# CONTENTS

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can You Trust Perceptual Maps?</td>
<td>3</td>
</tr>
<tr>
<td>Ross Bowden</td>
<td></td>
</tr>
<tr>
<td>Factors Driving the Diffusion of Market Research in East Asia</td>
<td>26</td>
</tr>
<tr>
<td>Al Marshall</td>
<td></td>
</tr>
<tr>
<td>Five Point Vs. Eleven Point Scales: Does It Make a Difference to Data Characteristics?</td>
<td>39</td>
</tr>
<tr>
<td>John Dawes</td>
<td></td>
</tr>
</tbody>
</table>
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All papers for submission should be sent to

Professor Lester W. Johnson
Editor, AJMR
Mt. Eliza Business School
P.O. Box 7262 St Kilda Road Post Office
Melbourne Victoria 3004
Australia

All business enquiries and requests for additional copies should be sent to

The Market Research Society of Australia
P.O. Box 697
North Sydney, NSW 2059
Phone 02 9955 4830
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CAN YOU TRUST PERCEPTUAL MAPS?

Ross Bowden
Western Power Corporation

Perceptual maps (McDonald and Vangelder (1998), Bagozzi (1994) and Lilien and Rangaswamy (1998)) are commonly used in the analysis of survey data to represent the relationship between brands or organisations and values or characteristics as described by respondents. The aim of perceptual maps is to present these relationships visually so that:

- The data analyst can investigate and assess these relationships; and
- The analyst can present these patterns to clients in a form that is as simple as possible.

Perceptual maps are often prepared using so-called correspondence analysis which is a way of visually presenting the dominant patterns in a cross-tabulations table. The graphical nature of perceptual maps is particularly appealing both for analysis and presentation. In this regard, correspondence analysis allows the patterns in a table of cross-tabulated frequencies to be approximated by the interaction between points in a simple two-dimensional plot. Excellent introductions to correspondence analysis can be found in Greenacre (1984) and (1993), Weller and Romney (1990) and Hoffman and Franke (1986).

Unfortunately it is my experience that perceptual maps (using correspondence analysis) are often produced without regard to whether the differences shown on the maps are statistically significant i.e. do the distances between points occur purely from random chance alone without any other influence. We will use a recently developed statistical technique called bootstrapping to investigate the statistical uncertainty in perceptual maps. Bootstrapping is a vehicle for investigating the statistical properties of research models without recourse to “challenging” mathematical methods.

Bootstrapping was first developed by Efron (1979) as an extension of the ‘jackknife’ and has been used extensively in statistical analyses that would normally involve significant problems in mathematical statistics. Excellent review papers are available in Leger et al (1992), Efron and Tibshirani (1986), Diciccio and Romano (1988) and Hinkley (1988) with an early text being Efron (1982). Bootstrapping has the very appealing property that it requires very little ‘statistics’ on the part of the user to appreciate its considerable usefulness and potential applications. Indeed it is quite straightforward to implement with the appropriate programming environment.

In Section 1 of this paper, perceptual maps in the context of correspondence analysis will be reviewed and applied to the analysis of data on home ownership and income. Section 2 will introduce the bootstrap as a way of assessing the reliability of any model fit and a simple example will be explored using electricity consumption data. Section 3 combines perceptual mapping and bootstrapping in revealing the stability of the correspondence analysis symmetric plots of the row and column entities.

1 Address for Correspondence: Ross Bowden, Market Research Manager, Western Power Corporation, 363 Wellington St, Perth, 6000, Western Australia. Email: ross.bowden@wpcorp.com.au
1. CORRESPONDENCE ANALYSIS

Correspondence analysis is very similar to principal components analysis. In principal components analysis (PCA), the aim is to represent a large number of variables by a much smaller number of dimensions. In order to plot the results in a scatterplot, the total space occupied by the variables must be shrunk into two dimensions only.

Principal Components Analysis

To revise PCA, the variables in the original data are re-configured using matrix methods to produce new variables or components. The new components, which are weighted sums of the original (standardised) variables, are derived so that:

- They have zero mean;
- The first component explains as much as possible of the variation in the original dataset i.e. its variance is made as large as possible;
- The second component is similarly derived except that it must have zero correlation with the first component;
- And so on for subsequent components.

The (two) correlations between each of the original variables and the first two derived components can then be plotted as paired coordinates for each of the original variables. This gives some idea of the correlations between the original variables. Variables that are close together tend to have a strong relationship.

An alternative approach yielding complementary outcomes is to take the paired scores for each of the first two components and plot the scores one against the other. This gives a two-dimensional representation of the rows of the data. Points that are close together indicate that the respective rows, i.e. data points, have similar values.

PCA progressively fits a point, a line, a plane and then hyperplanes (planes in greater than two dimensions) to the data. Typically, as discussed above, we only use the PCA representation in a simple plane i.e. in two dimensions. The new plane is derived to maximise how closely it matches the raw data using a criterion of the sum of the squared distances between the plane and the points. This plane forms the scatterplot surface on which the original data points are plotted.

Correspondence Analysis Assumptions

The mechanics of correspondence analysis are not exactly the same as those of PCA but the general procedure is similar. The original variables are the so-called row or column profiles from a cross-tabulations table. These are simply the percentages of occurrence of each cell in the table but they are presented such that they add to 100% across the rows or columns depending on whether the rows or columns are being analysed. Note that this eliminates the size of the sample from the analysis because we are dealing with relative frequencies only. Hence, the derived percentages could have been produced from any total sample size.

For say the rows, the row profiles are taken as the data points to be analysed and each column contributes a dimension to the data i.e. they become the variables of interest. Hence if there are ten rows and five columns then there are five dimensions or variables to be analysed for the ten rows. The distance between these points could be
taken to be the usual squared distance as in PCA but there is a more natural measure. This is the so-called ‘chi-squared’ distance. It is not necessary to define this explicitly in this paper but it totals across all points to the well-known chi-squared statistic which is a measure of the independence in the table.

The chi-squared test of independence statistic can be shown to measure whether the row profiles differ from each other. This turns out to be the same as measuring whether the column profiles differ from each other also. Further it equates to testing whether the row profiles differ significantly from the average row profile for the whole table (i.e. the so-called marginal total proportions shown at the bottom of each column) and similarly for column profiles.

So that the sum of all the distances between the data points, say the row profiles, and the average row profile adds up to the chi-squared statistic, the new variables (i.e. the column values in each row profile) are weighted by the proportion of total observations in each column. Similarly each row profile (i.e. the data points for our analysis) is inversely weighted by the proportion of observations in each row. This implies that rows and columns with smaller numbers of observations have a disproportionate effect on the analysis.

If we could plot the result of these re-weightings, each row profile would appear as a point in some multi-dimensional space with as many dimensions as there are columns. However the distances between these points would be re-calculated depending on the weights for each of the dimensions (i.e. the columns) and for each point (i.e. the row profile as a list of proportions summing to one). It can be shown that if two row profiles are similar then the re-weighted points tend to be close together in the new distance measure.

A similar description applies to the analysis of the relative frequencies for each column (column profiles) where the rows represent variables and the columns are the data points. Weighting of the data proceeds in a parallel fashion.

Correspondence analysis attempts to represent the re-weighted points for, say the rows, in as small a number of dimensions as possible - just as with PCA. At the same time, correspondence analysis attempts to preserve the chi-squared distances as closely as possible in the new representation. This allows the preparation of a simplified single point (for use in, say, a scatterplot) for each row profile. This profile could relate to a brand or organisation depending on what the rows represent.

After a point has been plotted for each row, the same process is carried out for the column profiles and, depending on what algorithm has been used to derive the solution, the associated points can be plotted on the same graph. If two characteristics or entities, say the points for two rows, are close together in the scatterplot then, as stated above, the rows can be said to have similar profiles in the original data table.

**Assessment of the Correspondence Analysis Model**

A summary would be helpful of how effective is the two-dimensional representation of the rows and column profiles. Obviously the representation can’t be perfect unless we are very fortunate. A measure of the fit is provided by the amount

---

3 This is not strictly true because each row profile adds up to one and hence all the profiles exist in a number of dimensions that is one less than the number of columns.
(% of the total chi-squared statistics (i.e. the total chi-squared distance) that the flat two-dimensional representation has preserved. This measure is typically available from the model fit and should be close to 80% or thereabouts for an accurate representation of the cross-tabulations table.

With standard statistical analysis there remains the question of whether the patterns from the model fitting are ‘significant’, whatever the model may be. In this case, the patterns are the distances, or rather the differences, shown in the perceptual plot. The question here is ‘Which of these differences are the result of the random nature of the data and which are the result of some inherent lack of independence between the rows and/or the columns?’. In other words, is the spread of certain points real or only apparent?

Standard correspondence analysis methodology requires that users check that the data passes the chi-squared test of independence before proceeding. That is, before the data is submitted to a correspondence analysis, the analyst should ensure that the data does in fact contain significant differences before attempting to explore them further. However:

- Even, if the test indicates that the data are not independent, it is still unclear how to assess which of the row or column profiles are the atypical entities;
- Often the analyst proceeds straight to the perceptual map due to lack of time or through an oversight. In this case a graphical indication of which entities are really atypical would be very helpful.

- Some indication of the instability in the points representation would be informative in using the perceptual map.
- The correspondence analysis projection onto a scatterplot contains no indication of the effect of the sample size involved.

Mathematical statistics can be used in many circumstances to assess the variability in fitted models. For example the standard deviation of the sample mean can be readily shown using mathematical statistics to be the standard deviation of the individual data points divided by the square root of the number of points. However in many cases it is not possible to theoretically derive a rigorous measure of the variability or distribution of the elements of the fitted model. Moreover the mathematical statistics involved are often quite “deep” and are difficult for a non-statistician to follow and use.

An Example involving Home Ownership and Income

Let us examine the problem of variability in connection with survey data on home ownership, age structure of the senior householder and household income. This data is from a survey undertaken in Perth in the 1990’s and can be summarised in the following cross-tabulations. The set of variables is of some importance to marketers in that it is often more difficult to sell household improvements and certain appliances to “renters” than other household types.

The raw cross-tabulations data is shown in the following table.
### Cross-Tabulations of Home Ownership, Age and Income

<table>
<thead>
<tr>
<th>Home Ownership</th>
<th>Age Group</th>
<th>$0K to $30K</th>
<th>$30K to $70K</th>
<th>$70K+</th>
<th>Refused</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renting</td>
<td>18-34</td>
<td>96</td>
<td>99</td>
<td>108</td>
<td>113</td>
<td>416</td>
</tr>
<tr>
<td></td>
<td>35-44</td>
<td>57</td>
<td>51</td>
<td>39</td>
<td>64</td>
<td>211</td>
</tr>
<tr>
<td></td>
<td>45-54</td>
<td>43</td>
<td>28</td>
<td>25</td>
<td>31</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td>55+</td>
<td>124</td>
<td>13</td>
<td>9</td>
<td>83</td>
<td>229</td>
</tr>
<tr>
<td>Owner Occupier</td>
<td>18-34</td>
<td>96</td>
<td>220</td>
<td>324</td>
<td>115</td>
<td>755</td>
</tr>
<tr>
<td></td>
<td>35-44</td>
<td>129</td>
<td>361</td>
<td>559</td>
<td>249</td>
<td>1298</td>
</tr>
<tr>
<td></td>
<td>45-54</td>
<td>109</td>
<td>272</td>
<td>516</td>
<td>278</td>
<td>1175</td>
</tr>
<tr>
<td></td>
<td>55+</td>
<td>425</td>
<td>201</td>
<td>171</td>
<td>852</td>
<td>1649</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1079</td>
<td>1245</td>
<td>1751</td>
<td>1785</td>
<td>5860</td>
</tr>
</tbody>
</table>

The chi-squared statistic for the test of independence is 784.4 with 21 degrees of freedom which is significant at the 5% and 1% levels. The tables below show the row and column profiles.

#### Row Profiles

<table>
<thead>
<tr>
<th>Home Ownership</th>
<th>Age Group</th>
<th>$0K to $30K</th>
<th>$30K to $70K</th>
<th>$70K+</th>
<th>Refused</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renting</td>
<td>18-34</td>
<td>23.1%</td>
<td>23.8%</td>
<td>26.0%</td>
<td>27.2%</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>35-44</td>
<td>27.0%</td>
<td>24.2%</td>
<td>18.5%</td>
<td>30.3%</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>45-54</td>
<td>33.9%</td>
<td>22.0%</td>
<td>19.7%</td>
<td>24.4%</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>55+</td>
<td>54.1%</td>
<td>5.7%</td>
<td>3.9%</td>
<td>36.2%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Owner Occupier</td>
<td>18-34</td>
<td>12.7%</td>
<td>29.1%</td>
<td>42.9%</td>
<td>15.2%</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>35-44</td>
<td>9.9%</td>
<td>27.8%</td>
<td>43.1%</td>
<td>19.2%</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>45-54</td>
<td>9.3%</td>
<td>23.1%</td>
<td>43.9%</td>
<td>23.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>55+</td>
<td>25.8%</td>
<td>12.2%</td>
<td>10.4%</td>
<td>51.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>18.4%</td>
<td>21.2%</td>
<td>29.9%</td>
<td>30.5%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

#### Column Profiles

<table>
<thead>
<tr>
<th>Home Ownership</th>
<th>Age Group</th>
<th>$0K to $30K</th>
<th>$30K to $70K</th>
<th>$70K+</th>
<th>Refused</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renting</td>
<td>18-34</td>
<td>8.9%</td>
<td>8.0%</td>
<td>6.2%</td>
<td>6.3%</td>
<td>7.1%</td>
</tr>
<tr>
<td></td>
<td>35-44</td>
<td>5.3%</td>
<td>4.1%</td>
<td>2.2%</td>
<td>3.6%</td>
<td>3.6%</td>
</tr>
<tr>
<td></td>
<td>45-54</td>
<td>4.0%</td>
<td>2.2%</td>
<td>1.4%</td>
<td>1.7%</td>
<td>2.2%</td>
</tr>
<tr>
<td></td>
<td>55+</td>
<td>11.5%</td>
<td>1.0%</td>
<td>0.5%</td>
<td>4.6%</td>
<td>3.9%</td>
</tr>
<tr>
<td>Owner Occupier</td>
<td>18-34</td>
<td>8.9%</td>
<td>17.7%</td>
<td>18.5%</td>
<td>6.4%</td>
<td>12.9%</td>
</tr>
<tr>
<td></td>
<td>35-44</td>
<td>12.0%</td>
<td>29.0%</td>
<td>31.9%</td>
<td>13.9%</td>
<td>22.2%</td>
</tr>
<tr>
<td></td>
<td>45-54</td>
<td>10.1%</td>
<td>21.8%</td>
<td>29.5%</td>
<td>15.6%</td>
<td>20.1%</td>
</tr>
<tr>
<td></td>
<td>55+</td>
<td>39.4%</td>
<td>16.1%</td>
<td>9.8%</td>
<td>47.7%</td>
<td>28.1%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
The correspondence analysis of the row and column cross-tabulations are shown in Figure 1.1 and uses the so-called symmetric scaling which is the default in SPSS Categories. Further details of the coordinate system are in Greenacre (1984) and (2000). These two-dimensional points for the rows and column profiles are devised such that row profiles with similar values tend to be close to each other as with the original points. A similar situation exists for the column profile plots. The plot shows 85% of the overall chi-squared statistic (68% and 17%).

Figure 1.2 is a joint plot of these representations and is a so-called biplot. A biplot is a special joint plot of the approximate representation of the rows and columns of a data matrix\(^4\) (in this case, row or column profiles minus the average profile). For a particular row and column, the product of the length of the two lines from the row point and column point to the origin and the cosine of the angle between the lines approximates to the indicated entry in the original data table. It approximates to how much the cell entry differs from the respective average row and column profile, that is, how much that cell in that profile contributes to an atypical profile.

Hence an indicated higher positive cell value from the correspondence analysis biplot suggest that the row is more heavily loaded on that column’s entry and vice versa. Conversely a negative value says that the cell entry is below expectations in frequencies.

Of course there is some sacrifice of accuracy to derive a two-dimensional representation but the plot will show the general trends of the effect of columns and rows on the cell entries. However, in order to derive a biplot, the distances on the graph no longer represent chi-squared distances between the rows and between the columns as is the case with the so-called “asymmetric plot” (which is not a biplot).

The symmetric plot has the property that the row profile points are attracted to a position in the plot which is close to the point for the column entry prominent in that row profile. This makes the distance between the row and column points an important result.

The points on the plots represent the rows and columns in the frequency table introduced above with the following abbreviations:

\(^4\) Typically the data matrix has been mean corrected in some way so that the mean of the “variables” is zero.
Figure 1.1
Row and Column Symmetric Plots

<table>
<thead>
<tr>
<th>Home Ownership</th>
<th>Age Group</th>
<th>Abbrev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renting</td>
<td>18-34</td>
<td>“r26”</td>
</tr>
<tr>
<td></td>
<td>35-44</td>
<td>“r40”</td>
</tr>
<tr>
<td></td>
<td>45-54</td>
<td>“r50”</td>
</tr>
<tr>
<td></td>
<td>55+</td>
<td>“r55+”</td>
</tr>
<tr>
<td>Owner Occupier</td>
<td>18-34</td>
<td>“o26”</td>
</tr>
<tr>
<td></td>
<td>35-44</td>
<td>“o40”</td>
</tr>
<tr>
<td></td>
<td>45-54</td>
<td>“o50”</td>
</tr>
<tr>
<td></td>
<td>55+</td>
<td>“o55+”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Income</th>
<th>Abbrev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0K to $30K</td>
<td>“$30K”</td>
</tr>
<tr>
<td>$30K to $70K</td>
<td>“$50K”</td>
</tr>
<tr>
<td>$70K+</td>
<td>“$70K+”</td>
</tr>
<tr>
<td>Refused</td>
<td>“No”</td>
</tr>
</tbody>
</table>
Interpretation

From the row plot, households 55 and over appear to be somewhat unique with respect to income for both renters and home owners. That is, they have distinct income profiles. Similarly there is a grouping on income of home owners 54 years and under but these have a different income profile to older home owners and renters. There also appears to be a distinct group of all renters 54 years and under. Combining these in one biplot in Figure 1.2, we see that rental households are closest to the lowest income group ("$15K")

In reviewing the column plot, we see that households earning $30K and above appear to have a different home ownership and age profile to those earning less than this and are different to those who would not give their income.

Combining these in one biplot in Figure 1.2, we see that rental households are closest to the lowest income group ("$15K") although the 18-34 year old rental group ("r26") was the closest to the higher income region. Perhaps we are seeing in this group a number of higher income households that are saving up to buy a home but haven’t yet reached their deposit target. The logical conclusion is that older rental households tend to be permanent renters without the funds to begin owning their own home. Conversely households that are buying or already own their own home are more strongly represented in the higher income group. This is quite logical given that they have the funds to afford the purchase price or deposit on a home. Finally home owners in the 55+ age group were the most likely to refuse to supply their income.

Figure 1.2
Combined Row and Column (Symmetric) Plot

---

2 In the remainder of this paper, “home owners” and “owner occupiers” shall also refer to those purchasing their own home.
Although the plots have been helpful in establishing these tentative conclusions, the graphics give little if any indication of the stability of the points. Even though we know that the chi-squared test indicated that the rows and columns were not independent we have little indication of which of the rows and columns are truly “different”. Also we have little indication of how stable the above perceptual maps are. For all we know if we undertook the study again we could get some decidedly different results due to the non-linear (and possibly unstable) way that correspondence analysis points are calculated. This is where “bootstrapping” has made a revolutionary contribution to modern statistics.

2. BOOTSTRAPPING

A Tutorial on Bootstrapping

Bootstrapping is used to establish the properties (e.g. variability) of sample statistics (e.g. median). It repeatedly re-estimates the model fitted to sample data by re-sampling with replacement from the original data as if the data were substituted for the whole population. Each time a new (re-)sample is drawn the statistic(s) in question is calculated, stored and later reviewed. This allows the analyst to empirically examine the distribution of the fitted model parameter(s) (i.e. the statistic(s)) without recourse to complicated mathematical results and indeed without requiring any sophisticated understanding of statistics at all. Bootstrapping only requires the user to have some appreciation of random sampling and of frequency distributions.

To reiterate, bootstrapping re-samples with replacement from the sample data as if the sample were the whole population and calculates the model parameter (say a mean, median, or regression coefficient) for each re-sample. Sampling with replacement implies that the data points are replaced if they are chosen in the re-sampling. This allows them to be drawn again and further contribute to calculating the quantity of interest. The establishment of new samples and of new parameter estimates can be done repeatedly until enough of the model parameters have been calculated to allow say a histogram to be drawn for the statistic in question. A diagrammatic representation of bootstrapping is shown in Figure 2.1.

The bootstrap approach has been made possible by the advent of high-speed computers which permit the speedy repetition of the estimation calculations. Up to 1,000 sample repetitions are not uncommon. The availability of powerful computers has also permitted the emergence of data mining. Data mining uses the power of modern computers and of new artificial intelligence algorithms to uncover ‘interesting’ patterns in large, otherwise impenetrable, datasets.

Bootstrapping is a similar method to "jackknifing" and was derived from it. Jackknifing involves deleting each data point in turn from the sample data and recalculating the sample statistic of interest without the particular data point. The derived set of sample statistics is then examined. This gives some idea of how dependent the statistic is on each data point and also gives some idea of the distribution of the sample statistic. However the jackknife sample estimates are highly

\textsuperscript{6} The middle value when the data is value sorted. For a tie, the mean of the two values is typically used.
correlated. Bootstrapping overcomes this problem.

Bootstrapping does not deal well with estimating some statistics such as the minimum or maximum of a sample. In addition bootstrapping is not as powerful as when a theoretical model of the underlying population can be assumed and when the distribution of the sample statistic is known for small sample sizes. However these conditions don't often hold and hence bootstrapping allows reliable non-parametric analysis which is much simpler to implement than some conventional methods.

**Figure 2.1**

**Bootstrapping**

**A Case Study on Sample Medians**

As an example, we already know that a formula for the variation in the sample mean is available. However there is no equivalent expression for variation in the sample median. In some instances perhaps through design or regulation, the sample median can become an important measure of central tendency and it would be useful to have some idea of its variation particularly for comparing two medians.

Bootstrapping can assist here by taking a sample of points and drawing repeated samples from them using the same sample
size as in the original sample. For each repeated sample the sample median is found and stored away. After an appropriate number of re-samplings say 500, a histogram or the like is prepared for the stored medians. This will give an empirical idea of how variable the sample median is and will allow comparisons with other sample medians.

As an example we will use a dataset that describes the annual electricity usage of residential customers in Perth (and indicates whether they have ceiling insulation or not with n=627 and 251). A histogram of the consumption data is shown in Figure 2.2 with the median indicated by a dashed line and the mean by a full line.

**Figure 2.2**

Annual Electricity Consumption (kWh)

To illustrate bootstrapping applied to sample medians, the table below gives the first eighteen data points from the data set with a median of 3091 which is the average of the two ‘middle’ values, 3025 and 3057.
Extract of Annual Residential Electricity Consumptions

<table>
<thead>
<tr>
<th>No.</th>
<th>Insulation</th>
<th>Annual Consumption (kWh)</th>
<th>No.</th>
<th>Insulation</th>
<th>Annual Consumption (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No</td>
<td>1900</td>
<td>10</td>
<td>Yes</td>
<td>1822</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>2366</td>
<td>11</td>
<td>Yes</td>
<td>3025</td>
</tr>
<tr>
<td>3</td>
<td>Yes</td>
<td>7726</td>
<td>12</td>
<td>No</td>
<td>1277</td>
</tr>
<tr>
<td>4</td>
<td>Yes</td>
<td>2016</td>
<td>13</td>
<td>Yes</td>
<td>2371</td>
</tr>
<tr>
<td>5</td>
<td>Yes</td>
<td>4687</td>
<td>14</td>
<td>No</td>
<td>4612</td>
</tr>
<tr>
<td>6</td>
<td>Yes</td>
<td>1344</td>
<td>15</td>
<td>Yes</td>
<td>3057</td>
</tr>
<tr>
<td>7</td>
<td>Yes</td>
<td>8395</td>
<td>16</td>
<td>Yes</td>
<td>4610</td>
</tr>
<tr>
<td>8</td>
<td>Yes</td>
<td>3164</td>
<td>17</td>
<td>Yes</td>
<td>5158</td>
</tr>
<tr>
<td>9</td>
<td>Yes</td>
<td>2865</td>
<td>18</td>
<td>Yes</td>
<td>10248</td>
</tr>
</tbody>
</table>

The following bootstrap sample was generated from the above list. The sample contains repeated items from the original sample, i.e. items 1, 4, and 8. The median from this bootstrap sample is 2368.5. In bootstrapping, this value is stored away as the first bootstrap estimate of the sample median and the process repeated.

A Bootstrap Re-Sample

<table>
<thead>
<tr>
<th>No.</th>
<th>Annual Consumption (kWh)</th>
<th>No.</th>
<th>Annual Consumption (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1277</td>
<td>8</td>
<td>3164</td>
</tr>
<tr>
<td>4</td>
<td>2016</td>
<td>11</td>
<td>3025</td>
</tr>
<tr>
<td>2</td>
<td>2366</td>
<td>7</td>
<td>8395</td>
</tr>
<tr>
<td>8</td>
<td>3164</td>
<td>4</td>
<td>2016</td>
</tr>
<tr>
<td>6</td>
<td>1344</td>
<td>4</td>
<td>2016</td>
</tr>
<tr>
<td>14</td>
<td>4612</td>
<td>10</td>
<td>1822</td>
</tr>
<tr>
<td>16</td>
<td>4610</td>
<td>15</td>
<td>3057</td>
</tr>
<tr>
<td>1</td>
<td>1900</td>
<td>1</td>
<td>1900</td>
</tr>
<tr>
<td>13</td>
<td>2371</td>
<td>17</td>
<td>5158</td>
</tr>
</tbody>
</table>

Rather than use the truncated sample indicated in the table, we shall demonstrate the capabilities of bootstrapping on the entire dataset. As a first example which is in some sense rather trivial, let us look at the sample mean for which we already know the sample properties very well. A histogram of the bootstrapped sample means is shown in Figure 2.3. The overall sample mean is indicated by the dotted line. We can see the familiar bell-shaped pattern that we would expect from the “Central Limit Theorem”. There are no surprises here from an analytical viewpoint with the distribution of the sample statistic having a symmetric shape and a relatively tight range of values.
Applying the same procedure to the sample medians produced the histogram of bootstrapped sample medians in Figure 2.4. The sample median from the original data is 4560.5 and is indicated on the graph. One immediate feature of the plot is that the sample median is not Normally-distributed. It appears to have a bimodal distribution which would seriously affect any standard inferential analysis undertaken using the median. A more detailed inspection of the distribution of the annual consumptions (used in Figure 2.2) reveals that the distribution of consumptions may itself be bi-modal. This is likely related to the use of gas in some households.
We can go further with bootstrapping to look at the difference between the two median consumptions for households with and without insulation. The question here is whether there is a "significant" difference in the median electricity use between those with and without insulation. A histogram in Figure 2.5 compares the original data for those with and without insulation.
Figure 2.5
Consumption for Customers With and Without Insulation

The median consumptions for those with and without insulation are shown below.

<table>
<thead>
<tr>
<th>Insulation</th>
<th>Median Consumption (kWh)</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>4263</td>
<td>251</td>
</tr>
<tr>
<td>Yes</td>
<td>4685</td>
<td>627</td>
</tr>
</tbody>
</table>

Given the magnitude of the difference in the medians (422 kWh), it is possible that the difference is significant but a more conclusive result would be useful. To this end, a bootstrap analysis of the two medians has been undertaken and the results are shown in Figure 2.6. To reiterate the previous description, our objective is to better understand the variation in the estimate in question, in this case the median. The original sample is again treated as if it is the entire population of interest and the variation in the median is examined by taking repeated re-samples from the original sample with replacement. In most bootstrap studies, the re-sample size is the same as the size of the original sample of data.
Figure 2.6
Bootstrapped Estimates of the Median for Two Groups

Without Insulation

With Insulation

There appears to be a substantial difference in the sample medians and hence in the underlying population medians. We can explore this still further by bootstrapping the difference in the sample medians i.e. we will simultaneously generate repeated samples from each group and calculate the difference in the sample medians. We can then store these differences away for analysis say via a histogram as shown in Figure 2.7.
It is clear from the graphic that few of the differences in the medians are close to zero. This provides strong evidence that the difference in the sample medians reflects a difference in the underlying (population) medians between those with and without insulation.

It may interest readers that the difference in median electricity consumption is in the ‘wrong’ direction. That is, those households with insulation actually use more electricity than those without - presumably households install insulation to reduce their energy use. There are two likely reasons for this anomaly:

- It requires a significant expenditure of funds to install insulation. Hence the presence of insulation will either reflect the householder’s propensity to install the insulation or the capacity to purchase a house with insulation already installed. Hence, the presence of insulation reflects in a general sense the income level of the households and it is well-known that households with higher incomes tend to use more electricity.

- Anecdotal evidence suggests that households install insulation to improve the efficiency of room heating and cooling appliances such as reverse cycle heating and airconditioning. However these appliances are often installed at the same time as the insulation. Hence there can be an increase in electricity use (and energy use in a more general sense) when households install insulation.

Of course a viable method of accounting for the income effect mentioned above would be to undertake a study of the consumption medians whilst adjusting for income. For example the researcher could generate bootstrap estimates for the presence of insulation crossed with above-average and below-average income.
3. BOOTSTRAPPING AND CORRESPONDENCE ANALYSIS

To return to our original perceptual mapping problem, a standard correspondence analysis was undertaken on the home ownership data and a number of perceptual maps were prepared. However the maps provide no obvious way to access the variability in the plotted points or to reflect the effect of sample size.

Given our previous discussion, a natural process for assessing variability would be to apply bootstrapping to correspondence analysis (Greenacre (1984)). That is, we could repeatedly draw bootstrap samples from our original sample and, for each re-sample, generate new points for plotting on the perceptual map. Hence we will see multiple overlayed points on each perceptual map, one set of points for each of undertaken in Figures 3.1 and 3.2 with 16 bootstrap replicates. This is quite a modest number for bootstrap studies but any larger number would make the presentation of results rather confusing in this paper.

**Figure 3.1**
Bootstrapped Row Profiles
It is clear that the column entities, i.e. the income groups, are quite distinct in their perceptual map. There is little if any overlapping of points and the lines enclosing each set of points do not overlap. In fact the whole representation is quite tight.

The picture is not so clear for the row entities, i.e. the home ownership and age group categories. There seems to be four distinct groups, owner occupiers under 55, renters under 55, older owner occupiers and older renters. But within groups there is considerable overlap of the point clouds.

The points for renters are much less stable than for the owner occupiers because renters are a smaller proportion of the population. Due to their inverse weighting in the calculations, they have an undue influence on the outcome and on its variability. Hence in correspondence analysis it would be wise to ensure if possible that the elements of the row and column overall profiles are not too different in size. Otherwise the associated perceptual maps could be unstable.

A joint symmetric plot was not prepared because of the large number of overlaid points.

The sample size involved in this example was quite large (n=5860) and the same exercise could be repeated with a more usual sample size of say 292 from the same sample
dataset. This will demonstrate the use of bootstrapping in revealing the effect of sample size on correspondence analysis results.

The perceptual maps for the row and column profiles are shown in Figure 3.3 and the respective bootstrapped plots in Figures 3.4 and 3.5. The chi-squared statistic was 103.9 with 21 degrees of freedom which was significant at both the 5% and 1% level. The scales have been expanded compared to the previous plots and the plots represent 86% of the total chi-squared statistic.

![Figure 3.3](image)

The row and column profiles are somewhat consistent with the previous bootstrapped maps (Figure 3.1) and indeed with the overall row map for this entire dataset (Figure 1.1). However the positions of the low income and “Refused” groups and of the two +55 groups have been reversed on the page. This is due to the initial set up of the perceptual map’s axes. The change of data has resulted in a reflection of the y-axis about the x-axis i.e. the y-axis is reversed. However the distances between points remain consistent. The interpretation of a perceptual map remains the same even if the map is seen in mirror image, up side down or a combination of these. It is the consistency...
of the distances between points that is the essential element and the distances are not changed by these transformations.

Figure 3.4
Bootstrapped Row Profiles (n=292)

Figure 3.5
Bootstrapped Column Profiles (n=292)

The new plots strongly reflect the effect of the reduced sample size. The reduction in sample size has resulted in a substantial aberration of the column points to the extent that it is difficult to decide which groups are now distinct. The owner occupiers over 55 still present as a consistent entity (in the bottom right corner) distant from the
younger owner occupiers. However the points for all ages of renters are quite dispersed and it would be difficult to make conclusions about renters as a distinct group on the basis of this evidence.

It is interesting to compare these cautions with the "evidence" from Figure 3.3 showing the original perceptual maps for the reduced sample size. It would appear from that map that the older (55+) renters are clearly in a separate region. Moreover it would be tempting to conclude on the basis of that plot that the renters are a distinct group separate from older households and from owner occupiers. The bootstrap results do not support these conclusions with the smaller sample, primarily because of the relatively small proportions in the renters group, as discussed previously.

4. CONCLUSIONS

This paper has introduced the concept of bootstrapping and how it could assist researchers in assessing the variability of fitted models. The results of bootstrapping as applied to correspondence analysis have shown that perceptual maps are not as stable as they may first appear. Even with sample sizes of around 300 a wide variation in the location of correspondence analysis points was demonstrated.

In addition it was noted that the correspondence analysis projection does not reflect changes in sample size. However the effect of reduced sample size can be seen in the variability of the bootstrap plots. Indeed a logical conclusion here would be to bootstrap the preparatory chi-squared statistics themselves to access their stability along with that of the perceptual maps. Moreover the new points on the perceptual map could be realigned so that the position and distance between the points for two selected entities are always fixed. The points for other entities would be adjusted accordingly. This would stabilise the bootstrapped plots to some degree.

The lessons to be learnt from this study are:

- Always use a chi-squared test of independence before embarking on correspondence analysis. This ensures at least some level of significant difference in the rows and columns;

- If possible, use bootstrapping to investigate the stability of the correspondence analysis plots. The bootstrapped estimates introduced here were produced using the statistical programming language, S-Plus, but I understand that SAS and SPSS are planning to introduce bootstrapping in future releases of their packages.

- Bootstrapping examples in this paper indicate that the row and column entities should be chosen so that the elements of the average row and column profiles are not too different in size (and therefore in influence). This may not always be possible.

Bootstrapping can be applied to other forms of perceptual maps. For example, calculations involved with factor analysis can be bootstrapped producing indications of the variability of scree plots, factor loadings and plotted factor scores. This would provide a convenient method for assessing the number of factors to retain in the final analysis (via the scree plot). In addition the bootstrapped factor scores could be assessed in a similar way to that applied to the correspondence analysis symmetric maps presented in this paper.
REFERENCES


FACTORS DRIVING THE DIFFUSION OF MARKET RESEARCH IN EAST ASIA

Al Marshall
Brand Life
and
Australian Catholic University

ABSTRACT

While market research had its origins in the mid to late 19th century, market research in East Asia is a comparatively recent phenomenon. Market research in East Asia only really started to be applied in the post World War II period, with significant growth only from the 1960s. Since then the industry has grown exponentially. The process by which it was adopted in the region and the reasons for its meteoric growth (barring recent problems in regional economies) remain somewhat unclear. It is suggested that the growth of market research in the West has been linked to the gradually increasing sophistication of the marketing function as the marketing discipline grew. In contrast to this, in the East Asia market, research was initially introduced by multinational corporations seeking to investigate potential business opportunities in the region. It is suggested that its growth there is linked to the relative openness of, and the levels of economic growth these economies have been experiencing. The penetration of multinational corporations, growing consumer sophistication, the expansion of services, the globalisation of world markets, technological developments and the high costs and risks of international marketing are all suggested driving factors.

INTRODUCTION

Zaltman and Burger had identified six phases of marketing research, beginning in the 1880s in the West (Myers, Massey and Greyser, 1980). Since its beginning at this time through to its maturity in the 1950s and the 1960s market research has experienced rapid growth (particularly in the post World War II period).

The history of marketing research in the West has in fact been well documented, since its establishment in the 1880s. Some formalised research applications were being used in the early 1900s in some big companies such as Dupont, while the period 1910-1920 was recognised as the formal beginning of marketing research when many manufacturing establishments and advertising media began to establish marketing research divisions. The period 1920-1950 was labelled as "the adolescent years" when the marketing research industry was growing at a gradual pace and most of the research was conducted by advertising agencies.

In early 1936, only "$3 million was spent on marketing research...as compared with $200 million spent on production research..." but by 1944, "$12 million was spent on marketing research..." (Drake et al, 1969 p.32).

From this point market research budgets increased dramatically and the industry expanded. The latter included "internal" marketing research conducted by companies and "external" marketing research done by advertising agencies, media and marketing research supplier firms. The size, diversity
and scope of market research grew rapidly between 1952 and 1977 in particular (Myers, Massey and Greyser, 1980).

From the very beginning, the USA and the UK have accounted for a disproportionate share of this market research both in terms of number of firms involved and the budgets (Gronhaug et al., 1987) (with the USA representing about half of the world market) (Worcester and Downham, 1986). Continental European countries, such as France, Germany and Italy, also have historically had high level research expenditures (Cavusgil, 1984).

Drivers in the West

A number of possible reasons have been advanced for the emergence and the growth of the market research industry since the 1880s. The general tenet of these is that economic growth and subsequent socio-economic changes have been catalysts and drivers. It has also been advanced that the growing sophistication of the market and the evolution of business operations have been catalysts and drivers.

Industrialisation of economies, growth in consumer incomes, the adoption of the marketing concept, the introduction of segmentation tools, increased marketplace competition and the availability of government statistics are all likely to have been instrumental.

More recently internationalisation of the Western economies is likely to have been a contributing factor. For instance, prior to the adoption of the marketing concept businesses were principally product orientated and market research (in so far as it did exist) was defined and operationalised narrowly.

As there was a change from the product (and latter the selling) concept to the marketing concept this created a need for consumer research, as well as a need for someone in the organisation to take charge of it.

As the marketing concept grew, more manufacturers were persuaded to study consumer needs, attitudes and behaviours through market research and the industry was able to gradually extend its frontiers beyond its traditional boundaries.

In part reflecting this, the nature and role of market research has broadened to a point "where the emphasis is on contact between researchers and marketing management" (Worcester and Downham, 1986). It has now become an integrated part of decision making processes in business operations in the West.

Emergence and Growth in East Asia

In East Asia on the other hand, market research is at quite a different stage of its evolution. The history of market research in East Asia is in fact relatively short and it is essentially a post war phenomenon. It was virtually unheard of in the region prior to World War II (Ch'eng, 1991). It has grown in a different period to market research in the West.

Marketing as a discipline itself in the region is relatively young with Japan (the most developed country in the region) only embracing marketing in the 1950s. The Japan Marketing Association was established in 1957 and the first marketing research agency and first marketing periodicals appeared in the years between 1953 and 1964. And there is evidence marketing research has only been widely
practiced in Japan since 1955 (Fujitake, 1990).

It was only in the early 1960s that survey research began to be carried out to any extent elsewhere in East Asia. It revealed the important and encouraging fact that market and public opinion research provides information which could not be obtained in this region by any other means. This represented the beginning of the growth of market research in East Asia.

It should be noted, that aside from Japan and Singapore which graduated some considerable time ago from the status of developing countries to that of developed countries, most of the countries in East Asia still remain in the developing group. Some of them such as China, Indonesia, and Vietnam are still grouped as less developed countries.

Irrespective of their status however, in the past 30 years the economies of most East Asian countries have shown substantial growth and they have been outstanding in their economic achievements compared to other developing countries in Africa and Latin America. At the same time, market research as a practice appears to have emerged in the region and to have grown strongly in terms of the number of companies, and the volume and value of business.

The possible reasons for the emergence and the growth of market research may or may not be the same as the reasons for the earlier growth of the industry in the West. Or there may be a middle path with some of the reasons for emergence and growth being the same, with others quite different.

Possible Drivers in East Asia

At the broadest and most obvious level it appears that the development of market research in East Asia is correlated with the very rapid development of many of the economies in the region (until recently). It also appears that there is a correlation with the growing sophistication of the market and the evolution of business operations.

These are factors which market research in East Asia may share in common with market research in the West. Beyond these very "macro" possible similarities, there may be a number of differences. These may be grouped into the following broad categories, which can help our understanding of the industry in our region and what drives it. These include economic factors, technological factors, socio-cultural factors, market specific factors, governmental factors and globalisation (amongst others).

Economic Growth and Internationalisation

The rapid and explosive economic growth in East Asia has been driven mainly by economies that until 1997 expanded faster than any others in the world. For instance the region outpaced the growth of the world's 24 leading industrial economies by more than 6 times in 1993 and the developing countries in East Asia grew at an average 7% annually whilst the world's mature economies historically have grown a lot more slowly (Czinkota and Ronkainen, 1995).

This growth provided huge potential for profit for corporate investors, most of whom (with the exception of the Japanese) are located outside the region. To become a player though, irrespective of origin, information is needed. At the most fundamental level companies need a means
of estimating demand for their products (Aminé and Cavusgil, 1986).

Beyond this, once the decision is made to proceed, the process of industrialisation itself means heavy investment and mass production which requires careful planning. Market research supplies the base for this forecasting and planning.

The rapid growth that has occurred in East Asia up until recently has in part been fuelled by the big Japanese and Western pension funds and financial institutions. In 1993 alone, $US61 billion of net equity capital flowed into emerging markets (almost 20 times the 1986 figure), with East Asia attracting almost two thirds of the total (Fletcher, 1995). Such capital was attracted by changes in government policies to open and free up markets, economic reforms and the cultivation of certain industries in the services sector as well as those in capital intensive and high tech sectors.

Governments in the region have in fact been actively relaxing rules and regulations in order to attract global investment and provide a conducive environment for the entry of foreign firms, thus creating intensified competition for local industries. This process has accelerated recently under IMF directives demanding more openness. Market research certainly appears to be growing in those economies where the degree of openness has increased.

For instance, fifteen years ago, few people would have dreamt of conducting market research in China. The authorities at the time saw little distinction between collecting market information and gathering intelligence - a dangerous activity in a closed economy!

Yet since economic policy took a new direction in 1979, retail sales have grown at a compound rate of 15% per year and while in 1980, there were two million retail outlets in China, by the mid 1990's there were more than 12 million (Sharman, 1994). In part reflecting this, market research in China is growing rapidly.

The Entry of Multinationals

The above is clearly linked to the role played by multinational corporations in the region. As the East Asian economies rapidly expanded until 1997, multinational corporations have wanted to take advantage of the opportunities.

Many multinationals have perceived that their future in part lies in the Asia Pacific and have targeted this region. Many have been acting on the belief that the Asia Pacific will be the growth centre for the next century:

"by the end of the decade, Pac Rim economies will be bigger in total than those of the EC and about equal to North America's" (Cavusgil, 1984).

Since marketing services have historically been scarce in these markets, multinationals bring in support services, such as their advertising and research agencies, to fill the service and information gaps they experience.

It is believed by academics like Yavas (1983) that multinationals may in fact be instrumental in diffusing research consciousness in developing nations by acting as change agents (Yavas, 1983).

The growth of market research in the region can be likened to the growth and experiences encountered by advertising agencies there. For instance, a study by Lo and Yung (1988) of the growth of foreign
advertising agencies in China showed that many agencies came to China as a result of their clients doing business there. In addition to “service to clients” many agencies were attracted by the previously commented on enormous market potential (Lo and Yung, 1988).

As multinationals move into more foreign markets, they expand both their resources committed to these markets and the risks involved in doing business overseas (Czinkota and Ronkainen, 1995). The multinational’s information shortfall necessitates market research to help make decisions about market entry and operations in East Asia, given their risk exposure and necessary resource commitment.

Market research is in fact among the first ancillary services that multinationals need, since it’s ultimate objective is to reduce uncertainties (and uncertainty is exactly what a Western firm entering the East Asian marketplace experiences). Beyond the reduction of these uncertainties, the focus of market research attention has shifted from the provision of information assisting decisions concerning the standardisation versus the adaptation of the marketing mix across countries (Craig and Douglas, 1983). Ongoing marketing research is needed to help managers and advertising planners formulate these strategies on an ongoing basis.

It should of course be pointed out that multinationals and other large companies are not the only ones interested in East Asia and which need to commission research. Many smaller companies want a “slice of the action”. Asia abounds with niche markets which offer lucrative rewards for these smaller marketers (and which require research).

Population Growth and Urbanisation

The region’s substantial (and growing) population has in part fuelled East Asia’s growth in the last thirty years. East Asia has a third of the world’s population (approx. 1.8 billion people). The population in the region during the next 30 years is estimated to grow by 2.3 billion people, and in China, the estimated growth of 345 million people during this period represents nearly 20 times the total population of Australia (Czinkota and Ronkainen, 1995).

In the West in comparison minimal population growth is predicted. Compared to Western markets the East Asian figures indicate a staggering potential for the consumption of good and services, as Asian economies continue to recover from the recent meltdown.

The opportunities for marketers are also evident when one notes the ages of consumers in some markets in the region. For instance, half the 70 million people in Vietnam are aged under 20 and 50% of the people in Indonesia are aged less than 25 (Sharman, 1994). Almost half of China’s 1.2 billion citizens are under 24. These young markets have also been growing in education and living standards. They are demanding, worldly, increasingly affluent and are driving consumer changes (Sharman, 1994). Understanding their changing needs and wants is a key challenge, requiring market research.

Population movements within markets are also of significant interest to marketers. Worthy (1990) states:

“In just 30 years...South Korea’s population has flip-flopped to 73% urban from 72% rural and though less developed countries such as Thailand, Indonesia, and the
Philippines are still predominantly rural, their urban areas are growing rapidly too. Bangkok, Jakarta and Manila will grow roughly 50% over next ten years...giving them populations of 12 million, 17 million and 12 million respectively...” (Worthy, 1990).

The consequence is intensified population concentration and an inevitable change in people’s lifestyles, values and their consumption patterns. More urban households mean greater demand for goods such as furniture, household appliances and electronic gadgetry (Abdoolcarim, 1994). Market research in the region has expanded as a consequence of the growth of these urban cash economy based demands.

**Growth in Personal Incomes**

With the strong growth in most East Asian economies, personal income has also been growing as average hourly wages and salaries increase. For instance, in China although income is still small (approx. $US420 per capita in urban areas), the heavily subsidised essential living costs of Chinese citizens are low, leaving residents with money to spend on consumer goods. Unsurprisingly therefore, along with the growth in these disposable incomes, there has been an increase in demand for Western and Japanese branded consumer goods.

This can be contrasted with the prevailing situation in major Western markets where the market for consumer goods is saturated, and the growth in disposable incomes is slow. Given this, Asian markets have appeared to have multiple commercial opportunities to take advantage of rising demand.

As noted earlier, information is however needed in order for companies to study differing market conditions and to evaluate these opportunities. Outside the basic macro-economic data, there has historically not been much information available on market characteristics, competition, consumer behaviour, or the other elements of the marketing mix – price, promotion, product and distribution (Tuncalp, 1988). Hence the need for companies to use market research.

**Consumer Attitudes and Preferences**

With the consistent economic growth and rising incomes in the region (up until recently), consumers attitudes and preferences have been changing very quickly, and market leaders have been striving to stay one step ahead of the often multiple and complex trends.

Consumers have been demanding a wide variety of different products. In addition to a product’s quality, usage and price, they are asking questions such as how it can improve their lives. Their needs are diversifying and becoming considerably more individually-oriented. Given such trends companies are having to become more customer-oriented and consequently, strategies such as segmentation, are becoming more widespread (Fujitake, 1990). For instance, fast food chains in Malaysia managed to increase their sales by around 15%, simply by introducing halal alternatives and thus offering food acceptable to Muslims (Sharman, 1994).

Although many developing countries (including some in the region) still have very low per capital incomes on average, economic research has found that when the annual per capita income barrier of $1,000 is reached, not only an absolute increase in consumers’ demands will occur but also a wide diversification of their tastes and preferences (Anon, 1993).
Such increasing and diversifying purchasing power has given the consumers wider options and power in the market place, and buyer’s market are taking shape throughout the region. Research has found that as the middle class increases, consumers are developing these different tastes and preferences. They no longer merely consider price in their purchase decisions but also seek other values, such as image, satisfaction and status. In addition, East Asian consumers appear to have the ability to adopt new ideas quickly. As a consequence, consumers in the region tend to “leapfrog” through product categories, more often than not preferring the latest and greatest product adaptation compared to the West where consumer habits are often more slow moving or difficult to change (O’Brien, Fitzpatrick, Winton and Ferrier, 1994).

Since the aim of market research is to “to do valid, reliable and actionable work to help managers make better informed marketing decisions”, market research can help provide meaning to these dynamic changes (Holbert, 1993).

Competition for Local Companies

In the past the majority of local companies did not bother with marketing research. This situation however did not present an immediate problem for two reasons, the first being that market demand exceeded supply (thus producers could sell very profitably), the second reason being the low levels of competition, meaning that there was little pressure to get ahead. In addition, there were various government rules and regulations that protected local manufacturers against competition from imports. These conditions made life easy for producers, who saw no need for researching their markets (Tuncalp, 1988).

With multinationals having entered the marketplace competition however was introduced, forcing local companies to adapt to the new conditions. As these new conditions require information, local demand for research services has increased, thus stimulating the growth of these service activities. Local companies are having to use research to satisfy their customers’ needs more effectively and to increase profitability in the face of the increasing competition.

In addition, the marketing concept is slowly gaining acceptance, reinforcing the need to study consumer attitudes and behaviour through market research. As noted earlier, Japan was the first country in East Asia to introduce the marketing concept and market research in that country is highly developed. Hence many local companies were forced to change their traditional production orientation and many have had to establish formal marketing research departments (Kurtulus, 1979) or to engage the services of outside marketing research agencies (Yavas, 1983).

Local Attitudes

One might assume that local companies would eagerly seek to import marketing research know-how because of their obvious need for information about the market, in order to effectively plan and control their economic development.

There is little evidence though, to indicate that marketing research has been indigenously used to the extent it has in the West. Outside competitive pressures remain the single most significant driver. Perhaps the major obstacle to the use of marketing research has been the attitude toward marketing of business and government administrators.
Previously, many local firms simply manufactured their goods for overseas markets, but now, with emerging middle classes and increases in disposable incomes, the local market is becoming equally attractive. These same firms are increasingly employing the marketing concept, and the increasing competition, and the widening distance between producer and consumer in the region suggests the need for ongoing market research for these local firms (Lecksheidt, 1973). This is in part due therefore to an attitudinal change (as well as the influence of external factors).

For instance, those marketing managers that have received a formalised marketing or management education would have gained exposure to training in computers as well as studied statistics. As a result, the store of quantitative knowledge has led them to further understand the marketing research process, its usefulness and its applications. In addition, many of the managers in these developing economies have been educated in the West and therefore understand the relevance and application of marketing research in a Western context.

Internationalisation of Market Research

The trend towards globalisation of research agencies seems to be another reason for the growth of market research in the East Asian region. As part of the increase in international alignments, international agencies have been “going global” to be proactive with their research services, and to help recover some of the investments made over the last decade in technological advances (Sharman, 1994).

As a result of these factors, many have been actively searching for opportunities for international expansion. Like the multinationals, East Asia quite some time ago ceased to be seen by them as an impenetrable market of poor workers with no interest in new products. Its economic and population growth, level of industrialisation, rising incomes and growing consumer demand has instead meant that the region has become an important part of many market research agencies globalisation plans. Although the hurdles of entry and subsequent operations may seem prohibitive, market research agencies (like marketers) realise that the figures are now too big to ignore (O’Brien, Fitzpatrick, Winton and Ferrier, 1994).

Some market research agencies and international marketers of course saw the potential of East Asia decades ago. For instance, Frank Small and Associates (now Taylor Nelson Sofres) have been doing business in East Asia since 1972. These and other successful operators entered East Asian markets for the long haul, expecting slow progress at first as business connections and brand images were built to secure a base for the future (Sharman, 1994). Weinstein believes that market research firms tended to move into Asia due to either an offensive opportunity, a defensive reaction, a client service requirement, or due to the driving force of a senior executive (Weinstein, 1974).

It must also of course be acknowledged that there has been a great deal of emotional hype about “getting into Asia”, with a more circumspect view only really emerging after 1997.

Expansion of Technologies

Research agencies have invested heavily in technology, and now have the capacity to provide information via techniques like simulated purchase tests, retail audits, TV people meters, warehouse withdrawal data or
scanning technologies. Market research agencies might thus be eager to push into historically fast developing economies in order to justify the rising costs of research technologies in their domestic markets.

Furthermore, these new technologies have allowed these agencies to provide a greater volume and a wider range of information to marketers in both developed and developing markets.

New media in the region based on similar technological innovations has also opened up a range of opportunities, among them faxes, interactive TV, satellite TV, fibre optics and cable TV (Williams, 1994). Some of these new media can serve as measurement tools and can help pinpoint consumers and their reactions in a real-time environment (Shergill, 1993). They also of course present interesting research opportunities in their own right.

The latest developments in internet and communication technologies in addition are transforming the world into a global market, producing global consumers. East Asian consumers are part of this process. Indeed it could be that market research has grown in the region simply because it can!

Growth of Service

Market research is part of the general growth of services in developing economies (lagging but at the same time paralleling, the structural shift in Western economies towards services).

While the initial entry of market research into East Asia may have been initially as a service provider to multinationals who themselves have established a beachhead in developing economies (Czinkota and Ronkainen, 1995), its presence has now broadened.

Certainly industries such as material and machinery production industries, which played a leading role in the high growth period, are now giving way to service industries (which require market research in order to reach full potential) in the new slower growth period. Additionally, reflecting this move towards services, East Asian consumers are increasingly orientated towards pursuing a more pleasant lifestyle, which in turn creates additional market research opportunities.

There are increasing opportunities for research agencies to anticipate fashion trends and lifestyle goods and services, and to use this information as a basis for formulating strategy (Fujitake, 1990).

Undoubtedly the increasing use of media by consumers in the region has had a positive stimulating effect on the marketing research industry. It has for instance been found that per capita GNP and advertising as a percentage of GNP are directly correlated; that is the higher the per capita GNP, the higher the advertising as a percentage of GNP.

Improvements in other communications services (such as phone systems, mailing lists and postal services), as well as the increasing availability of trained staff and sources of secondary data have also contributed to growth.

Availability of Secondary Data

In recent years, the availability and reliability of statistics from East Asian countries has improved markedly. The United Nations in particular has been instrumental in helping to upgrade the level
and quality of statistical data collection in developing countries since 1958 (Cavusgil, 1984).

The original problems encountered by market research agencies with the complexity of extended family structures, multiple households and confusion in statistical classifications have largely been eradicated in the countries where an accurate census has been regularly conducted by the government (Ch’ng, 1991).

The governments in some East Asian countries such as Taiwan and Japan now release enough census data on individuals to make sample building as easy and accurate process as it is in most Western countries (Brock, 1989).

Furthermore, the availability of reliable secondary data is directly related to the level of economic development of a country (Jain, 1987). In other words, as countries progress economically (like those in East Asia), the respective government authorities see it as necessary to collect and publish statistical information concerning local developments on a regular basis.

**Contrasts with the West**

It is fairly obvious that the growth in marketing research that has occurred in East Asia is different to that experienced earlier in the West. The growth of the marketing research industry in the West was less to do with growing economies, and more to do with the gradually increasing sophistication of the marketing function.

As firms began to operate under a marketing discipline (as opposed to being production or sales oriented), market research (almost by definition) grew, and managers began to understand the need for market research. Universities began to understand the need for market research. Universities began to offer whole courses in marketing (Dahlinger, 1991), and the marketing philosophy (and market research) grew organically. There was an increase in the sophistication of marketing, and marketers started to understand the need for research and the benefits of it. The research function accordingly grew to where we are today.

More recently, new technologies have facilitated further developments in marketing research in the West, with sophisticated modelling like multi dimensional scaling, and advances like scanning, warehouse withdrawal data, and ratings technologies all providing more information for the marketer.

In the West it appears that market research evolved to where it is today, while East Asian research has largely had modern Western techniques thrust upon it by Western research agencies and Western multinational corporations, due to the perceived business opportunities in the region.

Market research therefore has been brought to East Asia by the West and has been driven by external not internal needs. Domestic markets in the West have been saturated and companies, whether multinationals, internationals, small or medium sized have looked outside for growth.

Were it not for the entry of Western multinationals into the region, and the “follower” strategy of the international research agencies who service these Western companies, it is doubtful that marketing research would be so prevalent in East Asia today. This is in stark contrast to the story of marketing research growth in the West.
which (as noted above) involved a step-by-step growth of the industry according to the evolving definition of marketing.

The growth of market research in East Asia therefore has been mainly driven by the West’s need for information to apply their Western framework to doing business in East Asia.

As a corollary of this, the key difference between marketing research in the West and East Asia is that the latter has historically to date focused on first order information need areas (such as where to enter, how many markets to pursue) while the former principally focuses on second order information need areas such as how to understand mature and saturated markets better (in order to make refinements to existing marketing mixes).

Commonalities with the West

There is only one over-riding commonality – marketing research has grown in both regions due to increasingly diverse and complex market places. Growth in both East Asia and the West has accompanied growth in the industries that require marketing research services (primarily, consumer goods and services industries). In both, changes in the economy leading to information shortfalls has stimulated demand for market research services. Industrialisation and later a move towards services remain key “macro” drivers in both the West and East Asia (though they are at different stages).

Furthermore, growing competition in markets everywhere has led marketers to either discover (in the case of East Asia) or rediscover (in the case of the West) the consumer as a primary unit to study, and to shape goods and services around. The computer and other technological tools have made the former a far easier task, irrespective of geographical location.

Globalisation of business has been having a significant impact in both the West and East Asia, allowing such technologies to be disseminated more rapidly, and multinationals remain change agents wherever they are.

Everywhere marketers are confronted with change impacting on their businesses, causing uncertainty in business planning. The imperative for market research has never been greater, and the old cliché about “information being power” remains valid.

Future Drivers of East Asian Market Research

In general while marketing started later in East Asia than it did in the West, it is arguably advancing more quickly because of the opportunity to borrow already developed systematic methods (Brock, 1989). In other words, the influence of borrowed technology has accelerated market development. It is not an exaggeration to say that many parts of East Asia have in fact been propelled from the 18th century to the 21st century in the span of two decades. It is also fairly clear that East Asia has not progressed systematically through the marketing stages that the West has. In some cases, the region has bypassed stages completely or telescoped several stages into one (Cateora and Hess, 1973).

There are not many markets left in the West that are in their infancy, with rapid growth expected, however (recent problems aside), this has been the norm in East Asia in the last thirty years. This obviously impacts upon the function of marketing research in each respective market.
In the future therefore it is likely that each emerging East Asian market (including those which suffered economic meltdown), will increasingly develop its own style of marketing (as Japan has done) based on its own skills and business styles. Out of this will come its own style of market research based on the information requirements of marketers in those specific countries.

REFERENCES


FIVE POINT VS. ELEVEN POINT SCALES: DOES IT MAKE A DIFFERENCE TO DATA CHARACTERISTICS?

John Dawes
Marketing Science Centre
University of South Australia

ABSTRACT

This study examines whether the number of scale points used in a market research survey affects the resultant data. It uses two 'split sample' surveys, one using face to face interviews and one gathered using telephone interviews. In each case, a subset of the sample was administered questions using a five point scale and another subset was administered an eleven point 'zero to ten' scale. The results show that the eleven point scale produces data that is essentially the same as that produced by the five point scale in terms of mean, after allowing for the five point scale to be re-scaled for comparability. However, the eleven point scale produced data with more variance (coefficient of variation) than the five point scale. There were some differences between the scale types in terms of kurtosis and skewness, but these were not systematic.

Background & Previous Research

One of the most ubiquitous tools of the marketing or academic researcher is the use of multiple category numerical scales. The question of finding the 'optimal' number of scale points has been discussed from a variety of perspectives. Several studies have used simulations to examine issues of information recovery and the precision of data (Givon and Shapiro 1984; Green and Rao 1970; Lehmann and Hubert 1972). Others have used survey data. Hubert (1975) examined the degree to which respondents used different response categories in a very lengthy questionnaire, where the respondents were not provided with pre-set response categories, but simply allocated numbers to each question. He found that the mean number of different responses was between six and ten. This suggests that ten may be an upper limit in terms of the degree to which respondents can discriminate between questionnaire stimuli, confirming earlier research from the 1950's.

Cox (1980) extensively reviewed previous studies to conclude that scales with two or three response categories were inadequate - (rebutting Jacoby & Mattell (1971)), but there was little marginal gain from using more than nine categories. Clarke (2000) found that increasing the number of scale categories from three to five reduced extreme responses but beyond five categories there was little effect. Holmes (1974) conducted an experiment comparing the responses for unstructured versus structured scales and other derivations of scale construction, but did not test for differences according to the number of response categories. Scherzer & Kernan (1985) investigated the semantic intensity, ordinality and interval level qualities of response labels according to the number of labels used (such as three, four, five categories of response label etc.), however respondents did not rate objects per se, they matched each response label to a point on a 100 point scale. Alwin (1997) found that eleven point scales performed better than seven point scales in terms of reliability and validity. Grigg (1980) found that an eleven
point scale produced more dispersion in responses than a seven point scale. Grigg's result is closer to the issue examined in this paper, however was conducted twenty years ago and used a self completion method. More analysis using data gathered via telephone as well as by self completion would be desirable.

Several studies have also examined whether the inclusion of scale mid points affect responses. Worcester & Burns (1975) found that descriptors such as tend to agree represented more positive sentiment on a four point scale compared to a five point scale. Spagna (1984) found that the omission of a mid point had most effect on increasing the frequencies of the neighbouring scale responses. Si & Cullen (1998) found that mid points did not affect mean response levels. Dawes (2001) found a scale mid point resulted in fewer positive responses. Garland (1991) found the opposite - a mid point resulted in fewer negative ratings. So there is mixed evidence on this issue.

In general there is support for the view that more scale categories reduce the incidence of extreme responses, and may produce more dispersion in the data. However, as this review demonstrates, not much is known in descriptive terms about the effect of different numbers of scale response categories on basic data characteristics such as the relative mean, variance, shape and so on - and certainly not for data gathered via telephone. Yet these are important issues:

- The mean (average) forms the basis of many evaluations contained in market research reports. Would the mean (relative to the highest possible score obtainable from the scale used) have been different if a different number of response categories had been used?
- The variance (i.e. standard deviation) is integral to many tests of statistical inference. For example, if one has a hypothesis that responses may differ according to a certain grouping variable, ideally support for this would come in the form of little within-group variance and considerable across-group variance. Does the number of scale points affect the amount of variance in the data?
- Some statistical techniques are sensitive to kurtosis. Do scales with different numbers of response categories produce different degrees of kurtosis?
- The degree of skewness in the data may affect various statistical analyses. Do scales with different numbers of response categories produce different degrees of skewness?

This study sets out to address these four issues using results from two survey studies.

Data

Two data sets are used in the analysis. The first comprised a convenience sample of 301 undergraduate students who were interviewed at various campuses of an Australian university. The topic was the campus cafeteria at that location. Respondents were interviewed face-to-face at various locations on each campus by IQCA accredited interviewers. A voucher for a free cup of coffee was offered as an incentive to participate. There was no criteria for inclusion except that the respondent was a student at that campus.

Of the 301 respondents, 146 were administered a series of questions and asked
to respond using a five point "1 = strongly disagree ... 5 = strongly agree" scale. The other 155 were administered the same questions but were asked to respond on an eleven point zero to ten scale, where zero meant no agreement and ten denoted 100% agreement. Allocation of respondents to the respective scale type was random. The response rate for this survey was not recorded but qualitative information from the interviewers was that it was approximately 50%.

The second data set was part of a telephone survey of 751 people who had used taxis in the past six months. The sample was selected from a random generation based on the electronic telephone directory. Of the 751 respondents, 151 were administered a series of questions and asked to respond using a five point "strongly disagree - strongly agree' scale. The other 592 were administered the same questions but were asked to respond on an eleven point zero to ten scale, where zero meant no agreement and ten denoted 100% agreement. The difference in sample sizes for the two groups was due to commercial considerations. The sponsor of the study was particularly interested in obtaining scores "out of ten" to retain comparability with previous research, but was prepared to allow a sub group of respondents to be administered the other five point scale to determine how it might affect results. As with the first study, allocation of respondents to the respective scale was random. The response rate for this survey, based on automated call management software was 49%. Therefore we have confidence that the results are likely to be typical of such surveys since they did not suffer from unduly low response rates.

### Analysis

The first issue concerns the possible effect on the mean value of the variables. In order to determine whether the two different scale types had any effect on the level, the mean score for each question was tabulated. To compare the mean scores for the two scale types, the 5 point scale data was re-scaled, by recoding the five point scores to a score out of ten as shown in the diagram below:

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1 and 5, the extreme points on the five point scale were transformed to 0 and 10, the corresponding extreme points on the eleven point scale. 3 was transformed to the corresponding mid-point on the eleven point scale, namely 5. 2 and 4 were fixed midway between the extreme point and the mid point. This meant that 2 was transformed to 2.5 and 4 was transformed to 7.5. Obviously the analysis based on this re-scaling depends on the assumption of equal intervals for both scales. This presumption is arguable with some writers findings showing a lack of intervality (e.g. Schertzer and Kernan 1985) and others much more supportive (Crask and Fox 1987). The assumption of equal interval qualities was assumed for this analysis, and if the different scale types produced similar results this assumption would be justified. Table 1 shows the differences between the eleven point and five point (rescaled) data for both data sets; so all scores are "out of 10". The Mean Absolute Difference (MAD) is shown at the bottom of the table, which is
the average of differences, not accounting for the sign of the difference. The data are ordered by mean score.

Table 1: Differences in Means for Data Set 1 & 2

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<td>Q12</td>
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<td>Q8</td>
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<td>Q11</td>
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<td>Q9</td>
<td>7.5</td>
<td>7.6</td>
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<td>Q6</td>
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<td>7.6</td>
<td>-0.3</td>
<td>Q3</td>
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<td>7.2</td>
<td>+0.1</td>
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<tr>
<td>Q10</td>
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<td>+0.1</td>
<td>Q10</td>
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<td>6.9</td>
<td>0</td>
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<tr>
<td>Q7</td>
<td>7.7</td>
<td>7.5</td>
<td>+0.2</td>
<td>Q4</td>
<td>6.7</td>
<td>6.2</td>
<td>+0.5</td>
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<tr>
<td>Q9</td>
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<td>7.2</td>
<td>+0.1</td>
<td>Q6</td>
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<td>6.3</td>
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<tr>
<td>Q8</td>
<td>6.7</td>
<td>5.9</td>
<td>+0.8</td>
<td>Q5</td>
<td>6.3</td>
<td>6.2</td>
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**MAD** 0.25

On average, the use of a five point scale compared to an eleven point scale results in quite a small difference in mean scores (when re-scaled). The MAD (Mean Absolute Difference) is 0.25 of a scale point on a zero to ten scale (once the 5 point data has been re-scaled) for both data sets. If we do take the sign of the differences into account, the eleven point scale produces mean scores that are around 0.1 of a scale point higher than the re-scaled five point scale. So the difference is minor.

It is also noteworthy that there are more cases where the use of the eleven point scale results in a higher comparative score than a lower comparative score. In Table 1, for data set 1 the eleven point scale produces higher mean scores than the re-scaled five point scale in five out of seven instances. In data set 2 this occurs in eight out of thirteen instances.

There is also a tendency for this effect to be more marked where the particular question attracted a lower average score across respondents. We see in Table 1, for data set 1 the difference between the 11 point score and the 5 point re-scaled score is larger for question 8 (the question with the lowest mean score). This occurs again in data set 2 (still in Table 1) for the two lower scoring questions, namely Q11 and Q7.
Variance

To examine the impact of the different scales on the variance, we report on the coefficient of variation for each variable. The coefficient of variation is the standard deviation divided by the mean score, then multiplied by 100. It facilitates the comparison of variances for items with different mean levels.

Table 2 shows the results for both data sets. The results suggest that the use of an eleven point scale results in a greater amount of variance (relative to the mean score) compared to a five point scale - note how the "difference" column is mostly positive. The results from data set 2 confirm this, as shown in the right-hand side "difference" column for data set 2 in Table 2. The rationale for this result is that the eleven point scale simply provides a wider range of responses, therefore produces more dispersion in responses (consistent with Grigg 1980). Note that data set 2 overall has much higher coefficients of variation for most questions than data set 1. This result is not relevant to the major issue examined in the study, (which is within-data set differences according to the number of scale points used) but the reason for this result should be clarified. It is simply due to a much higher degree of variation in perceptions of service quality by users of taxicabs compared to student users of cafeteria services.

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<td>Q8</td>
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<tr>
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<td>Q7</td>
<td>21.0</td>
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<td>Q1</td>
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<td>+0.1</td>
<td>Q8</td>
<td>23.6</td>
</tr>
</tbody>
</table>

MAD 2.2 MAD 7.1

Kurtosis

Kurtosis is the degree to which the data is peaked, or flat. Kurtosis is also 'scale free' so it is possible to directly compare the results for the five and eleven point scales without any need to transform the data. Table 3 shows that for data set 1, the eleven
point scale data has higher levels of kurtosis in four out of six cases. In data set 2 the eleven point scale data produces lower levels of kurtosis in eight out of 13 cases. Therefore, there does not appear to be any systematic association between the two scale types and the amount of kurtosis, in these two data sets.

Table 3 Differences in Kurtosis for Data Set 1 & 2

<table>
<thead>
<tr>
<th></th>
<th>Data set 1</th>
<th></th>
<th></th>
<th>Data set 2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kurtosis (11 point scale)</td>
<td>Kurtosis (5 point scale)</td>
<td>Difference (11 point - 5 point)</td>
<td>Kurtosis (11 point scale)</td>
<td>Kurtosis (5 point scale)</td>
<td>Difference (11 point - 5 point)</td>
</tr>
<tr>
<td>Q6</td>
<td>2.1</td>
<td>1.9</td>
<td>+0.1</td>
<td>Q1</td>
<td>-0.3</td>
<td>-0.43</td>
</tr>
<tr>
<td>Q7</td>
<td>1.6</td>
<td>2.2</td>
<td>-0.6</td>
<td>Q2</td>
<td>-0.52</td>
<td>-0.38</td>
</tr>
<tr>
<td>Q8</td>
<td>0.1</td>
<td>-0.6</td>
<td>+0.7</td>
<td>Q3</td>
<td>0.12</td>
<td>0.43</td>
</tr>
<tr>
<td>Q9</td>
<td>1.6</td>
<td>1.9</td>
<td>-0.3</td>
<td>Q4</td>
<td>-0.39</td>
<td>-0.93</td>
</tr>
<tr>
<td>Q10</td>
<td>2.1</td>
<td>0.8</td>
<td>+1.3</td>
<td>Q5</td>
<td>-0.54</td>
<td>-0.73</td>
</tr>
<tr>
<td>Q11</td>
<td>3.9</td>
<td>0.5</td>
<td>+3.4</td>
<td>Q6</td>
<td>-0.35</td>
<td>-0.48</td>
</tr>
<tr>
<td>Q12</td>
<td>2.5</td>
<td>2.6</td>
<td>-0.1</td>
<td>Q7</td>
<td>-0.45</td>
<td>-0.97</td>
</tr>
<tr>
<td></td>
<td>Q8</td>
<td>0.86</td>
<td>1.23</td>
<td></td>
<td>0.53</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Q9</td>
<td>1.32</td>
<td>0.78</td>
<td></td>
<td>-0.79</td>
<td>-0.85</td>
</tr>
<tr>
<td></td>
<td>Q10</td>
<td>0.53</td>
<td>0.67</td>
<td></td>
<td>0.39</td>
<td>+0.39</td>
</tr>
<tr>
<td></td>
<td>Q11</td>
<td>-0.79</td>
<td>-0.85</td>
<td></td>
<td></td>
<td>-0.22</td>
</tr>
</tbody>
</table>

MAD 0.8

Skewness

Negative skewness denotes the extent to which there is a "tail" below the mean. A positive skew means the opposite - a "tail" above the mean. The data from both surveys is all negatively skewed, with mean scores all above the scale mid-point.

The results for skewness according to scale type are rather mixed. In Table 4, for data set 1 there is no clear pattern in the difference in skewness between the two types of scales. For the second data set, there is a tendency for the 11 point scale to produce a more negative skewness figure (a longer tail below the mean). However, this appears in only one of the data sets. The conclusion is that there is no systematic relationship between the number of scale points and skewness.
Table 4 Differences in Skewness for Data Set 1 & 2

<table>
<thead>
<tr>
<th>Data set 1</th>
<th>Data set 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skewness (11 point)</td>
<td>Skewness (5 point)</td>
</tr>
<tr>
<td>Q6</td>
<td>-1.0</td>
</tr>
<tr>
<td>Q7</td>
<td>-0.91</td>
</tr>
<tr>
<td>Q8</td>
<td>-0.54</td>
</tr>
<tr>
<td>Q9</td>
<td>-1.15</td>
</tr>
<tr>
<td>Q10</td>
<td>-1.11</td>
</tr>
<tr>
<td>Q11</td>
<td>-1.54</td>
</tr>
<tr>
<td>Q12</td>
<td>-0.81</td>
</tr>
<tr>
<td>Q8</td>
<td>-0.92</td>
</tr>
<tr>
<td>Q9</td>
<td>-1.14</td>
</tr>
<tr>
<td>Q10</td>
<td>-0.9</td>
</tr>
<tr>
<td>Q11</td>
<td>-0.41</td>
</tr>
<tr>
<td>Q12</td>
<td>-0.38</td>
</tr>
<tr>
<td>Q13</td>
<td>-0.68</td>
</tr>
</tbody>
</table>

MAD 0.21  MAD 0.17

DISCUSSION & CONCLUSIONS

This study found in two "split sample" experiments that:

- In both cases, the difference in mean scores produced by the eleven point scale was small, compared to the re-scaled scores produced by the five point scale. The eleven point (zero to ten) scale produced more instances of slightly higher mean scores than the five point scale - after allowing for the five point scale to be re-scaled.

- Furthermore, this tendency of the eleven point scale to produce slightly higher comparative scores was more marked for questions that attracted lower overall mean scores to begin with.

- An eleven point (zero to ten) scale produced higher levels of variance (i.e. coefficient of variation) compared to a five point scale.

- There was no systematic relationship between the use of an eleven point vs. a five point scale in terms of kurtosis.

- There was no systematic relationship between the use of an eleven point vs. a five point scale in terms of skewness.
It would appear that the choice of the number of response categories depends on the purpose of the study. If the major purpose is simply to obtain numerical responses and produce mean scores, the number of response categories does not make a marked difference to the mean score obtained, relative to the upper scale limit. In terms of interpretability, a 'score out of ten' has some appeal in terms of managerial interpretability.

However, if there is an intent to examine dependence relationships between scale variables using tools such as regression, for example, a scale with more response categories could be more useful as it appears to result in more variance in the data.

The results from this study are also 'good news' for those who commission or undertake market research for clients with historical data they wish to preserve comparability. For example, if an organisation had years of data that was gathered using a five point scale, it is likely that it could be converted or transformed to make it comparable with other data that was gathered using more scale categories. Comparability would be more of an issue with items that received lower scores. In this study, the rescaling process had the effect of 'delating' the questionnaire variables that received lower scores using the five point scale. The author plans to conduct more replications of this result to test the robustness of the findings.

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