age population (CVAP). The latter may be particularly salient for racial/ethnic groups composed of large percentages of noncitizens. One might draft a hypothetical majority-minority district based on that group's share of the total population, but such a district might fail to function as a majority-minority group based on other measures. In this section, we examine how experts evaluate such criteria and distinguish the key considerations and issues that arise.

A vote dilution challenge to the six-member Board of County Commissioners (BCC) in Orange County, Florida exemplifies the circumstance in which experts employ competing methodologies to gauge the voting strength of a minority group within a district. The six members of Orange County's BCC are elected from single-member districts. Following the 2010 Census, the county adopted a redistricting plan that adjusted existing district boundaries to the changed distribution of the county's population. A group of plaintiffs then sued the county, alleging that the enacted redistricting plan violated Section 2 of the VRA. Below, we focus on the first *Gingles* precondition, involving the plaintiffs' claim that the adopted plan failed to create a majority-Hispanic commission district in a county that had registered substantial Hispanic population growth.¹¹

Plaintiffs specifically asserted that Commission District 3 could have been drawn to afford Hispanics a majority of the district's *eligible* voters. Their expert constructed an illustrative six-district plan in which Hispanics purportedly constituted a majority (50.19 percent) of the CVAP in District 3. The defendant's expert disputed this claim, asserting that what the demonstration district encompasses is less than a majority. The opposing conclusion hinged on a methodological point, which exemplifies the judgment an expert must exercise in evaluating a vote dilution claim.

Both experts drew on the same two bodies of U.S. Census Bureau data routinely used for redistricting applications: (1) the 2010 decennial PL94-171 data, furnishing the official "complete count" of the voting-age population of individual areas as small as a *census block*; and (2) the 2008–2012 five-year American Community Survey file (ACS 2008–2012), furnishing the Bureau's official estimate of the *citizen* voting-age population of individual areas as small as a *census block group*. The Census Bureau publishes the five-year American Community Survey file precisely for applications such as redistricting, which need maximum spatial resolution.

¹⁰See Bullock (2010) and Pildes and Niemi (1993) on the constitutionality of districts and the issue of compactness.

¹¹*Rios-Andino v. Orange County*, 51 F. Supp.3d 1215 (M.D. Florida 2014).

A demonstration district (like the one here) is composed of numerous geographic units for which the Census Bureau reports population data. The first, and smallest, unit is the *census block* (typically corresponding to a city block in urban settings). The second geographic unit is the *census block group* (BG), made up of multiple census blocks.¹²

The plaintiffs' expert deemed citizenship rates for Hispanics and non-Hispanics to be reliable only at the county level. Accordingly, he calculated the *countywide* proportion of all voting-age persons and Hispanic voting-age persons who were citizens. These county-wide proportions were then applied to the corresponding total and Hispanic voting-age populations residing within the illustrative District 3. This estimation technique (hereafter, Method 1) assumes that citizenship rates are invariant across subareas within the county. Were that assumption invalid, the resulting estimates would be inaccurate.

For a large and diverse area such as Orange County, it is quite plausible that the proportion of adults who are citizens would vary geographically, and that proved to be the case. The defendant's expert adopted an alternative approach to capture this spatial variation. That approach (hereafter, Method 2) leveraged data from the American Community Survey, along with the decennial "complete count" population data, to estimate citizenship down to the BG level.

The boundary of plaintiffs' demonstration District 3 encompassed both whole BGs and some individual census blocks. This distinction is noteworthy because the Census Bureau's official CVAP estimate from the ACS is published for whole BGs, not individual census blocks. For a district composed of both individual blocks and whole BGs, standard demographic practice favors allocating the total CVAP of a parent BG to those individual blocks within the district based on the VAP counted in each block.¹³

For example, assume a BG is composed of two blocks (A and B) and contains 500 voting-age persons. If 400 reside in Block A and the other 100 reside in Block B, then one assigns 80 percent of the BG's CVAP to Block A and the other 20 percent to Block B. The rationale here is that the known distribution of VAP (from the decennial census) best reflects the distribution of CVAP across the individual blocks of a given BG. Likewise, one allocates the Hispanic CVAP of a parent BG to those individual blocks based on the fraction of Hispanic VAP in each block. To derive the Hispanic share of CVAP for District 3 using this methodology, one tabulates the Hispanic CVAP estimate and the total CVAP estimate for all BGs and blocks within District 3, and then divides the former by the latter.

Table 2 compares the estimates of the Hispanic share of CVAP for District 3 using these two methods. Using Method 1 (assuming Hispanic citizenship rates are invariant across Orange County), Hispanics would comprise 50.19 percent of the total CVAP of the illustrative District 3. Using Method 2 (accounting for variations in the citizenship share across BGs), Hispanics would constitute less than a majority (48.04 percent) of District 3.¹⁴ Depending on which method is employed, then, Hispanics may or may not comprise a majority of District 3 CVAP. If Hispanics are not a voting-eligible majority within the demonstration district, then the district cannot actually function as a majority-minority district. Clearly, underlying technical assumptions can make for legally significant differences that support opposite conclusions on issues of law. Best practices call for using

¹²See *2010 Geographic Terms and Concepts* for more discussion on the geographic hierarchy the Census employs (<https://www.census.gov/geo/reference/terms.html>).

¹³This methodology accords with standard demographic practice for apportioning the population of a geographic unit (e.g., block group) among its subareas (e.g., blocks). Its logic follows the U.S. Census Bureau's procedures and adheres to a key principle that "all of the estimates we produce must be consistent across geography." See U.S. Census Bureau (2014:2).

¹⁴One could calculate confidence intervals for these estimates as well. Even if the CVAP estimate for a group constitutes a majority, it is possible that the confidence interval may fall below the 50 percent threshold level.

TABLE 2

Hispanics' Share of Voting-Age Citizens in Demonstration District 3 (Orange County, Florida):
Comparison of Countywide Approximation and Block-Group-Level Estimates

	Voting Age Population	ACS Estimate of Citizenship (%)	Citizens of Voting Age	Percent of CVAP
Method 1:				
Hispanic	73,854	76.00	56,129	50.19
Total	135,248	82.69	111,833	—
Method 2:				
Hispanic	78,855	73.28	54,124	48.04
Total	135,251	83.30	112,663	—

the most precise data available and formulating defensible assumptions when constructing demonstration districts.

The Second and Third *Gingles* Preconditions

The second and third *Gingles* prongs are typically examined together to detect the presence of conditions resulting in minority vote dilution for the election system under analysis. How does one translate the concept of vote dilution into a real-world test? The second prong concerns the degree to which the minority group in question is politically cohesive. Put another way, does a clear candidate of choice exist for minority voters?

How exactly does one define one or another group's "*clear candidate of choice*"? A standard definition is: it is the candidate who received a majority of the vote (50.01 percent) from the minority group in question. If a clear candidate of choice can be discerned, one next proceeds to evaluate the third prong: determining whether the minority candidate of choice was defeated by the majority (white) voting bloc. The presence of both these conditions for a given contest—a clear minority candidate of choice who was defeated by a majority bloc vote—demonstrates an instance of minority vote dilution.¹⁵

The *Gingles* test established by the Court makes clear that plaintiffs must show a *pattern* of vote dilution. What constitutes a pattern? The language used by the Court adds the qualifier *typically*—meaning the minority candidate of choice is *typically* defeated by the majority voting bloc. Operationally, one can define typically as meaning "more often than not." Accordingly, a plaintiff's expert must demonstrate that both prongs two and three are sustained in a numerical majority of cases considered for a vote dilution claim to have any merit.

In analyzing the second and third *Gingles* prongs, the first task involves determining the appropriate universe of elections to be analyzed. Election contests can be categorized based on four criteria: type, time, overlap, and candidates. Courts view those races directly

¹⁵For the second prong, attention may focus on the presence and/or degree of *polarization* present between the minority and the white voting blocs. Note, however, that the presence of polarization (even where strong) between a majority and minority group alone is insufficient to establish claims of vote dilution. Polarization in the vote dilution context may be thought of as the degree of support of a racial/ethnic group for a candidate measured against the level of support of another racial/ethnic group for the same candidate. For example, if 91.0 percent of black voters in a congressional district voted for the Democratic candidate, while 34.0 percent of white voters did so, the level of polarization would be 57.0 (91.0 – 34.0).

pertaining to the office in question (termed *endogenous* elections) as being the most probative. As noted, however, it takes a series of elections to detect the existence of a typical pattern of vote dilution. It may be necessary then to expand the scope of inquiry to include other types of elections (*exogenous*) as well.

The relevant universe of elections should include both contested general and primary elections (not uncontested elections, which reveal nothing about any group's ability to elect a candidate of choice). Consider a majority-black legislative district. Here, black voters will likely support the Democratic nominee in the general election; yet the black community's candidate of choice in such a district quite often is determined at the primary stage. As such, primary elections can have even more probative value than general elections.

There is no hard-and-fast rule concerning how many election cycles one should use when conducting a vote dilution analysis. Contemporary elections are considered more relevant; however, it is a common practice to analyze historic elections as well, in order to define a sufficiently large universe of relevant elections to analyze. It is not uncommon to use a 10-year timeframe for identifying relevant elections.

Overlap is another characteristic that bears on the selection of exogenous election contests for analysis. If one is analyzing a particular congressional district, it is important to consider the geographic congruity of an exogenous election with the district under challenge.¹⁶ For example, in deciding whether to include a state house election, one should take into account how congruent the house district is geographically with the congressional district under examination. Is the state house district wholly encompassed within the district or only partially contained? The closer the geographic congruence, the more relevant the election insofar as the behavior exhibited is that of essentially the same voters.¹⁷

Finally, one must also consider the race/ethnicity of the candidates running for election. Of the elections available for analysis, the more relevant are those that feature a minority candidate from the racial/ethnic group suing the jurisdiction in question.¹⁸ For example, in a vote dilution suit brought by Latino voters, one would seek election contests featuring Hispanic candidates, while also keeping in mind the other criteria previously discussed.¹⁹

Analyzing any election entails estimating the share of the vote by the subject minority group that favored each candidate in a particular election contest, as well as the share of the majority block vote that opposed a minority-favored candidate. This type of analysis derives inferences about individual-level voting preferences from aggregate-level data—typically precincts or VTDs (voting districts), which are the smallest geographic areas for which election return data are generally reported. Racial/ethnic data must then be *matched* to such election precincts in order to produce estimates of voting behavior based on these characteristics. For some jurisdictions, this is straightforward, while for others it can be painstaking. It is also critical to assure that the geographic unit to which the election return data refer is congruent with the geographic unit whose voters one has characterized with separate demographic data.

¹⁶Here, GIS software can be used to calculate the percentage of overlap between two election districts.

¹⁷As a further refinement, one might analyze the results of a statewide gubernatorial contest by subsetting the results to correspond to just those precincts housed within the congressional districts being analyzed.

¹⁸Determining a candidate's race/ethnicity may not be simple and straightforward. For example, a candidate named Mary Garcia Jones may or may not self-identify as Hispanic. Here, a researcher can draw upon a variety of sources: candidate guides, campaign materials, websites, or newspaper articles documenting self-identified race or ethnicity. Researchers might also turn to individuals familiar with the political setting under study (local political activists).

¹⁹As with the choice of exogenous races, one must also decide whether an election contest that does not feature a *minority* candidate per se still warrants inclusion because it featured an identifiable *minority-favored* white candidate of choice.

Data quality may vary greatly across jurisdictions. For some areas, one may be able to obtain registration or even turnout data by race/ethnicity summarized at the precinct level. For others, one may be forced to use Census data to characterize the voting-age population or citizen voting-age population, aggregated from small units such as census blocks to match election precincts.²⁰ Given a choice, the order of preference for data type would be turnout, otherwise registration, otherwise CVAP or VAP.²¹

The courts have recognized several different statistical methods for deriving inferences about individual-level voting preferences from aggregate-level data. They include homogenous precinct analysis, ecological regression (sometimes referred to as Goodman's double regression), and ecological inference (EI) (King, 1997). In certain circumstances, a particular method may be unsuitable, given the available data. For example, homogenous precinct analysis would be inapplicable in a jurisdiction lacking any precincts that contain an overwhelming majority (usually 90 percent or more) of a specific racial/ethnic group. The accompanying supporting information provides a detailed tutorial on implementing these statistical methods, along with illustrations.

Having derived estimates of vote choice by race/ethnicity, the analyst can bring that evidence to bear on the second *Gingles* prong. Again, one way to operationalize political cohesion is to determine for each contest analyzed if there is a clear *candidate of choice* for voters of the racial/ethnic group in question. Specifically, did the vote share from the minority voting bloc reach a simple majority for any of the candidates in the race? For example, if one's estimates show that 54.0 percent of black voters supported the black candidate in a particular election contest, that estimate reveals a clear candidate of choice among black voters.²² At this juncture, the analyst must categorize each contest according to the presence or absence of a clear candidate of choice among the minority group of interest.

Having categorized election contests this way, the analyst next can determine if said candidate won the election. A simple summary table can be used to report the relevant details:

1. The number of election contests analyzed.
2. The number of contests with an identifiable candidate of choice by minority voters.
3. The percentage of those contests where the minority candidate of choice was defeated.

This last percentage is the critical one for a vote dilution claim. As related to the second and third prongs, it answers the question: Is the minority candidate of choice *typically* defeated by the majority voting (white) bloc in the election system under challenge?

Prongs Two and Three: An Example from Orange County, Florida

We refer again to *Rios-Andino v. Orange County* to illustrate testing the second and third *Gingles* prongs. At the time of litigation, county commissioners were elected from

²⁰These data can often be obtained from state redistricting offices or their equivalent. At the local level, larger jurisdictions will often have a dedicated GIS office housing these data. Barring these possibilities, researchers may be forced to produce these calculations using Census data and GIS shapefiles of voting precincts.

²¹Recently, another alternative has emerged to derive racial estimates by geographic unit. This technique makes use of various algorithms to predict an individual's race based on surname and geocoding (see Imai and Khanna, 2016). Using this method one could assign a race to registrants in a voter file where this quantity is not present and then aggregate these individuals by a geographic unit such as a voting precinct. Of course, since one must estimate vote choice, an ecological estimation technique must still be used.

²²Again, one generally would expect the candidate of choice for a racial/ethnic group to be of the same race or ethnicity as the group in question; however, it is certainly possible for a candidate of choice to be from another racial/ethnic group, including an Anglo (non-Hispanic) majority.

TABLE 3
2012 Primary for Orange County Commissioner—District 3

Candidate	Actual (%)	Hispanic (%)	Anglo (%)	Black (%)	Other (%)
Michael Aviles (H)	10.72	45.4	3.1	14.2	16.9
Eric Armando Lasso (H)	15.19	10.1	16.5	15.9	14.1
Pete Clark	22.95	19.8	24.5	25.9	15.2
Lui Damiani*	31.10	11.7	35.2	13.9	35.6
Lydia Pisano	20.05	13.0	20.7	30.1	18.2

NOTES: Entries represent vote percentages estimated by ecological inference. H, Hispanic candidate; * = Winner.

TABLE 4
2010 Primary for Orange County Commissioner—District 4

Candidate	Actual (%)	Hispanic (%)	Anglo (%)	Black (%)	Other (%)
Mayra Uribe (H)*	18.27	64.0	14.1	4.7	3.3
Jennifer Thompson*	48.31	9.9	46.9	79.7	88.0
Lydia Pisano	17.79	11.9	21.1	6.6	2.9
Pete Clarke	15.64	14.2	18.0	8.9	5.9

NOTES: Entries represent vote percentages estimated by ecological inference. H, Hispanic candidate; * = Winner; Hispanic candidate of choice in bold font.

TABLE 5
2010 General for Orange County Commissioner—District 4

Candidate	Actual (%)	Hispanic (%)	Anglo (%)	Black (%)	Other (%)
Mayra Uribe (H)	28.99	78.4	19.5	19.1	14.9
Jennifer Thompson*	71.01	21.6	80.5	80.9	85.1

NOTES: Entries represent vote percentages estimated by ecological inference. H, Hispanic candidate; * = Winner; Hispanic candidate of choice in bold font.

six single-member districts in nonpartisan elections. Under this election scheme, an initial contest is held during the primary election period. If no candidate in the race receives a majority of the votes cast, a run-off election is then held during the general election to determine the winner.

Our focus centers on eight county commission races held from 2000 to 2012, involving a total of 10 Hispanic candidates. These eight *endogenous* contests each contained at least one Hispanic candidate. Estimates were derived using precinct-level turnout data by race/ethnicity.²³ As the electorate in Orange County includes more than one racial/ethnic group, the voting behavior of Anglos, blacks, Hispanics, and others could be estimated using a variant of the EI technique.²⁴

Examples of the analysis undertaken are shown in Tables 3–10. Table 3 reveals the results of the 2012 primary race for County Commission District 3, a five-person race featuring two Hispanic candidates. The Hispanic vote is fractured among the five candidates and, as

²³In Florida, the race/ethnicity of registrants and voters is recorded.

²⁴EI estimates derived from the ei.RxC procedure in R. For more information on this EI variant, see Rosen et al. (2001).

TABLE 6
2008 General for Orange County Commissioner—District 3

Candidate	Actual (%)	Hispanic (%)	Anglo (%)	Black (%)	Other (%)
Mildred Fernandez (H)*	56.75	77.3	43.1	52.5	71.5
John Kelly Harris	43.25	22.7	56.9	47.5	28.5

NOTES: Entries represent vote percentages estimated by ecological inference.
H, Hispanic candidate; * = Winner; Hispanic candidate of choice in bold font.

TABLE 7
2006 Primary for Orange County Commissioner—District 4

Candidate	Actual (%)	Hispanic (%)	Anglo (%)	Black (%)	Other (%)
Martin Collins	5.33	3.6	4.9	13.1	21.2
J. P. Quinones (H)	11.78	69.1	1.2	56.9	17.5
Linda Stewart*	51.24	19.1	62.9	7.4	4.0
Jennifer Thompson	31.64	8.2	31.0	22.6	57.4

NOTES: Entries represent vote percentages estimated by ecological inference.
H, Hispanic candidate; * = Winner; Hispanic candidate of choice in bold font.

TABLE 8
2004 Primary for Orange County Commissioner—District 3

Candidate	Actual (%)	Hispanic (%)	Anglo (%)	Black (%)	Other (%)
Mildred Fernandez (H)*	24.33	79.8	10.1	16.5	12.5
Lui Damiani*	21.40	3.3	26.8	6.6	18.6
Larry Calabretta	17.13	5.5	19.7	19.6	19.7
Jeremy Markman	12.96	1.1	18.1	7.2	7.8
John Kelly Harris	9.87	4.9	9.1	12.7	22.3
Cheryl Taubensee	7.54	1.6	7.9	26.6	7.9
Jonathan D. Cook	6.78	3.8	8.3	10.7	11.2

NOTES: Entries represent vote percentages estimated by ecological inference.
H, Hispanic candidate; * = Winner; Hispanic candidate of choice in bold font.

TABLE 9
2004 General for Orange County Commissioner—District 3

Candidate	Actual (%)	Hispanic (%)	Anglo (%)	Black (%)	Other (%)
Mildred Fernandez (H)*	50.93	88.7	31.1	74.5	62.4
Lui Damiani	49.07	11.3	68.9	25.5	37.6

NOTES: Entries represent vote percentages estimated by ecological inference.
H, Hispanic candidate; * = Winner; Hispanic candidate of choice in bold font.

a result, no clear candidate of choice emerges. While the two Hispanic candidates together received an estimated 55.5 percent of the Hispanic vote, neither candidate alone had a clear majority of Hispanic votes.

Table 4 shows the results of the 2010 nonpartisan primary race for County Commission District 4, a four-person race featuring one Hispanic candidate, Mayra Uribe. Here, Uribe

TABLE 10
2000 Primary for Orange County Commissioner—District 3

Candidate	Actual (%)	Hispanic (%)	Anglo (%)	Black (%)	Other (%)
Mary Johnson (H)*	50.72	47.1	52.1	78.9	33.0
Lou Pendas (H)	33.04	43.4	30.7	8.5	44.7
Larry Calabretta	16.24	9.5	17.1	12.7	22.3

NOTES: Entries represent vote percentages estimated by ecological inference.
H: Hispanic candidate. * = Winner.

TABLE 11
Summary of Results—Orange County Commission Races Analyzed

Contests	Frequency	Percent
Number of races analyzed	8	—
No clear Hispanic candidate of choice	2	25.0
Clear Hispanic candidate of choice	6	75.0
Hispanic candidate of choice wins	4	50.0
Hispanic candidate of choice defeated	2	25.0

was the clear candidate of choice for Hispanics, receiving an estimated 64.0 percent of their vote. The same evaluation is undertaken for each of the remaining six contests under analysis (see Tables 5–10). Once completed, a summary compilation of results (see Table 11) can expose any pattern of vote dilution based on the elections analyzed in Tables 3 through 10.

In six of the eight contests (75 percent) our analyses reveal a clear candidate of choice by Hispanic voters. In four of these six races, the Hispanic candidate of choice won election. In 25 percent of the contests analyzed, the Hispanic candidate of choice was defeated. Two of these losses are attributable to an Anglo voting bloc defeating the Hispanic candidate of choice. Is there a clear pattern of Hispanic vote dilution in Orange County commission races? No, because in 75 percent of the contests analyzed there is no evidence of minority vote dilution. Stating these results with reference to Prong 3, Hispanic candidates running for Orange County Commission seats have not typically been defeated by an Anglo voting bloc (which has on occasion occurred). Thus, objective analyses failed to substantiate the first and the third prongs of the *Gingles* test. Accordingly, plaintiffs failed to prevail because they could not demonstrate the existence of conditions associated with all three prongs.

Additional Issues to Consider

While some components of a Section 2 vote analysis are well established, other aspects have yet to be fully resolved through the legal process. Two noteworthy issues are: (1) Exactly *who* should be counted when one engages in drawing district boundary lines? and (2) How can vote dilution analysis techniques described above assist in making a determination concerning the percentage of a racial or ethnic minority that is constitutionally permissible when creating a districting plan? Both these issues are discussed in the accompanying supporting information.

Discussion and Conclusion

For about three decades, Section 2 of the Voting Rights Act has been used as an effective means to combat minority vote dilution. With Section 5 of the Act presently unenforceable, Section 2 has taken center stage as a litigation tool in this area of the law. For at least the short term, voting rights cases are essentially synonymous with Section 2 claims, underscoring the need to understand how to conduct a vote dilution analysis.

Since the *Thornburg* decision and subsequent opinions, a standard formula has informed vote dilution claims. In this article, we have endeavored to provide practitioners and social scientists with a rudimentary understanding of the operational steps involved in analyzing a vote dilution claim. Further, we also develop a generalizable road map using examples from actual cases in order to demonstrate how to empirically examine the three prongs of the *Gingles* test as established by the U.S. Supreme Court.

To be sure, the methods we detail will not cover every contingency that may arise related to a vote dilution case. As well, the exact process will continue to be refined through future legal proceedings. Our hope is that this workshop article will nevertheless place any analyst on firm footing when it comes to carrying out a vote dilution analysis and understanding the issues surrounding such an analysis.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Appendix A: Additional Issues for Consideration

Appendix B: Techniques to Estimate Candidate Vote Shares by Race/Ethnicity