

A Fresh Look At Estimating Readership Frequency Distributions

Modelling readership and exposure distributions using a ‘frequency’ question

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The paper focuses on the ‘frequency’ approach to measuring both ‘average issue’ readership and publications turnover/casualness rates, with an emphasis on the measurement of turnover (or casualness) figures. The main findings are:

- While the **‘frequency’** question may produce in some cases reasonable ‘average issue’ readership estimates, **some estimates are very wrong!** Readership estimates using a ‘frequency’ question tend to be **overestimated** for publications with low turnover/casualness rates (derived using the ‘frequency’ question) and tend to be **underestimated** for publications with high turnover/casualness rates.
- Turnover/casualness rate estimates computed from the four-issue or six-issue ‘frequency’ question are significantly **underestimated** relative to the ‘correct’ turnover/casualness rate estimates derived from a ‘re-interview’ survey.
- Using the ‘frequency’ question in estimating **multiple-issue reach** will consistently **overestimate** the proportion of respondents with a frequency of zero and consistently **overestimate** the proportion of respondents with maximum ‘frequencies’. This finding is obtained by comparing the ‘frequency’ estimates with the corresponding beta-binomial distribution estimates derived from using the ‘true’ readership and ‘true’ turnover/casualness figures.
- For the above reasons, a respondent’s ‘proportion of reading’ derived from the ‘frequency’ question **cannot** be used as ‘personal probabilities’ to predict future behaviour.

These above findings have major implications in evaluating the value of a print-media schedule or a multi-media (print, TV, radio, Internet, etc) schedule. Campaign schedules which use the ‘frequency of reading’ question will in many instances use too many publications and an insufficient number of issues for the publications used.

1. Introduction

In readership measurement research, there are three main approaches used to estimate a publication's 'average issue' readership:

- Specific Issue:
 - a) Full 'through-the-book' specific issue approach: for publications read or looked into in some broad time period, (eg the last six months) each respondent is shown a particular issue (4-6 weeks old for a weekly magazine, 8-12 weeks old for a monthly magazine, etc) and Roy Morgan Research then have the respondents look through the publication and say (i) Which articles or features look especially interesting. They are then asked: (ii) Whether or not they have read or looked into that specific issue before now.
 - b) 'Truncated-issue' or 'front-cover' specific issue approach, where respondents are shown either a truncated version or the front-cover of a publication and asked: Whether they have read or looked into that specific issue before now.
- The 'recency' approach: Recent reading is based on the reading of any issue of a publication in the last publishing interval. The interval is different for different publications: e.g. for a weekly magazine, respondents are asked about their readership of that publication in the last week or 7 days, while for a monthly magazine, the last month, etc. To accurately measure 'average issue' readership the respondent should only be classified as a reader if they have read the publication for the 'first time' in the publication interval (FRIPI) (See the 1983 paper 'Developing A Magazine Readership Validating Technique' by Wayne Eadie of Newsweek and Richard L Lysaker of Audits & Surveys [7]).
- The 'frequency' method: Respondents are asked how many issues of a publication they read in the last, say four, publication intervals, with possible answers for this example being 0, 1, 2, 3 or 4+. 'Average issue' readership is calculated as the weighted average frequency divided by four.

Theoretically, and mathematically, all these methods should produce the same 'average issue' readership estimate for a publication. However measurement errors and respondent biases of various kinds mean that not all methods are equally accurate.

There have been many experiments in readership research to compare the various measurement techniques (See, for example, [2,3,4,5,13,14,15,19,20,25] and references therein). Different methods have different problems but the 'gold standard' (in terms of believable accuracy) is the full 'through-the-book' method.

Moreover, a readership estimate (normally an 'average issue' estimate in the survey period), however accurate, is not sufficient by itself to calculate an exposure distribution or a total reach for multiple issues. And it is clear that exposure distributions for multiple issues are necessary for any advertising campaign. Therefore, any measurement method should be 'evaluated' not only in terms of accuracy of the readership measurement but also *how accurately it can model exposure distributions*.

It is the 'frequency' approach we are going to 'evaluate' in this paper. In the last 5-10 years, the 'frequency' question seems to have become more popular and attracted more use by media research companies and publishers. Indeed, it does have attractive features: it is relatively simple and inexpensive. Perhaps, the most attractive feature is that theoretically and mathematically, 'frequency of reading' could be used to calculate *both* the 'average issue'

readership *and* the publication turnover (or casualness) rate (See Section 3) so that one can ‘kill two birds with the one stone’. (The ‘turnover rate’ or ‘casualness rate’, together with the readership, can be used to model exposure distributions for multiple issues.)

Unfortunately, this approach has inherent problems. It is important to realise the limitations and drawbacks of the various ways of asking the ‘frequency’ question. For instance, the ‘frequency’ question has the problem of contributing to *replication*: if the question is asked as “how many times have you read the publication” a respondent may read the same issue of a publication several times over the time period for which the ‘frequency of reading’ is asked, with each repeated reading being counted in the frequency. This will result in inflated ‘average issue’ readership estimates (See, for example, the 1967 Politz Study [22]). Asking “how many different issues in the time period” reduces, but does not completely eliminate, the ‘replication’ problem (as respondents may re-read older publications in the period - the perfect example of this error being old cooking magazines re-read for many years).

To overcome this, the ‘frequency’ question is sometimes asked without a time constraint, i.e. instead of how many issues in the last four weeks (or relevant publication period) the question asks how many out of the last four issues. One problem with this question is that a respondent may have *not yet* read the most recently published issue but was going to read it soon. Should the respondent count this issue or not? Another problem is that a respondent may have read or looked into a couple of issues recently but is not aware of whether these are among the last four issues.

Other approaches to measuring ‘frequency’ seen by us have introduced further sources of error. For instance, mixing publications with different time periods (i.e. weekly, monthly, etc). Although theoretically and mathematically this should have no impact, respondents are likely to be confused. The resulting error would be expected to favour weekly (or frequent publications) against less frequent publications. Another approach, the use of actual specific front covers as stimuli, is confusing when used for a ‘frequency of reading’ question.

This paper focuses on reviewing what we consider to be the optimal ‘frequency’ question.

The first serious study of frequency distributions (derived from the ‘frequency’ question) was conducted by W. R. Simmons in 1969 and was presented at the 15th Annual Conference of the ARF (See [27]). Bill Simmons found that the shape of frequency distributions is almost entirely determined by ‘turnover rates’ (calculated from the ‘frequency’ question). It is important to realise that Simmons only looked at the distribution among readers i.e. the distribution of 1, 2, 3 or 4+ issues – not those who read 0. This means he made no comment about net reach for 4+ issues. Another Simmons’ finding was that the ‘average issue’ readership estimates based on ‘frequency’ and ‘through-the-book’ method agree on the overall level but differ among many breakdowns of the population. Not a logical finding, but Simmons offered no explanation. Simmons only looked at readership of magazines whereas today readership and ‘frequency of reading’ of newspapers and newspaper magazine inserts/supplements must also be measured accurately.

However, the emphasis of this paper is on the *measurement of turnover (or casualness) figures*. Simmons did not compare ‘turnover rates’ derived from the ‘frequency of reading’ with any other figures and probably assumed that they were accurate. The main message from our analysis is that the ‘frequency’ method also fails to ‘kill the second bird’: *‘turnover rates’ based on claimed ‘frequency of reading’ are significantly underestimated*. We also compare frequency distributions with the corresponding beta-binomial distributions, and this comparison shows what exactly is wrong with the ‘frequency of reading’ results. This means

that media schedules based on such data are ‘mathematically’ clearly wrong and conclusions drawn from this will be erroneous.

Our findings suggest the ‘frequency of reading’ question fails to provide accurate estimates of turnover or casualness; therefore it cannot generate accurate exposure distributions even for four issues. Furthermore, the **total reach for four issues** of a publication derived from the ‘frequency’ question is in most cases **underestimated**.

Therefore, the ‘frequency’ question based on four issues *cannot be used by itself* to model the exposure distributions of a publication for multiple issues.

Moreover, when the ‘frequency’ question is used to generate ‘personal probabilities’ the problems are exacerbated. Recall that essentially and mathematically the same approach is used to calculate ‘personal probabilities’ and ‘average issue’ readership from the ‘frequency’ question. (i.e. ‘average issue’ readership is simply the average personal probability derived from the corresponding ‘frequency’). This means that there is solid mathematical proof that the ‘frequency’ question cannot be used to estimate ‘average issue’ readership. Thus the method fails to kill even the first bird.

Our conclusion is, therefore, that while the ‘frequency of reading’ question theoretically promises an elegant solution and a single method to measure both ‘average issue’ readership and turnover/casualness, it fails on both counts.

2. ‘Average Issue’ Readership

In this section all calculations are based on Australian Roy Morgan Readership Survey data. Industry-currency ‘average issue’ readership estimates based on a ‘face-to-face’ interview (‘establishment’ survey) are compared with the corresponding estimates using the ‘frequency’ question (asked in a self-completion questionnaire). The ‘establishment’ survey uses a combination of several measurement methods: full ‘through-the-book’ method for business weekly magazines, the ‘first-time-reading in the last 7 days’ question for other weekly magazines and newspaper magazine inserts/supplements and ‘specific-issue’ method (with front cover recognition) for fortnightly, monthly and less frequently published magazines.

The results of these comparisons are shown in Table 1.

It can be seen that the ‘frequency’ question produces readership estimates which are sometimes similar to the ‘establishment’ survey. However, it is also clear that the magnitude of some of the differences is unacceptable. Further analysis of the errors in the ‘frequency’ question presented later in the paper provides some explanation for the magnitude and direction of the errors.

We emphasise once again that the Roy Morgan Research ‘recency & first-time reading’ question does not have the replication problem. It has been illustrated many times that if *all* ‘recent’ readers (rather than ‘first-time’ readers) are counted, the readership estimates will be inflated.

**Table 1. Readership Estimates: ‘Establishment’ Survey Versus ‘Frequency’
(March-August 1999)**

	‘Establishment’ Survey	‘Frequency’ Question	% Difference	Difference
Australian Geographic	4.1	7.1	-42	-3.0
Australian Women’s Weekly	17.6	14.2	+24	+3.4
B	3.7	1.7	+118	+2.0
Better Homes & Gardens	11.5	10.9	+6	+0.6
Business Review Weekly	2.5	2.6	-4	-0.1
Bulletin	2.7	3.1	-13	-0.4
Cleo	5.0	3.7	+35	+1.3
Cosmopolitan	4.7	4.0	+18	+0.7
Dolly	3.4	3.4	0	0.0
Elle	1.4	0.8	+75	+0.6
Family Circle	3.5	4.1	-15	-0.6
Financial Review Magazine	1.1	1.3	-15	-0.2
For Me	3.2	2.6	+23	+0.6
Girlfriend	2.6	2.9	-0.3	-0.3
Good Weekend *	11.1	11.0	+1	+0.1
Harper’s Bazaar	1.6	0.6	+167	+1.0
Marie Claire	3.9	1.7	+129	+2.2
National Geographic	4.9	4.7	+4	+0.2
New Idea	14.8	12.6	+17	+2.2
New Woman	2.0	1.4	+43	+0.6
New Weekly	3.0	3.2	-6	-0.2
Personal Investor	1.3	1.1	+18	+0.2
Reader’s Digest	7.0	7.9	-11	-0.9
Royal Auto	5.9	7.5	-21	-1.6
Shares	1.5	1.3	+15	+0.2
She	1.3	1.3	0	0.0
Sunday Life *	9.5	11.4	-17	-1.9
Sunday Magazine *	12.7	16.1	-21	-3.4
That’s Life	9.9	9.8	+1	+0.1
The Australian Magazine *	5.4	5.7	-5	-0.3
Time	3.0	3.5	-0.5	-0.5
TV Week	8.9	7.1	+25	+1.8
Vogue Australia	2.0	1.6	+25	+0.4
Who Weekly	7.4	5.3	+40	+2.1
Woman’s Day	18.3	15.1	+21	+3.2
Average difference	5.8	5.5	+5	0.3
Average absolute difference			27.9	1.1

* Newspaper magazine insert/supplement

3. Frequency Distribution and Turnover/Casualness

The relationship between ‘turnover rates’ and shapes of frequency distributions was first studied by W. R. Simmons in his 1969 paper [27]. In this section, we repeat the same analysis for Roy Morgan Research data and confirm Simmons conclusions.

3.1 Turnover and Casualness

Here, the concepts of turnover and casualness are introduced. It is also shown how turnover and casualness can be computed using only ‘frequency’ data.

The *additional reach of two issues over one issue* is the average of the additional reach relative to the readership of the first issue over the second issue and the second issue over the first issue. For example, if 10% of respondents read the first issue of a publication and not the second issue while 15% read the second issue and not the first issue, the additional reach is $(10\%+15\%)/2=12.5\%$.

Definition 1 (in conjunction with George Rennie)¹

For a given family of issues, *casualness* is the ratio of the average additional reach across all pairs of issues to the average additional reach across all pairs which would be expected if the readership was the same for all issues and if the readers of each issue in each pair of issues were independent of one another.

Let R be the average readership across all issues. If all issues have the same readership R and readers of any two issues are independent of each other, the additional reach for any pair of issues is simply $R(1 - R)$. The average additional reach across all pairs is then still $R(1 - R)$. Therefore, in mathematical terms casualness γ is expressed as:

$$\gamma = \frac{D}{R(1 - R)}, \quad (1)$$

where D is the (actual) average additional reach.

Casualness was originally invented by Christopher Fry (See [8 ,9]) in the early seventies and further developed by George Rennie (See [23,24]) for The Roy Morgan Research Centre. The latest developments in casualness theory by Roy Morgan Research have been done in conjunction with George Rennie.

For a more detailed introduction into casualness see our 2001 paper [18].

Casualness can also be expressed in terms of a frequency distribution. More precisely, assume that there are m issues and p_0, p_1, \dots, p_m is the corresponding frequency distribution (i.e. p_i is the proportion of persons who read i issues out of m). Let γ denote the casualness and R the ‘average issue’ readership. Then the formula for γ in terms of the frequency distribution is the following:

$$\gamma = \frac{1}{R(1 - R)} \cdot \frac{m}{m-1} \sum_{k=1}^m \frac{k}{m} \left(1 - \frac{k}{m}\right) p_k. \quad (2)$$

¹ George Rennie is an Operations Research Consultant who has worked extensively with Roy Morgan Research over the last 15 years on media schedule evaluation.

A proof of this formula is given in the Appendix. It is a general formula (without any conditions) so that it may serve as another definition of casualness. It follows from this formula that it does not matter which particular issues a person reads – as long as the person’s ‘frequency’ remains the same.

The *turnover* τ is defined as the average additional reach relative to the ‘average issue’ readership:

$$\tau = \frac{D}{R}. \quad (3)$$

Hence, there is a simple relationship between turnover and casualness:

$$\tau = \gamma(1 - R), \quad (4)$$

where R is the ‘average issue’ readership.

Note that all definitions above correspond to ‘true’ turnover/casualness values calculated for the whole population. However, in practice turnover and casualness values are *measured* using established sampling techniques.

A common formula to measure turnover/casualness is based on sampling *two reading occasions* for each respondent. The two occasions are usually different for different respondents. The estimated additional reach consists of respondents who read one issue but not the other issue (alternatively, the additional reach is simply two-issue-reach minus one-issue-reach). A casualness estimate is then obtained as the estimated additional reach divided by $R(1 - R)$, where R is the estimated ‘average issue’ readership.

Formula (2) above gives another method to estimate casualness using a frequency distribution from a sample. In other words, the casualness can be estimated by formula (2), where the proportions (p_k) and the ‘average issue’ readership are based on the sample data.

3.2 Simmons Analysis

Table 2 shows ‘relative’ four-issue frequency distributions for the same magazines as in Tables 1 based on Roy Morgan Readership Survey data from March-August 1999².

The word ‘relative’ means that the corresponding proportions are computed only *among readers* (non-readers are ignored). The table also contains turnover and casualness figures computed from the frequency distributions according to formulae (2), (4).

The publications are sorted by increasing ‘turnover rate’.

The shape of the frequency distributions agrees with the conclusion in the W. R. Simmons’ 1969 paper [27]. More precisely, if the ‘turnover rate’ exceeds 40%, there tend to be more readers of one issue than readers of two issues, than readers of three issues, than readers of four issues. The higher the ‘turnover rate’, the stronger the trend. If the ‘turnover rate’ is between 20% and 40%, most of the distributions have a U-shaped form. When the ‘turnover rate’ is below 20%, the distributions are skewed towards the frequency of four.

² The four-issue ‘frequency’ question was subsequently replaced by a two-issue ‘frequency’ question.

Table 2. Relative Frequency Distributions³ (%)

	Casualnes s	Turnove r	No. of Issues Read			
			1	2	3	4
Sunday Magazine (NSW/VIC) ^{3,*}	24.8	18.3	16.9	17.7	14.2	51.2
Sunday Life (NSW/VIC) ^{3,*}	22.7	18.5	17.4	18.0	13.8	50.9
Good Weekend (NSW/VIC) ^{3,*}	24.2	19.8	18.6	18.6	14.6	48.2
The Australian Magazine [*]	24.4	23.0	24.8	19.8	11.9	43.5
Royal Auto (VIC) ³	34.3	24.1	19.6	19.2	22.5	38.7
TV Week	27.3	25.4	28.6	21.7	9.0	40.8
That's Life	28.9	26.1	30.7	19.3	11.0	39.0
Reader's Digest	30.8	28.3	25.5	26.3	12.7	35.5
Australian Geographic	34.3	31.9	21.2	30.6	19.5	28.7
Shares	32.5	32.1	28.1	24.5	18.9	28.6
Financial Review Magazine	34.2	33.8	25.6	30.8	16.2	27.4
Personal Investor	34.8	34.5	32.9	25.6	14.4	27.2
Dolly	37.2	35.9	29.1	24.4	24.3	22.2
Girlfriend	38.0	36.8	28.8	24.2	26.8	20.2
National Geographic	40.3	38.4	36.1	28.2	12.1	23.6
Woman's Day	45.9	39.0	34.3	30.3	12.6	22.8
Australian Women's Weekly	46.8	40.1	32.9	29.1	18.4	19.5
For Me	42.3	41.2	38.1	23.0	21.3	17.6
Better Homes & Gardens	47.0	41.9	35.4	26.8	20.9	17.0
New Idea	48.8	42.7	34.2	34.1	12.8	19.0
New Weekly	44.5	43.0	39.0	28.4	14.4	18.3
Family Circle	47.3	45.4	36.6	29.7	19.6	14.1
She	46.0	45.4	46.5	18.2	21.2	14.0
Who Weekly	48.2	45.7	42.3	29.6	10.9	17.2
Time	49.0	47.3	47.2	26.4	10.2	16.3
Harper's Bazaar	49.1	48.8	40.3	28.8	19.8	11.1
Marie Claire	49.7	48.9	42.0	28.0	18.4	11.6
Cleo	51.1	49.2	42.8	26.9	19.1	11.2
Elle	49.7	49.3	51.0	17.3	20.6	11.1
New Woman	50.6	49.8	46.1	24.0	19.0	10.9
Cosmopolitan	52.7	50.6	44.9	26.5	18.2	10.5
Business Review Weekly	54.7	53.2	49.6	29.3	9.0	12.1
Bulletin	55.9	54.2	49.1	30.2	9.7	11.1
Vogue Australia	55.8	54.9	50.2	24.4	17.7	7.8
B	56.8	55.9	45.7	29.4	18.6	6.2

* Newspaper magazine insert/supplement

³ The distributions are based on the main circulation region for the four regional magazines

This has a logical implication for readership estimates using a ‘frequency’ question. If the ‘frequency’ turnover/‘frequency’ casualness is artificially high because there are too many readers with the frequency of one should lead to an **underestimated** ‘frequency’ readership. Similarly, an artificially low ‘frequency’ turnover/ ‘frequency’ casualness due to too many readers with the frequency of four then the ‘frequency’ readership estimate should be **overestimated**. These expectations are confirmed by analysis of Tables 1 and 2: for the ten magazines from Table 2 with the lowest turnovers, the average % difference from Table 1 is – 7.5%, that is their ‘frequency’ readership is, on average, **overestimated**. On the other hand, for the ten magazines from Table 2 with the highest turnovers, the average % difference from Table 1 is 59.3%, i.e. their ‘frequency’ readership is significantly **underestimated**.

If low turnover/casualness is associated with overestimated readership, and high turnover/casualness is conversely associated with underestimated readership, what does this tell us about how respondents answer the ‘frequency of reading’ question?

Where turnover/casualness is low there is a greater polarisation between readers and non-readers. This may imply a greater involvement with the publication by those who do read it, including those who do not *always* read it, leading to a tendency to overstate their individual ‘frequency of reading’ and thus to push up the ‘average issue’ readership estimate.

High turnover/casualness, on the other hand, implies a greater random element in reading behaviour and a lower level of commitment to the publication, which may cause at least the less regular readers to understate their reading, thus decreasing the ‘average issue’ readership estimates for such publications.

4. ‘Frequency’ Based Turnover/Casualness Figures Are Wrong!

Simmons knew that something was wrong with the frequency distributions (See his conclusions in [27]). However, the problem is that Simmons’ ‘turnover rates’ are again ‘frequency’ based. In other words, if only ‘frequency’ data are used, it is impossible to see what is wrong. There must be a comparison with another method which is known to be reliable. In fact, Simmons did such a comparison for the ‘average issue’ readership – ‘frequency’ (or filter-recall in his terminology) versus the ‘through-the-book’ method. In his experiment, the overall ‘frequency’ readership was similar to the overall ‘through-the-book’ readership (but different for many sub-samples). The conclusion was that while there is a serious inflationary bias in the ‘frequency of reading’ among readers, it must be compensated by a downward bias to get similar reading audiences (at the overall level). Unfortunately, the ‘average issue’ readership is not very helpful if the goal is to study frequency distributions: a distribution may be wrong but still have the correct mean!

What we propose to do instead is to estimate *turnover/casualness figures* using a reliable method and then to compare them with the corresponding estimates derived from frequency distributions. The alternative method to estimate turnover/casualness is based on the ‘face-to-face’ interview or ‘establishment’ survey (See Section 2) with a ‘re-interview’ (the ‘recency and first-time reading’ question in a self-completion questionnaire). It is well accepted that the ‘re-interview’ method is the ‘gold standard’ in turnover/casualness measurement, and it is the method Roy Morgan Research uses to measure magazine and newspaper casualness figures in Australia.

The comparison between the ‘re-interview’ turnover/casualness and ‘frequency’ turnover/casualness estimates is shown in Tables 3 and 4.

The conclusion from these tables is clear – *turnover and casualness figures from the four-issue 'frequency of reading' question are significantly underestimated.* The difference in estimates between the two methods is very consistent and cannot be explained by a sampling error.

This simple experiment (a natural extension of what Simmons did in 1969) finally tells us one thing which is wrong about frequency distributions: they cannot be used to estimate turnover or casualness figures. The danger in accepting underestimated turnover or casualness figures has been illustrated in our paper 'A New Method To Measure Media Casualness For Magazines And Newspapers' [18] (See also a discussion in Brian Shields' paper 'Selling Print Short: The Need To Re-Assess Reading And Readership' [26]).

More precisely, underestimated turnover/casualness figures will result in a significantly underestimated reach for multiple issues (for each publication). **Thus misleading the media planner in planning an advertising campaign, and in the post evaluation of the campaign.**

Table 3. Roy Morgan Research Turnover Estimates (%)⁴ (March-August 1999)

	Turnover calculated by		Difference
	'Re-interview'	'Frequency'	
Australian Geographic	52.5	31.9	20.6
Australian Women's Weekly	50.2	40.1	10.1
B	58.6	55.9	2.7
Better Homes & Gardens	50.7	41.9	8.8
Business Review Weekly	63.4	53.2	10.2
Bulletin	69.8	54.2	15.6
Cleo	58.6	49.2	9.4
Cosmopolitan	56.3	50.6	5.8
Dolly	40.0	35.9	4.1
Elle	72.0	49.3	22.6
Family Circle	60.4	45.4	15.0
Financial Review Magazine	64.5	33.8	30.7
For Me	51.5	41.2	10.2
Girlfriend	45.6	36.8	8.7
Good Weekend (NSW/VIC) ^{4,*}	36.4	19.8	16.6
Harper's Bazaar	73.3	48.8	24.4
Marie Claire	62.3	48.9	13.4
National Geographic	51.3	38.4	12.9
New Idea	47.2	42.7	4.5
New Woman	70.0	49.8	20.2
New Weekly	57.8	43.0	14.8
Personal Investor	46.9	34.5	12.5
Reader's Digest	40.5	28.3	12.1
Royal Auto (VIC) ⁴	42.4	24.1	18.2
Shares	47.4	32.1	15.3
She	67.5	45.4	22.1
Sunday Life (NSW/VIC) ^{4,*}	39.5	18.5	21.0
Sunday Magazine (NSW/VIC) ^{4,*}	38.1	18.3	19.8
That's Life	33.7	26.1	7.6
The Australian Magazine [*]	39.8	23.0	16.8
Time	60.6	47.3	13.3
TV Week	50.1	25.4	24.7
Vogue Australia	75.1	54.9	20.3
Who Weekly	53.6	45.7	8.0
Woman's Day	42.4	39.0	3.4
Average	53.4	39.2	14.2

* Newspaper magazine insert/supplement

⁴ The estimates are regional for the four regional magazines

Table 4. Roy Morgan Research Casualness Estimates (%)⁵ (March-August 1999)

	Casualness calculated by		Difference
	'Re-interview'	'Frequency'	
Australian Geographic	55.1	34.3	20.8
Australian Women's Weekly	61.4	46.8	14.6
B	60.5	56.8	3.7
Better Homes & Gardens	58.4	47.0	11.4
Business Review Weekly	65.0	54.7	10.3
Bulletin	71.8	55.9	15.9
Cleo	61.6	51.1	10.5
Cosmopolitan	59.0	52.7	6.3
Dolly	41.5	37.2	4.3
Elle	73.0	49.7	23.3
Family Circle	62.9	47.3	15.6
Financial Review Magazine	65.0	34.2	30.8
For Me	53.3	42.3	11.0
Girlfriend	47.0	38.0	9.0
Good Weekend (NSW/VIC) ^{5,*}	44.8	24.2	20.6
Harper's Bazaar	74.3	49.1	25.2
Marie Claire	64.7	49.7	15.0
National Geographic	54.2	40.3	13.9
New Idea	54.7	48.8	5.9
New Woman	71.4	50.6	20.8
New Weekly	59.7	44.5	15.2
Personal Investor	47.6	34.8	12.8
Reader's Digest	44.0	30.8	13.2
Royal Auto (VIC) ⁵	59.0	34.3	24.7
Shares	48.2	32.5	15.7
She	68.5	46.0	22.5
Sunday Life (NSW/VIC) ^{5,*}	48.3	22.7	25.6
Sunday Magazine (NSW/VIC) ^{5,*}	50.1	24.8	25.3
That's Life	37.6	28.9	8.7
The Australian Magazine [*]	42.1	24.4	17.7
Time	62.5	49.0	13.5
TV Week	55.1	27.3	27.8
Vogue Australia	76.5	55.8	20.7
Who Weekly	57.6	48.2	9.4
Woman's Day	51.3	45.9	5.4
Average	57.3	41.7	15.6

* Newspaper magazine insert/supplement

⁵ The estimates are regional for the four regional magazines

5. Beta-Binomial Distribution

Now we introduce the beta-binomial distribution, a powerful tool in ‘reach’ and ‘frequency’ modelling.

A beta-binomial distribution depends on two parameters $\alpha, \beta > 0$ and the corresponding beta-binomial probabilities p_0, p_1, \dots, p_n are calculated in the following way:

$$p_i = \frac{\binom{n}{i} (\alpha + i - 1) \cdot \dots \cdot \alpha \cdot (\beta + n - i - 1) \cdot \dots \cdot \beta}{(\alpha + \beta + n - 1) \cdot \dots \cdot (\alpha + \beta)}, \quad i = 0, 1, \dots, n.$$

The mean and variance of this distribution for n issues are

$$\mu = \frac{n\alpha}{\alpha + \beta}, \quad \text{var} = \frac{n\alpha\beta(n + \alpha + \beta)}{(\alpha + \beta)^2(1 + \alpha + \beta)}.$$

It has been known for a long time that beta-binomial distributions are well suited to model exposure distributions for multiple insertions, for one publication at a time. This issue has been discussed in the papers [1,10,11,12,16,17,18] (See also references therein). In our paper, ‘A New Method To Measure Media Casualness For Magazines And Newspapers’ [18], it has been illustrated that the beta-binomial distribution fits empirical data from the 1953 Alfred Politz Study (See [21]).

The two parameters α and β can be estimated using readership and casualness estimates.

Therefore, once there are reliable readership and casualness estimates, a beta-binomial distribution (based on these estimates) can be calculated for any number of issues. The natural thing to do then is to compute a beta-binomial distribution for *four issues* and *to compare it with the original frequency distribution*. This simple idea (which is again a logical extension of what Simmons did in 1969) should help us to find out exactly what is wrong about frequency distributions.

These calculations have been carried out for the same magazines as above using Australian Roy Morgan Readership Survey data from March-August 1999. The results are shown in Table 5 (‘relative’ distributions) and Table 6 (‘full’ distributions) below. Beta-binomial distributions are based on ‘correct’ readership and casualness figures: the ‘establishment’ survey readership estimate and the ‘re-interview’ casualness estimate.

Table 5 shows what is a typical problem with a frequency distribution: the proportion of readers with a frequency of one is usually *underestimated* while the proportions of readers with frequencies of three and four in most cases is *overestimated*. A conclusion from Table 6 is that the proportion of readers with a frequency of zero is usually higher in a frequency distribution than in the corresponding beta-binomial distribution. In other words, the reach for four issues derived from a frequency distribution is often significantly *underestimated*.

The above analysis is in a perfect agreement with one of Simmons' conclusions in [27]:

“The demonstrable inflation in ‘frequency of reading’ must inevitably yield a frequency distribution that is much more nearly skewed toward more four out of four issue readers than towards the one out of four issue readers.”

It is also worthwhile to realise what these findings mean in terms of accuracy of respondents' answers about ‘frequency of reading’. Clearly, there should be fewer respondents with a frequency of zero. In other words, many non-readers *underestimate* their ‘frequency of reading’: they probably forget an ‘occasional’ issue they read in the last four publication intervals. On the other hand, there should be significantly fewer respondents with frequencies of three or four. Hence, many respondents claiming to have read three or four issues *overestimate* their ‘frequency of reading’. This could be due to, for example, prestige, poor memory or a desire to look more ‘consistent’ etc.

The findings have significant implications in evaluating the value of print-media schedules or a multi-media schedule (print, TV, radio, Internet, etc). The implication of understated reader turnover/casualness is that in an advertising campaign additional issues of a publication deliver very little incremental reach. It may appear, incorrectly, that the most, or only, cost-effective way to achieve additional reach is to add more titles, whereas in fact further issues of the same publications will deliver far more than they appear to.

Table 5. Relative Frequency Distribution Versus Relative Beta-Binomial Distribution⁶

	Relative Distribution							
	'Frequency'				Beta-binomial			
	1	2	3	4	1	2	3	4
Australian Geographic	21.2	30.6	19.5	28.7	49.8	24.7	15.5	10.0
Australian Women's Weekly	32.9	29.1	18.4	19.5	45.4	26.4	17.3	10.8
B	45.7	29.4	18.6	6.2	54.4	24.8	13.7	7.1
Better Homes & Gardens	35.4	26.8	20.9	17.0	47.6	25.6	16.4	10.4
Business Review Weekly	49.6	29.3	9.0	12.1	59.0	24.3	11.8	5.0
Bulletin	49.1	30.2	9.7	11.1	64.8	23.2	9.2	2.8
Cleo	42.8	26.9	19.1	11.2	54.3	25.0	13.7	6.9
Cosmopolitan	44.9	26.5	18.2	10.5	52.5	24.9	14.5	8.1
Dolly	29.1	24.4	24.3	22.2	39.4	22.6	18.1	19.9
Elle	51.0	17.3	20.6	11.1	67.0	22.4	8.3	2.4
Family Circle	36.6	29.7	19.6	14.1	56.5	24.7	12.9	6.0
Financial Review Magazine	25.6	30.8	16.2	27.4	60.0	23.9	11.4	4.7
For Me	38.1	23.0	21.3	17.6	48.9	24.5	15.8	10.8
Girlfriend	28.8	24.2	26.8	20.2	44.2	23.7	17.1	15.0
Good Weekend (NSW/VIC) ^{6,*}	18.6	18.6	14.6	48.2	34.9	22.6	19.4	23.1
Harper's Bazaar	40.3	28.8	19.8	11.1	68.0	22.0	7.8	2.1
Marie Claire	42.0	28.0	18.4	11.6	57.7	24.6	12.3	5.4
National Geographic	36.1	28.2	12.1	23.6	48.6	24.7	15.9	10.8
New Idea	34.2	34.1	12.8	19.0	43.0	25.1	18.0	13.9
New Woman	46.1	24.0	19.0	10.9	65.0	23.0	9.1	2.8
New Weekly	39.0	28.4	14.4	18.3	54.2	24.7	13.8	7.3
Personal Investor	32.9	25.6	14.4	27.2	45.3	23.8	16.8	14.1
Reader's Digest	25.5	26.3	12.7	35.5	39.7	23.0	18.2	19.0
Royal Auto ⁶	19.6	19.2	22.5	38.7	40.4	26.0	19.2	14.4
Shares	28.1	24.5	18.9	28.6	45.7	23.8	16.7	13.7
She	46.5	18.2	21.2	14.0	63.0	23.4	10.1	3.6
Sunday Life (NSW/VIC) ^{6,*}	17.4	18.0	13.8	50.9	38.3	23.7	19.0	19.0
Sunday Magazine (NSW/VIC) ^{6,*}	16.9	17.7	14.2	51.2	36.7	23.9	19.6	19.8
That's Life	30.7	19.3	11.0	39.0	33.7	21.1	18.8	26.4
The Australian Magazine [*]	24.8	19.8	11.9	43.5	39.0	22.6	18.2	20.1
Time	47.2	26.4	10.2	16.3	56.5	24.6	12.8	6.1
TV Week	28.6	21.7	9.0	40.8	46.9	25.0	16.6	11.5
Vogue Australia	50.2	24.4	17.7	7.8	69.8	21.5	7.1	1.7
Who Weekly	42.3	29.6	10.9	17.2	49.6	25.2	15.6	9.6
Woman's Day	34.3	30.3	12.6	22.8	38.9	24.3	19.1	17.7

* Newspaper magazine insert/supplement

⁶ The distributions are based on the main circulation region for the four regional magazines

Table 6. Frequency Distribution Versus Beta-Binomial Distribution⁷

	Frequency Distribution					Beta-binomial Distribution				
	0	1	2	3	4	0	1	2	3	4
Australian Geographic	88.9	2.4	3.4	2.2	3.2	91.2	4.4	2.2	1.4	0.9
Australian Women's Weekly	74.7	8.3	7.4	4.7	5.0	63.6	16.5	9.6	6.3	3.9
B	96.4	1.6	1.1	0.7	0.2	91.5	4.6	2.1	1.2	0.6
Better Homes & Gardens	80.2	7.0	5.3	4.1	3.4	75.8	11.5	6.2	4.0	2.5
Business Review Weekly	94.3	2.8	1.7	0.5	0.7	93.9	3.6	1.5	0.7	0.3
Bulletin	93.2	3.3	2.1	0.7	0.8	92.8	4.7	1.7	0.7	0.2
Cleo	92.5	3.2	2.0	1.4	0.8	88.5	6.3	2.9	1.6	0.8
Cosmopolitan	91.8	3.7	2.2	1.5	0.9	89.5	5.5	2.6	1.5	0.9
Dolly	94.3	1.7	1.4	1.4	1.3	93.8	2.5	1.4	1.1	1.2
Elle	98.4	0.8	0.3	0.3	0.2	96.2	2.6	0.9	0.3	0.1
Family Circle	92.2	2.9	2.3	1.5	1.1	91.7	4.7	2.1	1.1	0.5
Financial Review Magazine	97.9	0.5	0.6	0.3	0.6	97.3	1.6	0.7	0.3	0.1
For Me	95.3	1.8	1.1	1.0	0.8	93.2	3.3	1.7	1.1	0.7
Girlfriend	95.1	1.4	1.2	1.3	1.0	94.9	2.3	1.2	0.9	0.8
Good Weekend (NSW/VIC) ^{7,*}	75.3	4.6	4.6	3.6	11.9	68.3	11.1	7.2	6.2	7.3
Harper's Bazaar	98.8	0.5	0.3	0.2	0.1	95.6	3.0	1.0	0.3	0.1
Marie Claire	96.7	1.4	0.9	0.6	0.4	90.6	5.4	2.3	1.2	0.5
National Geographic	91.6	3.0	2.4	1.0	2.0	89.6	5.0	2.6	1.7	1.1
New Idea	76.7	8.0	7.9	3.0	4.4	70.8	12.6	7.3	5.3	4.1
New Woman	97.1	1.3	0.7	0.5	0.3	94.7	3.5	1.2	0.5	0.2
New Weekly	93.9	2.4	1.7	0.9	1.1	93.1	3.7	1.7	1.0	0.5
Personal Investor	98.2	0.6	0.5	0.3	0.5	97.4	1.2	0.6	0.4	0.4
Reader's Digest	87.7	3.1	3.2	1.6	4.4	87.1	5.1	3.0	2.4	2.5
Royal Auto (VIC) ⁷	57.7	8.3	8.1	9.5	16.4	55.5	18.0	11.6	8.5	6.4
Shares	98.0	0.6	0.5	0.4	0.6	97.0	1.4	0.7	0.5	0.4
She	97.5	1.2	0.5	0.5	0.3	96.6	2.1	0.8	0.3	0.1
Sunday Life (NSW/VIC) ^{7,*}	74.9	4.4	4.5	3.4	12.8	71.1	11.1	6.8	5.5	5.5
Sunday Magazine (NSW/VIC) ^{7,*}	64.9	5.9	6.2	5.0	18.0	62.4	13.8	9.0	7.4	7.4
That's Life	84.8	4.7	2.9	1.7	5.9	83.4	5.6	3.5	3.1	4.4
The Australian Magazine*	91.7	2.1	1.6	1.0	3.6	90.2	3.8	2.2	1.8	2.0
Time	92.8	3.4	1.9	0.7	1.2	92.9	4.0	1.8	0.9	0.4
TV Week	89.2	3.1	2.3	1.0	4.4	81.5	8.7	4.6	3.1	2.1
Vogue Australia	96.4	1.8	0.9	0.6	0.3	94.3	4.0	1.2	0.4	0.1
Who Weekly	89.5	4.4	3.1	1.1	1.8	84.0	7.9	4.0	2.5	1.5
Woman's Day	73.1	9.2	8.1	3.4	6.1	66.1	13.2	8.3	6.5	6.0

* Newspaper magazine insert/supplement

⁷ The distributions are based on the main circulation region for the four regional magazines

6. Using ‘Personal Probabilities’ To Estimate a Distribution

What happens if we try to use respondent’s frequencies as their individual probabilities to read a publication in future? The correspondence between frequencies and ‘personal probabilities’ is given in the following table:

Frequency	0	1	2	3	4
Probability	0.0	0.25	0.5	0.75	1.0

The point is that once respondents have ‘personal probabilities’, the binomial distribution for four issues can be computed for each respondent separately and then the average distribution across all respondents will be the exposure distribution for four issues. The natural thing is then to compare this exposure distribution with the original frequency distribution.

More precisely, the binomial distributions for the five ‘personal probability’ values are easily calculated:

Personal probability	Binomial distribution				
	0	1	2	3	4
0.00	1.0	0.0	0.0	0.0	0.0
0.25	0.316	0.422	0.211	0.047	0.004
0.50	0.063	0.25	0.375	0.25	0.063
0.75	0.004	0.047	0.211	0.422	0.316
1.00	0.0	0.0	0.0	0.0	1.0

These binomial distributions are then ‘averaged’ with weights derived from the corresponding frequency distribution. If, for example, the distribution corresponding to frequencies (0,1,2,3,4) is (50%,10%,13%,7%,20%), then the binomial distribution for personal probability 0.0 has a weight of 50%, the binomial distribution for personal probability 0.25 has a weight of 10% etc. Hence, the weighted average of these binomial distributions will produce the overall exposure distribution for four issues.

These calculations have been conducted for each magazine above (using Australian Roy Morgan Research data from March-August 1999). The results are shown in Table 7.

The table makes it clear that when ‘personal probabilities’ (derived from the ‘frequency of reading’) are used to estimate a distribution, the original frequency distributions are not reproduced. Furthermore, the proportion of respondents with a frequency of one is **underestimated** and the proportion of respondents with a frequency of four is **overestimated**, relative to the original frequency distribution.

It has been already observed that with a frequency distribution, the proportion with a frequency of one is underestimated and the proportion with a frequency of four is overestimated. Consequently, using ‘personal probabilities’ makes this situation *even worse*: it does not fix the problems with frequency distributions but only makes them larger.

The new distribution also has a higher proportion of respondents with a frequency of zero and so a **lower reach** than the original frequency distribution. Thus, the situation again becomes worse: for most magazines, the total reach for four issues from the ‘frequency of reading’ was already underestimated (in comparison with the beta-binomial reach – See Table 7).

Hence, the conclusion is that ‘personal probabilities’ based on ‘frequency of reading’ cannot be used to estimate exposure distributions. To estimate respondents’ ‘personal probabilities’, a much more sophisticated mathematical procedure is required which takes into account other available information (e.g. demographics).

The conclusion may look obvious and it may be intuitively clear that not all respondents with a frequency of zero (out of four issues) should have a personal probability of zero and not all respondents with a frequency of four should have a personal probability of one. However, it is important to realise that it is the ‘personal probability’ approach which is used when the ‘average issue’ readership is calculated: the ‘average issue’ readership is simply the average personal probability (derived from the corresponding ‘frequency’) across all respondents.

The point is that while using ‘personal probabilities’ may **sometimes appear to work** to estimate the ‘average issue’ readership, it follows from the analysis above that this approach does not pass the test of mathematical logic and completely fails when the goal is to model exposure distributions (including single exposure distributions, i.e. ‘average issue’ readership).

**Table 7. Original Frequency Distribution Versus
Distribution Estimated From Using ‘Personal Probabilities’**

	Original distribution (from the ‘frequency’ question)					Estimated distribution from using ‘personal probabilities’				
	0	1	2	3	4	0	1	2	3	4
Australian Geographic	88.9	2.4	3.4	2.2	3.2	89.8	2.0	2.2	1.9	4.1
Australian Women’s Weekly	74.7	8.3	7.4	4.7	5.0	77.8	5.6	5.5	4.2	6.9
B	96.4	1.6	1.1	0.7	0.2	97.0	1.0	0.9	0.6	0.5
Better Homes & Gardens	80.2	7.0	5.3	4.1	3.4	82.8	4.5	4.3	3.4	5.0
Business Review Weekly	94.3	2.8	1.7	0.5	0.7	95.3	1.6	1.3	0.8	1.0
Bulletin	93.2	3.3	2.1	0.7	0.8	94.4	2.0	1.6	0.9	1.1
Cleo	92.5	3.2	2.0	1.4	0.8	93.7	1.9	1.7	1.3	1.4
Cosmopolitan	91.8	3.7	2.2	1.5	0.9	93.1	2.2	1.9	1.3	1.5
Dolly	94.3	1.7	1.4	1.4	1.3	94.9	1.1	1.2	1.0	1.8
Elle	98.4	0.8	0.3	0.3	0.2	98.7	0.4	0.4	0.3	0.3
Family Circle	92.2	2.9	2.3	1.5	1.1	93.2	1.9	1.8	1.4	1.7
Financial Review Magazine	97.9	0.5	0.6	0.3	0.6	98.2	0.4	0.4	0.3	0.7
For Me	95.3	1.8	1.1	1.0	0.8	95.9	1.1	1.0	0.8	1.2
Girlfriend	95.1	1.4	1.2	1.3	1.0	95.6	1.0	1.0	0.9	1.5
Good Weekend (NSW/VIC)*	75.3	4.6	4.6	3.6	11.9	77.0	3.3	3.5	2.9	13.4
Harper’s Bazaar	98.8	0.5	0.3	0.2	0.1	99.0	0.3	0.3	0.2	0.2
Marie Claire	96.7	1.4	0.9	0.6	0.4	97.2	0.8	0.8	0.6	0.6
National Geographic	91.6	3.0	2.4	1.0	2.0	92.7	1.9	1.7	1.2	2.5
New Idea	76.7	8.0	7.9	3.0	4.4	79.7	5.5	5.3	3.6	5.9
New Woman	97.1	1.3	0.7	0.5	0.3	97.6	0.8	0.7	0.5	0.5
New Weekly	93.9	2.4	1.7	0.9	1.1	94.8	1.5	1.3	0.9	1.5
Personal Investor	98.2	0.6	0.5	0.3	0.5	98.4	0.4	0.4	0.3	0.6
Reader’s Digest	87.7	3.1	3.2	1.6	4.4	88.9	2.2	2.2	1.6	5.1
Royal Auto (VIC)	57.7	8.3	8.1	9.5	16.4	60.9	6.0	6.8	6.4	19.9
Shares	98.0	0.6	0.5	0.4	0.6	98.2	0.4	0.4	0.3	0.7
She	97.5	1.2	0.5	0.5	0.3	97.9	0.6	0.5	0.4	0.5
Sunday Life (NSW/VIC)*	74.9	4.4	4.5	3.4	12.8	76.6	3.1	3.3	2.8	14.2
Sunday Magazine (NSW/VIC)*	64.9	5.9	6.2	5.0	18.0	67.1	4.3	4.6	3.9	20.0
That’s Life	84.8	4.7	2.9	1.7	5.9	86.4	2.8	2.4	1.7	6.7
The Australian Magazine*	91.7	2.1	1.6	1.0	3.6	92.5	1.3	1.3	0.9	4.0
Time	92.8	3.4	1.9	0.7	1.2	94.0	1.9	1.6	0.9	1.5
TV Week	89.2	3.1	2.3	1.0	4.4	90.3	1.9	1.7	1.1	4.9
Vogue Australia	96.4	1.8	0.9	0.6	0.3	97.0	1.0	0.8	0.6	0.5
Who Weekly	89.5	4.4	3.1	1.1	1.8	91.1	2.7	2.3	1.5	2.4
Woman’s Day	73.1	9.2	8.1	3.4	6.1	76.6	6.1	5.7	3.9	7.7

* Newspaper magazine insert/supplement

7. Implications of the Research

The best way to demonstrate the implications is by example.

Sunday Magazine (newspaper inserted magazine)

The ‘average issue’ readership for the Sunday Magazine from the ‘establishment’ survey is 12.7% compared with an estimate of 16.1% using the ‘frequency’ question. However, the turnover estimate using the ‘establishment’ survey ‘re-interview’ is 38.1 - almost twice the turnover estimate using the ‘frequency’ question (18.3) i.e. the ‘frequency’ turnover for the Sunday Magazine is only 18.3. Looking at the distributions, two things are clear:

- 1) The ‘frequency’ question generates a higher proportion of readers who say they read 4-in-4 issues. This results in a **higher** ‘average issue’ readership and **lower** turnover.
- 2) The total ‘net’ reach for 4 issues is **lower** using the ‘frequency’ distribution (35.1%) than the ‘net’ reach for 4 issues estimated from the ‘beta-binomial distribution’ based on the ‘establishment’ survey and the ‘re-interview’ turnover (37.6%).
Thus, the publication will **under-perform** in a schedule if the ‘frequency’ question is used.

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 12.7%					‘Average issue’ readership - 16.1%				
‘Re-interview’ turnover*- 38.1					‘Frequency’ turnover* - 18.3				
Beta-binomial distribution (%)*					‘Frequency’ distribution (%)*				
0	1	2	3	4	0	1	2	3	4
62.4	13.8	9.0	7.4	7.4	64.9	5.9	6.2	5.0	18.0
4-issue net reach - 37.6%					4-issue net reach - 35.1%				

*The estimate is for NSW & Victoria only as the publication is only published in these regions.

WHO Weekly (like People in the USA)

Even though there are more ‘4’s in the ‘frequency’ distribution than the ‘beta-binomial distribution’, there are also more ‘0’s. Therefore the net result is a **lower** ‘average issue’ readership estimate and a **lower** net readership of 4 issues (10.5% cf 16%). As a result, using a ‘frequency’ distribution will not help Who Weekly (or People in the USA) – either in terms of ‘average issue readership’, or multiple issue schedules.

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 7.4%					‘Average issue’ readership - 5.3%				
‘Re-interview’ turnover - 53.6					‘Frequency’ turnover - 45.7				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
84.0	7.9	4.0	2.5	1.5	89.5	4.4	3.1	1.1	1.8
4-issue net reach - 16%					4-issue net reach - 10.5%				

TV Week (like TV Guide in the USA)

Again, using the ‘frequency’ methodology will disadvantage TV magazines such as TV Week in Australia and TV Guide in the USA. It obtains a lower ‘average issue’ readership, lower turnover, and lower net reach for multiple issues. The 4 issue ‘net’ reach for the TV Week example shows 18.5% using the ‘re-interview’ distribution compared to 10.8% using the ‘frequency’ distribution.

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 8.9%					‘Average issue’ readership - 7.1%				
‘Re-interview’ turnover - 50.1					‘Frequency’ turnover - 25.4				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
81.5	8.7	4.6	3.1	2.1	89.2	3.1	2.3	1.0	4.4
4-issue net reach - 18.5%					4-issue net reach - 10.8%				

Reader’s Digest

For Reader’s Digest, the results from the two methodologies are more similar in terms of ‘average issue’ readership and ‘net’ reach over 4 issues. However, the ‘turnover’ calculated from the ‘frequency’ question is lower (28.3) than the ‘turnover’ calculated from the ‘re-interview’ survey (40.5).

While using the ‘frequency’ method doesn’t make a big difference when estimating Reader’s Digest’s ‘average issue’ readership, or up to the 4-issue ‘net’ reach estimate, once a schedule goes beyond 4 issues, the underestimated ‘frequency’ turnover results in a **lower** ‘net’ reach estimate of 5 or more issues – and **disadvantages** Reader’s Digest.

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 7.0%					‘Average issue’ readership - 7.9%				
‘Re-interview’ turnover - 40.5					‘Frequency’ turnover - 28.3				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
87.1	5.1	3.0	2.4	2.5	87.7	3.1	3.2	1.6	4.4
4-issue net reach - 12.9%					4-issue net reach - 12.3%				

Australian Geographic

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 4.1%					‘Average issue’ readership - 7.1%				
‘Re-interview’ turnover - 52.5					‘Frequency’ turnover - 31.9				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
91.2	4.4	2.2	1.4	0.9	88.9	2.4	3.4	2.2	3.2
4-issue net reach - 8.8%					4-issue net reach - 11.1%				

Australian Women's Weekly

Establishment Survey					'Frequency'				
'Average issue' readership - 17.6%					'Average issue' readership - 14.2%				
'Re-interview' turnover - 50.2					'Frequency' turnover - 40.1				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
63.6	16.5	9.6	6.3	3.9	74.7	8.3	7.4	4.7	5.0
4-issue net reach - 36.4%					4-issue net reach - 25.3%				

B

Establishment Survey					'Frequency'				
'Average issue' readership - 3.7%					'Average issue' readership - 1.7%				
'Re-interview' turnover - 58.6					'Frequency' turnover - 55.9				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
91.5	4.6	2.1	1.2	0.6	96.4	1.6	1.1	0.7	0.2
4-issue net reach - 8.5%					4-issue net reach - 5.6%				

Better Homes & Gardens

Establishment Survey					'Frequency'				
'Average issue' readership - 11.5%					'Average issue' readership - 10.9%				
'Re-interview' turnover - 50.7					'Frequency' turnover - 41.9				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
75.8	11.5	6.2	4.0	2.5	80.2	7.0	5.3	4.1	3.4
4-issue net reach - 24.2%					4-issue net reach - 19.8%				

Business Review Weekly

Establishment Survey					'Frequency'				
'Average issue' readership - 2.5%					'Average issue' readership - 2.6%				
'Re-interview' turnover - 63.4					'Frequency' turnover - 53.2				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
93.9	3.6	1.5	0.7	0.3	94.3	2.8	1.7	0.5	0.7
4-issue net reach - 6.1%					4-issue net reach - 5.7%				

Bulletin

Establishment Survey					'Frequency'				
'Average issue' readership - 2.7%					'Average issue' readership - 3.1%				
'Re-interview' turnover - 69.8					'Frequency' turnover - 54.2				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
92.8	4.7	1.7	0.7	0.2	93.2	3.3	2.1	0.7	0.8
4-issue net reach - 7.2%					4-issue net reach - 6.8%				

Cleo

Establishment Survey					'Frequency'				
'Average issue' readership - 5.0%					'Average issue' readership - 3.7%				
'Re-interview' turnover - 58.6					'Frequency' turnover - 49.2				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
88.5	6.3	2.9	1.6	0.8	92.5	3.2	2.0	1.4	0.8
4-issue net reach - 11.5%					4-issue net reach - 7.5%				

Cosmopolitan

Establishment Survey					'Frequency'				
'Average issue' readership - 4.7%					'Average issue' readership - 4.0%				
'Re-interview' turnover - 56.3					'Frequency' turnover - 50.6				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
89.5	5.5	2.6	1.5	0.9	91.8	3.7	2.2	1.5	0.9
4-issue net reach - 10.5%					4-issue net reach - 8.2%				

Dolly

Establishment Survey					'Frequency'				
'Average issue' readership - 3.4%					'Average issue' readership - 3.4%				
'Re-interview' turnover - 40.0					'Frequency' turnover - 35.9				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
93.8	2.5	1.4	1.1	1.2	94.3	1.7	1.4	1.4	1.3
4-issue net reach - 6.2%					4-issue net reach - 5.7%				

Elle

Establishment Survey					'Frequency'				
'Average issue' readership - 1.4%					'Average issue' readership - 0.8%				
'Re-interview' turnover - 72.0					'Frequency' turnover - 49.3				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
96.2	2.6	0.9	0.3	0.1	98.4	0.8	0.3	0.3	0.2
4-issue net reach - 3.8%					4-issue net reach - 1.6%				

Family Circle

Establishment Survey					'Frequency'				
'Average issue' readership - 3.5%					'Average issue' readership - 4.1%				
'Re-interview' turnover - 60.4					'Frequency' turnover - 45.4				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
91.7	4.7	2.1	1.1	0.5	92.2	2.9	2.3	1.5	1.1
4-issue net reach - 8.3%					4-issue net reach - 7.8%				

Financial Review Magazine

Establishment Survey					'Frequency'				
'Average issue' readership - 1.1%					'Average issue' readership - 1.3%				
'Re-interview' turnover - 64.5					'Frequency' turnover - 33.8				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
97.3	1.6	0.7	0.3	0.1	97.9	0.5	0.6	0.3	0.6
4-issue net reach - 2.7%					4-issue net reach - 2.1%				

For Me

Establishment Survey					'Frequency'				
'Average issue' readership - 3.2%					'Average issue' readership - 2.6%				
'Re-interview' turnover - 51.5					'Frequency' turnover - 41.2				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
93.2	3.3	1.7	1.1	0.7	95.3	1.8	1.1	1.0	0.8
4-issue net reach - 6.8%					4-issue net reach - 4.7%				

Girlfriend

Establishment Survey					'Frequency'				
'Average issue' readership - 2.6%					'Average issue' readership - 2.9%				
'Re-interview' turnover - 45.6					'Frequency' turnover - 36.8				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
94.9	2.3	1.2	0.9	0.8	95.1	1.4	1.2	1.3	1.0
4-issue net reach - 5.1%					4-issue net reach - 4.9%				

Good Weekend (newspaper magazine insert/supplement)

Establishment Survey					'Frequency'				
'Average issue' readership - 11.1%					'Average issue' readership - 11.0%				
'Re-interview' turnover* - 36.4					'Frequency' turnover* - 19.8				
Beta-binomial distribution (%)*					'Frequency' distribution (%)*				
0	1	2	3	4	0	1	2	3	4
68.3	11.1	7.2	6.2	7.3	75.3	4.6	4.6	3.6	11.9
4-issue net reach - 41.7%					4-issue net reach - 24.7%				

*The estimate is for NSW & VIC only as the publication is only published in these regions.

Harper's Bazaar

Establishment Survey					'Frequency'				
'Average issue' readership - 1.6%					'Average issue' readership - 0.6%				
'Re-interview' turnover - 73.3					'Frequency' turnover - 48.8				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
95.6	3.0	1.0	0.3	0.1	98.8	0.5	0.3	0.2	0.1
4-issue net reach - 4.4%					4-issue net reach - 1.2%				

Marie Claire

Establishment Survey					'Frequency'				
'Average issue' readership - 3.9%					'Average issue' readership - 1.7%				
'Re-interview' turnover - 62.3					'Frequency' turnover - 48.9				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
90.6	5.4	2.3	1.2	0.5	96.7	1.4	0.9	0.6	0.4
4-issue net reach - 9.4%					4-issue net reach - 3.3%				

National Geographic

Establishment Survey					'Frequency'				
'Average issue' readership - 4.9%					'Average issue' readership - 4.7%				
'Re-interview' turnover - 51.3					'Frequency' turnover - 38.4				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
89.6	5.0	2.6	1.7	1.1	91.6	3.0	2.4	1.0	2.0
4-issue net reach - 10.4%					4-issue net reach - 8.4%				

New Idea

Establishment Survey					'Frequency'				
'Average issue' readership - 14.8%					'Average issue' readership - 12.6%				
'Re-interview' turnover - 47.2					'Frequency' turnover - 42.7				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
70.8	12.6	7.3	5.3	4.1	76.7	8.0	7.9	3.0	4.4
4-issue net reach - 29.2%					4-issue net reach - 23.3%				

New Woman

Establishment Survey					'Frequency'				
'Average issue' readership - 2.0%					'Average issue' readership - 1.4%				
'Re-interview' turnover - 70.0					'Frequency' turnover - 49.8				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
94.7	3.5	1.2	0.5	0.2	97.1	1.3	0.7	0.5	0.3
4-issue net reach - 5.3%					4-issue net reach - 2.9%				

New Weekly

Establishment Survey					'Frequency'				
'Average issue' readership - 3.0%					'Average issue' readership - 3.2%				
'Re-interview' turnover - 57.8					'Frequency' turnover - 43.0				
Beta-binomial distribution (%)					'Frequency' distribution (%)				
0	1	2	3	4	0	1	2	3	4
93.1	3.7	1.7	1.0	0.5	93.9	2.4	1.7	0.9	1.1
4-issue net reach - 6.9%					4-issue net reach - 6.1%				

Personal Investor

Establishment Survey					'Frequency'				
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‘Average issue’ readership - 1.3%					‘Average issue’ readership - 1.1%				
‘Re-interview’ turnover - 46.9					‘Frequency’ turnover - 34.5				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
97.4	1.2	0.6	0.4	0.4	98.2	0.6	0.5	0.3	0.5
4-issue net reach - 2.6%					4-issue net reach - 1.8%				

Royal Auto

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 5.9%					‘Average issue’ readership - 7.5%				
‘Re-interview’ turnover* - 42.4					‘Frequency’ turnover* - 24.1				
Beta-binomial distribution (%)*					‘Frequency’ distribution (%)*				
0	1	2	3	4	0	1	2	3	4
55.5	18.0	11.6	8.5	6.4	57.7	8.3	8.1	9.5	16.4
4-issue net reach - 45.5%					4-issue net reach - 42.3%				

*The estimate is for Victoria only as the publication is only published in this region.

Shares

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 1.5%					‘Average issue’ readership - 1.3%				
‘Re-interview’ turnover - 47.4					‘Frequency’ turnover - 32.1				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
97.0	1.4	0.7	0.5	0.4	98.0	0.6	0.5	0.4	0.6
4-issue net reach - 3%					4-issue net reach - 2%				

She

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 1.3%					‘Average issue’ readership - 1.3%				
‘Re-interview’ turnover - 67.5					‘Frequency’ turnover - 45.4				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
96.6	2.1	0.8	0.3	0.1	97.5	1.2	0.5	0.5	0.3
4-issue net reach - 3.4%					4-issue net reach - 2.5%				

Sunday Life

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 9.5%					‘Average issue’ readership - 11.4%				
‘Re-interview’ turnover * - 39.5					‘Frequency’ turnover * - 18.5				
Beta-binomial distribution (%)*					‘Frequency’ distribution (%)*				
0	1	2	3	4	0	1	2	3	4
71.1	11.1	6.8	5.5	5.5	74.9	4.4	4.5	3.4	12.8
4-issue net reach - 28.9%					4-issue net reach - 25.1%				

*The estimate is for NSW & VIC only as the publication is only published in these regions.

That’s Life

Establishment Survey					‘Frequency’				
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‘Average issue’ readership - 9.9%					‘Average issue’ readership - 9.8%				
‘Re-interview’ turnover - 33.7					‘Frequency’ turnover - 26.1				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
83.4	5.6	3.5	3.1	4.4	84.8	4.7	2.9	1.7	5.9
4-issue net reach - 16.6%					4-issue net reach - 15.2%				

The Australian Magazine

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 5.4%					‘Average issue’ readership - 5.7%				
‘Re-interview’ turnover - 39.8					‘Frequency’ turnover - 23.0				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
90.2	3.8	2.2	1.8	2.0	91.7	2.1	1.6	1.0	3.6
4-issue net reach - 9.8%					4-issue net reach - 8.3%				

Time

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 3.0%					‘Average issue’ readership - 3.5%				
‘Re-interview’ turnover - 60.6					‘Frequency’ turnover - 47.3				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
92.9	4.0	1.8	0.9	0.4	92.8	3.4	1.9	0.7	1.2
4-issue net reach - 7.1%					4-issue net reach - 7.2%				

Vogue Australia

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 2.0%					‘Average issue’ readership - 1.6%				
‘Re-interview’ turnover - 75.1					‘Frequency’ turnover - 54.9				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
94.3	4.0	1.2	0.4	0.1	96.4	1.8	0.9	0.6	0.3
4-issue net reach - 5.7%					4-issue net reach - 3.6%				

Woman’s Day

Establishment Survey					‘Frequency’				
‘Average issue’ readership - 18.3%					‘Average issue’ readership - 15.1%				
‘Re-interview’ turnover - 42.4					‘Frequency’ turnover - 39.0				
Beta-binomial distribution (%)					‘Frequency’ distribution (%)				
0	1	2	3	4	0	1	2	3	4
66.1	13.2	8.3	6.5	6.0	73.1	9.2	8.1	3.4	6.1
4-issue net reach - 33.9%					4-issue net reach - 26.9%				

8. The New ‘Frequency’ Method

The problems associated with using frequency distributions to measure ‘average issue’ readership have long been known by Roy Morgan Research. As already discussed, in Australia, Roy Morgan Research uses an ‘establishment’ survey to estimate a publication’s readership and the ‘establishment’ survey with a ‘re-interview’ (self-completion ‘diary’) to estimate a publication’s casualness. However, for Roy Morgan surveys outside Australia (US, UK, NZ & Indonesia) there is no ‘face-to-face’ interview, and the problem was how to accurately estimate casualness figures using only a self-completion ‘diary’. Recently, this problem has been solved.

More precisely, Roy Morgan Research has developed a new ‘frequency’ method to measure casualness for magazines – see our paper ‘A New Method To Measure Media Casualness For Magazines And Newspapers’ [18]. The new method is based on *two* rather than four issues. Together with the ‘recency & first-time reading’ question (‘first-time-read in the last publication interval’), respondents are asked how many issues they read in the last *two* publications intervals, with possible answers being 0, 1 or 2+. The casualness is then computed using both the ‘recency & first-time reading’ and the new ‘frequency’ question: their combination works better than the ‘frequency’ question alone. (The readership is based on the ‘recency & first-time reading’ question). The new method has been tested and has produced casualness estimates which are similar to ‘correct’ casualness figures based on a ‘face-to-face’ interview and a ‘re-interview’. Roy Morgan Research has applied to patent this new method (See [6]), and the question is copyright. Permission to use this knowledge is given to other media researchers on the understanding that Roy Morgan Research is fully and correctly credited.

Appendix: Proof of formula (2)

The overall additional reach is computed across all pairs of issues. In the summation over all pairs, a respondent may be counted several times because there could be several pairs where he/she read one issue but not the other issue. More precisely, assume that a respondent read k issues out of m . Then there will be $k(m - k)$ pairs where this respondent read one issue but not the other issue. Hence, this respondent will be counted in the additional reach $k(m - k)$ times. The total number of pairs is $m(m - 1)$. Hence, the overall additional reach D can be computed as

$$D = \frac{\sum_{i \neq j} D_{i,j}}{m(m-1)} = \frac{\sum_{k=1}^m k(m-k)p_k}{m(m-1)} = \frac{m}{m-1} \sum_{k=1}^m \frac{k}{m} \left(1 - \frac{k}{m}\right) p_k .$$

Formula (2) is then easily obtained: casualness is equal to the ratio of D to $R(1 - R)$.

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