A NEW METHOD TO MEASURE MEDIA CASUALNESS FOR MAGAZINES AND NEWSPAPERS

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1 Summary

This paper can be briefly summarized with the following conclusions:

- An estimate of casualness (or some form of audience turnover) is essential when modelling a media's (print, TV, radio, internet etc.) reach and frequency distribution. If casualness is underestimated, reach for more than one insertion is also underestimated. This is equally important for single media or multi-media schedules.
- Casualness estimates for print media are at least as important as average issue readership estimates when computing reach and frequency estimates for a *large number of insertions*.
- A new 'frequency' question is proposed to measure a media's casualness. The new 'frequency' question produces more accurate casualness estimates than the traditional single interview 'frequency' question.
- The new 'frequency' method is a single interview version of the 're-interview' survey method, which until today has been considered the 'gold' standard for measuring casualness or *turnover*. In other words, the new method uses a single interview and obtains results which up until now were only possible with a 're-interview'.
- For daily newspapers, 'between-weeks' casualness is significantly higher than 'within-weeks' casualness. Hence, 'between-weeks' casualness for daily newspapers cannot be substituted by 'within-weeks' casualness as this would result in a significantly underestimated reach for more than one insertion.
- When a consistent readership methodology is used for the same magazines across different countries, it generally produces similar readers-per-copy and casualness estimates for the magazines across those countries.

2 Introduction

Much has been written about scheduling ad campaigns and calculation of reach and frequency distributions for magazines, newspapers, TV programs and other media. The emphasis of most previous papers has been largely on creating a methodology which produces internally consistent results (e.g. no 'negative reach', group additivity - distributions for two complementary population groups (e.g. men and women) should be reconciled with the distribution for the total population). However, what has been largely ignored is a solid and accurate method of measuring media casualness or turnover.

Media casualness is a powerful mathematical tool which can be used to model reach and frequency distributions for media schedules covering print, TV, radio, internet and other media. It is a measure of audience turnover with particular advantages over simpler measures and is defined and explained in Section 3. Casualness was invented by Christopher Fry (See References [1], [2]) in the early seventies. Since then, it was adapted and further developed by George Rennie for The Roy Morgan Research Centre (See References [3],[4]). In this paper we discuss mainly the measurement issues and present a new and, we believe, a superior method to measure casualness for magazines and weekly newspapers. Most of our results and examples will be for print media but all conclusions are applicable to TV, radio, internet and other media.

This is important as the survey method (Roy Morgan Single Source) collects information on all media - print media (magazines and newspapers), TV, radio and the internet. The casualness estimates can be used for schedules within a media or for multi-media schedules. They are currently being used in Roy Morgan multi-media schedules (See Reference [5]).

To measure casualness, one needs at least two reading or viewing or listening occasions for each respondent in the sample. The traditional measurement of casualness is based on a 'face-to-face' re-interview with the same respondent. In other words, it is the same 'face-to-face' interview conducted twice with the same respondent. Although this is the ideal form of measurement, it is too costly, especially for large samples. At Roy Morgan Research, the casualness for Australian magazines and newspapers is currently measured by a 'face-to-face' interview ('establishment' survey) and a follow-up 'diary' self-completion questionnaire using the same sample of respondents. However, for Roy Morgan multi-country surveys (presently USA, UK and New Zealand) magazine and newspaper readership and casualness estimates are being measured using only the 'diary' questions.

The challenge is therefore to compute the casualness estimates from the 'diary' survey only. The traditional 'diary' questions from which casualness can be measured are 'recency' (e.g. read in the 'last week' for weekly publications) and 'frequency' (e.g. 'number of issues read in the last four weeks' for weekly publications) questions. One problem with this approach is that 'frequency' answers are usually not reliable - respondents tend to overestimate or underestimate their frequency of reading (See References [6], [7]). As a result, the casualness computed from a 'diary' is usually much lower than the "correct" casualness based on an 'establishment' survey with a re-interview. (See Section 4 for an explanation of why casualness is lower in both cases).

We propose a new method to calculate casualness from 'recency' and 'frequency' questions: the new 'frequency' measurement is based on *two* rather than four issues. The Roy Morgan Research Centre Pty Ltd has applied to patent this new method (see Reference [8]). In addition, the questionnaire is copyright.

Together with the 'recency' question, respondents are asked how many issues they read during the last *two* time periods, with possible answers being 0, 1 or 2+. The new single interview method has been tested by Roy Morgan Research and the results presented here are significant: the new casualness estimates in most cases match the 'true' estimates obtained from the two stage 'establishment' survey and 'diary' survey method ('re-interview'), a result which up until now has not been possible to obtain using only a 'single' interview.

Casualness, together with average issue readership, is essential to modeling a media's reach and frequency distribution, and in this paper we illustrate what can happen if casualness measurements are wrong.

Another problem we discuss is the difference between 'within-weeks' casualness and 'between-weeks' casualness estimates for daily newspapers (and daily TV programs). The data suggests there is a real difference and one casualness cannot be used as a substitution for the other.

The following is a short introduction to casualness theory. The latest developments in casualness theory by Roy Morgan Research have been done in conjunction with George Rennie.

3 The Concept of Casualness

The '*additional reach*' *of two issues of a publication over one issue of a publication* is the average of the 'additional reach' 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%.

Casualness definition (in conjunction with George Rennie)
For a given family of issues of a publication, 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 were the same for all issues and if the readers of each issue in each pair of issues were independent of one another.*

To illustrate this casualness definition, assume for simplicity that there are two issues of a publication with readership figures of 10% and 12%, respectively, and also assume that 6% of respondents read both issues. Then 10% - 6%=4% of respondents read the first issue and not the second issue while 12% - 6%=6% read the second issue but not the first issue. Hence, the 'additional reach' is (4% + 6%)/2 = 5%.

The next step is to find the 'additional reach' which would be expected if: -
1) all issues had the same readership, and
2) the audience of the second issue were independent of the audience of the first issue.

The assumption that the readership is the same means that both issues would have a readership of 11% (it is assumed to be the average of 10% and 12%). If the ''second-issue" readers were independent of the ''first-issue" readers, the distribution of the 11% readership of the second issue would be the same (11%) among both readers and non-readers of the first issue. Hence, in this case 11% of the ''first-issue" readers as well as 11% of the ''first-issue" non-readers would read the second issue. The 'additional reach', therefore, in this case would be 11% of the 89% non-readers of the first issue which is 9.79% of the total. Consequently, the casualness in this example is 5% / 9.79% = 0.511 or 51.1%. (It is common to express casualness figures as percentages.)

Let R be the average issue readership (as a fraction between 0 and 1) across all issues of a publication. 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

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

where D is the (actual) average 'additional reach' of the publication.

The original definition of casualness (See References [1, 2, 4]) used only two issues with an implicit assumption that these issues have the same readership levels. The new definition is more appropriate because it removes this assumption (issues in the new casualness definition do not have to have the same readership) and because the casualness computed from several issues of a publication is more suitable for mathematical modelling of reach & frequency than that computed from just two issues. Furthermore, it agrees with the measurement of the *average issue readership*. Indeed, the readership of a publication as well as the 'additional reach' of two issues over one issue are seldom measured for two *specific* issues and are much more likely to be measured across a *range* of issues. The case when there are two issues is a particular case of the casualness definition.

The *minimum* casualness value is 0.0 and this happens only if there is no 'additional reach' for any pair of issues, that is all readers of all issues are the same. Formula (2) below shows that the absolute *maximum* casualness value is *m*/(*m* - 1) (where *m* is the total number of issues), and this happens when all respondents have the same frequency of reading. In particular, if there are two issues, the maximum casualness value is 2.0.

Although the maximum casualness value is *m*/(*m* - 1), in most practical situations casualness values are below 1.0. The reason is that any value greater than one would mean that the 'additional reach' is more than would be expected in the independent case. This means that there will be a greater than expected turnover among readers, i.e. most readers would have a 'negative loyalty' to the publication (the proportion of respondents who will read the second issue would be higher among non-readers of the first issue than among readers of the first issue). Obviously, this situation could not last for a long time.

Turnover is the most common tool media research companies use to model reach & frequency distributions. *Turnover* of a publication is defined as the ratio of the average 'additional reach' to the average issue readership. In mathematical terms,

$$\tau = \frac{D}{R},$$

where τ is *turnover*, *D* the 'additional reach' and *R* the average issue readership. Hence,

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

where γ is the casualness. In other words, *turnover* of a publication is equal to a publication's casualness times one minus readership.

The significant advantage of using casualness rather than *turnover* is that casualness can have any value from 0.0 to 1.0 independently of readership. (There are some restrictions for casualness values greater than 1.0 but, as has been discussed above, these values are infrequent in practice). On the other hand, the range of possible *turnover* values is dependent on readership.

One more significant advantage of casualness is that the casualness statistical measurement error does not depend on the readership statistical measurement error. In other words, an underestimated or overestimated readership does not necessarily imply that casualness will be wrong: it is the *relationship* between the readership and 'additional reach' which defines casualness. In comparison, a readership measurement error may have a serious implication for *turnover*. As a simple example, consider two issues of a publication with the 'true' readership of 50%. The range of possible *turnover* values is then from 0.0 to 1.0. Assume, however, that the readership estimate is 55% (so that readership is overestimated). For this estimate, the maximum additional reach would be 45% and so the maximum *turnover* value is 45% / 55% =0.818. In other words, the whole range of legitimate *turnover* values (0.818,1.0) would be excluded from consideration.

Casualness can be expressed in terms of the variance of the *exposure distribution*. (For a given number of issues, the *exposure distribution* specifies, in terms of proportions, how many people in the population will read no issues, how many will read one issue, etc.)

To obtain the formula, assume that there are *m* issues and *R* is the average issue readership proportion. Let *V* be the variance of the exposure distribution for *m* issues. Then the formula for casualness γ is the following (See Appendix 1(i) for a proof):

$$\gamma = \frac{m}{m-1} \cdot [1 - \frac{V}{m^2 R(1-R)}]. \tag{2}$$

An important point to recognize is that casualness depends on the population group. For instance, if the population is split into two groups each of which has the same casualness, it does not mean that the whole population has the same casualness. This can be illustrated by a simple example. Assume that there are two population groups each comprising 50% of the population with the same casualness of 50% and with average issues readership figures of 20% and 80%, respectively. Therefore, the total average issue readership will be

$$R = 0.5 \cdot 20\% + 0.5 \cdot 80\% = 50\%$$

The 'additional reach' *D*, as we know from formula (1) is computed by the formula

$$D = \gamma\ R(1 - R).$$

Hence, the additional reach for each of the two groups is

$$D_1 = \gamma_1 R_1(1 - R_1) = 0.5 \cdot 0.2 \cdot 0.8 = 0.08 \text{ and } D_2 = \gamma_2 R_2(1 - R_2) = 0.5 \cdot 0.8 \cdot 0.2 = 0.08$$

or 8% in both of them. Hence the total 'additional reach' is $D = 0.5 \cdot 8\% + 0.5 \cdot 8\% = 8\%$ and the total population casualness is $\gamma = 8\% / 25\% = 0.32$ or 32%.

It can be proved (see Appendix 1(ii)) that if two population groups have the same casualness then the casualness of the combined group cannot be greater than the original casualness figure and can be equal only if the two groups have the same readership. This also works in reverse. When we subdivide a population, we should expect on average that the casualness will rise. This means that the casualness has another useful property: it is a measure of *homogeneity* of the population. In a perfectly homogeneous population, the probability of reading any issue is the same for all respondents and does not depend on a population subgroup. Hence, all issues will have the same readership level and their audiences will be independent of each other -- which is why the casualness for a perfectly homogeneous population must be 100%.

This property of casualness is the reason why casualness figures for regional publications are often lower than for national publications. For a regional publication, most of its readers are in a particular area while most people outside this area are non-readers. Therefore, the total population for that publication is clearly less homogeneous than for a national publication.

Another important point is that the casualness of a publication can be different for different areas even if these areas have the same readers. For instance, for a regional publication there will be a casualness estimate for its circulation region as well as a state casualness estimate and a national casualness estimate. This is because the casualness formula uses fractions from 0 to 1, not absolute totals.

To illustrate this, assume that a state-based publication has 2,000 readers in the state in which it is circulated and that the state population is 10,000. Also suppose that for a second issue of a publication the 'additional reach' in the state is 800 respondents and that the total national population is 100,000. Then the state readership and 'additional reach' figures are

$$\frac{2{,}000}{10{,}000} = 0.2 \text{ (i.e. 20\%) and } \frac{800}{10{,}000} = 0.08 \text{ (i.e. 8\%),}$$

respectively. Hence, the state casualness is

$$\frac{0.08}{0.2(1-0.2)} = \frac{0.08}{0.16} = 0.5 \text{ or 50\%.}$$

To get the national casualness figures, we should now divide the number of readers by the total population 100,000. Consequently, the national readership is $2{,}000/100{,}000 = 0.02$ and the 'additional reach' $800/100{,}000 = 0.008$ so the national casualness is $0.008/[0.02(1-0.02)] = 0.408$ or 40.8%.

To establish the relationship between a 'regional' casualness and a 'total' casualness assume that a publication is available in an area (all readers are only from this area) and assume that we have a region which contains this area. The region could be the area itself or it could be the state where the area is located, etc. Denote the readership and casualness figures from that region by R_{reg} and γ_{reg}, respectively. Then suppose that we also have a second region which *contains* the first region; we call this a 'total' region. It could be, for instance, the whole country but, in general, it could be any area which includes the first region as a part of it. The readership and casualness figures from this 'total' region are denoted by R_{tot} and γ_{tot}, respectively. Then the following equation holds true

$$\gamma_{tot}(1-R_{tot}) = \gamma_{reg}(1-R_{reg}). \tag{3}$$

The proof of this formula is shown in Appendix 1(iii) (the formula was originally developed by George Rennie - See Reference [4]). The formula shows, for instance, that the 'total' casualness γ_{tot} can never be greater than the 'regional' casualness γ_{reg}. Indeed, if both parts of formula (3) are divided by $1-R_{tot}$, the formula becomes

$$\gamma_{tot} = \gamma_{reg} \cdot \frac{1-R_{reg}}{1-R_{tot}}.$$

Each readership figure is computed as the ratio of the number of readers in a region to the population of the region. The readers for both regions are the same when the 'total' region contains the original one. Hence, the 'total' readership R_{tot} cannot be greater than the 'regional' readership R_{reg} which means that the fraction

$$\frac{1-R_{reg}}{1-R_{tot}}$$

cannot exceed 1.0.

In general, even if a ‘regional’ publication has some readers outside its circulation area, the ‘regional’ casualness (for the circulation area) tends to be higher than the ‘total’ casualness, for that publication. This follows from the principle of homogeneity explained above: people in the circulation area are obviously more homogeneous than the total population.

4 The New Method To Measure Print Media Casualness

Before presenting the new method to measure casualness of magazines and newspapers, it is worthwhile understanding what is wrong with casualness estimates obtained by using the traditional ‘frequency’ question. The traditional ‘frequency’ question asks respondents in a single interview how many issues of a publication they read in the last four publication intervals (eg months or weeks) or out of the last four issues. It has been known for some time (See Reference W. R. Simmons’ paper [7]) that the main problem with this question is that many respondents who give a frequency of zero or one tend to *underestimate* their frequency while respondents who give a frequency of four tend to *overestimate* their frequency. In other words, regular readers who usually read most issues sometimes ‘forget’ that, for instance, in the last four weeks they read only three issues out of four. On the other hand, ‘light’ readers sometimes ‘forget’ an ‘occasional’ issue they read in the last four publication intervals. In a frequency distribution, the proportion of respondents with a frequency of one is usually underestimated while the proportion of respondents with a frequency of four is overestimated; the proportion of non-readers is also usually overestimated. In general, people overestimate the consistency of their behaviour.

What does it mean in terms of a media’s casualness estimate?

Clearly, respondents who claim to have read four issues out of four but really read only three issues will not be treated as ‘casual’ readers and hence will be excluded from the ‘additional reach’. In other words, the ‘additional reach’ will be underestimated. On the other hand, if a respondent read one issue but claims a frequency of zero, he/she is again excluded from the ‘additional reach’. Hence, *both* problems will lead to an underestimation of casualness. These arguments are also confirmed by mathematical formulae. Let $p_0, \ldots, p_4$ be the proportions of respondents with frequency $0, \ldots, 4+$, respectively. If the casualness is computed from the ‘frequency’ question only (without the ‘recency’ question), then the casualness formula is (See Appendix 1(iv)):

$$\gamma = \frac{1}{12R(1-R)} \cdot (3p_1 + 4p_2 + 3p_3), \tag{4}$$

where R is the average issue readership (from the ‘frequency’ question). The formula shows that if we correct the four issue frequency and move some respondents from p_4 to p_3 or p_2, the casualness will be increased. Similarly, if we move some respondents from p_0 to p_1 or from p_1 to p_2 (or from p_0 to p_2), the casualness will be also increased. Without these corrections, the casualness is clearly underestimated.

The implication of underestimating casualness is that the cumulative reach of a publication over a large number of issues will be underestimated.

Including the ‘recency’ question into the calculations does not solve the problem for similar reasons: respondents with recency=‘yes’ (read in the last publication interval) usually overestimate their frequency and respondents with recency=‘no’ (did not read in the last publication interval) underestimate their frequency. The ‘additional reach’ of the second issue will clearly be among respondents who did not read the first issue so casualness is again underestimated. Using various complex mathematical tools may improve the situation for some publications but not enough to get accurate estimates for all publications. The problem is further confused because different publications may require different ‘correcting’ formulae. This is obviously not acceptable from the measurement point of view.

Table 1 below compares the casualness estimates for Australian magazines computed from using the ‘establishment’ survey and the ‘diary’ survey results (i.e. ‘re-interview’) with the casualness estimates computed from using only the ‘diary’ survey results (i.e. single interview). The latter method (i.e. based only on data from the ‘diary’ survey) uses the traditional single interview ‘frequency’ question (number of issues read in the last four publication intervals) and ‘recency’ question (whether or not read in the last publication interval). In Australia, Roy Morgan Research uses both the single interview and ‘re-interview’ methods. For most publications, the casualness estimates computed from using only the ‘diary’ survey (single interview) are significantly below the casualness estimates computed using *both* the ‘establishment’ survey and ‘diary’ survey, i.e. ‘re-interview’. (Note: casualness estimates below are given as percentages.)

TABLE 1: Comparison of casualness estimates (Apr-Dec 1998)

	'Re-interview' ('Establishment' survey and 'diary')	'Old' single interview (Only 'diary': freq 0-4)	Difference
Australian Women's Weekly	62.5	65.9	-3.4
BRW	66.3	48.3	18.0
Bulletin	74.5	58.7	15.8
Cleo	65.4	56.8	8.6
Cosmopolitan	62.0	59.2	2.8
For Me	49.2	41.8	7.4
Good Weekend	41.5	26.5	15.0
Home Beautiful	75.1	60.9	14.2
National Geographic	57.6	46.9	10.7
New Idea	53.8	55.2	-1.4
New Weekly	58.2	52.0	6.2
People	58.7	44.7	14.0
Reader's Digest	47.4	39.1	8.3
She	70.3	62.3	8.0
Sunday Life	48.0	24.5	23.5
Sunday Magazine	48.4	26.4	22.0
That's Life	35.7	30.6	5.1
The Australian Magazine	36.1	26.6	9.5
TIME	63.9	42.5	21.4
TV Week	53.7	29.2	24.5
Vogue Australia	79.3	63.7	15.6
Who Weekly	56.9	51.5	5.4
Woman's Day	51.2	53.8	-2.6
Average difference			10.8
Average absolute difference			11.5

Even if we make an allowance for the fact that casualness estimates may have a high standard error (two to four percentage points is not unusual), the table clearly shows that using only the 'diary' survey underestimates the casualness for most magazines. What is even worse, the underestimation is *not evenly spread* so that even if we try to correct the 'diary' survey estimates by using a different formula, the results will still not be satisfactory.

The New Method (not an alternative but a necessity!)

We have replaced the 'four' publication intervals from the 'diary' 'frequency' question by 'two' publication intervals (number of issues read in the last 'two' publication intervals), with possible answers 0, 1 or 2+. This question, together with the 'recency' question, effectively gives us the information about readership in the last two publication intervals, from which the casualness can be computed. (The Roy Morgan Research Centre Pty Ltd has applied to patent this new method, and the question is copyright (See Reference [8]).)

The first question is, of course, why should the new method produce more reliable results? There are four main reasons for this:

1. The new frequency estimates will be more reliable because it is easier for respondents to recall more recent events (i.e. two time-periods rather than four). The improvement will be especially large for monthly and bi-monthly magazines: it is considerably easier to remember what was read in the last two months than in the last four months

2. For many respondents, their underestimated or overestimated answers for the four publication intervals become either correct or more plausible when only two publication intervals are considered. Assume, for instance, that for a weekly magazine a respondent has a frequency of zero which is underestimated and should be one. If the 'missing' reading occurred more than two weeks ago, the answer 'zero out of two' will be correct. For respondents overestimating their frequency, it will be easier to recall more recent events. Some of these respondents may even *correctly* answer 'one out of two' if they suddenly recall that they did not read a magazine during the week before last week.

3. Some of the underestimated and overestimated answers will *cancel* each other when the casualness is calculated from the new frequency distribution. To see how this happens, denote by q_0, q_1, q_2 the proportions of respondents with frequency 0, 1 and 2+, for the new frequency. Then the casualness can be computed as

$$\gamma = \frac{q_1}{2R(1-R)},$$

where R is the average issue readership. When the new frequency is two but is overestimated and should be one, the proportion q_2 is inflated while q_1 is deflated. But when the frequency is one and is underestimated, just the *opposite* happens: q_1 is inflated and q_2 is deflated. Therefore, in the overestimated case the 'additional reach' is decreased while in the underestimated case it is increased, so the errors will partially cancel each other and, in the end, the 'additional reach' will be closer to the 'true' estimate.

4. The more precise frequency of reading for each respondent also increases the precision of the average issue readership estimate. This will be especially helpful when there is a large discrepancy between readership estimates calculated from using the 'recency' question and the traditional 'frequency' question (number of issues read in the last four publication intervals).

The two-occasion or two-period measure also corresponds to the way Roy Morgan Research (and Simmons) have traditionally measured the casualness by using the 're-interview' survey method. The new two-period survey method is a single interview version of the 're-interview' survey method, which until today has been considered the 'gold' standard for measuring casualness or *turnover*.

In other words, the new method uses a single interview and obtains results which up until now were only possible with a re-interview. This obviously results in a significant survey cost-saving.

Another advantage of the new method for newspapers (TV programs) is that it allows us to distinguish between the 'within-weeks' and 'between-weeks' *cross-readership of two daily or weekly newspapers* (or cross-viewing of two TV programs). This may help to estimate parameters of a model more precisely when reach and frequency distributions are modelled.

The new 'frequency' question has been tested. In Table 2 (on the next page) we compare the new casualness estimates (obtained using the 'recency' and new 'frequency' questions) with the 'target' estimates for the same publications.

Comparing Table 2 with Table 1 shows the casualness estimates using only the single interview 'diary' survey have been considerably improved. Indeed, the average absolute difference now is 5.0% while it was 11.5% using the traditional 'frequency' method. Furthermore, the differences are now more evenly spread with fewer outliers and most differences are not statistically significant. Hence, the new 'diary' casualness estimates from a single interview closely match the estimates obtained from the face-to-face 'establishment' survey and the 'diary' survey (the 're-interview' method).

TABLE 2: Comparison of casualness estimates (Oct 1999 - Mar 2000)

	'Re-interview' ('Establishment' survey and 'diary')	'New' single interview (Only 'diary': freq 0-2)	Difference
Australian Women's Weekly	63.5	63.9	-0.4
BRW	66.3	64.0	2.3
Bulletin	72.5	70.6	1.9
Cleo	56.3	63.3	-7.0
Cosmopolitan	54.9	62.0	-7.1
For Me	56.8	56.6	0.2
Good Weekend	45.2	41.4	3.8
Home Beautiful	72.9	65.4	7.5
National Geographic	54.7	47.1	7.6
New Idea	50.8	64.7	-13.9
New Weekly	56.9	58.4	-1.5
People	64.7	63.1	1.6
Reader's Digest	44.1	41.5	2.6
She	71.8	66.3	5.5
Sunday Life	44.1	37.4	6.7
Sunday Magazine	46.8	52.0	-5.2
That's Life	36.7	41.9	-5.2
The Australian Magazine	36.2	37.8	-1.6
TIME	63.8	51.8	12.0
TV Week	53.3	43.0	10.3
Vogue Australia	73.7	68.8	4.9
Who Weekly	55.5	55.2	0.3
Woman's Day	50.2	56.9	-6.7
Average difference			0.8
Average absolute difference			5.0

The above results are significant and allow us to say that the new method of casualness measurement using a single interview and a frequency out of two outperforms the traditional single interview method (based on 'frequency' out of four). We do not claim that every estimate produced by the 'new' method will be correct: there are other measurement problems which affect the results. For instance, the well-known readership measurement problems of replication, prestige or telescoping could have an effect on casualness estimates. The 're-interview' method is, of course, not free from errors. The precision of measurement also depends on the sample size and this is especially problematic with a small readership estimate. The 'additional reach' depends on the number of 'casual' readers and, for a small readership estimate, this number could sometimes be a few respondents. In fact, the standard error for casualness is usually at least two or three times higher than the standard error for a readership estimate, a problem common to all methods of measurement. Nevertheless, all these problems do not diminish the fact that the new frequency method (number of issues read in the last two publication intervals) still produces significantly better casualness estimates than the traditional 'single' interview 'frequency' question (number of issues read in the last four publication intervals).

5 How Reach Estimates Are Affected By Casualness

Casualness, together with readership, is essential when modelling reach and frequency distributions. If casualness is underestimated, the reach for several insertions will also be underestimated. By reach here we mean the 1+ reach, that is the number of respondents who will read at least one issue out of a given number of insertions.

In the case of two issues, the total reach as we know from formula (1) is given by $R + \gamma R(1 - R)$. If, for instance, $R = 0.2$ or 20%, we can calculate the reach for several values of γ :

TABLE 3: Reach for two issues

γ	70%	60%	50%	40%	30%
reach	31.2%	29.6%	28.0%	26.4%	24.8%

In this case, therefore, when the casualness value is decreased by 10 percentage points, the total reach of two issues is decreased by 1.6 percentage points.

Underestimating casualness becomes more serious for a large number of insertions. The beta-binomial distribution is the formula which is used today to model a publication's reach and frequency (See References [9], [10], [11]). In other words, this distribution usually gives a close approximation to the 'true' population reach. We can illustrate this using a case-study. Back in 1953, Alfred Politz Research Inc. conducted a survey (See Reference [12]) to measure cumulative audiences of four USA magazines (Ladies' Home Journal, LIFE, Look and The Saturday Evening Post) and five television programs (Colgate Comedy Hour, Fireside Theatre, Red Skelton, Texaco Star Theatre and Your Show of Shows). For each of these media, there were three objectives:

1. To show the kinds and number of people reached by a single or average issue, broadcast or telecast.
2. To show the kinds and number of people reached by a series of issues, broadcasts or telecasts.
3. To show how frequently people are reached and what kinds of people they are.

The actual survey was designed in 1951 and conducted in 1952-53. Each respondent in the sample was interviewed six different times during the period. A total of 36,686 interviews with 7,141 respondents were made during this survey. The empirical data was then projected to estimate audiences of the media up to 13 issues using a mathematical model.

We will illustrate our findings by using the study estimates for LIFE magazine. The 'empirical' reach for LIFE magazine from this study was 22.1% for one issue and 32.4% for two issues. The 'additional reach' is therefore 32.4% - 22.1% = 10.3% and hence the casualness is 0.103/[0.221 * (1 - 0.221)] = 59.83%. Using this value of casualness and the readership value of 22.1%, the beta-binomial distribution can be used to project the beta-binomial reach for 13 issues of LIFE. The following table compares these results with the actual 'empirical' reach obtained from the 1953 Alfred Politz Research study (the Politz 'empirical' reach from seven to thirteen issues was estimated using a mathematical model):

TABLE 4: 'Empirical' reach versus beta-binomial reach

Audience reached by	'empirical' reach (%)	beta-binomial reach (%)
one issue	22.1	22.1
two issues	32.4	32.4
three issues	39.1	38.8
four issues	44.0	43.3
five issues	47.7	46.7
six issues	50.6	49.4
seven issues	53.0	51.6
eight issues	54.9	53.5
nine issues	56.6	55.1
ten issues	57.9	56.5
eleven issues	59.1	57.8
twelve issues	60.2	58.9
thirteen issues	61.1	59.9

Similarly, we compared the *repeat* 'empirical' audiences of LIFE with the corresponding beta-binomial simulations using the casualness estimate:

TABLE 5: 'Empirical' versus beta-binomial distribution (6 issues)

Number of issues read out of six issues	'empirical' reach (%)	beta-binomial reach (%)
One or two	29.1	26.7
Three or four	12.7	14.0
Five or six	8.8	8.7

TABLE 6: 'Empirical' (actual & modelled) versus beta-binomial distribution (13 issues)

Number of issues read out of thirteen issues	'empirical' reach (%)	beta-binomial reach (%)
One to three	30.3	28.2
Four to seven	17.6	17.5
Eight to thirteen	13.2	14.2

A practical model could be much more complicated. For instance, the model developed in the study to fit the data used a distribution at the individual level rather than at the total level. Nevertheless, even these deliberately over-simplified calculations show that the total beta-binomial distribution (using casualness) gives a good approximation to the actual data.

The Politz study also compared the accumulative audiences of LIFE with a previous study conducted in 1950. The comparison of two studies on an index basis is presented in the next table. We have done the same calculations for the index figures from both surveys: first, the empirical one issue 'index reach' and two issues 'index reach' are used to estimate the magazine casualness and then, the beta-binomial 'index reach' is computed. The results are the following (the empirical figures are from the Politz 1950 /1953 studies):

TABLE 7: 'Empirical' versus beta-binomial reach

	1950 Study		1953 Study	
Audience reached by	'empirical' reach (index)	beta-binomial reach (index)	'empirical' reach (index)	beta-binomial reach (index)
one issue	1.00	1.00	1.00	1.00
two issues	1.44	1.44	1.47	1.47
three issues	1.72	1.72	1.77	1.78
four issues	1.92	1.93	1.99	2.00
five issues	2.07	2.09	2.16	2.18
six issues	2.20	2.23	2.29	2.33

The 1950 Politz study casualness is 44% while the 1953 Politz study casualness is 47%. The table again confirms that the beta-binomial distribution (using casualness) fits the data.

It should be noted that the casualness estimate is *at least as important as the readership estimate* when calculating the reach estimate for a *large number* of insertions. To illustrate this point, Table 8 below gives the reach (as a percentage) using a beta-binomial distribution with up to fifteen insertions, for four pairs of readership and casualness values (R denotes the readership, γ denotes the casualness):

TABLE 8: The beta-binomial reach

Number of issues	R = 25%, γ = 70%	R = 25%, γ = 60%	R = 30%, γ = 60%	R = 30%, γ = 50%
1	25.0	25.0	30.0	30.0
2	38.1	36.3	42.6	40.5
3	46.5	43.1	50.0	46.5
4	52.3	47.8	55.0	50.5
5	56.7	51.4	58.7	53.4
6	60.1	54.2	61.5	55.8
7	62.9	56.5	63.8	57.7
8	65.3	58.4	65.7	59.2
9	67.2	60.0	67.4	60.6
10	68.9	61.5	68.8	61.8
11	70.4	62.7	70.0	62.8
12	71.7	63.8	71.1	63.8
13	72.8	64.8	72.0	64.6
14	73.9	65.8	72.9	65.4
15	74.8	66.6	73.7	66.0

If we assume, for example, that the 'true' readership is 25% and the 'true' casualness is 70%, then the 'true' reach for fifteen insertions is 74.8% (in the first column). In the second column, when we underestimate the casualness and use the 60% value, the fifteen-insertion reach is only 66.6%. The estimates for fifteen insertions in the third and fourth columns are even more interesting: although the readership is overestimated, the fifteen-insertion reach is lower (significantly in the fourth column and slightly in the third column) due to underestimated casualness figures!

The conclusion clearly is that the accuracy of casualness measurement is vital, especially when estimating the reach for a large number of insertions.

6 Between-Weeks and Within-Weeks Casualness

Another point of this paper is to bring attention to the difference between two types of casualness for daily newspapers: the 'between-weeks' casualness defined between days from *different weeks* and the 'within-weeks' casualness defined between days from one week. Until now most syndicated readership surveys throughout the world produce only the 'within-weeks' casualness (referred to as *turnover*) for input into print media schedules.

To measure 'between-weeks' casualness for daily newspapers, Roy Morgan Research uses an 'establishment' survey followed by a 'diary' self-completion questionnaire. In the 'establishment' survey, respondents are first asked about their day-by-day specific-issue readership of all Monday to Friday (Saturday) newspapers in the last seven days. In the 'diary' survey, the same respondents are also asked about their day-by-day specific-issue readership of the same newspapers in the last seven days. The 'week' covered by the 'diary' survey is different from the 'week' covered in the 'establishment' survey. 'Within-weeks' casualness is measured using the 'diary' week only. Different respondents are sampled in different weeks; therefore, both 'between-weeks' and 'within-weeks' casualness are measured not for a specific week or a specific pair of weeks but across *a range of weeks*.

Roy Morgan Research has applied the two-phased approach described above to measure casualness for daily newspapers in the USA. The sampling was conducted in July-November 2000. Respondents were sampled using random digit dialling. Appropriate quotas were imposed to ensure the sample was representative of the USA population.

The 'establishment' survey was actually followed by two self-completion 'diary' questionnaires which measured media usage, product usage information and respondent attitudes and opinions -- Roy Morgan Single Source (See Reference[13]).

The total sample size of respondents who returned diaries was 5,544. Respondents were projected to represent the total USA population aged 14 and over using estimates sourced from the latest USA Census. The following table shows 'between-weeks' and 'within-weeks' casualness estimates for USA daily newspapers. To derive the 'average issue' casualness, the 'average weekly' readership from the 'diary' survey was used for each respondent (as well as the 'establishment' survey readership): if, for instance, a respondent read 3 issues out of 5 during the week, his/her average weekly readership would be 3/5=0.6.

TABLE 9: 'Average issue' casualness (%)[1]

	'between-weeks'	'Within-weeks'	Difference
USA Today	70.2	40.6	29.6
Wall Street Journal	61.6	35.6	26.0
Investors Business Daily	56.9	31.7	25.2
New York Times	53.4	34.6	18.8
Los Angeles Times	50.3	22.8	27.5
Washington Post	46.6	23.6	23.0
Average	56.5	31.5	25.0

Table 9 above clearly shows that 'between-weeks' casualness estimates are significantly higher than 'within-weeks' casualness estimates. The difference between the two types of casualness estimates cannot be explained from a sampling design or a sampling error.

The tables in Appendix 3 show the two types of casualness estimates for *individual pairs of days*. The conclusion is the same - <u>for daily newspapers, 'between-weeks' casualness estimates are significantly higher than 'within-weeks' casualness estimates</u>.

The same comparison can be made with Australian data. In Table 10 below, we present 'between-weeks' casualness estimates for several Australian daily newspapers for the period July-December 1999. The estimates have been derived from the 'establishment' survey and 'diary' survey described above.

TABLE 10: 'Between-weeks' casualness for daily newspapers

	Average issue	Mon	Tue	Wed	Thu	Fri
The Australian	51.4	50.1	41.5	46.7	47.0	49.6
Financial Review	51.5	45.4	49.5	45.7	49.9	52.8
The Sydney Morning Herald	38.0	30.1	34.3	34.4	35.7	36.2
The Daily Telegraph	37.3	33.5	34.6	36.3	36.5	37.9
The Courier Mail	33.4	26.8	28.0	29.4	31.4	34.9
The West Australian	40.9	31.4	33.3	41.0	36.7	43.7
Herald Sun	36.9	31.3	36.1	34.2	34.6	38.0
The Age	39.3	34.4	31.8	33.8	32.7	40.0
The Adelaide Advertiser	34.3	27.8	26.9	31.5	28.1	33.5
The Hobart Mercury	24.1	23.0	19.8	24.5	25.1	22.0
The Examiner	17.2	14.1	15.3	16.8	14.1	17.7
The Advocate	13.5	12.4	12.4	11.0	15.1	11.0
Average casualness	34.8	30.0	30.3	32.1	32.2	34.8

Table 11 shows 'within-weeks' casualness estimates between various days for the same newspapers in the same period. The Monday to Friday average 'within-weeks' casualness (in the first column) was computed using the 'average weekly' 'diary' readership (as explained above) for each respondent. All estimates therefore in Table 11 are derived from the 'diary' survey only, *without using the 'establishment' survey*.

TABLE 11: 'Within-weeks' casualness for daily newspapers

	Average issue	Mon-Tue	Mon-Wed	Mon-Thu	Mon-Fri
The Australian	27.3	36.2	31.8	32.5	34.0
Financial Review	23.1	27.5	29.9	28.9	36.5
The Sydney Morning Herald	19.9	27.1	27.8	29.2	26.6
The Daily Telegraph	17.3	20.1	21.1	23.9	21.1
The Courier Mail	19.0	20.3	24.8	24.2	23.5
The West Australian	21.5	23.1	32.6	26.9	28.6
Herald Sun	20.3	25.6	27.6	26.8	26.7
The Age	22.8	21.5	26.1	33.2	23.7
The Adelaide Advertiser	19.2	21.5	26.8	23.0	25.5
The Hobart Mercury	14.3	18.2	18.5	20.2	21.0
The Examiner	9.7	9.8	14.0	14.0	14.2
The Advocate	7.8	10.3	9.0	11.3	11.0
Average casualness	18.5	21.8	24.2	24.5	24.4

[1] The 'between-weeks' casualness estimates have been calculated by Ron Morgan Research proprietary software ASTEROID. See Appendix 2 for further details. See also website www.roymorgan.com.

TABLE 11 (continued): 'Within-weeks' casualness for daily newspapers

	Tue-Wed	Tue-Thu	Tue-Fri	Wed-Thu	Wed-Fri	Thu-Fri
The Australian	37.6	32.0	39.8	33.1	30.1	33.7
Financial Review	23.3	20.4	31.5	28.7	31.9	28.7
The Sydney Morning Herald	23.6	19.4	22.9	25.1	24.0	22.5
The Daily Telegraph	21.2	21.7	23.0	22.2	21.1	21.1
The Courier Mail	28.0	18.7	24.9	25.7	23.7	23.1
The West Australian	30.5	17.8	23.8	29.7	31.5	24.7
Herald Sun	28.5	21.0	24.7	25.5	25.2	21.7
The Age	28.2	28.6	23.3	36.9	27.7	33.2
The Adelaide Advertiser	27.8	17.4	24.9	26.0	28.4	18.8
The Hobart Mercury	18.1	14.4	18.0	18.7	16.2	15.4
The Examiner	13.5	12.1	15.0	9.5	9.7	9.0
The Advocate	10.0	9.9	10.7	8.9	8.7	8.2
Average casualness	24.2	19.5	23.5	24.2	23.2	21.7

The above tables again show that the 'within-weeks' casualness estimates are significantly lower than the 'between-weeks' casualness estimates. In particular, the 'within-weeks' Monday-Tuesday casualness estimate (i.e. from the same week) is *not* an average of 'between-weeks' Monday-Monday and Tuesday-Tuesday estimates.

The result that 'between-weeks' casualness is significantly higher than 'within-weeks' casualness is not surprising because generally during a shorter time period more people tend to read or not read both issues than for a longer time period. There are also more reasons for a 'disruption' in reading between two weeks: for example, people might go on holidays or there could be something special in one weekly issue and not in the other one. Hence, the number of 'casual' readers between different weeks should in general be greater than within a week. Unfortunately, the result means that the 'within-weeks' casualness computed only from the 'diary' survey (or any 'single' interview) *cannot replace* the 'between-weeks' casualness. Therefore because of this *some form of a re-interview is necessary* when measuring the 'between-weeks' casualness for daily newspapers (and TV programs).

We have shown in Table 8 that underestimated casualness estimates would result in schedules producing a significantly underestimated reach for multiple issues. This conclusion is illustrated once again (this time, for USA daily newspapers) in Table 12 below which shows reach for multiple issues derived from the beta-binomial model[2], separately for 'within-weeks' and 'between-weeks' casualness:

TABLE 12: Beta-binomial reach for multiple issues (%)

	Number of issues	Reach based on within-weeks' casualness	Reach based on 'between-weeks' casualness
USA Today	2	6.7	8.0
average issue	5	9.3	13.8
readership=4.8%	10	11.2	19.0
	20	13.2	24.5
Wall Street Journal	2	3.2	3.8
average issue	5	4.4	6.3
readership=2.4%	10	5.2	8.4
	20	6.1	10.7
Investors Business Daily	2	0.8	0.9
average issue	5	1.0	1.5
readership=0.6%	10	1.2	2.0
	20	1.4	2.5
New York Times	2	3.1	3.5
average issue	5	4.1	5.4
readership=2.3%	10	5.9	7.0
	20	5.7	8.6
Los Angeles Times	2	2.4	3.0
average issue	5	3.0	4.5
readership=2.0%	10	3.4	5.8
	20	3.8	7.0
Washington Post	2	1.6	1.9
average issue	5	2.0	2.8
readership=1.3%	10	2.3	3.5
	20	2.5	4.3

[2] Roy Morgan Research software ASTEROID can also calculate reach & frequency estimates. For one publication at a time, these estimates are closed to beta-binomial reach estimates: see Appendix 4 for a comparison.

The value of advertising in a newspaper is determined by the reach obtained by one or more insertions in that newspaper. The above table makes it clear that this value can be strongly affected by the choice of casualness. For example, to reach 6% of the population using The Wall Street Journal, one needs more than ten insertions if the model is based on the 'within-weeks' casualness (more precisely, eighteen insertions are required). However, if the model is based on the 'between-weeks' casualness, more than 6% of the population will be reached after only five insertions!

The cost per thousand readers reached is obviously very different depending on a newspaper's 'average issue' readership and which casualness is used. Because of this, the correct measurement of casualness (as well as average issue readership) is crucial for any advertising campaign.

The above results may look obvious and a reader of this paper may wonder why we have spent so much time and space trying to prove a 'self-evident' conclusion. However, unfortunately, many media research companies (and industry bodies) who conduct newspaper readership surveys use only

1)'one-week' data, and
2) 'within-weeks' casualness rather than 'between-weeks' casualness,
to estimate daily newspapers reach and frequency for multiple issues covering more than one week. Even if casualness is not explicitly used in the model, the model will significantly underestimate a newspaper's reach if only 'one-week' data is used.

The same idea that casualness depends on the time interval becomes even clearer for TV (or radio) media. For a TV (or radio) program, there are *two* types of 'within-weeks' casualness: one is between two different days within a week and the other is the so-called 'within-episode' casualness measured between two advertisements shown in the one episode. The reason for the latter casualness is that each TV (or radio) program may have several ads during the same episode. Assume that program ratings are measured by quarter hour time slots - for each respondent, there is a 'yes'/'no' answer for each 15-minute interval. For many programs, the number of within-episode 'casual' viewers (i.e. respondents who watched some time slots and did not watch the other ones) will be relatively small due to the fact that people tend to watch the whole program (and answer 'yes' to all time slots) if it is interesting and not very long. On the other hand, people are less likely to watch the same program twice during different days so that there will be more 'casual' viewers between two days. For most programs, therefore, the 'within-episode' casualness is significantly lower than the 'between-days' casualness. There could be programs where the 'within-episode' casualness is relatively high. For instance, for a seven-hour long cricket match very few people would watch it for the full seven hours, which means that many viewers are 'casual' viewers of the program.

It is possible, of course, to measure program ratings for different time slots or continuously by meters. But it is still true that, in general, casualness figures between two different days tend to be higher than casualness figures between two time periods from the same day, for the same TV program.

7 Consistency Of Measurement Is Also Important

Roy Morgan Research readership and casualness estimates are now available in the USA, Australia and New Zealand (and will soon be available in the UK). We have discovered that, when a consistent measurement method is used for the same magazines in different markets, similar readership patterns emerge across those markets. We illustrate this conclusion for reader-per-copy estimates as well as for casualness estimates for different magazines in the USA, Australia and New Zealand.

7.1 Pitfalls of International Market Measurement

Most of us know that we cannot equate a USA dollar to an Australian dollar -- any Australian travelling in the USA does so at their peril.

Most also know that the US gallon is not the same as an Imperial gallon; a US ton is not the same as a tonne.

But how many organisations operating across different countries are unaware of the less obvious or less easily defined differences that can distort their perspective?

The following example is from the media market (most companies operating internationally make media decisions in countries outside their own).

If we look at the readers-per-copy of two well-known magazines in three markets - using the local readership currency - we would believe that magazines are ''passed-on" to a lot more people in the USA and NZ than Australia. For instance, an average copy of People is read by 9.8 people aged 18+ in the USA, and the same magazine (called Who in Australia and New Zealand) is read by 8.5 people aged 20+ in New Zealand, but only 4.3 people aged 18+ in Australia.

Similarly, an average copy of Reader's Digest is read by 3.9 people aged 20+ in NZ, 3.4 people aged 18+ in the USA and only 2.4 peopled aged 18+ in Australia.

Similar differences are shown for Cosmopolitan, TIME and Newsweek in Table 13 below.

TABLE 13: Readership currency reader-per-copy estimates across countries

Magazine	Australia RMR (18+)	New Zealand Nielsen (20+)	USA MRI (18+)
People/Who[3]	4.3	8.5	9.8
Reader's Digest	2.4	3.9	3.4
Cosmopolitan	3.0	n/a	6.1
TIME	3.4	5.7	5.1
Newsweek/Bulletin[4]	4.0	n/a	6.1

However, Table 14 below shows that when Roy Morgan Research applies the same measurement methodology across the different countries, the differences all but disappear.

People (or Who) has readers-per-copy, aged 18 and over of 4.3 in Australia, 4.7 in New Zealand, and 4.4 in the USA; and Reader's Digest has readers-per-copy of 2.4, 2.5 and 2.9 respectively. TIME has readers-per-copy aged 18 and over of 3.4 in Australia, 3.7 in New Zealand and 4.3 in the USA. A similar pattern of result is shown for Newsweek with slightly higher readers-per-copy in the USA (5.1) than Australia (4.0).

In other words, when we apply a consistent proven methodology to different markets comparing the same magazines, we discover that they attract very similar readers-per-copy despite the market-place differences. Common sense would say this is correct.

TABLE 14: Roy Morgan Research readers-per-copy (18+) estimates across countries

Magazine	Australia	New Zealand	USA[5]
People / Who[3]	4.3	4.7	4.4
Reader's Digest	2.4	2.5	2.9
Cosmopolitan	3.0	3.5	3.4
TIME	3.4	3.7	4.3
Newsweek/Bulletin[4]	4.0	Not published	5.1

Readers-per-copy estimates calculated as:

$$\frac{\text{Average issue readership}}{\text{Published audited circulation figures}}.$$

The reasons for the differences between Roy Morgan Research estimates and those of Nielsen and MRI are the subject of other papers, but are primarily due to replicated reading using the 'recency' method and questionnaire confusion.

The critical point for anyone wanting to understand their industry across markets is that there are traps for the unwary in just taking local measures at face value, and drawing conclusions outside the local arena.

Source:

Australia: Roy Morgan Research Jan-Dec 2000, 49,589 (18+)
Circulation: Jul-Dec 2000

New Zealand: Roy Morgan Research Jan-Dec 2000, 14,454 (18+)
Nielsen Jul 99-Jun 00, 11,097 (15+), 10,299 (20+)
Circulation: Jul-Dec 2000

United States: Roy Morgan Research Jul- Nov 2000, 5,238 (18+)
MRI Fall 2000
Circulation: Jul Dec 2000

[3] In Australia and new Zealand, People is Who
[4] In Australia, Newsweek is included in The Bulletin
[5] Based on a final USA sample of 5,238 respondents aged 18+. Total USA sample 14+ : 5,544.

7.2 Casualness Estimates Across Different Countries

Table 15 below compares casualness estimates for similar magazines in the USA, Australia and New Zealand. All estimates are based on the new 'recency' and 'frequency' questions from the Roy Morgan self-completion 'diary' survey: July-November 2000 database for the USA and July-December 2000 database for Australia and New Zealand.

TABLE 15: Casualness estimates (%) across countries

	Country		
	USA	Australia	New Zealand
Better Homes & Gardens	54.8	61.7	54.7
Cosmopolitan	47.4	61.5	61.9
Family Circle	49.6	59.5	62.7
Marie Claire	68.8	62.1	60.9
National Geographic	39.1	44.5	41.9
New Woman	60.2	66.0	not available
Newsweek/Bulletin[6]	52.2	75.2	63.6
People/Who[7]	61.0	57.7	49.1
Reader's Digest	44.9	41.2	42.8
TIME	55.7	54.7	39.5
TV Week/TV Guide[8]	42.1	43.6	36.6
Vogue[9]	52.5	69.7	68.6

As can be seen similar publications tend to have similar casualness estimates across different countries. There are several reasons which explain the few casualness differences. For instance, the lower casualness estimates for Cosmopolitan, Family Circle and Vogue in the USA are due to a significantly higher proportion of subscribers for these publications in the USA than in Australia and New Zealand.

There are several reasons which explain why there is a lower casualness estimate for TIME in New Zealand than in the USA and Australia. The USA TIME is one of the leading current affairs magazine covering mainly local USA issues and international issues related to the USA (i.e. TIME in the USA has a wide appeal). In Australia and New Zealand, TIME is predominantly an international current affairs publication with limited editorial coverage of local issues. The highest proportion of TIME readers is in the AB quintile. TIME's AB readership is much higher in New Zealand (9%) than in Australia (4%) (although TIME's AB readership is even higher in the USA (13%)). This means that it is more difficult to 'reach' more AB readers interested in international current affairs in New Zealand than in Australia which implies lower casualness.

TIME's casualness in Australia (54.7%) is lower than the casualness for The Bulletin (with a limited editorial from Newsweek) (75.2%) because The Bulletin mainly covers Australian current affairs and has a wider appeal than Australian TIME.

TIME's casualness in the USA (55.7%) is also lower than the casualness for The Bulletin in Australia. This is because the average issue readership of The Bulletin in Australia (measured by the full 'through-the-book' method) is 2% (66% men) while TIME's readership in the USA is significantly higher - 8% (54% men).

Appendix 1: Mathematical Proofs

(i) Casualness in terms of variance of the exposure distribution:

Let p_k be the proportion of people who read *k* issues out of *m*, $k = 1, \ldots, m$, where *m* is the total number of issues. For a pair of issues (*i, j*), denote by $D_{i,j}$ the 'additional reach' and by $T_{i,j}$ the proportion of people who read both issues *i* and *j*. For each issue *i*, denote by R_i its readership. Then

$$D_{i,j} = \frac{1}{2}(R_i + R_j) - T_{i,j}.$$

First, the sum $\sum_{i \neq j} T_{i,j}$ will be computed. Clearly, if a person's frequency of reading is zero or one, he/she will not read any two issues and hence will not appear in this sum. However, if the person's frequency of reading two or more, he/she will appear in this sum several times. More precisely, if the person read $k \geq 2$ issues out of *m*, he/she will appear $k(k-1)$ times (number of different pairs out of *k* elements) in $\sum_{i \neq j} T_{i,j}$.

[6] In Australia, Newsweek is included in The Bulletin
[7] In Australia and New Zealand, People is Who
[8] TV Week in Australia and TV Guide in the USA and New Zealand
[9] Australia edition of Vogue in New Zealand

Therefore,

$$\sum_{i\neq j} T_{i,j} = \sum_{k=2}^{m} k(k-1)p_k = \sum_{k=1}^{m} k^2 p_k - \sum_{k=1}^{m} kp_k$$

$$= \sum_{k=1}^{m} k^2 p_k - (\sum_{k=1}^{m} kp_k)^2 + (\sum_{k=1}^{m} kp_k)^2 - \sum_{k=1}^{m} kp_k = V + (mR)^2 - mR,$$

where V is the variance of the exposure distribution. Hence, the average 'additional reach' D is

$$D = \frac{1}{m(m-1)}\sum_{i\neq j} D_{i,j} = \frac{1}{m(m-1)}[\sum_{i\neq j}\frac{1}{2}(R_i + R_j) - \sum_{i\neq j} T_{i,j}]$$

$$= \frac{1}{m(m-1)}[m(m-1)R - V - m^2R^2 + mR]$$

$$= \frac{1}{m(m-1)}[m^2R - m^2R^2 - V] = \frac{m}{m-1}[R(1-R) - \frac{V}{m^2}]$$

and so the casualness is

$$\gamma = \frac{D}{R(1-R)} = \frac{m}{m-1}[1 - \frac{V}{m^2R(1-R)}]$$

(ii) If two groups have the same casualness γ, the casualness for the combined group cannot exceed γ :

Let R_1 and R_2 be the readership figures in the first and second group, respectively. Denote by D_1 and D_2 the corresponding 'additional reach' figures and by λ the proportion of the first group in the combined group. Then the combined readership is $R = \lambda R_1 + (1-\lambda)R_2$, while the combined 'additional reach' is $D = \lambda D_1 + (1-\lambda)D_2$. Expressing the 'additional reach' in terms of casualness, we obtain

$$D = \lambda\gamma\, R_1(1-R_1) + (1+\lambda)\gamma\, R_2(1-R_2) = \gamma[R - (\lambda R_1^2 + (1-\lambda)R_2^2)].$$

Straightforward calculations show that

$$\lambda R_1^2 + (1-\lambda)R_2^2 - R^2 = \lambda(1-\lambda)(R_1 - R_2)^2 \geq 0.$$

Hence,

$$\lambda R_1^2 + (1-\lambda)R_2^2 \geq R^2$$

and so

$$D \leq \gamma[R - R^2].$$

Then the total casualness is

$$\frac{D}{R-R^2} \leq \gamma.$$

The equality will be only when $\lambda R_1^2 + (1-\lambda)R_2^2 = R^2 or\ R_1 = R_2$

(iii) The relationship between the 'regional' and 'total casualness:

From formula (1),

$$\gamma = (D / R) / (1-R)$$

Notice that for both the 'regional' and 'total' casualness the expression D/R will be the same. Indeed, it is simply the ratio of the number of people who constitute the 'additional reach' to the number of readers (after the numerator and denominator have been multiplied by the total population), and by construction, the readers are the same for both regions. Therefore, if we consider the ratio of the 'regional' casualness to the 'total' casualness, the expression D/R will be cancelled so that

$$\frac{\gamma_{reg}}{\gamma_{tot}} = \frac{1/1(1-R_{reg})}{1/(1-R_{tot})} = \frac{1-R_{tot}}{1-R_{reg}},$$

from which equation (3) is easily obtained by the cross-multiplication.

(iv) The casualness formula based on 'frequency' (notations are as in (i)):

$$
\begin{aligned}
\gamma &= \frac{1}{R(1-R)} \cdot \frac{1}{m(m-1)} [\sum_{i \neq j} \frac{1}{2}(R_i + R_j) - \sum_{i \neq j} T_{i,j}] \\
&= \frac{1}{m(m-1)R(1-R)} . [m(m-1)R - \sum_{i=1}^{m} k(k-1) p_k] \\
&= \frac{1}{m(m-1)R(1-R)} . [m(m-1) \sum_{k=1}^{m} (k/m) p_k - \sum_{k=1}^{m} k(k-1) p_k] \\
&= \frac{1}{m(m-1)R(1-R)} . \sum_{k=1}^{m} ((m-1)k - k(k-1)) p_k = \frac{1}{m(m-1)R(1-R)} . \sum_{k=1}^{m} k(m-k) p_k .
\end{aligned}
$$

In other words,

$$\gamma = \frac{1}{m(m-1)R(1-R)} \ . \ [(m-1)p_1 + 2(m-2)p_2 + ... + (m-2)2p_{m-2} + (m-1)p_{m-1}].$$

To illustrate this formula, assume for instance that m=4. Then the formula is

$$\gamma = \frac{1}{12R(1-R)} . [3p_1 + 4p_2 + 3p_3].$$

Appendix 2: 'Between-weeks' casualness estimates computed by ASTEROID.

The 'between-weeks' casualness is measured by Roy Morgan Research using readership data from the 'diary' questionnaire and the original 'establishment' survey. However, this 'direct' measurement approach would not be recommended to apply *for all subsamples*, in particular those that are small. For small subsamples, statistical calculations from a 'direct' measurement become unreliable and result in casualness estimates which are very volatile -- sometimes too low, sometimes too high. Roy Morgan Research has developed a much better method which 'smooths' casualness calculations and produces 'sensible' casualness estimates even for small subsamples.

This method involves a sophisticated mathematical procedure to estimate respondent 'loyalties' which are individual probabilities to read each publication surveyed. The 'loyalties' are generated using the available readership data as well as all other available information (demographics, attitudinal statements, general reading/viewing/listening habits, etc.) These 'loyalties' are computed and stored separately for each publication. The same respondent usually has different 'loyalties' for different publications.

ASTEROID calculates '*between-weeks*' *casualness using the data from the* '*diary*' *questionnaire and respondents*' '*loyalties*' Once loyalties have been generated, they are calibrated so the total population casualness computed from loyalties and the 'diary' questionnaire data is the same as the 'true' casualness calculated from the 'diary' questionnaire and the original 'establishment' survey. The calibrated loyalties, together with the 'diary' questionnaire readership estimates, are then used by ASTEROID to compute casualness estimates for any subsample.

Respondent loyalties introduce a 'smoothing' factor in estimating a newspaper's casualness figures. This allows an ASTEROID user to obtain more reliable casualness estimates even for subsamples with a small size.

For details of ASTEROID, see website www.roymorgan.com

Appendix 3: Casualness estimates for USA daily newspapers

TABLE 16: 'Between-weeks' casualness for individual days (%)

	Mon-Mon	Tue-Tue	Wed-Wed	Thu-Thu	Fri-Fri	Sat-Sat
USA Today	70.6	70.9	71.7	69.7	70.9	
Wall Street Journal	60.9	62.9	64.4	59.7	61.5	
Investors Business Daily	65.1	52.5	53.3	59.2	55.0	
New York Times	54.1	51.0	52.4	51.4	54.1	60.6
Los Angeles Times	49.3	49.1	51.8	51.6	50.3	51.5
Washington Post	51.5	43.7	47.7	46.7	45.1	42.0

TABLE 17: 'Within-weeks' casualness for individual days (%)

	Mon-Tue	Mon-Wed	Mon-Thu	Mon-Fri	Mon-Sat
USA Today	43.1	40.9	36.4	41.6	
Wall Street Journal	38.2	32.8	35.8	35.9	
Investors Business Daily	38.6	36.3	33.0	41.3	
New York Times	36.1	33.9	32.9	31.2	48.5
Los Angeles Times	24.0	21.3	24.0	27.5	25.5
Washington Post	15.7	25.5	15.3	18.5	38.7

TABLE 17 (continued): 'Within-weeks' casualness for individual days (%)

	Tue-Wed	Tue-Thu	Tue-Fri	Tue-Sat	Wed-Thu
USA Today	39.9	32.3	44.7		36.8
Wall Street Journal	37.7	31.2	35.0		38.6
Investors Business Daily	24.2	26.5	29.5		26.4
New York Times	31.4	24.9	27.5	46.1	27.3
Los Angeles Times	20.0	14.8	22.3	26.7	19.1
Washington Post	18.0	12.1	15.3	34.6	20.2

TABLE 17 (continued): 'Within-weeks' casualness for individual days (%)

	Wed-Fri	Wed-Sat	Thu-Fri	Thu-Sat	Fri-Sat
USA Today	46.3		42.5		
Wall Street Journal	32.8		38.4		
Investors Business Daily	27.4		31.4		
New York Times	28.4	46.5	24.5	41.4	41.4
Los Angeles Times	21.3	25.3	17.8	24.0	26.8
Washington Post	20.3	39.9	13.9	31.8	30.3

Appendix 4: Beta-binomial model and ASTEROID model.

The ASTEROID reach & frequency model[10] is very complex and involves, in particular, assessment of respondents' probabilities to read a publication as well as several other advanced mathematical procedures. However, we illustrate in Table 18 below that *for one publication at a time*, the ASTEROID model produces reach estimates for multiple issues very close to the corresponding beta-binomial reach estimates. (To calculate a beta-binomial distribution, it is enough to have just two numbers: readership and casualness.) The illustration is done for USA daily newspapers:

[10] For details of ASTEROID, see website www.roymorgan.com

TABLE 18: Beta-binomial reach[11] versus reach from ASTEROID (%)

	Number of issues	Reach	
		beta-binomial	from ASTEROID
USA Today	2	8.0	8.0
average issue	5	13.8	13.9
readership=4.8%	10	19.0	19.1
	20	24.5	24.6
Wall Street Journal	2	3.8	3.8
average issue	5	6.3	6.3
readership=2.4%	10	8.4	8.5
	20	10.7	10.7
Investors Business Daily	2	0.9	1.0
average issue	5	1.5	1.5
readership=0.6%	10	2.0	2.1
	20	2.5	2.6
New York Times	2	3.5	3.6
average issue	5	5.4	5.5
readership=2.3%	10	7.0	7.2
	20	8.6	8.8
Los Angeles Times	2	3.0	3.0
average issue	5	4.5	4.6
readership=2.0%	10	5.8	5.8
	20	7.0	7.2
Washington Post	2	1.9	2.0
average issue	5	2.8	2.9
readership=1.3%	10	3.5	3.7
	20	4.3	4.4

The advantage of the ASTEROID model is that it can evaluate schedules consisting of multiple issues of *several publications*. In this case, the resulting exposure distribution is not necessarily beta-binomial.

Note that ASTEROID can deal both with 'between-weeks' and 'within-weeks' casualness. For example, for a daily newspaper, ASTEROID can run schedules for each individual day as well as for the 'average issue' readership. The 'average issue' readership is estimated using the day-by-day readership data. (For a daily newspaper, Roy Morgan Research collects readership data for each day of the week). The 'average issue' readership estimate is then considered as a separate (weekly) publication.

The 'between-weeks' casualness (which is regularly measured) is used to run schedules for the 'average issue' readership. Thus, if there are several 'average issues' of a newspaper, ASTEROID will put each issue into a different week and will use the 'between-weeks' casualness.

To run a schedule for several advertisements within a particular week, a user of ASTEROID has to choose individual days; ASTEROID will then run this schedule using *actual data* for each day: Roy Morgan Research collects readership data for each individual day.

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