

Circadian rhythms and their effects on advertising recall

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ABSTRACT

This study explores circadian rhythms and their effects on long term recall in 127 college students.

Students are exposed to a series of commercials over a period of time. Unaided recall is attempted two weeks later. Results from two studies (one examining recall in the morning at 9 AM and the other looking at recall at 3:30 in the afternoon) are tabulated and compared. A positive correlation between time of day recall and recall ability is found.

INTRODUCTION

The human body is a mystery that has been studied since the beginning of time. Sociology literature is notably marked with studies exploring the impact of time of day on human reactions, most notably, circadian rhythms, physiological arousal (body temperature) and their effects on short term memory (STM). However, only a few studies have been performed regarding long term memory (LTM). According to Folkard, et al., (1977) only three prior studies exploring LTM were discovered prior to their study, Baddeley, Hatter, Scott, and Snashall (1970), Hockey, Davis and Gray (1972) and Laird (1925). Since that time, several additional studies have been performed, exploring the topic (Monk and Kupfer 2007, Randler and Frech 2006, Hornik 1988; Folkard and Monk 1980, Folkard and Monk 1978). However, Laird (1925) continues to be the only study found that utilizes presentation of material over an extended period of time for retrieval amongst college students in an experimental environment. This is the area of particular interest for academics.

CONCEPTUAL FRAMEWORK

Circadian Rhythms and Memory

Differences exist as to how the human brain performs immediate or STM and delayed recall or LTM processes. These differences change not only throughout the day but also as the body ages. At the base of understanding memory is bio and circadian rhythms. Biorhythms are inherent rhythms that are said to control or initiate various biological processes. Classically, they are composed of three cyclic rhythms that are said to govern human behavior and demonstrate innate periodicity in natural physiological change composed of: physical, emotional, and intellectual cycles. Circadian rhythms are the internal biological clock that regulates a variety of biological processes according to an approximate 24-hour period. While numerous studies have explored these in relation to STM, little research has been performed correlating LTM and circadian rhythms in college students.

Klein (2001) points out circadian change in cognitive ability is attributed to the brain's hemispheric dominance; the left hemisphere is dominant during the morning and the right in the afternoon. The left hemisphere of the brain processes acoustic data, STM and routine activities while the right side processes visual information containing few semantic components and perceptual tasks which include organizational transformation of information and LTM (Folkard and Monk 1978; Natale and Lorenzetti 1997; Perri and Dawson 1988).

Folkard et al. (1977) reported findings suggesting LTM is greater after an afternoon presentation while STM recall is superior in the morning. Their study used meaningful information not simply recall of random digits or words which are frequently used in other studies. The superiority of LTM recall is found to be independent of time of day that the recall took place. Folkard et al. conclude that their study failed to yield evidence suggesting that time of day constitutes a "state" in the dependent learning sense and point out

that this may be due to the methodology of their test being merely a recognition test and further imply that a more sensitive memory test may improve their results.

When arousal is highest, attention is thought to increase. Circadian rhythms in body temperature parallel physiological arousal levels - "being at a minimum at 4 a.m. and reaching a maximum at about 8 p.m." (Hornik 1988, p. 588). Jarrett and Furnham's (1983) research bears this out with their finding that immediate recall deteriorated markedly across the day, but delayed or long term memory actually improved as the base arousal levels or circadian rhythms increased throughout the day. There is a crossover effect that was described between inferior STM and superior LTM which occurs at 30 minutes after the presentation (Craik and Blankstein 1975). Immediate recall and recognition "decline across the day" while delayed recognition improves significantly across the day and "delayed recall improved slightly later in the day" (i.e. 5 pm) compared with a bigger jump "earlier in the day" (i.e. 1 pm), according to Hornik (1988, p. 590).

"Information is thought to remain in short-term memory only briefly (a matter of seconds) and then is either forgotten or is transferred into long-term memory" (Mitchell and Olson 1975, p. 214). It is possible that as ads are repeated, they go through a period of "rehearsal" which means that they are written from our short term to our long term memory and this process could reduce or stop "forgetting by continually reinforcing the process of information retrieval from long-term memory" (Krugman 1972, p. 11). As Braun La-Tour and La-Tour (2004, p. 50) describe it, seeing an ad creates an "episodic memory of that experience and forms semantic associations to the brand, which first reside in short-term storage and may well go into longer-term storage". However, as viewers of advertising, we are bombarded with many messages and information overload which can deplete the memory and compete for our attention thus minimizing the retrieval and long term memory process. Edell (1993, p. 195) goes on to say that ads interact with "other information in storage, such as remembered ads, personal experience with an advertised brand, and word-of mouth information about the brand".

Age as a Factor of Memory

Apparently age is also a factor of memory retention. Klein (2001) found that test performance ability rises from morning to afternoon in elementary students regardless of prior scholastic achievement while the reverse is found in high school students. These results suggest support of Biggers's (1983) findings which found that adolescents score higher in the morning and then dip later in the afternoon. Further investigation by Klein revealed that the attention levels decreased for high school students as the day progressed, but also noted that low achievers had greater attention levels later in the day than high achievers. Klein also noted a morning slump amongst all groups. This morning slump is referenced throughout the literature and is often referred to as 'post-lunch weariness', which is directly related to biorhythms.

One of the most striking facts of biorhythms is the individuality of morningness and eveningness, often referred to as "Morning Larks" and "Night Owls" depending on the time of day one prefers to perform intellectual and physical activities. Children and adolescents shift their time of day preference from morning to evenings, thus morning academic achievement decreases as the person grows older. On average, students 18-20 are evening types (Randler and Frech 2006). However, in a study performed by Monk and Kupfer (2007) contradicting results are suggested. It is proposed the transcendence back to morningness in young adults (age 20-60 mean age 35.0) is related to sleep loss. In general however, recall is negatively affected by a person's age; "older viewers had lower recall and recognition scores than did younger viewers" (Rose 1994, p. 54).

Advertising, Brand Recall and Recall Ability

In past memory studies, many different measures of memory have been used: 1) free recall – where subjects write down all they can remember about an ad (Braun-LaTour, Heflin and Haygood 1985; Hornik, 1988; Braun-LaTour 2004; Norris and Colman 1994); 2) recognition of products – accurately report which product types they saw out of a long list of product types (Krishnan and Chakravarti 2003; Norris and Colman 1994; 3) cued recall of brand names – after giving subjects the product types, ask them to recall

the brand name (Dubow 1995; Heflin and Haygood 1985; Norris and Colman 1994); and 4) recognition of brand names – under each product type, the brand names were given in a list and subject must recall which brand it was in that product type (Heflin and Haygood 1985; Hornik 1988; Norris and Colman 1994).

In the field of memory psychology, memory is also studied for the impact of frequency, which is defined as the number of exposures of an advertisement. Krugman (1972, p. 11) believes that the first exposure “elicits a cognition – What is it?” while the second exposure elicits an “evaluative/personal response” and the third exposure is a “reminder” but also the point at which “disengagement begins to occur”. There is a “Common belief in advertising that three exposures are optimal and that beyond three exposures the ads lose any compounded advantage.” (Schumann et al. 1990, p. 201; Krugman 1972, p. 12). Schumann et al. (1990, p. 196) demonstrate that when given a moderate number of exposures (meaning 3), subjects had a significantly higher level of recall as compared to those with a high number of exposures (meaning 5 or more). Memory loss for ten advertising exposures drops off significantly “between three and five weeks” (Heflin and Haygood 1985, p. 41).

In their neurocognitive model of advertisement content and brand name recall, Chessa and Murre (2007) are able to capture a realistic framework for memory in advertisements. They based their model on two important aspects of memory: 1) memory is encoded as a number of representations which can be activated over time by a “memory cue”, such as a product category when a brand name has to be recalled; and 2) memories are stored in one or more parts of the brain with 1 store having a “process of memory decline or loss” and the other store an “induction process, which transfers representations from one store to another in a feed-forward fashion” (Chessa and Murre 2007, p.131).

RESEARCH QUESTION AND HYPOTHESIS

Based on the literature, several research questions arise. Primarily, does the ability to recall differ throughout the day? Does recall ability change with the time of day the initial exposure is experienced? Are the preferences of morningness and eveningness mediating factors of recall? This preliminary study seeks to find support to help answer two of these questions and the following hypotheses are derived:

H1: Ability to correctly recall stimuli will differ with time of day recall

H2: Morningness/eveningness subject preference will affect the number of correctly recalled stimuli.

METHODOLOGY

General Procedure Overview

The experiments are conducted in a classroom setting of a basic marketing course at a research university in the Southeastern United States. Subjects are exposed to stimuli of a series of ten, previously launched, United States created, well known brand, commercials lasting a total of 6 minutes 45 seconds to approximate the average commercial break time. The commercial stimuli is administered approximately forty-five minutes into the seventy-five minute class period to avoid any subject bias of late attendees. The subjects are not given any instruction as to why the commercials are being played. Over three consecutive course meetings, the subjects are exposed three times to the exact same stimuli. After each exposure, students are asked to answer the following three questions.

1. How much sleep did you get last night? Round to the nearest half hour.
2. Did you actively read the homework chapter?
3. If not, why not?

These questions were designed to divert the subjects from the true intent of the exposure and make them think roll is being taken with the quiz. Additionally students were led to believe the instructor was verifying who read the homework assignment and who did not. If the subjects suspected later recall requirements of the stimuli, they may have altered their attention and processing in an attempt to maximize their retrieval ability (Eysenck 1982). In fact, in a study by Tversky (1973), subjects who expected a recall

or recognition test displayed increased performance on the test. Diverting subjects from the true intent of their research (i.e. the recall and recognition of brands), Kent and Machleit (1990, p. 8) told subjects they were filling out a questionnaire to “aid the instructor in preparing a set of measures of ad content”. Intended memorization of the stimuli is undesirable and misleading the subjects as to the true focus of the study was necessary to promote incidental recall by the lack of post testing expectations (Bagozzi and Silk 1988; Bowers and Schacter 1990; Keller 1987; Krishnan and Shapiro 1996). Two separate studies are completed using this methodology.

The stimuli

Ten previously launched advertisements are acquired from Adforum, an online international advertising portal. All advertisements are top brand US products. The ads are placed together in a commercial break string. Advertisements are chosen based on content and length. Utilized ads are created using either humor or emotional appeal in an attempt to control for recall rationale. Commercials are either one minute or thirty seconds in duration. In a preliminary study of commercial lengths taking place on three different days and three different times of day, network channels rendered commercial breaks 6.5 minutes in duration with an average of 1/8 being 15 seconds long, 5/8 being 30 second spots, and the other 1/4 being 60 seconds in duration. Cable channel commercials were an average length of 4.5 minutes with 3/4 of the spots being 30 seconds long and the other 1/4 of the commercials being 15 second spots. Additionally, cable breaks included announcements of upcoming programs that ran between 10 and 15 seconds in duration adding, on the average, 30 seconds to the break.

Measurement Instrument

An unaided recall questionnaire is developed to determine recall ability of each commercial contained in the stimuli series. An open ended question is used to inquire as to ability to recall content, brand name, and reason for recall: (1) Describe the commercial’s content, (2) What made you remember this commercial, and (3) Name the brand that was advertised in the commercial. A categorical question is used to determine

previous commercial exposure and time of day preference: (1) Were you familiar with this commercial before viewing for this study? (2) Do you consider yourself a Morning Lark, Night Owl, or neither?

STUDY 1 – MORNING RECALL GROUP

Methodology

In the first study, subjects are exposed to the stimuli three times over a two week period at approximately 8:40 AM. Additional subjects are prevented from entering once the commercials begin and are allowed to enter once attendance check quizzes are collected for stimuli exposure control purposes. Subjects are neither given advanced warning that the stimuli is coming nor as to the purpose of the exposure. Once the commercials are viewed, subjects are given a distraction task of a three question quiz unrelated to the stimuli.

A recall survey is administered two weeks later at 9:00 AM. Only subjects who viewed the commercials at least once were allowed to take the survey. Actual number of times viewed is verified with the quizzes collected as an attendance check during stimuli administration. Subjects are instructed to complete the survey to the best of their ability and informed that extra credit is awarded based on how complete the survey is in regards to the commercials viewed. The intent is to deter subjects from not completing parts of the survey due to length. Instructions are also given that the survey administrator may not answer any questions and that subjects may have as much time as they need to complete the survey. A judgment call is made to categorize the open ended question regarding recall reasoning.

Sample

The sample consisted of 27 males and 32 females, n=59. The majority of the sample report being night owls, 55.9%. Morning larks constitute 20.3% of the sample and 22.0% report being neither a night owl nor

a morning lark. The majority of the sample were exposed to the stimuli three times, (49.2%; n=29); 37.3% (n=22) observed the stimuli twice and 13.6% (n=8) viewed the commercials only once.

Results

There are 590 possible results for correctly recalling all ten commercials. The subjects recall 207 of which 23 are incorrectly recalled but are contained within the stimuli for a correct recall percentage of 35.08%. The subjects did not recall any commercials that were not contained within the stimuli. Of the 230 recalls, 57.5% of the respondents were not previously familiar with the commercial. The number one commercial recalled is Pepsi, which is an emotional appeal advertisement. Captain Morgan, another emotional appeal ad, is the second most followed by Levis 501 jeans, a humor advertisement. Table 1 presents the advertisements in the order they appeared in the stimuli set. Frequency of recall and percent of overall recall are given (see Table 1).

	9:00 AM Study 1 Number of Correct Recalls		3:30 PM Study 2 Number of Correct Recalls		Overall Number of Correct Recalls	
Miller Genuine Draft	10	5.20%	28	7.30%	38	12.50%
Levis	25	13.00%	48	12.40%	73	25.40%
Captain Morgan	31	16.10%	48	12.40%	79	28.50%
Propel	9	4.70%	22	5.70%	31	10.40%
Cellular One	7	3.60%	12	3.10%	19	6.70%
Sonic	14	7.30%	22	5.70%	36	13.00%
Fed X	19	9.80%	33	8.50%	52	18.30%
Dominos	23	11.90%	8	9.60%	31	21.50%
Monster.com	21	10.90%	35	9.10%	56	20.00%
Pepsi	34	17.60%	40	10.40%	74	28.00%
Other Recall Situations						
Brand not in the Stimuli set	0	0.00%	21	5.40%	21	5.40%
Competitive Brand Given	0	0.00%	25	6.50%	25	6.50%
Correct Mfg. wrong Brand	0	0.00%	6	1.60%	6	1.60%
Brand in the stimuli set but given with wrong ad description	0	0.00%	1	3.00%	1	3.00%

Table 1 Correct recalls by Brand

The sample recalled an average of 3.31 commercials per subject. Further comparison of self proclaimed Morning Larks and Night Owls reveals night owls have a higher recall rate, rendering 3.24 commercials over the larks with 2.66 commercials per person recalled correctly. These results are significant at the $p=.01$ level. Of the 12 Morning larks, the highest frequency recall is 3 ads, (n=3). Night Owls (n=33) have a recall frequency tie between being able to recall 2 advertisements and 5 ads.

When comparing the ads by reasons for recall, humor is calculated as the number one reason for ad retention by 29.8% (n=67) of the participants. Creativity of advertising is comprised of comments including: creative, good story line, the constant use of red, which differed from vivid image. Vivid image consisted of comments such as: the huge ball, the scary bird, all those millions of people. Creativity is the second highest reason for recall with 41 correct recalls, rendering 18.2%. Vivid image is the reason 32 (14.2%) subjects recalled the commercial correctly. Ironically, the only other distinguishable reason for recall is irritation. Twenty-two (9.8%) people recalled advertisements because they found an aspect of the commercial irritating or dislikeable; higher than brand familiarity and emotional appeal. The top three recall reasons (humor, creativity of the ad and vividness of the image) account for 62.2% of the overall reasons for recall (see Table 2).

Reason for Ad Recall	9:00 AM		3:30 PM		Overall Results	
	Count	Percentage	Count	Percentage	Count	Percentage
Humor	67	29.8%	99	27.1%	166	56.9%
Creative Ad	41	18.2%	27	7.4%	68	25.6%
Vivid Image	32	14.2%	77	21.1%	109	35.3%
Irritating	22	9.8%	24	6.6%	46	16.4%
Emotional Appeal	12	5.3%	11	3.0%	23	8.3%
Brand Familiarity	11	4.9%	17	4.7%	28	12.3%
Music in Ad	9	4.0%	14	3.8%	23	7.8%
Unsure	8	3.6%	15	4.1%	23	7.7%
Previously viewed	7	3.1%	23	6.3%	30	9.4%
Exposure Repetition	6	2.7%	9	2.5%	15	5.1%
Celebrity in Ad	4	1.8%	10	2.7%	14	4.5%
Sex Appeal	3	1.3%	7	1.9%	10	3.3%
Other	2	0.9%	32	8.8%	34	9.7%
Like the Brand	1	0.4%	0	0.0%	1	0.4%

Table 2 Frequency of Recall Reason

STUDY 2 – AFTERNOON RECALL GROUP

Methodology

In study two, subjects are exposed to the stimuli three times at approximately 8:40 AM. Additional subjects are prevented from entering once the commercials begin and are allowed to enter once attendance check quizzes are collected for stimuli exposure control purposes. Subjects are given neither advanced warning that the stimuli are coming nor the purpose of the exposure. Once the commercials are complete, subjects are given the same distraction task of a three question quiz unrelated to the stimuli as in Study 1. A recall survey is administered two weeks later at 3:30 PM. Only subjects that viewed the commercials at least once were allowed to take the survey. The same method of verification of exposure and survey administration is utilized as in Study 1.

Sample

The sample consisted of 32 males and 36 females, n=68. The majority of the sample report being night owls, 52.3% (n=34), while 19.1%, (n=19) consider themselves to be morning larks and 25.0% (n=17) report being neither a night owl nor a morning lark. The majority (67.6.2%, n=46) of the sample is exposed to the stimuli three times, with 26.5% (n=18) observing the stimuli twice, and 5.9%, (n=4) viewing the commercials only once.

Results

Of the 680 available recalls, the sample recalled 334 advertisements correctly, 33 advertisements are incorrectly described but the brand name was given correctly and 19 advertisements that were not contained within the stimuli set. Of the correct recalls 57.5% (n=214) were not previously familiar with the advertisements. The average commercial recall per subject is 4.6. Morning Larks recall an average of 5.31 commercials while Night Owls recall an average of 4.18. The difference of these means are significant at the p=.01 level. Ten subjects were able to recall 4 advertisements correctly and eight subjects recalled six

correctly. Morning Larks and Night Owls both have highest frequency for four correct recalls. Additionally, both groups have 2 subjects each able to have complete accurate recall of all 10 commercials.

The unaided recall results in a tie between Captain Morgan and Levis for the number of correct recalls, each rendering 48. Pepsi is the third most recalled commercial with 40 subjects recalling it correctly. The top three recalls account for 35.2% of the overall recalled commercials. The study also produced recalls that were not part of the stimuli set. Twenty one subjects recalled advertisements that were from outside sources. Another 25 subjects (6.5%) gave a competitor's brand name instead of the brand given in the advertisement. Ironically, both of these situations (i.e. erroneous outside sources and mistaken competitor brand recalls) are actually higher than the lowest recalled brand of Cellular One (see Table 1).

The number one reason given for being able to recall an advertisement is humor, n=99, 27.1%. Closely following humor is a vivid image. Emotional appeal, which is the second criteria for advertisements being selected for the stimuli, rendered a very low 11 responses representing only 3.0% of the recalled ads. The top two reasons for recall account for 48.2% of the overall reasons for recall. The remaining 51.8% is disbursed without notable difference, with sex appeal ranking last at 1.9% with n=7 (see Table 2).

COMPARISON OF STUDIES 1 AND 2

Correlations

Pearson Correlation is used to evaluate whether a correlation exists between the time the survey is administered and the number of advertisements that are recalled correctly. Study One recall time is approximately 9:00 AM and Study Two recall time is 3:30 PM. Results suggest a strong positive correlation between the two variables, $r = .191$ and is significant at $p = .05$ (see Table 3).

Recalled

Time Survey

		Correctly	was Taken
Recalled Correctly	Pearson Correlation	1.000	0.191*
	Sig. (2-tailed)	.	0.027
	N	135	135
Time Survey was Taken	Pearson Correlation	0.191*	1.000
	Sig. (2-tailed)	0.027	.

* Correlation is significant at the 0.05 level (2-tailed).

Table 3 Correlations

Other Comparisons

The combined studies consist of 59 males and 68 females, n=127. Of these, 25 claim to be Morning Larks and 67 Night Owls. The remainder are either stated they are neither or did not respond. The number of times exposed to the stimuli varies: 9.4% (n=12) view it once, 31.5% (n=40) are exposed twice and the majority of the subjects (59.1%, n=75), observe the stimuli three times. A total of 510 advertisements are recalled of the possible 1270. The average recall per person is 2.97. The number one commercial recalled is the Captain Morgan, n=79. The second and third most recalled advertisements differ by only 1 recall and have two distinctly different advertising approaches. The second most recalled, Pepsi, n=74, is an emotional appeal advertisement. The third most recalled ad is Levis 501 jeans, n=73. The composition of the Levi ad is a combination of humor and sex appeal. The remainder of the recalls form three distinct categories, Monster.com and Fed X place close together n= 56 and 52, Cellular One is distinctively alone with n=19 and the remainder vary from n=31 to n=38 (see Table 1).

The number one reason for the ability to recall an advertisement in the combined stimuli set is humor. This reason outranks all other categories by nearly 10%, (n=166 28.18%). The only two other distinctive reasons are vivid image (18.51%, n=109) and creative advertisement development (11.54%, n=68). Notably, irritation is set apart from the remaining categories at fourth most cited reason rendering 7.81% (n=46). Sex appeal depicts the lowest recall reason with n=10 or 1.7%. The remaining categories are separated by less than 4% (see Table 2).

ANALYSIS AND DISCUSSION

An analysis of the correlation between recall times, suggest strong support of H_1 : Ability to correctly recall stimuli will differ with time of day recall. However, it must also be noted that both recall studies received the same time of day stimuli exposure. Further investigation of recall times with additional varying exposure times is needed to elaborate on this finding. Although, it is obvious that a foundation has formed by the strong initial correlation.

The individual studies provide interesting results leading to the end conclusion. In Study One, subjects are able to recall 3.31 commercials per person opposed to the recall ability of Study Two, the afternoon recall study, who recalled 5.30 each. Both sets of subjects are exposed to the stimuli in the same manner at the same time. In both studies, the self proclaimed Night Owls, those who function better later in the day, perform significantly better than those claiming to be Morning Larks. This further suggests support that one's recall ability is affected by the circadian rhythms of the participants, thus providing evidence of H_2 : Morningness/eveningness subject preference will affect the number of correctly recalled stimuli. This also collaborates research performed by Hornik (1988) which demonstrated delayed recall (LTM) improved significantly from morning to evening. The times of recall utilized in his study are 9:00 am, 1:00 pm and 5:00 pm. Literature states that a young adult will perform better in the afternoon versus morning whereas older adults find mornings to be their optimal time to recall information (Phillips and Stanton, 2004).

While arguments can be made as to whether ad content effects recall, it does not have an effect on difference by time of day and effects of circadian rhythms. The top three advertisement recalls, while different in placement, are the same in both morning and afternoon studies. Additionally, two of the three least recalled ads are the same in both studies. The most recalled advertisement (Captain Morgan) is one that reflects the use of alcohol; considering the sample is comprised of primarily seniors at a major university, this is not surprising. The Captain Morgan commercial combines the use of humor and creative story line to capture the audience. The advertisement is a story board of a young man in his twenties who

avoids going to a wedding with his significant other by stating he is sick and has to stay home. When she calls to check on him, he is at a bar. She inquires as to the noise and everyone at the bar pretends to be different commercials, giving the illusion that he is channel surfing. The commercial ends with the Captain Morgan logo and the three men posing as if they were on the label. This ad appeals to both young men and women. The least recalled advertisement utilized humor but older adults are depicted in the ad.

There exists a strong correlation between the time of day delivery and the ability to correctly recall stimuli exposure. The positive correlation suggests that as the day progresses so does the ability to recall correctly. The literature states according to the sample's age, the circadian rhythms will produce higher recall abilities later in the day. Study One (9:00 AM) indicates a 35.08% recall rate, while Study Two (3:30 PM) produced a 57.5% recall rate. This represents 22.42% increase in correct recalls. These results suggest support that circadian rhythms have an effect on recall ability.

Implications

Although in the preliminary stages, this study has several implications to both practitioners and academics alike. This study begins to form a foundation for academics to build upon in terms of understanding the human body's biorhythms and how they affect recall in college students. To date, only one similar study has been located which studied recall patterns in college students based on circadian rhythms and time of day effects, Laird (1925). Although Hornik (1988) studied randomly selected adult mall shoppers, his study found similar time of day effects on recall of television commercials which he also attributes to their circadian rhythms. Review of the literature surrounding circadian rhythms leads to the understanding that little is known about the circadian output pathways. It is generally acknowledged that these biorhythms affect our routine behavior throughout the day (Eysenck 1976; Hornik 1988). As this body of literature develops in terms of how a consumer behaves during the progression of the day and as their body ages, a better understanding of the driving forces behind the target market can be developed. In practice, fully understanding the target market in terms of where they are in their biorhythm stage is important. If

attempting to build brand recognition in young adults, it appears that time of day can affect ability to recall advertisements, which leads to an understanding of what supplemental aspects, if any, of integrated marketing communications are required to ensure recall. As this field of study is further developed, understanding time of day exposure in relation to desired time of day recall will greatly benefit practitioners to determine effective times to expose consumers to their communications. It appears that advertising effects should control for both the “time of the stimuli and the time of response testing” as recommended by Hornik (1988, p. 590).

Limitations of the Study

Although the study was a controlled experiment design, there are a number of limitations to the research. The study could not control the subjects in terms of previous activities or sleep patterns prior to exposure nor prior to administering the survey. These variations in activity patterns may affect the typical circadian rhythms. Further questioning of subjects is needed to more accurately determine individual biorhythm patterns. However, it should also be noted, that the recall ability follows expected recall capabilities in college students. There are noted outside references in Study Two. These are thought to derive from outside competing advertising exposures from other classes or other shared viewing experiences. This assessment is made due to the fact several students recalled the same incorrect advertisement. However, controlling for competing noise is a difficulty in an actual simulation and is an expected limitation of the study.

In addition, the study is limited by only one exposure time of the commercial set, 8:40 AM. Additional exposure times with morning and afternoon recall will help to develop a well rounded understanding of circadian rhythms and recall in young adults.

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