5.4

Essentials of Planning Media Schedules

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How should an advertiser schedule its advertising messages over time given a certain advertising budget? More specifically, should the budget be concentrated over a short period (i.e., a blitz schedule) or spread uniformly over the entire planning horizon (i.e., the even schedule)? Such questions arise when brand managers or media planners allocate gross rating points (GRPs)[1] worth hundreds of millions of dollars so that a few concentrated pulses of weekly advertising are interspersed with silent periods of no advertising over the annual planning horizon. The resulting on and off media spending patterns over time are called pulsing (or flighted) media schedules. The practical significance between pulsing versus even schedules boils down to making a "big impact periodically" versus maintaining a "continuous presence".

[1]GRPs are defined as the product of reach and frequency, with reach being the percentage of the target audience exposed to the campaign and frequency the average number of exposures among those reached (Danaher, 2007).

Figure 5.4.1 illustrates pulsing schedules used by a major telecommunications company in the United Kingdom (see Bass et al., 2005). It shows GRPs over time for five different advertising themes and other competitors' advertising (aggregated). Such pulsing schedules are universally used by managers across brands and countries, and academic research, at least in most cases, tends to suggest that pulsing is the optimal scheduling strategy.

The optimal allocation of advertising money over time and the various types of advertising schedules managers have at their disposal will be the main theme of this chapter. We will present insights and results from the scheduling academic literature that finds its roots in the classic study by Zielske (1959) and, over the last four decades, it attracted both scholars (e.g., Sasieni, 1971; Mahajan and Muller, 1986; Feinberg, 1992) and managers (e.g., Strong, 1977; Zielske and Henry, 1980; Jones, 1995). In addition, we will also address the following managerially important questions: If blitz schedule, then what should be the level or intensity of spending and how

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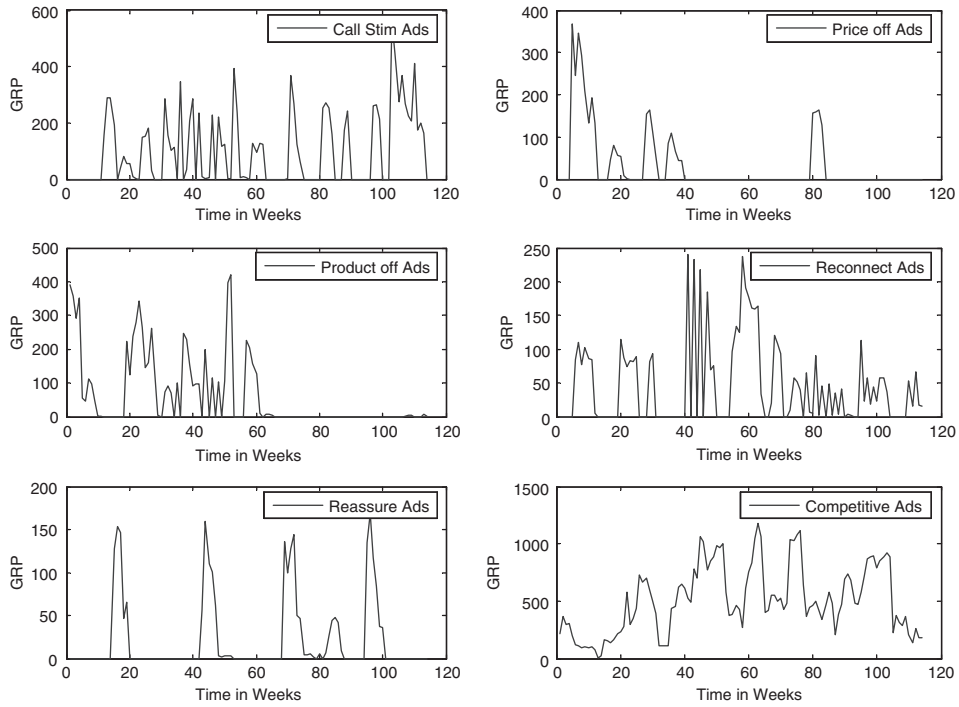

Figure 5.4.1 Pulsing schedules for five advertising themes and competitive ads

long should this burst last? More generally, for multi-pulse schedules, how long should each pulse last? Or should they be equally long? What should be the spacing between pulses? These questions – simple to state, but hard to answer – have remained open for a long time (see, e.g., Corkindale and Newall, 1978; Simon, 1982; and Table 8.1 in Hanssens et al., 1998: 254).

We organize this chapter as follows. We first define a few salient pulsing schedules; review the empirical pulsing studies and identify the long-standing open questions on duration and spacing of advertising pulses. To understand the issues of duration and spacing, we then describe the ad wearout model, which reveals the main insights and new results via the blitz, two-pulse, multi-pulse and multi-campaign schedules. Next, we summarize various other factors that justify the use of pulsing schedules. Finally we provide a chapter summary in the form of "scheduling prescriptions", which should be useful for practitioners. Also, for the interested reader, we elucidate the S-shaped response theory of pulsing in a Technical Appendix.

DEFINING MEDIA SCHEDULES

The total number of media schedules from which managers can consider a few good ones to implement an annual media plan is over one thousand trillions (see the section on Optimal Multi-Pulse Schedule for details), and so here we define a few prominent types of schedules.

- *Blitz (or massing).* A one-pulse media schedule in which an advertiser concentrates its entire efforts (i.e., GRPs, dollar budget) in some initial period of the planning horizon.
- *Flighting (or bursting).* An advertiser uses irregularly scheduled "bursts" of spending for short periods, separated by long periods of no advertising.
- *Pulsing.* An advertiser regularly alternates the spending rate between high and zero levels.

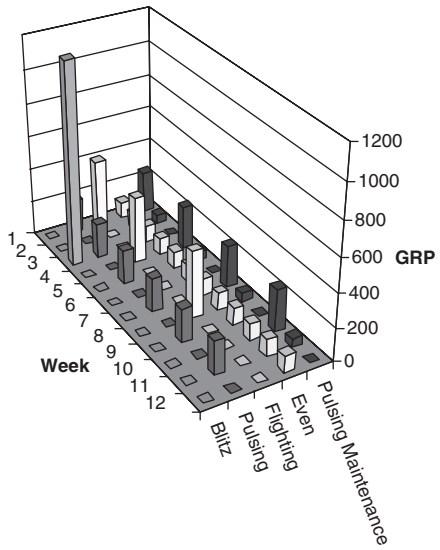

Figure 5.4.2 Examples of media schedules

- *Pulsing-maintenance*. A special case of pulsing with a minimum non-zero level of advertising, usually the maintenance level.
- *Even*. An advertiser expends its effort at some constant level throughout the planning horizon.

Figure 5.4.2 illustrates the previously defined media schedules.

The definition of the pulsing schedule above is the "standard" one, but it can be extended to include pulses of unequal length and size, which would also yield flighting schedules (Naik et al., 1998). We thus use the terms "flighting" and "pulsing" interchangeably. While we defined a few media schedules, in practice, managers implement media plans via a combination of such schedules. For example, they expend budgets on blitz campaigns for pre-release advertising of movies or launch of new products. Mature consumer brands utilize pulsing schedules with several weeks of no advertising. Pulsing-maintenance schedules find applications when managers combine general advertising with specific communication goals, for example, to announce corporate name change or limited time promotional offers (say, Memorial Day rebates on cars). No one technique is better to achieve all marketing goals; i.e., each has its own role in marketing communications.

EMPIRICAL STUDIES ON MEDIA SCHEDULING

Here we first describe field experiments and econometric studies, and then identify open questions that directed further research inquiry.

Field experiments

Zielske (1959) designed a field experiment to measure recall and forgetting of advertisements. Two randomly selected groups of women were exposed to thirteen print advertisement messages for a food ingredient product. One group was exposed at a frequency of once every week for thirteen weeks and nothing for the rest of the year (i.e., a blitz schedule). The other group received the same thirteen advertisements at a frequency of once every four weeks over the year (i.e., a 13-pulse schedule). Advertising recall was measured in both groups by telephone interview. Table 5.4.1 reports the results, showing that the pulsed schedule is superior to the blitz schedule based on total awareness as the measure of performance.

Strong (1974, 1977) noted that the better performance of the "even" schedule versus a blitz one does not necessarily imply that it is optimal. In fact, Zielske's even schedule can once again be interpreted as pulsing since advertising does not take place every single week of the year. Strong then conducted similar field experiments, but with three scheduling conditions: weekly, biweekly, and monthly. He concluded that "...schedules with flights should be considered as practical alternatives...that a schedule with flights

Table 5.4.1 Empirical performance of blitz and pulsing schedules

Schedule	*Cost $*	*% Recall*[a]	*Recall per dollar*[b]
Blitz (weekly)	650	21.0	4.2
Pulsing (monthly)	650	29.0	5.8

a. Percentage of housewives who remembered the advertised message (averaged over 52 weeks).
b. Number of housewives who remembered the advertised message per advertising dollar cost (averaged over 52 weeks).

obtains greater average annual recall in the audience than an even spaced schedule..." Strong (1977: 377).

Econometric studies

Given the superiority of some pulsing schedules, it is natural to ask the question: Which scheduling option is the best one? Hubert Zielkse, as the national director of Foote, Cone & Belding advertising agency, was interested in knowing the answer to this central issue, and so he extensively studied the effects of gross rating points (a measure of media budget) on unaided recall (a measure for awareness). Zielske and Henry (1980) reported the findings based on the econometric analysis of data from seventeen tracking studies, where the budget varied from 1600 to 4000 GRPs across six products and services, and the GRP allocation patterns were pulsing schedules with the pulse duration of 8–20 weeks. To gain insights, they specified an awareness formation model,

$$A_t - A_{t-1} = \beta u_t - \delta A_{t-1}, \qquad (1)$$

where $(A_t, u_t, \beta, \delta)$ denote percentage awareness, weekly GRPs, advertising effectiveness, and the forgetting rate, respectively. Equation (1) says that the growth in awareness, ΔA_t, is driven by GRPs, and the loss in awareness is due to forgetting, which is proportional to the prevailing awareness level. Regression analysis of tracking data using model (1) revealed that the ad effectiveness $\hat{\beta} = 0.03$ and the forgetting rate $\hat{\delta} = 0.092$.

Next, using the best fitted model $A_t = 0.03u_t + (1 - 0.092)A_{t-1}$, Zielske and Henry (1980) proceeded to determine the best pulsing policy. They considered the allocation of 1300 GRPs over 52 weeks via the following five pulsing schedules:

- Plan A: Blitz Schedule. 100 rating points per week for 13 consecutive weeks.
- Plan B: Blitz Schedule. 50 rating points per week for 26 consecutive weeks.
- Plan C: Even Schedule. 25 rating points per week for 52 consecutive weeks.
- Plan D: 13-pulse Schedule. 100 rating points at four week interval.
- Plan E: 2-pulse Schedule. 100 rating points per week for the first seven weeks, a nineteen-week hiatus, 100 rating points per week for the next six weeks, and no advertising for the remaining period.

Note that Plan A mimics the field experiment of mailing prints ads over 13 weeks; Plan B is twice as long and half as intense as Plan A; Plan C is the even schedule; Plans E and D are 2-pulse and multi-pulse schedules, respectively.

Figure 5.4.3 displays the awareness generated by the five pulsing schedules. We sum the awareness generated in each period and the terminal value to obtain the total awareness, which equals $\sum_{t=1}^{51} A_t + \frac{A_{52}}{0.092}$. Table 5.4.2 presents the resulting total awareness due to these plans. Based on those results, Zielske and Henry (1980) concluded that "...there are many recall patterns that can be achieved within the same budget...some patterns will be more productive than others...but it will not, in itself, answer the question: Which scheduling option is the best?" This conclusion is intriguing because the best scheduling option *can* be determined. Indeed, Table 5.4.2 shows that the best option is the even schedule via Plan C! In other words, this empirical study furnishes support for Sasieni's (1971) result that no pulsing schedule can outperform the even schedule.[2]

Nonetheless, practitioners' preference for pulsing schedules persisted. For example, J. Walter Thompson Company, a major advertising agency, continued the development of a media planning software, named SESAME, which stands for the System of Evaluating, Setting & Allocating Media Expenditure. Ms. Lilia Barroso, media director for Latin America, says that "...with SESAME, you have more flexibility in how you spread your advertising throughout the year" (Malkin, 1993: I-14). The flexibility comes from scenario analysis that brand managers can conduct to assess the impact of alternative

[2]The interested reader may refer to the Technical Appendix for a background on the S-shaped theory of pulsing schedules, related to the seminal work of Sasieni (1971).

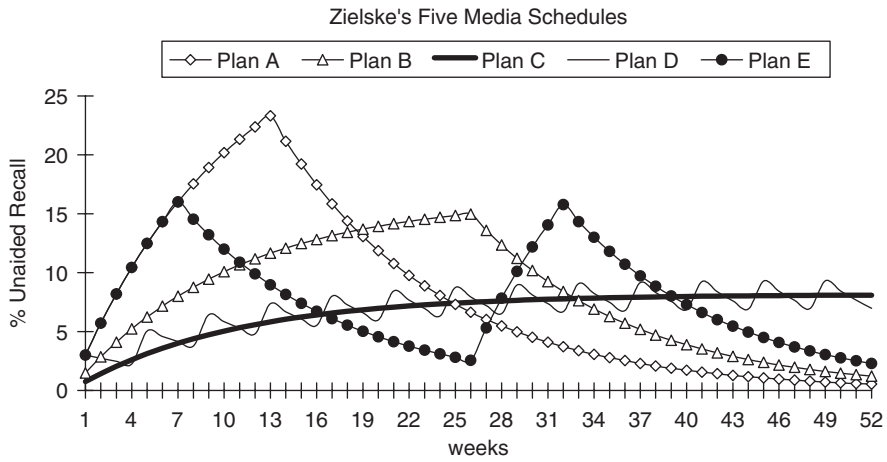

Figure 5.4.3 Awareness generated by five pulsing schedules using total budget of 1300 GRPs

Table 5.4.2 Performance of the five pulsing schedules

Pulsing Schedule	*Plan A Blitz*	*Plan B Blitz*	***Plan C Even***	*Plan D 13 Pulses*	*Plan E 2 Pulses*
Total Awareness	424.45	425.13	**432.01**	430.88	426.2

schedules and then decide the spending patterns and budget amount.

Finally, in a large-scale econometric analysis of TV advertising, Lodish and colleagues (1995) noted that "standard" pulsing schedules are not effective and that weight added either to the front or back of media plans would help generate increased sales. This does not necessarily contradict the optimality of pulsing schedules, in fact it is consistent with Strong's conclusion, it rather suggests that the bigger the difference between the "high" and "low" levels in a schedule, the more effective the plan.

Early academic studies have assumed standard response functions (concave or S-shaped), ignored competition, wearout, and typically assume allocation of budget in a single medium. For example, the extant models ignored an empirical feature: *advertising wearout*, i.e. a decline in the effectiveness of advertisements. The resulting implicit assumption of the constancy of ad effectiveness may have led to the smoothing of media spending patterns over time, suggesting uniform spending as the optimal strategy. Next we review factors such as wearout, restoration, competition and flexible advertising response that may influence the advertising scheduling decision.

ADVERTISING WEAROUT

Empirical evidence on ad wearout

Grass and Wallace (1969) conducted several laboratory and field experiments to learn about wearout characteristics of advertisements. In one such study, as reported in Greenberg and Suttoni (1973), he exposed a group of consumers to television advertisement for three months at varying exposure intensity: low (1–3 ads/month), medium (4–6 ads/month), and heavy exposure (7–12 ads/month). In addition, he tracked a matched sample of control group who did not see any advertisements. He measured brand awareness at the beginning and at the end of each of the three months. During this period, the awareness

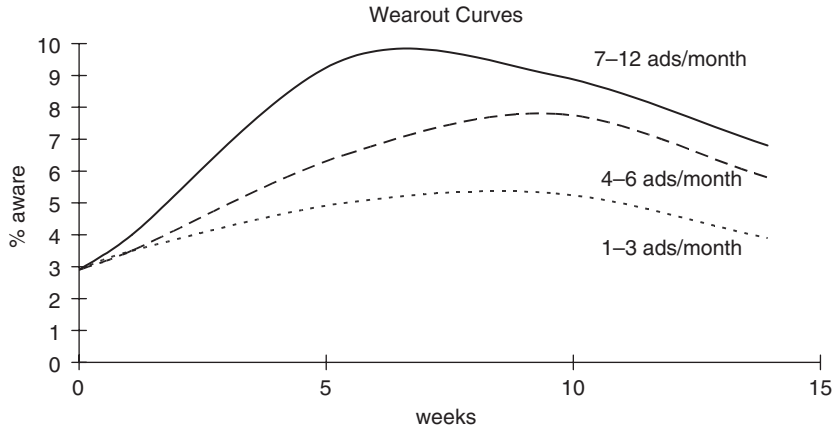

Figure 5.4.4 Awareness over time under constant exposure to television advertisements

level of the control group remained constant at 2.9% (due to other marketing activities). Figure 5.4.4 plots brand awareness over time under constant exposure to television ads at three levels of intensity. These wearout curves clearly show that continued exposure to advertising drives the decline in brand awareness.

Other empirical studies comport with these findings. For example, in the comprehensive review article, Pechman and Stewart (1990: 14) state that "... as the exposure rate increases and the exposures become increasingly massed, wearout becomes increasingly likely even under ordinary viewing conditions. More specifically, advertising at a high rate may be *no more* effective – or even *less* effective – than advertising at a low rate". For further evidence, see Blair and Rabuck (1998). The extant literature further identifies two kinds of wearout: copy wearout and repetition wearout. Copy wearout is due to the passage of time, while repetition wearout is due to the frequency of exposure. We briefly describe these phenomena.

Copy wearout

Ad copy provides information when it is new, while over time consumers acquire experience with the brand, and so the impact of advertising dilutes (Lodish et al., 1995). Sometimes advertising style gets imitated, resulting in lower perceived contrast between ads (Groenhaug et al., 1991: 44). For example, several brands in a single month came up with the "copy-catting" claims: "All fiber is not created equal" (Metamucil), "All calories are not created equal" (Campbell's Soup), "All gold is not created equal" (Visa), and "All cigarettes are not created equal" (Kool). Copy-catting interferes with consumers' memory, thus reducing ad effectiveness. Other reasons for copy wearout include decline in novelty of ads (Axelrod, 1980), diminished message persuasiveness (Blair, 1988), and drop in celebrity's popularity (e.g., O. J. Simpson, Michael Jackson, Kobe Bryant).

Repetition wearout

Cacioppo and Petty (1979) suggest that increase in repetition from low to moderate enhances agreement with message advocacy, whereas additional exposures result in a decline in agreement because negative thoughts exceed the positive ones. Other explanations for repetition wearout include irritation and inattention. Greyser (1973) notes that irritation in advertising is positively related to frequency of repetition, intensity of spending, similarity of ad executions and is negatively related to number of ad copies in a campaign. Ads wear out due to inattention of the audience to repeated exposure; for example, Craig et al. (1976) show experimentally that brand name recall declines when exposures exceeds the number needed

to learn brand names. Naik (1996) and Naik et al. (1998) provide mathematical models of the dynamics of advertising wearout and we refer the interested reader to these studies for details. Next we discuss scheduling optimality issues in the presence of advertising wearout.

Optimal blitz schedule

Given the ad wearout dynamics, the multimillion dollar question is, "Should managers concentrate resources or spread them evenly?" To this end, Naik (1996: 93) shows that, in the presence of wearout, blitz schedules can be superior to the even schedule. Figure 5.4.5 illustrates the total awareness R(l) generated by spending fixed amount of budget via blitz schedules of duration l weeks, where $l = 1, 2,\ldots, 52$. In this example, several blitz schedules with varying durations (say, $10 < l < 50$) are superior to the even schedule ($l = 52$ weeks), yielding total awareness R(l) > 9000 units. Furthermore, blitz schedules do not uniformly dominate the even schedule; for example, some highly concentrated blitz schedules ($l < 6$ in the left-hand region of Figure 5.4.5) are worse than the simple even schedule. Finally, *there exists one best blitz schedule*, which in this example, lasts for 19 weeks and generates the maximum total awareness of 11,359 units.

The intuition for the superiority of blitz over the even schedule is as follows. Copy and repetition wearout are two opposing forces. Because ad effectiveness declines due to copy wearout, advertisers should spend the media budget at the beginning (rather than spread it over the year) when ad effectiveness is still high. Now suppose an advertiser spends its entire budget in the first few nanoseconds; the spending intensity of this schedule will be too high, resulting in severe repetition wearout. To counteract repetition wearout, media budget needs to be spread out. But, to mitigate copy wearout, media budget needs to be concentrated. These opposing forces drive the optimal duration, l^*, so that budget is neither too concentrated, nor too spread out. In other words, the best blitz schedule avoids both the extremes of $l = 0$ (the nanosecond plan) and $l = T$ (the even schedule). Thus, in the presence of advertising wearout, *media resources should be optimally concentrated rather than spread evenly.*

In sum, an answer to the open question, raised originally by Little (1979) – why not make the duration of pulses half as long and twice as intense, or twice as long and half as intense? – is that increasing the spending

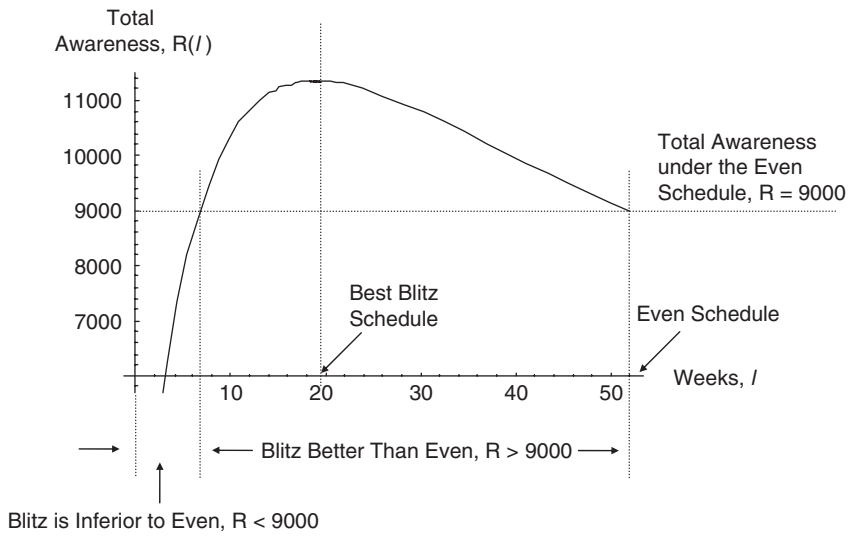

Figure 5.4.5 Total awareness as a function of the duration of blitz schedules

level intensifies repetition wearout, whereas extending the duration induces copy wearout. To offset these two countervailing forces, managers need to discover the best blitz schedule.

Optimal two-pulse schedule

Any two-pulse schedule differs conceptually from blitz schedules because of the presence of media hiatus, i.e., spacing between advertising pulses. This hiatus introduces silence, and "silence is golden" because spacing enhances attention. Below we discuss the existence of ad restoration phenomenon during hiatus, and present new results on how copy and repetition wear out affect the planning of pulsing schedules.

Ad restoration phenomenon

To forestall ad wearout after an intense blitz schedule, managers can introduce hiatus or spacing before commencing the next pulse. Grass and Wallace (1969: 8) observe that "regeneration of attention or interest level is possible after commercials have passed the satiation point if they are removed from the air". Greenberg and Suttoni (1973: 53) state that "a commercial that is running for a while can be removed and reintroduced after a time and take on a sense of newness". Corkindale and Newall (1978: 334) explains that ad effectiveness restores because people forget the advertisement messages and, hence, the greater the forgetting, the more the enhancement.

Figure 5.4.6 illustrates a two-pulse schedule and the corresponding dynamics of ad effectiveness, which declines due to wearout and restores due to hiatus. Based on the ad wearout and restoration dynamics, managers can determine the optimal duration and spacing of two-pulse schedules (for details, see Chapter 4 in Naik, 1996). Thus, advertisers should not only concentrate spending (as shown in Chapter 4.3), but also wait and restart advertising for the second time. The benefit of waiting lies in the restoration of ad effectiveness due to forgetting effects during the hiatus.

Optimal multi-pulse schedule

The general problem of determining the best multi-pulse schedule is challenging. Indeed, managers *cannot* allocate budget optimally across a 52-week planning horizon by experience and judgment alone. To appreciate this point, consider whether a brand should advertise or not in a given week, then the next week, the subsequent week, and so on for 52 weeks. This apparently simple task generates 2^{52} possibilities of various pulsing schedules, an astronomical number that exceeds $(2^{10})^5 > (10^3)^5 > 10^{15}$, which equals one thousand trillion pulsing schedules from which to choose one best plan. It is humanly impossible for a brand manager to

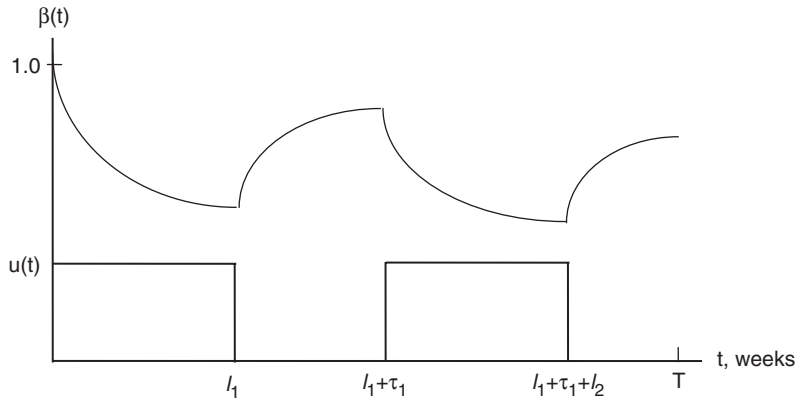

Figure 5.4.6 Ad effectiveness dynamics under the two-pulse media schedule

eye-ball these thousands of trillions of pulsing schedules even with the aid of sophisticated spreadsheets in modern computers. *Even if each pulsing plan requires just 1 second of managerial attention, this brand manger would have to live a long life of 30,000 millennia to find the best pulsing schedule*!

To solve this planning problem efficiently, Naik et al. (1998: 228) develop an implementable algorithm that searches a large number of alternative pulsing schedules and identifies a handful of "good candidates" for further managerial consideration. Their algorithm is based on the combination of Genetic Algorithm and the Kalman Filter; the former scans the decision space of 52 dimensional binary vector (with unity when ads are on, and zero otherwise), and the latter evaluates the total awareness generated by any candidate pulsing schedule, accounting for awareness formation dynamics, ad wearout dynamics, and ad restoration dynamics. They demonstrate this approach via two case studies for major cereal and milk chocolate brands in the United Kingdom. In both the cases, their algorithm discovers pulsing schedules, and not the even schedule, that were not only similar to the ones used in practice, but also superior to them in building total awareness.

To maintain focus on substantive issues, we do not elaborate here on the estimation of dynamic models or the development of decision-support systems. However, for model estimation, we refer interested readers to the review chapter by Dekimpe et al. (2007) and Dekimpe and Hanssens (2007). For the five-step algorithm to find good pulsing schedules, see section 5.2 in Naik et al. (1998). If managers seek to determine optimal unequal spending levels in different weeks when advertising is on, then the decision task becomes even more complicated and requires some modifications to the algorithm given in Naik et al. (1998).

Optimal multi-campaign schedules

The above analyses assume that an advertiser is using a single creative theme. In practice, however, advertisers concurrently run multiple campaigns. Hence, Bass et al. (2005) further extend the above ad wearout model by incorporating differential wearout and restoration effects across various themes. Specifically, they study advertising conducted in the UK by a major telecommunication company, who classifies its advertising into five themes: product offer, price offer, reconnection, reassurance, and call stimulation. Figure 5.4.1 shows the GRPs over time for each theme and competitive advertising. They develop an estimation approach and analyze the impact of budget re-allocation across the portfolio of themes. Their results indicate that copy wearout for price offer theme is faster than that for reassurance ads, furnishing new market-based evidence to support the notion that "hard sell" ads (e.g., informative) wear out faster than "soft sell" ads (e.g., emotional appeals). Interestingly, estimated values of the wearout parameter w were negative, indicating empirical support for the phenomenon of wear-in. It seems the rotation of ads across different themes keeps the ads fresh and induces the wear-in effect. In other words, although ad repetition causes wearout, the use of varied executions mitigate such wearout effects and can even reverse it to manifest wear-in effects. Comparing the optimal versus actual allocation of the total GRPs across the five different themes, they investigate the policy implications for re-allocating the same level of total budget – see Figure 5.4.7 for recommendations. The optimal re-allocation suggests that the company should increase spending on reconnect and reassurance ads at the expense of the other three themes, and it would generate an additional 35.82 million hours of calling time, which represents about 2% increase in demand.

COMPETITION

A notable omission from standard models considering the optimality of advertising scheduling strategies is competition. Yet, advertising does not work in isolation and competitive activity may have a detrimental effect on a brand's advertising efficacy

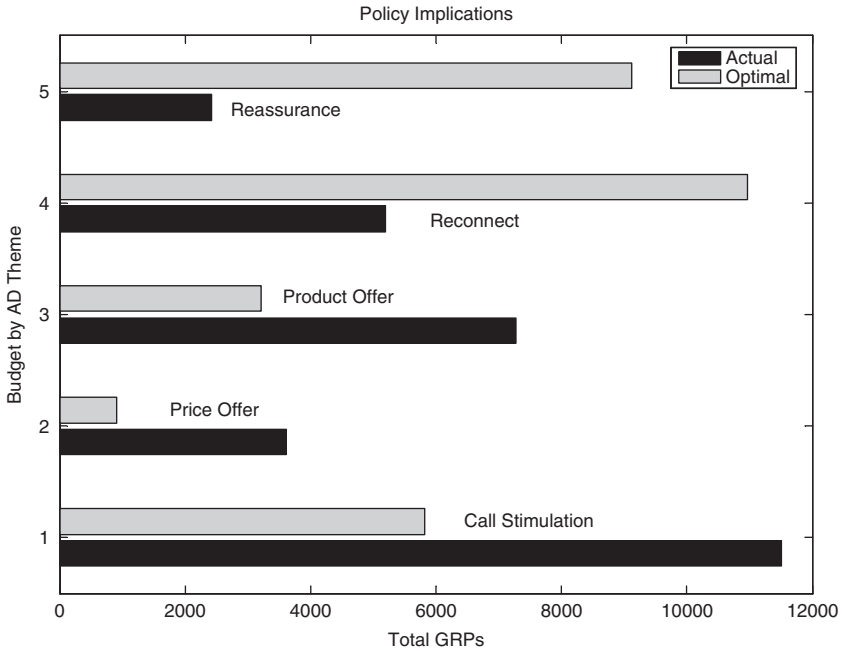

Figure 5.4.7 Actual versus optimal reallocation of GRPs for each theme

(Vakratsas et al., 2004). Research has shown that accounting for competition in standard advertising response models, leads to pulsing as the optimal scheduling strategy.

More specifically, Park and Hahn (1991), in one of the first theoretical advertising models accounting for competition, concluded that pulsing is the optimal policy even if market share change is a concave function of advertising. Thus, it is more beneficial for a firm to advertise "out of phase". A similar conclusion was drawn by Villas-Boas (1993), who investigated the oligopoly case using an S-shaped advertising response function. He concluded that firms should advertise "out of phase" and verified empirically his proposition by examining network TV advertising data on eight consumer product categories and one service category.

The issue of competition is also addressed by Dube et al. (2005), who consider a flexible advertising response function (see more details below), estimate it and then take their results to the supply side to derive optimal advertising strategies. They also find pulsing to be the optimal strategy. Although the optimality of pulsing is driven by the response function (S-shaped), it also holds under competition. Thus consideration of competition in advertising response models appears to suggest pulsing as the optimal advertising strategy.

FLEXIBLE ADVERTISING EFFECTS

A prominent feature of the debate whether pulsing is preferred to even schedules, has been the existence of increasing returns to advertising. In other words, since the optimality of pulsing schedules typically relied on an S-shaped function, such a response should be empirically observed for pulsing schedules to be a realistic possibility. Yet, early on, the overwhelming evidence on the shape of advertising response functions pointed to the lack of increasing returns (e.g. Simon and Arndt, 1980). Hanssens et al. (1998) point out that "the S-shaped response function cannot be used to justify a pulsing policy". However, since then, studies have suggested that advertising effects are frequently more

AU: Please provide citation for table 5.4.3 in the text.

Table 5.4.3 Optimal advertising policies under different conditions

Condition	*Optimal policy*	*Related studies*
Competition	*Pulsing* even if advertising response is concave	Park and Hahn (1991), Villas-Boas (1993)
Ad wearout	*Pulsing*	Naik et al. (1998)
Carryover effects	*Pulsing*	Dube et al. (2005)
Threshold effects (including S-shaped response)	*Pulsing*	Sasieni (1971), Mahajan and Muller (1986), Dube et al. (2005)
Budget constraints	No budget constraints: *even* Budget constraints-*even* or *pulsing* depending on the response and the rest of the conditions	Sasieni (1989)
Hysteresis	*Pulsing*	Simon (1982)
Brand switching or repurchasing	*Pulsing* (short pulses) when advertising affects switching Long pulses (*sustained*) when advertising affects re-purchasing	Bronnenberg (1998)

complex than assumed by a concave shaped function (e.g. Vakratsas, 2005; Vakratsas et al., 2004).

This intricacy of advertising effects influences the optimality of media schedules. In a seminal work, Simon (1982) suggested that advertising may exhibit hysteresis effects, where advertising increases may have stronger effects than corresponding decreases. This phenomenon, in turn, will lead to a pulsing optimal advertising policy. One shortcoming of Simon's paper is that the proposed advertising model can only yield pulsing as the optimal policy and does not include the even schedule as a possibility under any conditions.

Bronnenberg (1998), in a discrete Markov process framework, distinguishes between advertising effects on switching versus repurchasing. Similarly to Park and Hahn (1991) and Villas-Boas (1993), he finds that pulsing is the optimal policy despite the concavity of the response functions. Interestingly, he also finds out that long pulses (closer to a sustained or even schedule) are preferable if advertising affects predominantly repurchasing whereas short pulses, similarly to Sasieni and Mahajan and Muller, are preferable when advertising predominantly affects switching. These results can be explained in terms of the advertising effects on the untapped market: when advertising affects switching, it influences the untapped market which becomes increasingly smaller. Therefore, sustained advertising would generate less and less response. When advertising affects predominantly repurchasing, it influences the tapped market and sustained advertising can generate cumulative responses. Dube et al. (2005), similarly to Vakratsas et al. (2004), accommodate advertising threshold effects by employing a flexible (spline) sales response function. They apply their model to GRP data for frozen entrees and, using the estimates of their empirical model, derive pulsing as the optimal advertising strategy.

OTHER FACTORS

Other factors could drive pulsing patterns; for example, seasonality in sales, advertising goal, carryover effects, and media buying practices. Here we discuss issues related to the influence of such factors on scheduling decisions.

Advertising goals

Vakratsas and Ambler (1999) identify goals as a major driver of advertising strategy, and scheduling is no exception. If the goal of the advertiser is to gain attention or inform consumers, especially in the case of a new product, blitz would be the appropriate schedule. If the goal is persuasion, then pulsing is preferred since it represents a more persistent schedule and allows brands to advertise "out-of-phase" and thus avoid clutter and stand out in consumer memory

during a pulse. Finally, when the goal is to simply remind consumers (e.g. established brands or corporate advertising), an even schedule is preferable.

Sales patterns/seasonality

Sales patterns also dictate scheduling strategies such as asynchronous (for market expansion) or synchronous (for catching-the-wave). Variation in sales due to seasonality may induce advertisers to employ a pulsing or flighting schedule and also advertise at the same time as competitors do, engaging in advertising wars. For example, the shoe retailing (and manufacturing) market is characterized by two peak (Spring, Fall) and two off-seasons (Winter, Summer), essentially dictating a pulsing or a pulsing-maintenance schedule. Similarly, lawn-mower manufacturers may use a flighting schedule for attracting new buyers in their peak-season and clearing inventory in the off-season. Villas-Boas (1993) discusses how "out-of-phase" advertising may not work for seasonal products (e.g. cough medicines) that need to advertise during peak seasons.

Carryover effects

The role of carryover effects is also important. Tellis (1998) identifies four causes of delayed advertising effects: (a) Long-term memory, (b) delayed purchasing decisions, (c) purchase deliberation leading to delayed persuasion and (d) word-of-mouth diffusion of the advertising message. All these factors can justify the presence of advertising effects long after advertising stops, suggesting that pulsing should be better than even scheduling and that a new pulse should occur after the bulk of the effects of the previous pulse has been realized.

Buying tactics

Buying tactics of media buyers and the availability of advertising time by the networks may drive pulsing patterns. Networks control the sale of advertising time and they may implicitly or explicitly force advertisers to pulse depending on the advertising inventory that is available. Thus, an observed pulse may be the result of excess commercial time or advertising space availability. This issue is interesting and additional research is needed in order to investigate to what extent schedules are media-driven.

Multi-media scheduling

Scheduling research has focused on either a single medium or total aggregate expenditures. However, recent research suggests that advertisers may benefit from synergies across multiple media (e.g., Naik and Raman, 2003) or messages that vary in the levels of involvement; for example, television commercials with less involving media such as billboards or product placements, or complex versus simple messages, long copy versus short copy, or hard sell versus soft sell (see Janiszewski et al., 2003). It would be interesting to investigate whether the optimal combination of all media schedules is pulsing or whether optimal pulsing schedules for each medium result in an even schedule for all media combined.

Additional issues

Naik et al.'s (1998) ad wearout model shows that pulsing practices are justifiable, for example, when ad effectiveness declines under constant exposure (due to wearout effects) and restores during a media hiatus (due to the forgetting effect). Such waxing and waning of ad effectiveness, and thereby the induced duration and spacing of pulses, depend on the parameters reflecting ad wearout and restoration dynamics, which can be estimated using market data. Because various advertisements would yield different parameter estimates, future researchers can investigate the characteristics of advertisements that influence the magnitudes of wearout and restoration rates. For example, emotional ads wearout slower than ads based on non-emotional (or rational) appeals (e.g., Ray and Sawyer, 1971; Bass et al., 2005), possibly because emotional ads elicit imagery

processing while verbal arguments elicit cognitive processing (MacInnis and Price, 1987). Similarly, different wearout patterns across domestic versus international markets (China, South America) need further investigation.

Do pulsing principles apply across different time-scales (e.g., hourly, weekly, quarterly)? To derive the principles that remain invariant to the time-scale issue, pulsing models are formulated in continuous-time (e.g., Sasieni, 1971, 1989 or Naik et al., 1998). The "time" variable in a continuous-time model has no units, and so the principles apply generally regardless of the unit of measurement (time-scale). The issue of time-scale effects arises only when actual data are used (i.e., hourly, weekly, quarterly) to estimate the model. The different time scales lead to different estimated values of the model parameters. For example, if one estimates a model $y_t = a + by_{t-1}$ using weekly data, one will get different estimates from those obtained from using monthly data (or hourly or annual data). The size of the estimated coefficients reflects the time-scale of the data; specifically, $\hat{b}$ would increase as the time-scale becomes coarser (e.g., hourly to weekly to monthly to quarterly to annual). We encourage further research to shed light on this topic.

Finally, the influence of usage rate or purchase cycle or business cycles (Smith et al., 2005) on the optimal policy is an issue of practical import. Of particular significance is the scheduling of media for durable goods where purchase cycles are long but there are always consumers in the market at any given time. Given advertising's carryover effects, advertising should also influence consumers that are not currently in the market and this may eventually affect the optimal policy.

SUMMARY

Based on our discussion of academic studies, but also on practitioner experience with scheduling, media executives and brand managers should consider the following points:

- The objective of using pulsing media schedules is to make big impact periodically rather than maintain a continuous presence via the use of even schedule.
- In using a blitz schedule, managers spend their entire media budget in the first few months rather than spread it out over the year. While this strategy mitigates the copy wearout over time, they should not concentrate the spending in too short a time (e.g., a week) because that intensifies repetition wearout. To maximize impact, balance the trade-off between copy wearout and repetition wearout.
- In two-pulse schedules, managers can introduce a hiatus between two spending pulses. The benefit of the hiatus is to forestall ad wearout and restore ad effectiveness because people forget advertised messages when advertising is not on. The duration of the two pulses and the inter-pulse spacing can be unequal; they depend upon the magnitude of ad effectiveness, forgetting rate, and copy and repetition wearouts. To plan better pulsing schedules, managers need to estimate these effects using awareness and GRP data for their particular brands.
- For multi-pulse schedules, managers have an option to choose from over a trillion pulsing schedules. To select good schedules, they need to develop software (e.g., "dashboard") that deploys the algorithms mentioned in this chapter for planning multi-pulse schedules and re-allocating budget across multiple themes.
- In the presence of competition, managers should advertise out-of-phase (i.e., advertise own brands when competitors don't) to place own brands in consumers consideration set. Hence pulsing is preferred to even.
- In the presence of carryover effects, pulsing is preferred to even. A new pulse should begin after the effects of the previous pulse dissipate.
- In the presence of thresholds effects, pulsing schedules are recommended because managers can benefit from the increasing returns to media spending.
- In case of hysteresis, increased media spending leads to sales gains that exceeds the decline in sales for the same amount of media spending decrease; so managers can alternate between high and low spending to ratchet up their sales over time.
- In the case of brand-switching (repurchasing), pulsing schedules with short (long) duration are recommended.
- Other factors to consider when planning pulsing schedules include seasonality, advertising goals, and media buying practices. For example, if the goal is to remind, an even schedule is preferred,

blitz is better for gaining attention, and persuasion can be achieved via pulsing. Seasonality may induce competitors to advertise at the same time, at the risk of causing clutter. Buying tactics of media buyers and the availability of advertising time by the networks may result in observed pulsing patterns.

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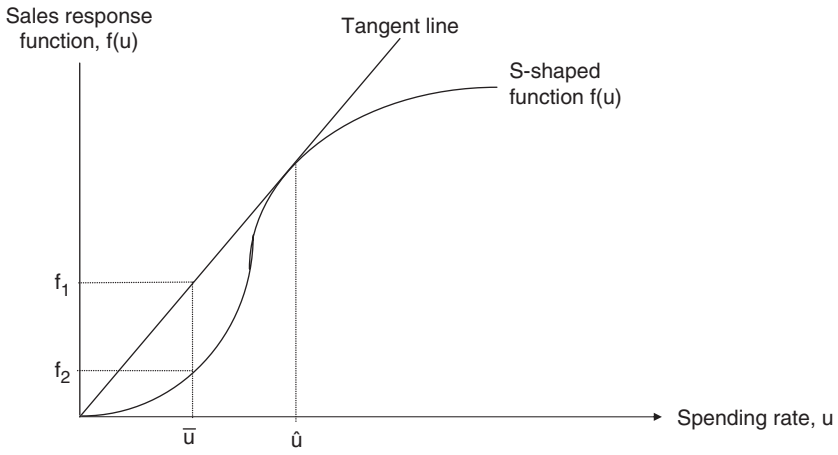
APPENDIX: S-SHAPED RESPONSE THEORY OF PULSING SCHEDULES

Let sales response to advertising be an S-shaped function as shown below:



When the sales response function has a convex region, an advertiser should alternate the spending rate between the minimum spending $u = 0$ (origin) and the maximum spending $u = \hat{u}$. By alternating *infinitely* often, the convex region gets linearized by the tangent line, in theory, leading to *chattering*. The resulting response under such a chattering policy is f_1, which is always larger than f_2 that would be achieved by spending uniformly at an average spending rate $\bar{u}$. Further, when pulsing frequency is finite, shorter cycle times (i.e., more number of pulses per planning horizon) perform better than the longer ones (Theorem 2, Sasieni, 1989). Mahajan and Muller (1986) suggest that three to four pulses can achieve 90% of the theoretical maximum attained by the chattering policy.