Modal-2 was found more accurate than Metheringham or the Beta function.

Reach and Frequency Estimating Services

Leon Liebman and Edward Lee

Reach and frequency estimating techniques to project beyond observed data are needed for media planning, particularly with the availability of fast, on-line systems for planning and evaluating media schedules. The two most common estimating techniques are the Metheringham formula (1964) and the Beta function, although alternatives to these procedures are continually being developed.

This paper reports on an evaluation of the accuracy of three techniques: The Metheringham formula, Personal Probability simulation (Greene, 1970), and the Modal-2 formula. The objective was to determine the relative accuracy of the procedures by comparing reach and frequency distribution estimates to actual data.

Methodology

Schedules were selected so it would be possible to derive conclusions applicable to broad classes of schedules rather than conclusions applicable to specific media or demographic groups. Thus, the focus was on structural properties common to groups of schedules. They were: (1) magnitude of the average issue audience of the vehicle, relative to base size; (2) duplication within media; (3) duplication between media pairs; and (4) base size.

These properties were chosen for three reasons. First, they are the principal structural characteristics determining the reach and frequency distribution of a schedule. Second, the Metheringham approach breaks down, or yields declining reach, when the actual probability of exposure to two vehicles (duplicated readership as a percentage of base size) exceeds the chance probability of exposure to the two vehicles (the product of the individual probabilities of exposure). Third, the Beta formula does not apply when duplication within media is either close to zero or close to 100 per cent.

Using 1972 data from the *W.R. Simmons Study of Selective Markets and the Media Reaching Them,* each magazine was assigned to one category. A representative selection of magazines was made from each category and combined to produce 57 schedules for use in the analysis. For 20 of the 57 schedules, results were available for the Personal Probability procedure.

Tabulated data were adopted as the criterion rather than estimates produced by the Beta formula, until now generally thought to be the best estimating technique. Simmons (1972) noted that very little test information was available on the reliability of Beta estimates where schedules comprised four or more vehicles: "Caution should be exercised particularly where the population bases become small. Moreover, as additional media are added, the number of cells increases geometrically and the data become less and less stable." Acceptance of the Beta method has been in part due to its apparently more realistic frequency dis-

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tribution and in part due to its ability to precisely reproduce schedule estimates where insertion levels are no greater than two for any vehicle. However, there is little data demonstrating its accuracy for larger schedules.

Insertion levels were limited to two so that actual data could be tabulated and used for comparison. Furthermore, each schedule was limited to a maximum of four media so that the frequency distribution tabulations would not become overly cumbersome.

There were three reach criteria: (1) comparisons of absolute and percentage differences from actual; (2) comparisons of the number of times each method overestimated or underestimated; and (3) comparisons of the number of times that each estimate was within the 95 per cent confidence limits established by Simmons for

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Table 1

Reach Estimate Accuracy

Method	57 Schedules Avg. Absolute Differences (000)	%	20 Schedules Avg. Absolute Differences (000)	%
Modal-2	299	.80	333	5
Metheringham	2,261	4.93	2,758	5.20
Beta-1 Personal Probability			1,696	5.91

their measured ("actual") reach figures.

The frequency distribution criteria were:

1. Comparisons of the sum of the absolute differences at each frequency level (zero level excluded) from the Simmons actual 1972 data.

2. Comparisons of the relative error of each schedule (the ratio of the sum of the absolute differences at each frequency level [zero level excluded] to the net reach of the schedule).

3. Comparisons of the shape of the frequency curves, with particular emphasis on each method's reproduction of peaks in the actual data. Frequency levels two and four, where most peaking occurred, were used for comparisons. The curve shapes of the methods were defined as correct when they assumed the same pattern as the actual data—i.e., rose five per cent or declined by five per cent or remained the same (less than five per cent change).

Results

Table 1 shows that Modal-2 was the most accurate in estimating reach. For the Metheringham method, errors clustered in the four to six per cent range; its largest error was 10.1 per cent. Modal's largest error was 2.8 per cent.

cent. Personal probability had errors in excess of 10 per cent in seven of 20 cases. Its largest error was 14.5 per cent.

The confidence limits analysis shown in Table 2 indicates that for the schedules analyzed, Modal-2 produced estimates consistently close to the tabulated data.

Further analysis showed that Modal-2's errors appeared to be random while Metheringham consistently overestimated reach. In only four cases was Metheringham closer to the tabulated

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Table 2
Confidence Limits Analysis

	57 Schedules Number of Times Estimate Fell Outside 95% Limits	20 Schedules Number of Times Estimate Fell Outside 95% Limits
Modal-2	0	0
Metheringham	23	10
Beta-1 Personal Probability	–	12

than Modal-2. The Personal Probability method underestimated more often than it overestimated.

Study of frequency distribution accuracy (Table 3) showed that Modal-2 produced the most accurate frequency distributions.

Where peaking of the frequency distributions were examined at the two and four levels, there were 114 cases in analysis for the 57 schedules and 85 uses for the 20 schedules. Table 4 compares the ability of the two procedures to reproduce the tabulated data The Metheringham method did not produce a peak at either the two or four level, even when the tabulated data exhibited peaks. Both the Modal-2 and Personal Probability methods reproduced the peaks and plateaus. The range of errors was smallest for Modal-2 followed by the Personal Probability method, then the Metheringham formula.

ity techniques in terms of reach estimate accuracy, frequency distribution accuracy, and ability to reproduce the peaks in the tabulated data. The procedure uses only average issue audience, two issue cumes, and pairwise duplication data—the same data required by Metheringham's procedure.

Since only magazine data were used in the analyses and schedules were re-

stricted to a maximum of four vehicles, it is not appropriate to generalize these conclusions to either larger schedules or other media. However, subsequent analyses have produced no data which negate the conclusions presented here.

References

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Table 3
Frequency Distribution Accuracy

Method	57 Schedules Avg. Absolute Differences (000)	%	20 Schedules Avg. Absolute Differences (000)	%
Modal-2	2,571	6.73	3,019	7.51
Metheringham	12,807	28.89	14,664	30.36
Beta-1 Personal Probability	–	–	4,991	18.31

Table 4
Frequency Distribution Peaking Analysis

Method	57 Schedules Number of Times Method Assumed Correct Shape	20 Schedules Number of Times Method Assumed Correct Shape
Modal-2	95	32
Metheringham	72	20
Beta-1 Personal Probability	–	21

Conclusions

Modal-2 is superior to both the Metheringham and Personal Probabil-

This is not to say such media plans are wrong.

Unfortunately, the possibility for opening "more commercials" to a target audience is limited by the extent

to which the definition of the target audience coincides with the definition of heavy viewers.

This does not happen perfectly for any brand, but when there is a gross mismatch, it may be more productive (and there was evidence of this in the

study) to target to a special audience through copy rather than to try and achieve it through the media device of increased frequency.

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