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Summary

The long overdue surge of interest in consumer behaviour texts in low-involvement purchasing has only begun to gather momentum. It often takes the form of asking whether concepts usually associated with high-involvement purchasing can be applied, albeit in a modified form, to low-involvement purchasing. One such concept is evoked set, that is the range of brands deemed acceptable by a consumer in a particular product area. This has characteristically been associated with consumption involving extensive pre-purchase search and evaluation. The consumer's evoked set is thus the brands he would actually consider purchasing in advance of the purchase event. However, when it comes to regularly purchased, low cost, non-durable low-involvement goods, can this evoked set concept be utilised?

The authors propose a new measure to gauge brand loyalties of respondents on consumer panels. It draws on the supposition that evoked set may be applied on panels. The measure also strives to incorporate desirable modelling features in being micro-based, unidimensional, and simple. Indications are given of how the measure might be further utilised to examine brand performance at the macro level and to predict market share.

Brand Loyalty Research

The topic of brand loyalty in Consumer Behaviour is both a contentious and complicated one. At one level the discussion centres on the correlates of brand loyalty. These might be classified as either consumer correlates such as age, educational level, personality and group membership[1] or market correlates such as product class, price, outlet and product conspicuousness.[2] At a deeper level, however, lies the more fundamental question of how to define and measure brand loyalty. Success in identifying a valid and strategically operational set of consumer and market based correlates of brand loyalty depends ultimately on the logically more basic and antecedent question of measurement and definition. Jacoby and Chestnut's review almost a decade ago of the proliferation of operational definitions of brand loyalty — they instanced over fifty — only serves to highlight the maelstrom that awaits both academics and practitioners venturing into this subject area.[3] A 'solution' to the brand loyalty question lies far beyond the scope of any one article. With this in mind the authors wish to confine themselves to brand loyalty as it arises in the context of panel data. Specifically they propose a brand loyalty index for panels which takes cognisance of the related topics of evoked set and involvement.[4]

The dispute over what precisely constitutes brand loyalty derives in part from the fact that some theorists on this subject are adherents of Behaviourist psychology while others are decidedly Cognitivist.[5] Since the former group regard mental processes as at best irrelevant and at worst non-existant in determining human behaviour, they opt for an empirical observable measure of brand loyalty. Thus for behaviourists brand loyal behaviour and repeat purchase behaviour are synonomous. By contrast cognitivists maintain that any discussion of brand loyalty divorced from its necessary mental antecedents such as attitudes is incomplete and ultimately pointless. Looking specifically at indices of brand loyalty, many behaviourists are drawn to stochastic measures where observed sequences of purchasing may be interpreted probabilistically thereby circumventing the need to consider any causative cognitive element. Bass provides perhaps the most succinct justification for the stochastic predilection with probabilistic models: "Such random occurances as out of stock conditions, mother-in-law visits, and weather do influence choice behaviour but it is not possible or useful to include all such variables in empirical studies".[6] This is not to claim that all proponents of stochastic models are doctrinaire behaviourists. The supposed correlates of brand loyal behaviour are so numerous, so varied and seemingly so unpredictable that, due to a proliferation of proposed 'causes', some cognitivists have embraced the stochastic approach as the more realistic. Other cognitivists insist that, despite the myriad 'explanations' advanced for brand loyal behaviour, there remains one or a few pivotal causes which *determine* this behaviour — hence the deterministic versus stochastic approaches to brand loyalty within the cognitivist school. The use of deterministic models has yet to meet with unqualified success. Critics of stochastic models, on the other hand, while admitting their predictive superiority, claim that they abrogate the possibility of exerting any influence on repeat purchasing.[7]

The polemical impasse of whether to view brand loyal behaviour deterministically or stochastically seems to have been solved by some authors with a modicum of selectivity. Jacoby suggests that brand loyal behaviour is a sub-set of repeat purchase behaviour, RPB, "the more generic construct".[8] It is this brand loyal sub-set of RPB which may be viewed deterministically as being a function of "psychological (decision-making, evaluative) processes".[9] In essence, the 'brand loyal' consumer is so termed because he possesses a *commitment* to the brand which is the source of his loyal behaviour and which differentiates him qualitatively from the mere repeat purchaser. Thus brand loyal behaviour and 'mere' RPB are "functionally different phenomena mediated by different underlying dynamics".[10]

Consumer Panels

Where does this leave the panel researcher? The purely behavioural data to which he has access has been deemed by Jacoby to be insufficient for determining brand loyalty. The diary method is unsuited to the estimation of commitment and the nature of the product classes monitored by diaries is such that 'commitment', if any, will be weak, possibly unarticulated and probably the outcome rather than the antecedent of purchase behaviour.

Traditionally, individual panel purchase strings were analysed using a variety of operational behavioural indices such as the percentage of purchases devoted to a brand, "three in a row" and the two thirds criterion.[11] These behavioural definitions of brand loyalty were followed by the application of stochastic models to panel data where consumers were deemed loyal based on the probability of repurchasing.[12] Alternatively, other probabilistic models were devised to predict future aggregate variables such as market share and market trends, the point being that such macro analysis was of greater benefit strategically. Ehrenberg's Negative Binomial Distribution and the Parfitt Collins Model are two such models.

Ehrenberg's NBD model demands the following conditions: 1. The likelihood of purchase in any period of short duration is independent of the time when the last purchase was made. 2. The likelihood of purchase does not change over time. 3. The purchasing rate (number of purchases made by individuals in a given period) is distributed according to a gamma distribution across the population of consumers. The first condition leads to the necessity for care in the choice of time period over which the purchase rates are measured, which in turn requires a high level of participation on the part of the researcher. The second condition — that the research be carried out in a situation of market equilibrium — is unrealistic from a practical point of view as one would expect more resources to be devoted to modelling as the uncertainty in the market increased. This restriction has led to comparisons of the model's predictions of the norm with the actual in order to measure in some way the impact of any factor causing a change in the market. Again, interpreting this requires high researcher participation. These first two conditions are required to ensure that the purchase rate will be governed by a Poisson statistical distribution process. This is a very strict requirement which when checked empirically was found not to hold.[13] The third condition introduces a very complex formula offending the school of modelling opinion which would suggest that models should not only be able to predict the future based on trends and relationships but also help to make the underlying activities more easily understood.

The NBD model is used to predict amongst other things the proportion of buyers (consumers who buy at least once) B in a time period T (termed penetration) using the formula $B_T = 1 - (1 + \frac{Tm}{k})^{-k}$, where m and k are coefficients derived from the data. This leads to overestimation when a long time period is used and hence inconsistency with the data from which the model parameters were derived.[14] It has been found that the entrance of even a minor new brand causes discrepancies in the model. Grahn [15] found that changing from the number of purchases made by individuals in a given period to the number of purchasing occasions in the period provided a better fit for the model, and overcame some of the discrepancies caused by the entrance of a minor new brand. However, it

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did not deal with the NBD model's tendency to over-predict. A final objection to the NBD is that it models brand sales directly. Naert and Leeflang[16] suggest that modelling brand sales indirectly is more robust because it can account for the distinction between influences on sales through product class (using economic, environmental, and macro-marketing variables) and through market share (using brand specific micro-marketing variables).

These weaknesses of the NBD model do not imply criticisms of Ehrenberg's seminal research. His empirical results[17] suggest a very reasonable picture for relatively low-involvement frequently purchased products. The following are some conclusions which could be argued from the findings. Simple rather than complicated rules (and hence models) apply. Purchasing behaviour does not change dramatically either over time periods or between different products; this applies irrespective of the number of products or of the purchase frequency. Observable empirical trends are reflected in appropriate coefficients. For example, if there is a high level of joint buying of two products compared to the industry norm these products turn out to be complementary.

The Parfitt-Collins model focusses on estimating repeat-purchases for new products in order to provide an early prediction of ultimate market share using panel data:

$$S = p\ r\ b$$

where S = ultimate brand share

p = ultimate penetration rate of the brand (percentage of new buyers of this product class who *try* this brand)

r = ultimate *repeat*-purchase rate of brand the (percentage of repurchases by persons who buy this brand)

b = *buying-rate* index of repeat purchase of this brand (average buyer = 1.00)

The model is simple, but has a number of deficiencies. It assumes that market conditions do not change from the start of the research onwards. Two of its three factors, p and r, involve calculating saturation levels from trends in the data. Saturation estimations are very sensitive to small variations in the data and would be better confined to entire product classes where there would be greater volumes of data. With only a few weeks data there can be wide dicrepancies in the saturation levels and the saturation models which might fit the data. Lilien and Kotler suggest its other limitations include "(1) lack of consideration of an aware state prior to trial, (2) no effects of advertising, promotion, or distribution, and (3) no consideration of different repeat rates for different repeat classes (first repeat, second repeat, etc.)"[18]

This latter criticism is supported by Eskin[19] and others. If this model uses only a few weeks data it may be sensitive to the choice of period over which the research is carried out. For instance, if customers use the product at different rates, slow users may or may not be classified as repurchasers depending on the research period. The model might work better for product classes with low shelf life or high usage rates such as bread rather than those with a longer time gap before repurchase such as pickles or mustard.

What criteria should be satisfied by a brand loyalty model based on panel data? The foundation of any model is the parameter on which it is based. Panel data contains strings of purchase sequences. This data must be reducible to a parameter which is a good statisical measure of 'loyalty'. That is, it should be simple and unidimensional unless loyalty for low-involvement products can be shown to be multidimensional. It should be usable to describe individual as well as group purchasing behaviour. It should be consistent with the empirically observed behaviour of the process being modelled. Thus if the purchases described by one set of panel data are deemed to be more 'loyal' than those described by another set then the 'loyalty measure' of the first should be greater than that of the second. This should be true for individuals and for groups so that any estimate of market share based on probability of purchase derived from the model should correlate with actual market share based on the same data. Ideally the same parameter should be usable to describe both brand and industry behaviour depending on the data for which it is computed. This is important for the manager/researcher who wishes to have measures of loyalty for different brands and for a product class which he can compare with one another and over time. It is also important so that market share and industry sales models can be constructed which incorporate decision variables. The parameter should contain no artificial elements such as arbitrary cut-offs. It should have an ability to differentiate between similar sets of panel data if this can be done by someone examining both sets.

Low-Involvement Consumer Behaviour

What is proposed here is a behaviour-based operational measure of brand loyalty for panel data. The cognitive decision process paradigm is clearly inapplicable in the consumer panel context since consumer diaries are not suited to measuring such variables and, even if they were, the low-involvement nature of the products concerned would suggest the absence of any such process. In essence the 'brand loyal' behaviour of the consumer panelist may not stem from any conscious deliberation or evaluation.

Krugman[20] is usually credited with the low-involvement paradigm while the concept of involvement itself derives from Sherif and Cantril.[21] The dimension used by him to designate such involvement was 'personal relevance'. Since then additional measures of involvement have proliferated. While the variety may be confusing it does seem to suggest that high-low involvement is best viewed as a continuum rather than as two discrete entities. It has variously been portrayed as the degree of 'bridging' between the stimulus and the individual, the interest or drive evoked by a particular stimulus, the relation to an individual's central values, the level of commitment, the ego involvement, and the level of relevance to one's self-concept.[22] Distinctions have also been made between the following types of involvement: product, purchasing, usage-situational, and advertising.[23] More recently Kassarjian's postulate of a generalised trait of involvement-in-purchasing regardless of product or situation has been supported.[24] Attempts have been made to standardise involvement measurement,[25] while others have questioned both the desirability and possibility of a single unidimensional tool.[26]

While virtually all the definitions assume that it is the *consumer* who is inherently involved, in many texts the terms high- and low-involvement are characteristically applied to products. Nonetheless there is evidence to suppose that consumer involvement is reflected differently in discrete product classes such that it does make sense to speak of a *product* involvement classification scheme.[27] The bulk of product classes included in panel research seem to lie clearly in the low-involvement spectrum. This being so, Robertson's analysis of consumption behaviour monitored in panel research seems apt. "This does not suggest that low commitment consumer behaviour is in any sense random or that brand 'preferences' do not exist. . . The act of decision making is often frustrating and can logically be branded by repetitive buying behaviour. Brand loyalty may reflect therefore only the convenience inherent in repetitive behaviour rather than commitment to the brand purchased"[28] Several other distinct features of low-involvement purchasing have been isolated.[29] However one rather significant finding has been that a low level of involvement with a product is positively related to a low level of commitment to the brand chosen.[30] In such a product area "a consumer's evoked set should be large, his brand commitment low and he should be observed switching brands more often than another consumer to whom this product is more highly involving".[31] Couched in Sherif's terminology, this means that low involvement purchasing should involve a broader latitude of acceptance. This conclusion is indirectly supported by the finding that low-involvement buying is also characterised by fewer criteria dimensions thereby rendering more brands acceptable.[32] In a word, the lower the involvement, the greater the number of brands which are acceptable and thus the lower the strength of brand loyalty.[33]

Evoked Set

Howard is generally credited with coining the term "evoked set".[34] A more specific definition appears in Howard and Sheth: "the brands that become alternatives to the buyer's choice decision, . . . at best a fraction of the brands that he is aware of and a still smaller fraction of the number of brands that are actually available in the market".[35] The concept is seen as a result of consumer's natural tendency to simplify the purchase process in markets where both the number of brands and the number of criteria on which these brands are judged proliferate.[36] In short, evoked set is an outcome of cerebral economy. In practice, inclusion in the consumer's evoked set is denoted by such terms as 'would find acceptable' or 'would consider purchasing' and researchers have found the average number of brands in such sets to range from less than two for some product classes up to eleven for others. Subsequent developments have been the division of the evoked set into untried brands, mixed brands (tried and untried), and all-tried brands.[37] This subdivision was found relevant for high involvement goods but seems marginally relevant for consumer non-durables. The evoked sub-set (accepted brands) combined with the inert sub-set (rejected brands) and the inept sub-set (in-between brands) have further been seen as constituting the awareness set which in turn complements the unawareness set to form the total brand set for a product area.[38] Research into consumer's evoked set has centred primarily on its size which correlated positively with age and education.[39] However, in general, attempted correlations with a selection of demographic and individual variables have proven insignificant. A further feature of evoked set research has been the investigation of the effect of purchase proximity.[40] Here, in the case of an impending automobile purchase the evoked set was seen to broaden as the time of the impending purchase approached.

There appears to be an element of confusion endemic in much of the research on evoked set. It stems from uncertainty regarding the proper object of such a set. Does the consumer's evoked set comprise differing brands within the same product area — the most common interpretation — or could it extend to brands in differing product areas as might be the case for a 'T.V. snack' evoked set? This latter possibility of consumers in multi-brand supermarkets making brand substitutions across product areas has prompted the notion of a consumer 'brand repertoire' for all the product classes purchased.[41] There also remains the questions of what precisely constitutes a 'product class'.

Of more immediate concern is the finding that for low-involvement products there are fewer purchase criteria employed and consequently a larger number of brands qualify for inclusion in the evoked set. Put simply, there are fewer reasons for not deeming a brand acceptable.[42] Specifically, the significant correlations between evoked set size and brand loyalty across a variety of product areas are of interest here.[43] The two variables have been found to relate inversely. At this stage the relationship has not been established as a causal one but there does seem to be a *prima facie* appeal in supposing that the size of the evoked set will determine the parameters of consumer loyalty. A measure of brand loyalty utilising the evoked set construct can be said to be broadly supported by the research cited above. It might be objected here that while the evoked set construct may relate to brand loyalty level it is essentially a construct whose origin and application lie purely in the domain of high-involvement decision making. There can be no denying that evoked set finds its most vivid application in such a purchasing paradigm. However, the claim being advanced here is that for low-involvement regularly purchased goods the notion of evoked set may apply but that it is unrealistic to suppose that it is an antecedent of purchasing. In the low-involvement situation characterised by an awareness-trial hierarchy it it more likely to exist as an unarticulated range of acceptable brands where the most adequate determinant of acceptability is the fact that the *brand has been purchased*. Given such a scenario, the best measure of evoked set may be the number of brands purchased. In short, a behavioural measure which eschews behaviourism.

The justificiation for such a stance is that in the low-involvement situation to determine a consumer's evoked set by interview or other recall method is to pre-suppose a conscious set of acceptable brands. This would seem problematic in the case of, say, chocolate bars. Here, it would seem more plausible to look to the brands *actually purchased* as a determinant of evoked set inclusion. 'Asking' the consumer would seem unnecessarily contrived in the case of such a low involvement product. And even if one were to ask 'what brands of chocolate are in your evoked set?', it would seem highly implausible to expect brands other than those actually purchased to be mentioned. This would clearly not be so in the case of high involvement products such as cars.

A Proposed Index of Brand Loyalty

The authors propose that such an index should take account of the inverse relationship between the brand loyalty and evoked set size referred to above. It is postulated that:

$$L = 1/r$$

where L is the index of brand loyalty, and
r is the size of the evoked set.

Thus we would find that purchase string AABACB with r= 3 would be considered more loyal than ABCADB with r= 4. The activity that occurs within the string should also be taken into account so that AAAAAB would be considered more loyal than ABABAB. The number of ways that r brands could be combined in a string of length n is very large. Furthermore, the permutation of any particular combination, e.g. AAAABB, ABABAA, AABBAA, etc, increases this number considerably. Rules such as three in a row have been seen to be arbitrary. So, as there is no evidence so far to suggest that the order in which brands enter a purchase string of moderate length has any significance for low-involvement products, it will be assumed that this is irrelevant.

If one were to assume no preference between the different members of an evoked set then one would expect to see them an equal number of times in a purchase string. On the other hand, if the consumer was particularly loyal to one of the brands one would expect to see variations between the actual number and the expected number based on the hypothesis of no preference between each brand in the evoked set. A continuous measure of this variation that is commonly used in statistics is the chi-square. In this case no preference shown between each of the brands in the evoked set would give a chi-square value of zero, and the other extreme, namely choosing each member but one of the evoked set once and the other member the rest of the time, would give a high chi-square value. In order to include this measure with the one based on the size of the evoked set a constant p would have to be included to ensure consistency. Thus the measure would now become

$$L = L(A...AB...BC...) = 1/r + p\chi^2$$

Evaluating a series of pairs of strings to find acceptable values for p, it turns out that p has an upper limit of $n/6(n^2-4n+2)]$ where n is the string length because of considering A-----ABB to be more loyal than A-----ABC. This corresponds with the view that a consumer who is loyal to A but buys B twice may be treating B as a complementary product. p gets a lower limit of $n/[6(n^2-18)]$ because of considering A-----ABC to be more loyal than A----ABBB for n greater than 5. This corresponds with accepting the idea that switching from the dominant brand A only twice to two different products represents higher loyalty than switching from A three times, even if it is to the same product. It is obvious that A-----AB is more loyal than A----ABB. A modification of the p function could be made which incorporated L(A-----AB) > L(A----ABB) but, unlike above, had L(A-----ABC) > L(A----ABBB). However, if the user wanted to go further in the other direction and have L(A----ABCD) X L(A---ABBBB) this could not be done consistently with the first rule without restricting the string length n to be greater than 18. Thus, the assumptions under which this behavioural measure operates are:

1. Loyalty decreases with size of evoked set.

2. The order in which brands appear in an evoked set is irrelevant.
3. L (A----ABB) > L(A----ABC).
4. L(A----ABC) > L(A---ABBB) but L(A---ABCD) < L(A--ABBBB)

Assumptions two and three can be seen to follow directly from assumption one. Assumption four, from which the second term in the equation arises, is based on the contention that a brand appearing on only one occasion in a string of twenty should not be treated as equivalent in all respects to a brand which appears ten times. The limit of this position is expressed in assumption four where, for example, a string of eight purchases comprising six of brand A and one each of brands B and C is deemed to be more loyal than a similar string comprising five purchases of A and three of B. Assumption 3 leads to an upper limit, and assumption 4 to a lower limit on the range of acceptable values for the coefficient p. The two limits turn out to be the same for n=5 (p=5/42). They diverge for n greater than 5. Obviously p should not be set at either limit because otherwise the > limits in either assumption 3 or 4 would become equalities. So p must be set between the two. For $p = n/[6(n^2-2n-6)]$ then, and for n greater than 4, L(A----ABB) > L(A----ABC). For n=4, L(AABB) = L(AABC), a result which suggests that purchase strings should be confined to more than n=4. Also, for n greater than 6, L(A---ABC) > L(A--ABBB), and for n=6, L(AAAABC) = L(AAABBB). For n less than 6 the first and second rules are automatically consistent. Thus we get the following Low-Involvement Loyalty Index:

$$L = \frac{1}{r} + \frac{n}{6(n^2-2n-6)} \chi^2$$

where L = an Index of brand loyalty with $0 \leqslant L \leqslant 1$.
r = the number of brands in the evoked set
n = the number of purchase occasions or the length of the purchase string

Illustration
The following two purchase strings can be compared using L, where string one is AABACBAD, and string two is AABABCCB. The number of purchase occasions in both cases is n=8. Thus the coefficient is 8/[6(64-16-6)] = 0.0317.

String one includes four brands, so r=4. Brand A appears four times, B twice and C, D once each. The expected number of appearances of each brand if there was no preference is n/r = 2. Thus the χ^2 value is:

$$(4-2)^2/2 + (2-2)^2/2 + (1-2)^2/2 + (1-2)^2/2 = 2 + 0 + 1/2 + 1/2 = 3.$$

Hence for the first string $L = 1/4 + 0.0317 \times 3 = 0.25 + 0.0951 = 0.3451$.

String two includes three brands, so r=3. Brands A and B appear three times, and brand C twice. The expected number of appearances of each brand is 2.67. Thus the χ^2 value is:

$$(3 - 2.67)^2/2.67 + (3 - 2.67)^2/2.67 + (2 - 2.67)^2/2.67 = 0.25$$

Hence for this string $L = 1/3 + 0.0317 \times 0.25 = 0.3333 + 0.0079 = 0.3412$.

Thus L(AABACBAD) > L(AABABCCB) or, in other words, four purchases of brand A, two of B and one each of C and D, is considered marginally more loyal than three purchases of brands A and B, and two of brand C.

Applications
The coefficient $n/[6(n^2-2n-6)]$ is based purely on the purchase string length n. Obviously strings of different lengths can be evaluated. Hence loyalty comparisons can be made between consumers with different numbers of purchase occasions. Also the loyalty of an individual consumer can, for example, be tracked over a series of fixed time periods each of which contains a different number of purchase occasions.

If we consider the loyalty measure L as having two parts, L1 = 1/r and $L2 = n/[6(n^2-2n-6)]\chi^2$, then the effect of a new entrant in the market can be measured in terms of its effect on L, L1 and L2. When a new brand enters a purchase string for the first time L and L1 will drop, and L2 will rise. This could be described as 'first purchase'. If it is bought again within a short period of time L and L2 will drop, and L1 will remain constant. This could be described as 'repeat purchase'. If it becomes the more popular product in the string then L and L2 will rise. This could be described as 'majority purchase'. Finally, if some other product is excluded because of this new entry then L and L1 will rise, and L2 will drop. This might be termed 'predominant purchase'. Of course, at any point in this process the new entrant could be rejected.

The loyalty measure L is based on an individual purchase string. By summing and averaging this can be found for any group, for example the purchasers of a certain type of product, those with a particular demographic characteristic, and so on. The strength of loyalty to different brands can be found by taking as a group all the strings which contain that brand. This would lead to multiple counting with a string containing three different brands being included in three different brand groups. This would not add appreciably to computer time as the calculation of the loyalty measure for each string need be done only once.

The loyalty measure L is based on the number of purchase occasions. If there is a reasonable consistency in packet size between different brands then L should be consistent with the volumes purchased, and thus with market share when the market is stabilized. Converting L into a market share estimate could follow a variety of models. Taking an approach that is commonly used[44] for converting the utility of different modes of passenger transport into the probability of choosing particular modes one gets:

$$p(b:B) = \frac{e^{f(L_b)}}{\sum_{b^1 \in B} e^{f(L_{b^1})}}$$

where b is an individual brand, B is the set of all brands, and $f(L_b)$ is a function of the loyalty to brand b. The best estimate of ultimate market share is then m(b:B) = p(b:B). It would be better to use models of probability to purchase (market share) which are linear or else linearizable functions of loyalty so that the mediating coefficients in functions such as $f(L_b)$ can be evaluated statistically. An underlying assumption of converting loyalty measures into probability of purchase, and hence into market share, is that there is one market. If the market was segmented into two parts then two separate probability measures would be needed, one for each part. With low-involvement products one would not expect to have hidden segmentation of markets.

If a new brand was about to be launched its performance within a certain subset of strings, i.e. a specific panel of purchasers, could be monitored, and from this a projection made of its likely market share. In a market where there are frequent launches of new products the first purchase, repeat purchase, majority purchase, and predominant purchase stages, and the ultimate market share, could be measured so as to provide a basis for early projection of likely ultimate market share for newcomers. An elaborate way of doing this could be to generate saturation models for each stage if there was sufficient data. Thus a proportion of first purchasers would become repeat purchasers, a proportion of these would become majority purchasers, and a proportion of these predominant purchasers.

A possible line of investigation would be to determine the correlation between variations in these four growth stages and variations in decision variables such as price, product quality, distribution, and advertising expenditure. More generally, the relationship between loyalty and decision variables could be measured using standard models, e.g.

$$L = a_0 P^{-a_1} X^{a_2}, \text{ and}$$
$$L = 1 - e^{-a_1 X}$$

where P = price, X = marketing effort, and a_0, a_1, a_2 are constants. Dynamic effects could be incorporated with models such as

$$\frac{dL}{dt} = rX(1 - L) - (1 - \lambda)L, \text{ and}$$
$$L_t = a_0 + \lambda L_{t-1} + a_1 X_t,$$

where r is a loyalty response constant, λ, with $0 \leqslant \lambda \leqslant 1$, is a loyalty carryover factor, t is time, and a_0, a_1, are other constants.

The brand loyalty index proposed here has yet to be empirically tested. It is hoped that testing will resolve some issues which are critical to the application of the index in models such as those illustrated. For instance, when evaluating a measure of the loyalty of purchasers of some particular brand should one sum over all purchase strings which include that brand or, as seems more appropriate, over all purchases of that brand? It appears that one should calculate the loyalty measure for each individual string and then find an average for the group. When modelling the relationship between the aggregate measure of loyalty L_b for some group to a particular brand and the probability of purchasing that brand p(b:B), it is not known in what form should L be used, directly or indirectly, such as L_b / L_B, the ratio of the loyalty to brand b to the average loyalty to all brands B in the industry. It may be appropriate to work with 1/L as this corresponds, basically, with the size of the evoked set. The authors are confident that these issues will be resolved as the index would appear to enjoy the advantage of being both simple and unidimensional. It may also be employed at the micro and macro levels to predict both individual probability of purchase and aggregate market share. Consequently, it should be of value in the construction of models which incorporate decision variables.

References

1. J.M. Carman, "Correlates of brand loyalty: some positive results", *Journal of Marketing Research*, vol. VII, Feb. 1970 pp. 67-76; G.P., Moschis, R.L. Moore, and T.J. Stanley, "An explanatory study of brand loyalty development" in Thomas Kinnear, (ed.), *Advances in Consumer Research*, vol. 11, Ann Arbor Association for Consumer Research, 1983, pp. 412-417.
2. H. Tranberg, and F. Han, "Patterns of brand loyalty: their determinants and their role for leading brands", *European Journal of Marketing*, 20, 3/4, 1986, pp. 81-109.
3. J. Jacoby, R.W. Chesnut, *Brand Loyalty Measurement and Management*, New York, John Wiley and Sons, 1978, Chpt. 3.
4. This paper arose in the course of supervisory work by both authors on an undergraduate thesis submitted to the College of Marketing and Design by Joseph O'Donoghue. His instrumentality in stimulating the authors' interest in this is gratefully acknowledged.
5. Brand loyalty theorists often seem either unaware or reluctant to state whether they draw on the Behaviourist or Cognitivist paradigm. Advocacy of a behavioural measure does not of itself indicate a Behaviourist standpoint. For an enlightening discussion of the need to clarify such paradigms see G. Foxall, "Consumer choice in behavioural perspective", *European Journal of Marketing*, 20, 3/4, 1986, pp. 7-18.
6. F.M. Bass, "The theory of stochastic preference and brand switching", *Journal of Marketing Research*, vol. XI, Feb. 1974, p. 2.
7. J. Jacoby and R. Chestnut, *op. cit.* p.4.
8. J. Jacoby, "A model of multi-brand loyalty", *Journal of Advertising Research*, vol. II, No. 3, June 1971, p. 26.
9. J. Jacoby and R. Chestnut, *op. cit.* p.80.
10. J. Jacoby, and D.B. Kyner, "Brand loyalty vs. repeat purchasing behaviour", *Journal of Marketing Research*, vol. 10, Feb. 1973, p. 7.
11. For a review of earlier operational measures of brand loyalty see J.E. Engel, and R.D. Blackwell, *Consumer Behaviour*, (4th. ed.), Dryden Press, 1982, pp. 566-569.
12. A seminal and succint retionale of probabilistic definitions is found in A.A. Kuehn and R.L. Day, "Probabilistic models of consumer buying behaviour", *Journal of Marketing*, vol. 28, October 1964, pp. 27-31.
13. C. Chatfield and G.J. Goodhardt, "A consumer purchasing model with Erlang inter-purchase times", *Journal of the American Statitistical Association*, December 1973, pp. 828-835.

14. J. O'Donoghue, An Exploration of Consumer Choice Patterns Under Conditions of Low Involvement, Unpublished Dissertation, College of Marketing and Design, Dublin, 1986, pp. 115-120.

15. G.L. Grahn, "NBD model of repeat-purchase loyalty: an empirical investigation", *Journal of Marketing Research*, February 1969, pp. 72-78.

16. P. Naert, and P. Leeflang, *Building Implementable Models*, Boston, Leiden Press, 1978, pp. 149-150.

17. A.S.C. Ehrenberg and G.J. Goodhardt, *Journal of Marketing Research*, February 1970, pp. 77-84.

18. G.L. Lilien and P. Kotler, *Marketing Decision Making – A Model Building Approach*, New York, Harper and Row, 1983, p. 725.

19. Gerald J. Eskin, "Dynamic forecasts of new product demand using a depth of repeat model", *Journal of Marketing Research*, Vol. 10, May 1973, pp. 115-129.

20. H.E. Krugman, "The Impact of television advertising: learning without involvement", *Public Opinion Quarterly*, 29, Fall 1965, pp. 349-356.

21. M. Sherif and H. Cantril, *The Psychology of Ego Involvement*, New York, Wiley, 1947.

22. Comprehensive reviews of the definitions of involvement are found in: A.G. Greenwald and C. Leavitt, "Audience involvement in advertising: four levels", *Journal of Consumer Research*, vol. II, no. 1, June 1984, pp. 581-593: A.A. Mitchell "Involvement: a potentially important mediator of consumer behaviour" in William L. Wilkie, (ed.), *Advances in Consumer Research*, vol. 6, Ann Arbor, Mich., Association for Consumer Research, 1979, pp. 191-196.

23. G. Laurent and J. Kapferer, "Measuring consumer involvement profiles", *Journal of Marketing Research*, vol. XXII, Feb. 1985, pp. 41-53.

24. M.E. Slama and A. Tashchian, "Selected socioeconomic and demographic characteristics associated with purchasing involvement", *Journal of Marketing*, vol. 49, Winter 1985, pp. 72-82.

25. J.L. Zaichkowsky, "Measuring the involvement construct", *Journal of Consumer Research*, vol. 12, Dec. 1985, pp. 341-352.

26. G. Laurent and J. Kapferer, *op. cit*, p. 52.

27. J.U. Farley, "Why does 'brand loyalty' vary over products?", *Journal of Marketing Research*, vol. I, Nov. 1964, pp. 9-14; J.L. Lastovicka, "Questioning the concept of involvement defined product classes", in William L. Wilkie, *op. cit.* pp. 174-179.

28. T.S. Robertson, "Low commitment consumer behaviour", *Journal of Advertising Research*, vol. 16, no. 2, 1976, p. 7.

29. J.F. Engel and R.D. Blackwell, *op. cit.* p. 542.

30. M.B. Traylor, "Product involvement and brand commitment", *Journal of Advertising Research*, vol. 21, no. 6, Dec. 1981, pp. 51-56.

31. *Ibid* p. 52.

32. J.L. Lastovicka and D.M. Gardner, "Low involvement versus high involvement cognitive structures" in H. Keith Hunt, (ed.), *Advances in Consumer Research*, vol. 5, Ann Arbor, Mich., Association for Consumer Research, 1978, pp. 87-92.

33. J. Jacoby, *op. cit.* p. 28.

34. J.A. Howard, *Marketing Management: Analysis and Planning*, Homewood, Ill., Richard D. Irwin, 1963.

35. J.A. Howard and J.N. Sheth, *The Theory of Buyer Behaviour*, New York, Wiley, 1969, p. 29.

36. S.P. Raj, "Striking a balance between brand popularity and brand loyalty", *Journal of Marketing*, vol. 49, Winter 1985, p. 54.

37. F.E. May, "Evoked set formation and composition: the learning and information processing hypothesis" in William L. Wilkie, *op. cit.* p. 222.

38. C.L. Narayana and R.J. Markin, "Consumer behaviour and product performance: an alternative conceptualisation", *Journal of Marketing*, Vol. 39, October 1975, pp. 1-6.

39. R.N. Maddox et al., "Correlates of information gathering and evoked set size for new automobile purchasers in Norway and the U.S.", in H. Keith Hunt, *op. cit.* pp. 176-170.

40. S.A. Eroglu, G.S. Omura and K.A. Machleit, "Evoked set size changes and temporal proximity to purchase", *Educators Proceedings*, American Marketing Association, No. 49, 1983, pp. 97-101.

41. J.U. McNeal, S.W. McDaniel and D.T. Smart, "The brand reperoire: its content and organisation" *Educators' Proceedings*, American Marketing Association, No. 49, 1983, pp. 92-96.

42. J.A. Belonax and R.A. Mittellstaedt, "Evoked set size as a function of the number of choice criteria and information variability", in H. Keith Hunt, *op. cit.* pp. 48-51.

43. K. Gronhaug and S.V. Troye, "Exploring the content of evoked set in car buying", *Educators' Proceedings*, American Marketing Association, 1980, pp. 143-147; L.E. Ostlund, "Evoked set size: some empirical results", in T.V. Greer, (ed.), Combined *Proceedings* of the Fall Conference of the American Marketing Association, No. 35, 1973, pp. 226-230; K. Gronhaug, "Some factors influencing the size of the buyer's evoked set", *European Journal of Marketing*, Winter '73/'74, pp. 232-241; L.G. Shiffman and L.L. Kanuk, *Consumer Behaviour*, (3rd. ed), Englewood Cliffs Prentice Hall, 1987, p. 256.

44. M.L. Manheim, *Fundamentals of Transportation Systems Analysis Volume 1, Basic Concepts*, Centre for Transportation Studies, Mass. Institute of Technology, 1977, pp. 3-2.