The Effectiveness of Random, Consecutive Day and Constructed Week Sampling in Newspaper Content Analysis

By Daniel Riffe, Charles F. Aust and Stephen R. Lacy

This study compares 20 sets each of samples of four different sizes (n=7, 14, 21 and 28) using simple random, constructed week and consecutive day samples of newspaper content. Comparisons of sample efficiency, based on the percentage of sample means in each set of 20 falling within one or two standard errors of the population mean, show the superiority of constructed week sampling.

Two studies cited widely to justify content analysis sampling decisions are Jones and Carter's[1] and Stempel's[2] explorations of "constructed week" sampling, in which sample dates are stratified by day of the week to account for systematic variation due to day of week.

But neither study explored fully the value of constructed week sampling for content analysis. This report compares the effectiveness of three types of samples in estimating population parameters for newspaper content: simple random, constructed week and consecutive day samples.

Background

Two decisions confronting content analysts involve defining the population and determining how many issues to sample. While both depend on research objective and design, sample size also is constrained by resources at hand.

The researcher's goal is to sample enough issues to achieve an "acceptable" estimate of unknown population parameters, while maximizing efficiency of time and effort. Selecting too few issues may produce unreliable data and invalid results; selecting too many may be a wasteful misuse of coding resources.

But in the case of newspapers, maximum sampling efficiency involves sampling procedure (e.g., simple random sampling, constructing a week to represent all days of the week or selecting a convenient sample

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of seven consecutive days) as well as sample size.

Simple random sampling requires no assumptions about variation in newspaper content; particularly large newsholes (e.g., Sundays) could by chance be over- or underrepresented in a sample. However, constructed week sampling assumes cyclic variation of content for different days of the week and requires that all the different days of the week be represented.[3]

For example, sports sections are larger on weekends when more sports take place. Ad space is greater on Wednesdays and Thursdays – and the newshole larger – in many papers when grocery and department store ads run. In a constructed week sample, all Sundays are identified and one is then randomly selected, as is a Monday, a Tuesday, etc., until all seven days of the week are represented.

In more convenient samples using sets of consecutive days, all weekdays may be present in a seven-day sample, but the procedure ignores between-week differences.

Research on sampling is limited. Studying 1941 Pravda headlines, Mintz used one month as a population and drew a whole-week sample, a three-day sample (5th, 10th and 25th of the month), a six-day sample (the 5th, 10th, 15th, 20th, 25th and 30th of the month) and an every-other-day sample of 15 days.[4] Only the six-day and 15-day samples did not differ significantly from the population mean.

But a six-day sample drawn from a population of only one month is a 20% sample, and a 15-day sample is a 50% sample. With larger populations, 20% and 50% samples become unmanageable.

Further, a fixed-interval, six-day sample drawn from one month must exclude one day of the week. And while a 15-day sample guaranteed each day of the week was present at least twice, one was present three times. Mintz, however, had concluded that "frequencies of headlines per day in Pravda were not subject to cycles," so representing all days of the week equally was unnecessary.[5]

Stempel examined front-page photographs in a six-issue-a-week (no Sunday edition) Wisconsin newspaper in 1951, comparing the population (a year) mean with means for different sample sizes.[6] He drew 10 samples each of 6, 12, 18, 24 and 48 issues, using a random starting point and selecting every nth issue. With samples of these sizes

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[1]Robert L. Jones and Roy E. Carter, Jr., "Some Procedures for Estimating 'News Hole' in Content Analysis," *Public Opinion Quarterly*, 23:399-403 (Fall 1959).

[2]Guido H. Stempel III, "Sample Size for Classifying Subject Matter in Dailies," *Journalism Quarterly*, 29:333-334 (Summer 1952).

[3]Guido H. Stempel III, "Content Analysis," in Guido H. Stempel III and Bruce H. Westley, eds., *Research Methods in Mass Communication*, 2nd Ed., (Englewood Cliffs: Prentice Hall, 1989), 119-131, espec. 125.

[4]Alexander Mintz, "The Feasability of the Use of Samples in Content Analysis," in Harold Lasswell, Nathan Leites and associates, *Language of Politics* (New York: George W. Stewart, Publishers, Inc., 1949), 127-152.

[5]Mintz, "Feasability of the Use of Samples," 133.

[6]Stempel, "Sample Size."

(multiples of six) and a six-edition-a-week paper, his sampling interval guaranteed a different day of the week was selected with each choice, thus acting "as a stratification for days of the week"[7] as in constructed week sampling.

He found 12 days – two constructed weeks – sufficient to represent the year, and that "increasing sample size may be a poor investment of the researcher's time."[8] He was, however, cautious about the effect of Sunday editions on sampling.[9] And he examined only front-page photographs.

Davis and Turner tested every-sixth-day sampling of crime news in four newspapers with Sunday editions, drawing six six-day samples (the first sample included the 1st of the month, the 7th, the 13th, etc.; the second sample included the 2nd, the 8th, the 14th, etc.) from each of two months, for four papers.[10]

Even though each six-day sample excluded one day of the week (e.g., if the first of the month was Saturday, no Sunday would be in the sample), they found no significant differences between sample means and population means in 48 samples. Note again that each sample included 20% of the one-month population.

In 1959 Jones and Carter constructed 30 separate weeks from a population of 21 days in examining four papers' newsholes.[11] Of the resulting 120 "tests" of the samples, 85% were within 2% of the papers' "true" population newsholes. But a constructed week drawn from three weeks includes one-third of the population.

Most of these studies sampled small populations and compared sample means to population parameters, a useful comparison. But the efficiency gained by constructed week sampling might be more apparent in direct comparisons among constructed week, simple random and consecutive day samples.

This study addresses two research questions about sampling local news content:

1. What is the minimum number of constructed weeks needed to estimate the average number of local news stories per day, including Sundays?

2. Is a constructed week more efficient than simple random or consecutive day samples of comparable size?

Method

Testing efficiency of different sampling approaches requires knowledge of population parameters to compare with obtained sample

[7]Stempel, "Sample Size," 333. Stempel reported that his approach also stratified for month of the year, though how that worked with samples of n=6 is unclear.

[8]Stempel, "Sample Size," 334.

[9]Stempel, "Sample Size," 333.

[10]F. James Davis and Lester W. Turner, "Sample Efficiency in Quantitative Newspaper Content Analysis," *Public Opinion Quarterly*, 15:762-763 (Winter 1951).

[11]Jones and Carter, "Procedures for Estimating 'News Hole.'" The researchers also stipulated that all three population weeks must be represented in each constructed week.

statistics. This study used data from content analysis of a group-owned evening and Sunday newspaper (approx. 39,000 circ.). Three trained coders had examined every local news item in every issue in a six-month (182-day) period (February-July 1988). A total of 2,774 local items were coded across the 182 days.

For this study the 182 days were treated as a population, each day having a local story count of from 6 to 27 items. The population mean was 15.2 local stories per day, the mode 8, the median 15, and standard deviation 6.18.

The first step involved drawing sets of 20 samples for different sample sizes using simple random sampling. Twenty seven-day samples were randomly selected, as were 20 14-day samples, 20 21-day samples and 20 28-day samples.

The second step involved drawing comparable sets of 20 samples using the constructed week method. Twenty samples of one constructed week (n=7) were drawn, as were 20 samples of two constructed weeks (n=14), 20 samples of three constructed weeks (n=21) and 20 samples of four constructed weeks (n=28).

In the third step we drew comparable sets of 20 sample weeks using the consecutive day method. Twenty random starting points were generated and, for each, seven consecutive days selected to form a sample week. Then 20 two-week (14-consecutive days) samples were drawn using random starting points, as were 20 three-week (21 consecutive days) and four-week (28 consecutive days) samples.

Finally, we examined how often – as a percentage of each set of 20 – sample means fell within one or two standard errors of the population mean of 15.2

Results

The basis for constructed week sampling – that newsholes vary by day of week – is supported by Table 1, showing average number of local stories for each of the seven days of the week. Sundays had the largest local newshole, averaging 24.77 stories, while Saturday's average of 9.81 was 5.39 fewer than the population average. Wednesdays and Thursdays were slightly above the population average, and Tuesdays, Mondays and Fridays were below it.

TABLE 1
Mean Number of Local Stories and Standard Deviations, by Day of the Week

	Mean Number of Stories	Standard Deviation	Number of Days
Monday	12.00	4.91	26
Tuesday	14.42	3.81	26
Wednesday	16.39	4.78	26
Thursday	16.15	4.78	26
Friday	12.81	3.46	26
Saturday	9.81	2.40	26
Sunday	24.77	5.41	26
Population	15.20	6.18	182

The distribution is not surprising; newshole cycles follow advertising space cycles. Sunday is the week's largest issue because of increased retail, real estate and classified advertising, and Sunday's extended leisure/reading time. Saturday's newshole is smaller because less ad space is bought, and Wednesdays and Thursdays have more space than all but Sunday issues because of grocery ads.

Table 2 shows, for simple random, constructed week and consecutive day sampling, the range of sample means obtained in each set of 20 samples. Note the obvious "effect" of sample size and sampling technique. As sample size increased, the range of sample means in the sets of samples declined, for all three sample types. For constructed week samples, the ranges were narrowest; for consecutive day samples, the ranges were widest.

TABLE 2
Low and High, and Range, of Mean Number of Local Stories for Sets of 20 Samples, by Type and Size of Sample

Days in Sample	Simple Random low–high (range)	Constructed Week(s) low–high (range)	Consecutive Day Week(s) low–high (range)
7	12.3–20.1	13.6–17.4	11.6–19.9
	(7.8)	(3.8)	(8.3)
14	11.4–17.5	12.9–17.3	11.4–18.4
	(6.1)	(4.4)	(7.0)
21	12.6–17.5	14.1–17.0	12.2-19.0
	(4.9)	(2.9)	(6.8)
28	12.9–16.9	14.3–16.8	13.3–18.5
	(4.0)	(2.5)	(5.2)

The first research question asked how many constructed weeks were necessary to estimate the population mean for local stories. Table 3 shows the percentages of sample means in each set of 20 that fell within one and two standard errors of the population mean. For example, of the 20 samples of one constructed week, 100% of sample means were within two standard errors of the population mean, exceeding the 95% predicted by the Central Limits Theorem.[12] By contrast, only 85% of the 20 one-week consecutive day samples were within two standard errors.

To estimate average daily number of local stories with 95% confidence, one constructed week would suffice for this population. Of course, 95% of the means for simple random samples of n=7 also fell within two standard errors, a higher percentage than for the 14-day or 21-day simple random samples, or for any size of consecutive day sample.

But the precision of constructed week sampling becomes even

[12] The Central Limits Theorem states that the distribution of sample means approaches a normal distribution as the size of sample increases, no matter what the distribution of the population, and is the basis for making inferences to unknown populations from randomly selected samples. See Hubert M. Blalock Jr., *Social Statistics*, rev. 2nd ed., (New York: McGraw-Hill, 1979), 183-186.

clearer with examination of results for one standard error. The Central Limits Theorem predicts that 68% of random sample means fall within one standard error of the population mean. Here, means for 85% of one- and four-constructed-week samples, and 90% of two- and three-constructed-week samples were within that narrow set of bounds.

Only the 28-day simple random sample, but none of the consecutive day sample sizes, was within one standard error.

Precision is increased slightly with two or three constructed weeks, but may not merit the increased resource commitment, which would be doubled or tripled. The "drop" in precision from three to four constructed weeks may be a "blip" in the pattern due to the error of random sampling.

TABLE 3
Percentage of Sample Means in Sets of 20 Samples Falling Within One and Two Standard Errors of Population Mean, by Type and Size of Sample

	Simple Random		Constructed Week(s)		Consecutive Day Week(s)	
Within:	2 S.E.	1 S.E.	2 S.E.	1 S.E.	2 S.E.	1 S.E.
Days in Sample	%	%	%	%	%	%
7	95	55	100	85	85	65
14	85	60	100	90	80	40
21	90	65	100	90	70	45
28	95	75	100	85	80	35

NOTE: Each percentage is based on the 20 samples in each combination of sampling technique and sample size.

The second research question asked if constructed week sampling is more efficient than simple random or consecutive day sampling. Tables 2 and 3 indicate the answer is "yes."

Table 2 shows that the range of sample means was always smaller for the sets of constructed week samples than for consecutive day or simple random samples of the same size. The range of the 20 simple random sample means of n=7 was 7.8 stories, compared to 8.3 for 20 samples of seven consecutive days, and only 3.8 for 20 samples of one constructed week. Similar differences were obtained as sample sizes increased.

And Table 3 shows that percentages of constructed week sample means falling within one or two standard errors of the population mean always exceeded percentages for the simple random samples and consecutive day samples of same size. Percentages of simple random sample means that fell within two standard errors of the population mean ranged from 85% to 95%, compared to 70% to 85% for consecutive day samples, while 100% of constructed week sample means fell within two standard errors of the population mean.

The percentage of simple random sample means that fell within one standard error of the population mean ranged from 55% to 75%, while the range of the percentages for constructed weeks ranged from 85% to 90%. Only 35% to 65% of consecutive day samples were within one standard error.

Discussion

Simple random sampling of newspaper editions will give a reliable estimate of the population mean, if sample size is large enough. That is true, generally speaking, of sampling from most other types of populations (e.g., people, acreage).

The Central Limits Theorem allows researchers to use random sampling to estimate sampling error when a population distribution is unknown. But relying on the Central Limits Theorem – and simple random sampling – becomes comparatively inefficient when the population distribution is known and not normal. In such cases, stratification based on that known and non-normal population distribution – as in the case of days of the week – yields better estimates with smaller samples.

This study has shown by direct comparisons between simple random, consecutive day and constructed week sampling that a smaller sample stratified for day of week will give just as good an estimate, if not better. The distribution of newspaper stories is simply not normal. Constructed weeks produce better estimates than purely random samples of days because they avoid the possibility of oversampling Sundays or Saturdays.

Our comparisons with consecutive day sampling, which may also avoid oversampling individual weekdays, demonstrate the further importance of sampling across weeks (as in constructed week sampling) if one seeks generalizability beyond the consecutive day period itself. Consecutive day samples are very easy and convenient to use, and different weekdays may be represented, but they are not a reliable means of estimating content for a six-month period or longer.

Of course, the study is limited by its focus only on local stories from six months of a single newspaper.

But showing that a constructed week procedure is more efficient than pure random or consecutive day sampling does not reveal how many constructed weeks are most efficient. This study found that for a population of six months of editions, one constructed week was as efficient as four, and its estimates exceeded what would be expected based on probability theory.

By extension, two constructed weeks would allow reliable estimates of local stories in a year's worth of newspaper entire issues, a conclusion consistent with Stempel's findings on front-page photographs in a six-day-a-week paper.

But if this study of sampling of local news stories supports and extends the findings of Stempel and Carter and Jones, we hope it also serves an additional heuristic purpose of showing "how" constructed week sampling works.