It has been proposed that the elimination of electronic-service quality (e-SQ) gaps holds the key to a better website experience when dealing with organizations on-line. In turn, this leads to increased perceived e-SQ, perceived value, and importantly purchases and repurchases. In this paper a method of measuring e-SQ gaps is proposed. Regression and coefficient analysis are used to analyse data collected from the relevant entities to first determine the existence of e-SQ gaps and then to measure the size of the gaps. This innovative way of measuring e-SQ gaps was tested on a study of Australian wineries and found to be effective.
1 Introduction

The importance of electronic service quality (e-SQ) is highlighted by Zeithaml, Parasuraman and Malhotra (2002) who claim that the elimination of e-SQ gaps will lead to customer satisfaction which results in increased perceived e-SQ, value, purchases and repurchases. In this paper a method of identifying and measuring e-SQ gaps is proposed.

This method was used in an extensive study of Australian wineries by Davidson as part of PhD research (Davidson and Cooper, 2005) and was found to be effective in identifying and measuring e-SQ gaps. The theory behind the gap analysis, the proposed measurement scale, and an example of its use from the Australian winery study is presented in this paper.

2 Electronic Service Quality Gaps

2.1 Zeithaml et al.’s Conceptual Model

Electronic service quality (e-SQ) is defined by Zeithaml et al. (2000) as “the extent to which a Web site facilitates efficient and effective shopping, purchases and delivery of products and services”. In this definition the meaning of service includes both pre- and post-website service aspects.

Zeithaml et al. (2002) identifies four e-SQ gaps; the information, design, communication, and fulfilment gaps. The information gap represents the difference between customers’ website requirements and managements’ beliefs about those requirements. The design gap represents the failure to fully incorporate knowledge about customer requirements into the structure and functioning of the website. The communication gap represents the inaccurate or inflated promises about a website made through traditional media and on the website itself, and the fulfilment gap represents the discrepancy between customers’ requirements and experiences (what they actually receive). The fulfilment gap stems from the cumulative effects of the information and design gaps. These gaps are illustrated in Figure 1. Zeithaml et al.’s (2002) ‘Conceptual Model of Understanding and Improving e-SQ’ is a refinement of an earlier and well-accepted conceptual model of service quality (SQ) (Parasuraman, Berry, & Zeithaml, 1991). The earlier model was set in the context of traditional SQ, while the revised model focuses on shortfalls in businesses interacting with their customers through the Internet.
Zeithaml et al., (2002) purport that the elimination of e-SQ gaps will result in a better website experience for customers, with the expectation of experience being based on the customers’ website requirements. The creation of satisfied customers will lead to greater perceived e-SQ, value and ultimately purchases and repeat purchases.

2.2 Formal Definition of e-SQ Gaps

If there is no information gap, managers know exactly what customers require and there is a perfect positive relationship between customer requirements and management's beliefs about customer requirements. Therefore, in a situation where there is no information gap, if customers are presented with a list of possible requirements and asked to rate the importance of each and managers are given the same list of requirements and asked to rate their beliefs about customers requirements, the ratings would match. Similarly, there will be no design, communication, and fulfillment gap when there is a perfect positive relationship between:

- managers' beliefs about customer requirements and the design and operation of the websites;
- the design and operation of the website and the marketing of the website; and
- the customers requirements and experiences.

These relationships can be shown graphically. The scatterplot in Figure 2 represents a ‘no gap exists’ situation and the scatterplots in Figure 3 represent ‘gap exists’ situations.
The position of the y-intercept ($\beta_0$), the slope of the regression line ($\beta_1$), and the coefficient of correlation ($r$) influence the existence and extent of a gap. In a perfect positive relationship no gap exists and the line of regression intercepts the y-axis at zero ($\beta_0 = 0$), has a slope of one ($\beta_1 = 1$), and a coefficient of correlation of one ($r = 1$). Any deviation from these three conditions will represent the presence of a gap. Technically, $r$ should equal 1, (as well as $\beta_0 = 0$ and $\beta_1 = 1$) for a perfect relationship. However, it is unusual for all data to occur in a straight line (Zar, 1999) which would result in the condition $r = 1$ never being satisfied when in fact it could be very close. Therefore, a threshold for $r$ is set at 0.75 as recommended by Zar (1999). Hence the $r = 1$ condition becomes $r \geq 0.75$ and any $r$ value that is significantly less than 0.75 results in a rejection. Mathematically ‘no gap’ and ‘gap’ situations can be expressed as:

- No gap exists when all of $r \geq 0.75$, $\beta_0 = 0$, and $\beta_1 = 1$ hold true.
- A gap exists when at least one of $r < 0.75$, $\beta_0 \neq 0$, or $\beta_1 \neq 1$ hold true.
3 Statistical Tests and Measurement of the e-SQ Gaps

3.1 The Existence of an e-SQ Gap

To test if an e-SQ gap exists, simple linear correlation and regression is used to determine the linear relationship between the pairs of variables. To test for $H_0: r \geq 0.75$, Fisher’s (1915, cited in Zar, 1999) $r$ to $z$ transformation is used with a one-tailed test and a critical value of $Z_{\alpha(1)\alpha} = t_{\alpha(1)\alpha} = 1.6449$. For ease of understanding and consistency with the tests for $\beta_0$ and $\beta_1$ the 95% confidence interval for $z$ is calculated then transformed back to an upper and lower limit for $r$. Therefore, for $H_0: r \geq 0.75$ and $H_1: r < 0.75$, if the upper or lower bounds of the 95% confidence interval are greater or equal to 0.75, accept $H_0$.

The tests for the slope and $y$-intercept use the 95% confidence interval for $\beta_1$ and $\beta_0$ respectively. For $H_0: \beta_1 = 1$ and $H_1: \beta_1 \neq 1$, if 1 falls within the upper and lower bounds of the 95% confidence interval, $H_0$ is accepted. For $H_0: \beta_0 = 0$ and $H_1: \beta_0 \neq 0$, if 0 falls within the upper and lower bounds of the 95% confidence interval, $H_0$ is accepted. In summary:

- $H_0: r \geq 0.75$ is true if $L$ or $U \geq 0.75$;
- $H_0: \beta_0 = 0$ is true if $L \leq 0 \leq U$; and
- $H_0: \beta_1 = 1$ is true if $L \leq 1 \leq U$.

A level of significance of 0.05 was chosen for this research, as 0.05 is the most conventionally accepted level for most business research (Cavana, Delahaye, & Sekaran, 2001). Thus, there is a 5% chance of making a Type I error of rejecting $H_0$ and declaring there is an e-SQ gap when in fact there is not.

3.2 Extent of the e-SQ Gap

A formula for calculating the extent of the e-SQ gap has been devised which uses the values of $r, \beta_0,$ and $\beta_1$. This formula,

$$D = \left( (1 - r^2) \times 0.5 \right) + \left( \left| \frac{\beta_0}{5} \right| \times 0.25 \right) + \left( \left| \frac{\beta_1 - 1}{4} \right| \times 0.25 \right) \times 100$$

converts $r, \beta_0,$ and $\beta_1$ to a value between zero and one. $D$ (Latin letter D bar representing discrepancy) is a combination of these three values weighted. The weightings given to the $y$-intercept ($\beta_0$) and slope ($\beta_1$), which represents agreement between the two variables in question, is 50% in total. The coefficient of determination ($r$), which represents the precision of the agreement between the two variables, is also given 50%. These weighted values are added and multiplied by 100 so that the range is from zero to 100 where zero indicates no discrepancy and 100 indicates a complete discrepancy. Zero and 100 are used for the extreme points.
simply to aid understanding and visualisation by the user. In Figure 4 a description of the extremes for each of the four gaps are given.

**Figure 4: Measurement of Discrepancy**

<table>
<thead>
<tr>
<th>Discrepancy</th>
<th>Information Gap</th>
<th>Design Gap</th>
<th>Communication Gap</th>
<th>Fulfilment Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – None</td>
<td>Managers know everything that customers require</td>
<td>Every thing that managers know about customer requirements is implemented on the website</td>
<td>Everything that is promised about the website by marketing is implemented on the website</td>
<td>Everything the customer requires is on the website</td>
</tr>
<tr>
<td>Complete - 100</td>
<td>Managers do not know what customers require</td>
<td>What managers know about customer requirements is not implemented on the website</td>
<td>What marketing promises about the website is not delivered on the website</td>
<td>None of the customer requirements are on the website</td>
</tr>
</tbody>
</table>

Given that the fulfilment gap results from the existence of the information, design, and communication gaps, it would be reasonable to expect the sum of these gaps to equal the fulfilment gap (info. gap + design gap + comm. gap = fulfilment gap). This concept has not yet been fully tested. However, in the Australian winery study (reported in the next Section) the information, design, and fulfilment gaps were measured and it was found that 9.6 (info. gap) + 39.9 (design gap) < 60.0 (fulfilment gap), which leaves scope for the inclusion of the communication gap. In the Australian winery study other combinations of weightings were tested and the 50/50 split minimised the discrepancy between the sum of the information and design gaps and the fulfilment gap. The 50/50 split between precision and agreement appears reasonable although it has not been statistically justified and is an area for further testing.

**Table 1: Relationship between $r$, $\beta_0$, $\beta_1$, and $D$**

<table>
<thead>
<tr>
<th>Discrepancy</th>
<th>Precision</th>
<th>Agreement</th>
<th>E-Service Quality Gap Discrepancy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$(r, \beta_0, \beta_1)$</td>
<td>$(\beta_0, \beta_1)$</td>
<td>$(\beta_0, \beta_1)$</td>
</tr>
<tr>
<td>Complete gap</td>
<td>0.00 0.00</td>
<td>-5.00 -3.00</td>
<td>1.00 1.00 1.00 1.00 100.0</td>
</tr>
<tr>
<td>3/4 gap</td>
<td>0.50 0.25</td>
<td>-3.75 -2.00</td>
<td>0.75 0.75 0.75 75.0</td>
</tr>
<tr>
<td>1/2 gap</td>
<td>0.71 0.50</td>
<td>-2.50 -1.00</td>
<td>0.50 0.50 0.50 50.0</td>
</tr>
<tr>
<td>1/4 gap</td>
<td>0.87 0.75</td>
<td>-1.25 0.00</td>
<td>0.25 0.25 0.25 25.0</td>
</tr>
<tr>
<td>No Gap</td>
<td>1.00 1.00</td>
<td>0.00 1.00</td>
<td>0.00 0.00 0.00 0.0</td>
</tr>
<tr>
<td>1/4 gap</td>
<td>0.87 0.75</td>
<td>1.25 2.00</td>
<td>0.25 0.25 0.25 25.0</td>
</tr>
<tr>
<td>1/2 gap</td>
<td>0.71 0.50</td>
<td>2.50 3.00</td>
<td>0.50 0.50 0.50 50.0</td>
</tr>
<tr>
<td>3/4 gap</td>
<td>0.50 0.25</td>
<td>3.75 4.00</td>
<td>0.75 0.75 0.75 75.0</td>
</tr>
<tr>
<td>Complete gap</td>
<td>0.00 0.00</td>
<td>5.00 5.00</td>
<td>1.00 1.00 1.00 100.0</td>
</tr>
</tbody>
</table>

The relationship between $r$, $\beta_0$, and $\beta_1$, and $D$ is illustrated in Table 1 above. It can be seen that when there is a perfect positive relationship and $r = 1$, $\beta_0 = 0$, and $\beta_1 = 1$, there is no gap and $D = 0$. Conversely when conditions change and $r$ moves towards zero, $\beta_0$ moves towards $\pm 5$, and $\beta_1$ moves...
towards −3 or +5 (−3 and +5 do not appear symmetrical but are 4 steps away in each direction from the perfect positive relationship position of \( \beta_1 = 1 \)), \( D \) moves towards 100, indicating a complete gap, or lack or knowledge. The values of \( r = 0, \beta_0 = \pm 5 \), and \( \beta_1 = -3 \) or +5 are the upper and lower bounds that can be obtained.

**4 A Practical Example**

**4.1 Australian Wineries**

Davidson used this method of determining the existence and extent of e-SQ gaps in a comprehensive study of Australian wineries (Davidson, 2004; Davidson & Cooper, 2005). This study used a portion of Zeithaml et al.’s (2002) model by focusing on customer requirements, managements’ beliefs about customer requirements, and website design and operations. An on-line survey, underpinned by a website design framework developed for Australian wineries (Davidson, 2002, 2003) was used to ask winery managers and winery website users to rate 90 website features on a five-point number scale with two polar positions (1-not important to 5-very important). In addition, Davidson evaluated 260 winery websites for the existence of these features. The results of each of the three data collections were analysed using the statistical tests described above. It was found that an information, design, and fulfilment gap did exist.

The relevant statistical measures and calculated \( D \)s are given in Table 2 and illustrated in Figure 5. It can be seen that winery managers have a good indication of what customers require (information gap of 9.6), however customer requirements are not being implemented on winery websites (design gap of 39.9), which results in customer dissatisfaction (fulfilment gap of 60.0).

<table>
<thead>
<tr>
<th></th>
<th>Precision (coefficient of determination)</th>
<th>Agreement (intercept) (slope)</th>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
<th>E-Service Quality Gap Discrepancy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( r )</td>
<td>( r^2 )</td>
<td>( \beta_0 )</td>
<td>( \beta_1 )</td>
<td>( 1 - r^2 )</td>
<td>(</td>
</tr>
<tr>
<td>Information Gap</td>
<td>0.922</td>
<td>0.850</td>
<td>0.313</td>
<td>0.910</td>
<td>0.150</td>
<td>0.063</td>
</tr>
<tr>
<td>Design Gap</td>
<td>0.542</td>
<td>0.294</td>
<td>-0.659</td>
<td>0.794</td>
<td>0.706</td>
<td>0.132</td>
</tr>
<tr>
<td>Fulfillment Gap</td>
<td>0.431</td>
<td>0.186</td>
<td>2.982</td>
<td>0.298</td>
<td>0.814</td>
<td>0.596</td>
</tr>
</tbody>
</table>
4.2 Practical Implications

Theoretically, decreasing the information and design gaps should have the flow through effect of decreasing the fulfilment gap, hence increasing customer satisfaction, which should ultimately lead to increased purchases and repurchases.

Winery managers and their website developers can use this knowledge to create or improve their websites. It must be remembered that the results show that as an industry, managers know what is required but do not implement it on websites. At an individual winery level, managers and websites will differ; hence the list of contributing items will differ for each winery. Therefore, individual winery circumstances and the complete list of customer requirements need to be taken into consideration, not just the items identified as contributing to the industry gaps.

5. Conclusion and Contribution

A way of measuring e-SQ gaps has been developed which enables easy comparison and visual representation. In the Australian winery study that this method was first tested on it was discovered that an information gap of 19.6, design gap of 39.9, and a fulfilment gap of 60.0 exists. This means that winery managers have a reasonable idea of what customers require on winery websites but these requirements are not always being implemented on the actual websites, which according to Zeithaml et al. (2002) leads to customer dissatisfaction. Armed with this knowledge, along with a detailed list of factors contributing to the e-SQ gaps, winery managers and their website developers can work towards closing the gaps and increasing customer satisfaction, provided they think the benefits outweigh the costs. The winery website framework upon which the surveys and evaluations were made is to be refined after taking into consideration the results. This framework will be the subject of future research.

From a scholarly perspectives this research has provide an innovative way of recognising and measuring e-SQ gaps. Further confirmation of its value and testing is warranted. It should be possible to develop a framework for any industry and use this method of e-SQ gap analysis. This has
the potential to provide practitioners in the industry with a guide on which to develop and improve their web presence.

References


