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LIFE CYCLES OF EXHIBITIONS IN A SCIENCE CENTRE: A NEW ZEALAND CASE STUDY

Visitor trends during the first seven years of operation of a small interactive science centre in Hamilton, New Zealand, show a steady increase for the first three years, after which repeated interventions have been necessary to defer an overall decline in visitor numbers. Modelling short-term exhibitions shows no trends that can be attributed to a product life cycle; rather the visitor numbers seem to be driven by external factors, most notably the occurrence of school holidays when the science centre's role as an entertainment appears to dominate.

Keywords**:** visitor trends, product life-cycle, visitors, exhibitions, science centres

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Introduction

In common with most science centres, the interactive science-technology centre in Hamilton, New Zealand was initiated by a group of committed scientists and educators. The centre's founding director coined the name EXSCITE, standing for Explorations in SCIence and Technology. The centre has a permanent collection of favourite hands-on exhibits showing a range of scientific principles and their technological applications complemented by themed science exhibitions, occasionally imported 'blockbusters', but more typically developed in-house or by one of the five other science centres in New Zealand.

From the beginning, EXSCITE has been required to earn a significant part of its operating costs through admission charges, and this meant that the number of its visitors has been monitored since first opening in 1993 as an independent science centre until several years after it was merged into the neighbouring regional museum in 1997. The archives of the centre contain a rich record of visitor characteristics and attendance statistics, especially from 1996 to 2003. This paper represents the first study of daily and annual visitor numbers at any New Zealand science centre, although there have been investigations of visitor characteristics at museums and science centres elsewhere in the world (e.g., Dalton, 2003; Bitgood, 2003; McDermott Miller, 1996; Samaranayake, 1992) and suggestions that permanent exhibitions at science centres have a product life cycle (Caulton, 1998; Black, 2005).

Overall visitor trends

The EXSCITE centre's early development was plagued with funding shortfalls and political machinations which, however frustrating to trustees and staff, served to maintain public interest in the venture through media coverage. Hamilton City has a population of about 120,000, and it was recognised early on that economic survival would depend strongly

on repeat visitation. Indeed, a survey in 1996 indicated that 46% of visitors had been to EXSCITE previously, with a further 7 % being regular visitors. Lundtorp and Wanhill (2001) have suggested that the number of visitors at a repeat visitor dominated attraction over time should show the 'classic' form of Butler's (1980) model: an initial 'exploration' stage with low numbers of visitors, the number of visitors then increasing through a 'development' stage to a mature 'consolidation' stage. From this point, visitor numbers typically decline, unless there is an intervention that stimulates rejuvenation. Annual attendance at EXSCITE climbed steadily through the 1990s, peaking in 1998 (**Figure 1**).

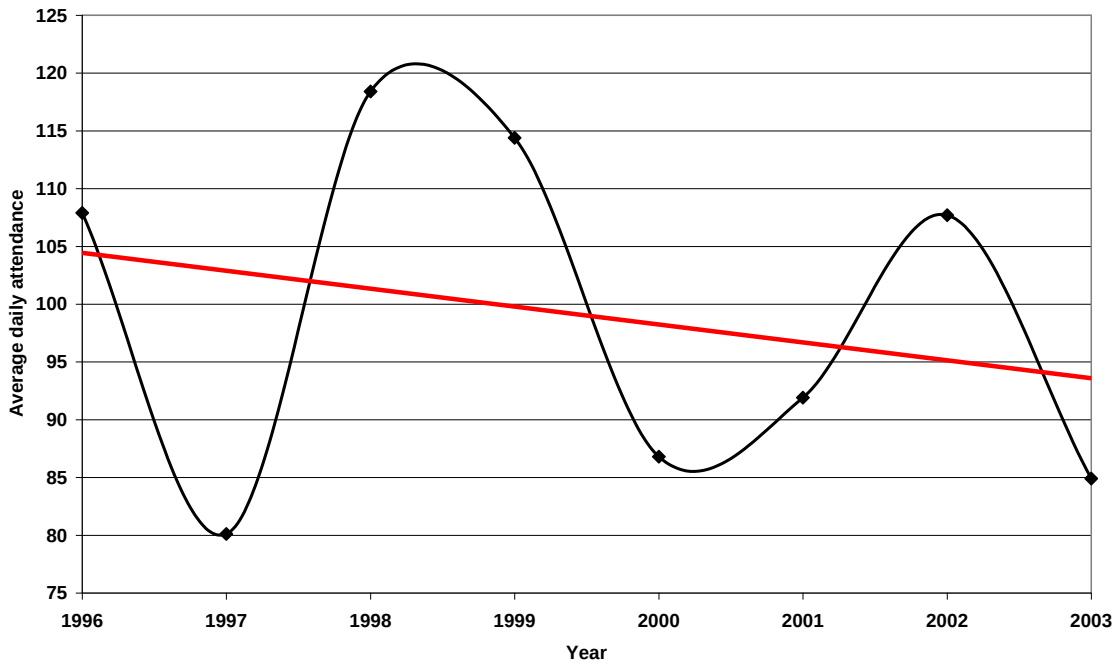

Figure 1. Variation in average daily attendance at EXSCITE, 1996–2003, showing overall declining trend, leavened by interventions.

This progression to Butler's stage of 'maturity' coincided with generally positive media stories about the venture. The Hamilton City Council assumed operational control of EXSCITE as part of a controversial amalgamation between the city's Library and Museum in 1997. Although financial security seemed likely through this arrangement, after the merger the visitor numbers reached Butler's 'stagnation' stage. The decline that the evolution plot

suggests should prevail from this point has been stayed by several 'rejuvenation' stages. Obviously these events have been important to the survival of EXSCITE: without them the Council – in the face of a now less supportive media – might have moved to close the doors. Generally these rejuvenations seem associated with an increased commitment to advertising both of the venue itself and of its exhibitions, but this activity tends not to be maintained for long and the overall decline in visitor numbers resumes. Thus, the plot of attendance versus time is transforming from the product cycle of a 'high learning product' characterised by an extended introductory period and requiring significant education of the customer to that of a plot with multiple maxima that is more attributed to trends in purchasing a fashion product (Kerin et al., 2004, p.240).

Exscite's temporary exhibitions

EXSCITE's permanent exhibits resemble those found in most other science centres throughout the world. Thus, visitors tend to be local. In 1997, for example, of 7226 visitors queried 53% were from Hamilton City, and a further 13% from the surrounding region. The same survey noted that 43% of visitors were prompted to visit through conversations with others. The exhibits were originally intended to appeal to all ages, but over time both the permanent exhibits and the temporary exhibitions have tended to become both more child-centric and more educationally oriented. Moreover, complementing the permanent exhibits with a succession of themed temporary exhibitions was fostered by funding being available for experiences and programmes that were demonstrably linked to school science and technology curricula. This study considers the 40 temporary exhibitions presented at EXSCITE between 1996 and 2003, with particular reference to those between 1996 and 2001.

Onofri and Scorcu (2006) asserted that "the length of the show represents the crucial factor that influences the pattern of the life-cycle". They found that attendance (A) was correlated with duration (T) of the exhibition, and their complex model was shown to reduce to a parabolic relationship, i.e.,

$A = c + a_1T + a_2T^2$, where c, a_1, a_2 are constants …. (equation 1)

If all the exhibitions were of a similar type, this parabolic relationship would be expected to show a maximum value, when $dA/dT = a_1 + 2a_2T = 0$. If the duration of an exhibition at this point on the graph is termed T_{max}, then it has the value given by:

$T_{max} = -a_1/2a_2$ …… (equation 2)

The trend-attendance data for the EXSCITE exhibitions show considerable scatter (**Figure 2**).

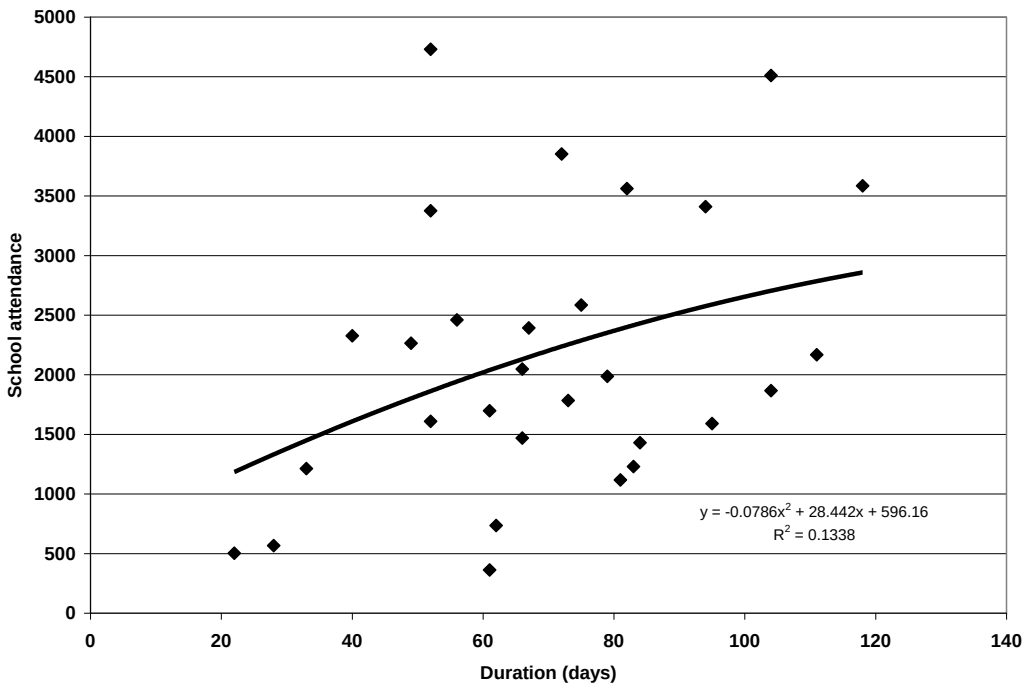

Figure 2. Attendance by students in school groups versus duration of exhibitions at EXSCITE. Solid line is parabolic regression.

The solid line on Figure 2 is that for parabolic regression, for which the equation is:

$A = -0.0786T^2 + 28.442T + 596.16$, for which the correlation coefficient (as r^2) is only 0.14.

Low correlation coefficients are also obtained for the parabolic regression for public visitors and all visitors, as shown in **Table 1**.

Table 1. Application of parabolic regression model of life cycle (Onofri and Scorcu, 2006) to all exhibitions at EXCITE

Audience	**No. of exhibitions** (note 1)	**Correlation coefficient**	**Premiere effect** (note 2)	**Average duration** T_{av}	**Maturity** (note 3) T_{max}	**Ratio** T_{av}/T_{max}	**Cycle status** (note 4)
All	40	0.311	Negative	70.9	177	0.40	Immature
Public	29	0.212	Positive	69.7	212	0.33	Immature
Schools	29	0.134	Positive	69.7	181	0.39	Immature

Notes
1. Although 40 exhibitions were presented at EXSCITE between 1996 and 2003, separate records of public and schools attendances were not maintained after September 2001. Thus the 'public' and 'school' attendance data are for 29 exhibitions from 1996 to September 2001.
2. If the regression gives a 'spike' in A when $T = 0$, then this is referred to by Onofri and Scorcu (2006) as a (possibly positive, i.e., $c \geq 0$) 'premiere effect'.
3. The maximum in the parabolic relationship occurs when $dA/dT = 0$, i.e., when $2a_2T + a_1 = 0$, i.e., at $T = -a_1/2a_2$. This value of T is called T_{max}.
4. If the ratio T_{av}/T_{max} is less than 1.0, then the product is maturing; if the ratio is greater than 1.0, then the product is already mature and the decline phase of the cycle is the only possible outcome.

The average duration of the exhibitions is about a third of the predicted maximum in the parabolic plot. This would suggest that the exhibitions overall have not become 'mature' in a product life-cycle sense. However, the extent of scatter suggests that not all exhibitions might behave in the same way: the prospect that the relationship might change with type of interactive exhibition themes is explored below.

Product cycles for types of temporary exhibitions

Exhibitions presented at EXSCITE can be broadly classified into four groups: 'science' exhibitions, which comprise exhibits about physical phenomena, such as sound and electricity, and natural phenomena in the geological and biological sciences; 'human'

exhibitions, such as the explanation of human features, activities and perceptions; 'technology', the application of science to the real world; and 'fun' exhibits, which although engaging have minimal scientific content. Applying equation (1) to the duration and attendance of exhibitions in the four categories, for sub-groups of attendance comprising the public and school parties gave the results shown in **Table 2**.

From this table it is clear that 'human' and 'technology' exhibitions are mature in terms of their product life cycle and are in decline from their opening at EXSCITE. This is consistent with daily visitor trends of specific exhibitions, many of which show no obvious trends of attendance with time, other than a spike corresponding to school holidays (e.g., **Figure 3**).

Table 2. Application of parabolic regression model of life cycle (Onofri and Scorcu, 2006) to various types of exhibitions at EXCITE

Audience	**Exhibitions**		**Parabolic regression**					
	Type	***Number*** (note 2)	***Correlation coefficient***	***Premiere effect*** (note 2)	***Average duration*** T_{av}	***Maturity*** (note 3) T_{max}	***Ratio*** T_{av}/T_{max}	***Cycle phase*** (note 4)
School	Science	10	0.37	Negative	69.3	87.3	0.79	Immature
	Human	6	0.64	Positive	76.3	66.9	1.13	Mature
	Technology	8	0.33	Positive	75.1	50.5	1.48	Mature
	Fun	4	0.98	Negative	52.2	59.3	0.80	Immature
Public	Science	9	0.54	Positive	73.8	49.8	1.48	Mature
	Human	6	0.40	Positive	76.3	55.1	1.38	Mature
	Technology	8	0.14	Positive	75.1	50.7	1.48	Mature
	Fun	4	0.99	Negative	52.3	81.6	0.64	Immature

Notes

1. One temporary exhibition simply featured favourites from the permanent collection; this is not included in this table. Another exhibition was for school groups only, and so is included in the 'school', but not in the 'public' audience. This gives a total of 28 exhibitions for 'schools' and 27 for 'public'.
2. If the regression gives a 'spike' in A when T = 0, i.e., $c \geq 0$, then this is referred to by Onofri and Scorcu (2006) as a (possibly positive) 'premiere effect'.
3. The maximum in the parabolic relationship occurs when $dA/dT = 0$, i.e., when $2a_2T + a_1 = 0$, i.e., at $T = -a_1/2a_2$. This value of T is referred to here as T_{max}.
4. If the ratio T_{av}/T_{max} is less than 1.0, then the product is maturing; if the ratio is greater than 1.0, then the product is already mature and the decline phase of the cycle is the only possible outcome.

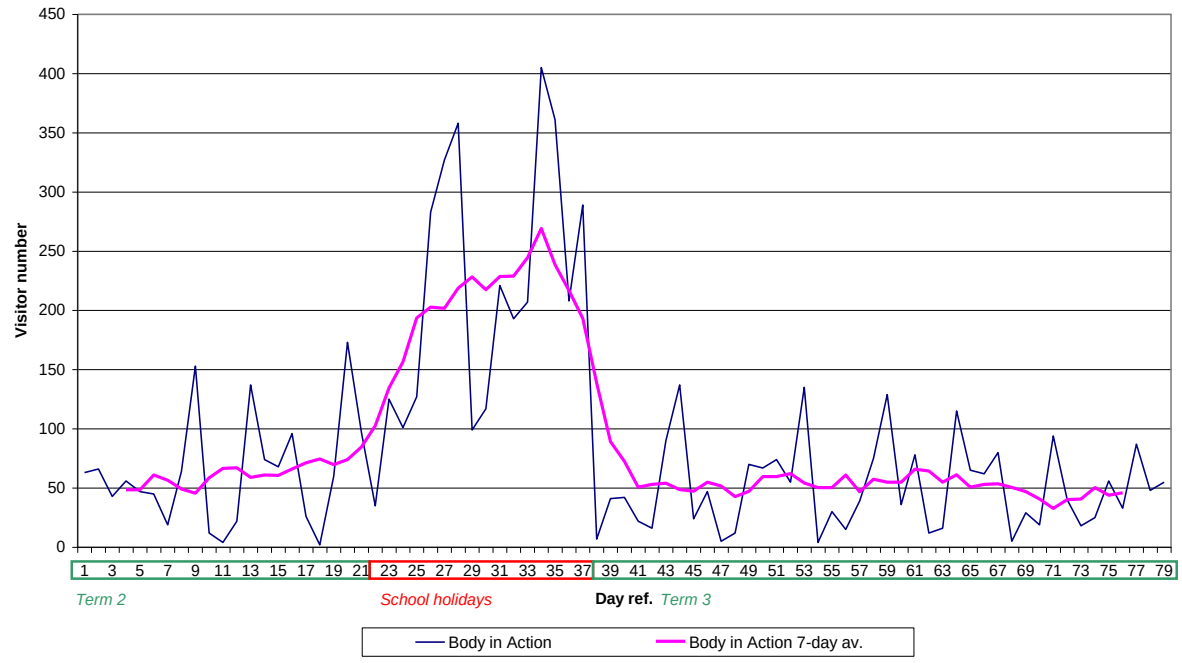

Figure 3. A peak in attendance in the middle of an exhibition period generally coincides with school holidays. The example given is the *Body in action* exhibition in 1997. The jagged line is the daily attendance; the smoother line the 7-day moving average attendance.

Onofri and Scorcu (2006) suggest that additional advertising or price discounting might be appropriate strategies for long-term exhibitions of this type. By contrast, the 'fun' exhibitions for both school and public audiences and the science exhibitions for school audiences probably need no further strategies to enhance attendance. That said, the low correlation coefficients mean that these inferences can be but tentative.

Conclusion

Attendance trends over the first seven years operation of the Exscite science technology centre in Hamilton (New Zealand) show a 'product life-cycle' of about three years, after which intervention was necessary to re-stimulate visitor numbers. This intervention was a combination of increased promotion and a 'block-buster' exhibition, and is probably a requirement when the catchment of a particular attraction is relatively small and return visits are necessary for financial survival. Perhaps disconcertingly for the mission of

science centres, this does suggest that external factors related to science centres as a place for entertainment seems to be the dominant control on visitation trends.

Individual exhibitions do not appear to show characteristics typical of product life-cycles, and even when grouped into sub-types any peaks in attendance seem more related to their timing with respect to school holidays than to any characteristic of the exhibitions themselves. It is possible visitor characteristics at larger and longer established science centres might show a relationship of product life-cycle that depended on the subject of the exhibition, and this would be a worthwhile area of research.

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