

Variety-Seeking and Time of Day

KELLEY GULLO

JONAH BERGER

JORDAN ETKIN

BRYAN BOLLINGER

Kelley Gullo ([kelley.gullo@duke.edu](mailto:kelley.gullo@duke.edu)) is a Marketing Ph.D. student in the Fuqua School of Business at Duke University. Jonah Berger ([jberger@wharton.upenn.edu](mailto:jberger@wharton.upenn.edu)) is an Associate Professor of Marketing in the Wharton School of Business at the University of Pennsylvania. Jordan Etkin ([jordan.etkin@duke.edu](mailto:jordan.etkin@duke.edu)) is an Associate Professor of Marketing in the Fuqua School of Business at Duke University. Bryan Bollinger ([bryan.bollinger@duke.edu](mailto:bryan.bollinger@duke.edu)) is an Assistant Professor of Marketing in the Fuqua School of Business at Duke University. They thank the SIEPR-Grannini Data Center for providing access to the grocery data. Supplementary materials are included in the web appendix accompanying the online version of this article.

## ABSTRACT

The desire for variety is a fundamental aspect of choice. But given circadian rhythms in chronobiology, might variety-seeking vary by time of day? Four studies, including an empirical analysis of millions of purchases, demonstrate diurnal variation in variety-seeking. Compared to other times of day, variety-seeking is lower in the morning: people pick items that are more similar to what they chose previously, and choose less-varied portfolios of options to consume at a later date. Consistent with the underlying role of circadian rhythms, the effects were moderated by sunlight and individual differences in circadian preferences. On mornings when people should feel more physiologically stimulated (i.e., earlier sunrise), they show greater variety-seeking, and people who should feel more physiologically stimulated in the morning (i.e., morning-types), prefer more variety then as well. These findings shed light on drivers of variety-seeking and the biological basis of consumer behavior more generally.

## CONTRIBUTION STATEMENT

A great deal of research has sought to understand the antecedents (e.g., McAlister 1982; Simonson 1990) and consequences (e.g., Etkin and Mogilner 2016) of variety-seeking. While this research provides important insights into situational factors that influence variety-seeking (e.g., choosing in public; Ratner and Kahn 2002) and individual differences that imply some people may prefer more variety than others (e.g., optimum stimulation level; Raju 1980), less is known about how variety-seeking might vary *within* an individual. Drawing on research in chronobiology, this research advances theory on drivers of variety-seeking by demonstrating that daily fluctuations of circadian rhythms shape how much variety people want throughout the day. The present findings demonstrate that people tend to prefer less variety in the morning, when circadian rhythms suggest physiological stimulation levels are low, than they do later in the day, when circadian rhythms suggest that physiological stimulation levels are higher. In addition to contributing to the understanding of drivers of variety-seeking, the present research also deepens understanding around the biological basis of consumer behavior by demonstrating circadian rhythms in variety-seeking.

*Keywords:* variety, decision making, choice, circadian rhythms

Variety-seeking is a fundamental aspect of choice. We have Chinese food for dinner because we had Italian last night. We buy different flavors of yogurt rather than multiple of the same. Instead of picking the same thing again and again, people have a preference for variation. Whether choosing something to consume now, or a portfolio of options to consume at a later date (Simonson 1990), decades of research have shown that consumers seek variety (see Kahn 1995, for a review).

But might how much variety people seek vary by time of day?

Consumers make choices at different times of the day. Sometimes people shop online in the middle of the day while other times they shop in the evening. Sometimes consumers go to the supermarket in the morning and other times they go later in the day. Might simple shifts in *when* people make their choices impact how much variety they choose? Might people be more likely to choose varied, rather than the same, flavors of yogurt, for example, if they go shopping in the afternoon rather than morning?

Building on research on chronobiology, we suggest that time of day impacts variety-seeking. Various internal biological processes naturally oscillate over an approximately 24-hour period (e.g., body temperature). Given several drivers of variety-seeking (e.g. stimulation and arousal) have biological underpinnings that systematically fluctuate throughout the day (Kleitman 1963; Thayer 1978, 1989), we suggest that *when* consumers choose may impact how much variety they prefer.

Four studies, including an empirical analysis of millions of supermarket purchases, demonstrate diurnal variation in variety-seeking. Through both manipulation and measurement, they demonstrate that relative to the rest of the day, variety-seeking is lower in the morning.

This article makes three main contributions. First, we shed light on drivers of variety-seeking. While economic approaches (Kahneman and Snell, 1990; Kreps 1979) often argue that variety-seeking is driven by uncertainty about future preferences, diurnal variation in variety-seeking highlights the important role of more physiological factors. Further, while research on optimal stimulation level (e.g., Pessemer and Handelsman 1984) suggests that certain individuals may prefer more variety, our results suggests that desires for variety may also vary *within* individuals. Depending on time of day, the same person may choose more or less variety.

Second, we deepen understanding around the biological basis of consumer behavior. While psychologists and neuroscientists have begun to examine how physiology shapes judgment and decision making, this area is still relatively young. Further, few papers have examined how these factors might impact consumer behavior (e.g., Durante and Arsena 2015; Kristofferson et al. 2017; Lichters et al. 2016). We contribute to the burgeoning research stream by demonstrating circadian rhythms in variety-seeking and the potential processes behind this effect.

Third, these finding have important implications for marketing practice. Given diurnal variation in variety-seeking, managers may want to consider time of day when thinking about product offerings or what to highlight in advertising.

## **VARIETY-SEEKING**

Decades of research have studied variety-seeking and its impact on consumer behavior (for a review, see Kahn 1995). From mundane choices, like what to eat, to important decisions, like how to spend one's time, people often seek and are influenced by variation (Broniarczyk,

Hoyer, and McAlister, 1998; Kahn 1995; McAlister and Pessemier 1982; Redden and Hoch 2009). Rather than picking multiple of the same thing (e.g., two Snickers bars), for example, people often pick a variety of familiar options when choosing a portfolio to consume at a later date (e.g., one Snickers and one KitKat, Simonson 1990). Variety-seeking is so deeply ingrained that it affects behaviors as basic as what infants eat (Gerrish and Mennella 2001) and where animals forage (Adessi 2008; Scott and Provenza 1998), and is so strong that people choose varied experiences even when it means selecting less preferred items (Ariely and Levav 2000; Ratner, Kahn, and Kahneman 1999). Variety influences choice (Kahn and Wansink 2004), satiation (Redden 2008), post purchase evaluations (Etkin and Sela 2016), motivation (Etkin and Ratner 2012), and even happiness (Etkin and Mogilner 2016).

Prior work has mainly focused on two drivers of variety-seeking: individual differences and situational factors (e.g., choosing in public). Research on individual differences suggests that certain people tend to prefer more variety. Work on optimal stimulation level (Raju 1980), for example, suggests that some people have greater needs for stimulation, and select more variety as a way to fill that need (Pessemier and Handelsman 1984). When planning dinner for the upcoming week, for example, people with higher optimum stimulation levels choose more dissimilar dishes (Steenkamp and Baumgartner 1992). Similarly, cross-cultural research has compared variety-seeking among Americans and East Asians (Kim and Drolet 2003). This work suggests that Americans choose more variety than East Asians because Western culture values the uniqueness that can be expressed through choosing variety.

Research on situational factors examines how aspects of the surrounding environment influence variety-seeking. When choosing in a group setting, for example, people select more varied options from their peers as a way of standing out or differentiating themselves (Ariely and

Levav 2000). Similarly, choosing in public, rather than private, leads people to select more variety because they think it will make others evaluate them more favorably (Ratner and Kahn 2002). Even the physical space where choice is made can influence variety-seeking (Levav and Zhu 2009). People in narrower aisles, for example, choose more variety than those in wider aisles in reactance to invasion of their personal space.

But while individual differences or situational factors shed some light on when and why people choose variety, they have less to say about time of day. Might simply choosing in the morning, for example, rather than the afternoon, change how much variety people seek?

## **CIRCADIAN RHYTHMS**

Building on research on circadian rhythms, and its impact on stimulation, we suggest variety-seeking will be lower in the morning.

Circadian rhythms are systematic fluctuations in physiological processes that naturally oscillate over an approximately 24-hour period. Hormone secretion, body temperature, blood pressure, and heart rate, for example, all fluctuate throughout the day (Hofstra and de Weerd 2008). As one example, melatonin levels are low in the daytime, increase in the evening and throughout the night, and decrease rapidly in the early morning. These various internal biological processes help regulate things like sleep and body temperature and allow organisms to coordinate their physiology so that different functions occur at different times.

In addition to regulating biological processes, circadian rhythms have a host of downstream effects. Researchers have long been interested in diurnal variations in judgment and behavior (Freeman and Hovland 1934). Time of day affects things like stereotyping

(Bodenhausen, 1990), athletic performance (see Cappaert 1999 for a review), decision speed and quality (Leone et al. 2017), creativity (Wieth and Zacks 2011), self-regulation (Digdon and Howell 2008), ad recall (Dacko 2012), risk taking behavior (Wang and Chartrand 2015), and performance on a wide range of tasks (Carrier and Monk 2000).

Most relevant to the current research are diurnal variations in physiological arousal (i.e., stimulation). Whether measured by skin conductance (Hot et al.1999), heart rate (Adan et al. 2012), or body temperature (Baehr, Revelle, and Eastman 2000), physiological arousal and alertness follows a consistent circadian pattern. People tend to feel lower arousal or less alert in the morning (Kleitman, 1963; Thayer, 1978, 1989) and arousal increases logarithmically throughout the day, with the steepest slope of change between morning and afternoon (Blake 1967). In general, people have lower heart rates and body temperatures in the morning, indicating lower feelings of stimulation relative to the rest of the day.

## **THE CURRENT RESEARCH**

Given the link between variety and stimulation, we suggest circadian rhythms will also affect variety-seeking. A great deal of research shows that variety is stimulating (for a review, see Kahn 1995). When consumers don't feel stimulated enough, they often seek variety as a source of external stimulation (Berlyne 1960, 1970; Raju 1980). Similarly, when needs for stimulation are already met, people seek less variety (e.g., Menon and Kahn 1995). Taken together, this suggests that circadian rhythms should influence the amount of variety chosen.

Time of day could shape variety-seeking in one of two ways. One possibility is that choice *compensates* for internal variation. If people feel less stimulated in the morning, they

might choose more variety to balance things out. Another possibility is that people choose in a way that *matches* their internal state. If people feel less stimulated in the morning, they might choose less variety as it better complements how they feel.

We investigate this question empirically, but also provide theoretical reasoning. It might seem like research on optimal stimulation supports the compensatory hypothesis. Menon and Kahn (1995), for example, find that having variety in one domain (i.e., drink options) made consumers less likely to choose variety in a second domain (i.e., snack options). Building on this, one could argue that if physiological stimulation levels increase throughout the day, consumers might choose less variety as they are already internally stimulated.

This line of thinking, however, assumes that optimal stimulation level is constant throughout the day. One person may prefer more stimulation than another, but *within* a person, optimal stimulation level should stay the same. A person would want the same amount of stimulation, for instance, whether it is morning, afternoon, or evening.

In contrast, we suggest that the amount of stimulation desired should also vary over the course of the day. People are generally less alert or physiologically aroused in the morning (Kleitman, 1963; Thayer, 1978, 1989) and we suggest this reflects not only how stimulated people feel, but how much stimulation they would like. Most people aren't looking for stimulation in the morning (though we consider morning-types as a moderator in Study 4). Rather than seeking complexity or challenge, people avoid things that are too stimulating until their body has had the chance to "wake up" (or has been encouraged by caffeine).

Consequently, we suggest that variety-seeking should be lower in the morning. While giving people variety in one domain may lead them to want less variety in another domain because they already feel stimulated (Menon and Kahn 1995), circadian rhythms should shift



how much stimulation consumers want, and thus how much variety they seek. Because physiological stimulation is lower in the morning, people should prefer less variety then as well. Further, since physiological stimulation increases logarithmically throughout the day, with the steepest slope of change between the morning and afternoon (Blake 1967), the biggest increase in people's variety-seeking should also be then as well. Whether people are choosing things to consume in the moment, or planning for future consumption, variety-seeking should be lowest in the morning, increase as the day goes on, but level off between the afternoon and evening.

Four studies test our theorizing in the laboratory and in the field. Study 1 analyzes over 6 million supermarket shopping occasions, examining whether variety-seeking is lower in the morning than the rest of the day. Study 2 provides a more controlled test, examining whether people eat less variety for breakfast than lunch or dinner. Studies 3 and 4 moves beyond the food domain, demonstrating that these effects generalize to a broader variety choice task.

The studies also test the underlying process, examining whether the effects are driven by circadian rhythms. Study 1 investigates whether time of day's effect on variety-seeking is moderated by factors that also affect circadian rhythms (i.e., sunlight). Study 4 underscores the underlying role of circadian rhythms by manipulating time of day and testing whether the effects are moderated by individual differences in circadian preference (i.e., whether people are morning-types or evening-types). By demonstrating moderation by circadian preferences, these findings underscore its role in why time of day influences variety-seeking.

It is worth noting that one paper (Roehm and Roehm 2004) started to examine the potential link between time of day and variety-seeking. Importantly, we predict the opposite of this work. While they suggest that variety-seeking should be higher at times of day when arousal is low (i.e., a compensatory effect), we theorize and show that variety-seeking should be lower in

the morning and higher in the afternoon (i.e., a matching effect). While a valuable first step, Roehm and Roehm (2004) examined only an extremely small sample (82 business students total across two studies) and a single domain (candy bars). They also compared only two points in time, thus many factors may have differed beyond time of day (e.g., how recently people had eaten). By examining a larger set of people (i.e., over 1 million), a broader set of domains (i.e., food and non-food), and a range of times throughout the day (i.e., 6AM to 12 midnight) we provide a more comprehensive examination of the effects of time of day on variety-seeking.

### **STUDY 1: SHOPPING BEHAVIOR OF 1 MILLION HOUSEHOLDS**

Study 1 analyzes the supermarket shopping behavior of over 1 million households over 25 months to test whether variety-seeking varies by time of day. Whether someone buying two yogurts, for example, buys two of the same flavor if they shop in the morning, but two different flavors if they shop in the afternoon.

We also test the underlying process by examining whether the effects are moderated by a factor that affects circadian rhythms (i.e., sunlight). Circadian rhythms are endogenous (Aschoff et al. 1971), meaning they can operate even in the absence of outside stimuli, but they are often adjusted, or synchronized, by external cues such as light (Bass, 2012). The circadian rhythms of the sleep/wake cycle, for example, are heavily dependent on cues from the sun. The onset of sunrise cues the secretion of various arousing hormones that aid in waking (i.e., cortisol) and the onset of sunset cues the secretion of hormones that aid in sleeping (i.e., melatonin; Schmidt et al. 2007). If the effect of time of day on variety-seeking is driven by circadian rhythms, as we suggest, it should be moderated by sunlight. We test this possibility.

## Method

*Data Description.* We use scanner panel data from a single California location of a major grocery chain. Each purchase includes the time of day and a unique household identifier for consumers using the grocery rewards card. This allows us to track the same household over time and isolate the time of day effect using within-household variation. The data includes purchases from 1,115,133 households across a 25-month time-period.

*Analysis Method.* Our analysis focuses on the variety purchased within a category for a given shopping trip. Variety is defined based on the number of unique UPCs purchased in a category, relative to the number of total items purchased in that category. For example, someone buying two yogurts might purchase two of the same flavor (i.e., less variety) or two different flavors (i.e., more variety).

The variety measure is defined as follows:

$$\text{Var}_{iCt} = \frac{\sum_{j \in C} 1\{j \in B_{it}\}}{\sum_{j \in C} q_j \in B_{it}}$$

This measure is calculated by product category for each shopping basket and is defined as the number of unique products  $j$  in shopping basket  $B_{it}$  in category  $C$  divided by the total number of products purchased in that category. If a consumer purchased four yogurts, for example, two each of two different types (e.g., flavor or brand), the variety in that category would be 0.5. The variable takes a maximum value of 1 when all products purchased in the category are unique. We use this measure rather than a simple count of unique products because we do not want to conflate variety with number of items purchased in the category (though, as we show below, all results also hold for simple counts as well). Our analyses focus on occasions where at least two products are purchased in the category, but the results are robust to both including one item-

purchases in the category (in which case the variety measure is equal to one) and when further restricting the sample to observations with more products purchased within the category (e.g., at least three or four).<sup>1</sup> We use all observations and categories in which multiple items were purchased in a category, and Web Appendix Table A1 gives a sense of which categories appeared most frequently (e.g., yogurts and frozen dinners) and what percentage of observations came from each category.

To determine the effect of time of day on variety purchased, controlling for other factors such as shopping basket size and day-of-week, we use the following model:

$$(1) \quad \text{Var}_{icdt} = \eta_h + \xi_m + \zeta_{dom} + \omega_{dow} + \gamma_{N_{icdt}} + \theta_{ic} + \epsilon_{icdt}$$

in which  $i$  designates the household,  $c$  indicates the category, and  $d$  and  $t$  indicate the day and time of the transaction, respectively. The subscripts  $i$ ,  $d$  and  $t$  together define a unique transaction. The  $\eta_h$  are the hour-of-day dummy variables of interest,  $\xi_m$  are month dummies,  $\zeta_{dom}$  are day-of-month dummies,  $\omega_{dow}$  are day-of-week dummies,  $\gamma_{N_{icdt}}$  are dummies for the number of purchased items in the category in transaction  $t$ , and  $\theta_{ic}$  are household-category fixed effects. By including fixed effects for all household-category combinations, we identify the time of day effects exclusively from within household-category variation. This allows us to compare the same household, purchasing in the same category, but purchasing at different times of day.

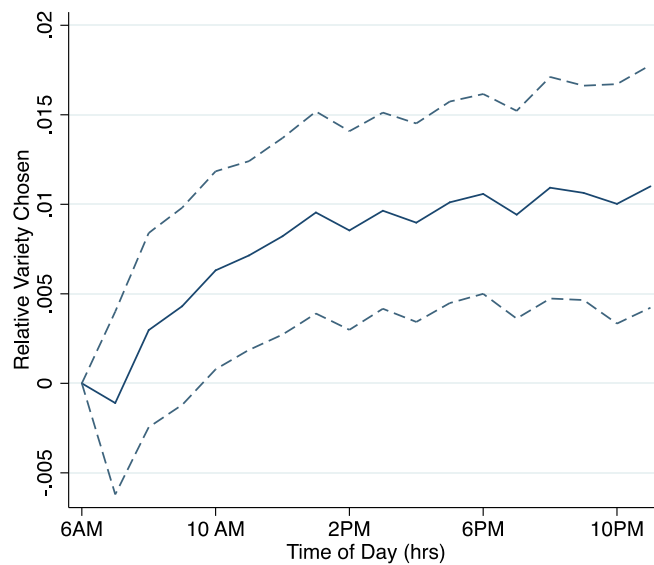
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<sup>1</sup> While one could argue that purchasing just one item in a category indicates that a consumer is not interested in variety, it could just as easily be that this person only needs one item or that the person is maximizing variety. When someone purchases at least two-items, quantity desired and variety-seeking can be disentangled. A consumer can purchase two items with or without seeking-variety. Thus, consistent with prior work (Hoch, Bradlow and Wansink 1999) our primary results focus on transactions in which multiple items are purchased in a category.

## Results

Figure 1 plots the estimates of the hour-in-day fixed effects with their 95<sup>th</sup> percent confidence intervals. The function is clearly increasing and declining over the course of the day, which implies that a log functional form would fit the data well.

**FIGURE 1: VAREITY-SEEKING VARIES BY TIME OF DAY**



Note: Points are plotted relative to average variety purchased at 6 AM. Dotted Lines indicate 95% CIs.

As such, we replace the hour fixed effects with log hours since 5AM and estimate the revised model shown below:

$$(2) \quad \text{Var}_{iCdt} = \alpha^0 \log(t_{it}) + \xi_m + \zeta_{dom} + \omega_{dow} + \gamma_{N_{iCdt}} + \theta_{iC} + \epsilon_{iCdt}$$

As predicted, people choose less variety in the morning than the rest of the day ( $\alpha^0 = 0.0051, p < .001$ , Table 1, column 1).

**TABLE 1: REGRESSION RESULTS**

Log Time (hours since 5AM)	0.0051*** (0.00039)
HH x Cat. FE	Y
# Items in Cat. FE	Y
Day-of-week FE	Y
Day-of-month FE	Y
Month FE	Y
R2	0.1395
N	3,478,696

Note: Standard errors are clustered at the household-category level. Significance levels: \*\*\* 0.1%, \*\* 1%, \* 5%

*Robustness Checks.* One might wonder whether the effect holds when the number of unique items is instead used as the measure of variety. We believe our variety measure is more appropriate because it controls for the number of items purchased in the category. Households that purchase more items, for example, likely purchase more unique items, but this may be driven by basket size more than by variety-seeking. That said, using this alternate measure of variety (i.e., counts of unique items in the category) shows the same effect ( $\alpha^0 = 0.0198$ ,  $p = 0.001$ , Table 2, column 1).

Results are also robust to different definitions of categories. Categories can be defined broadly (e.g., fruit) or narrowly (e.g., berries), so we perform the analyses using alternative definitions. Moving from more to less general, the firm used a category tree structure including group, category, class, subclass, and subclass. In many cases, the category, class, etc. are all the same. Refrigerated yogurts, for example, are a category, subclass, and everything in between. Blackberries, on the other hand, are in the berries category and class, but the subclass and subclass level distinguish between domestic and imported. We focus on “category” for the main analyses, but results are robust to different definitions of categories, looking at the

class, subclass, and subclass levels. People purchase less variety in the morning than the rest of the day (Table 2, columns 2-4).

**TABLE 2: ROBUSTNESS CHECKS**

	(1) Count Unique	(2) Class	(3) Subclass	(4) Subsubclass	(5) Yogurt only
Log Time (hours since 5AM)	0.0198*** (0.00141)	0.0043*** (.00039)	0.0037*** (0.00037)	0.0034*** (0.00036)	0.0071*** (0.00191)
HH x Cat. FE	Y	Y	Y	Y	Y
# Items FE	Y	Y	Y	Y	Y
Day-of-week FE	Y	Y	Y	Y	Y
Day-of-month FE	Y	Y	Y	Y	Y
Month FE	Y	Y	Y	Y	Y
R2	0.1395	0.1036	0.0895	0.0865	0.1871
N	3,478,696	3,149,418	2,970,938	2,905,984	127,847

Note: Standard errors are clustered at the household-category level (using category definitions for each column)

*Potential Alternative Explanations.* One could wonder whether the results are driven by between-household variation (e.g., different households having different variety preferences and shopping at different times of day). If households that prefer less variety tend to shop more in the morning, for example, maybe that could drive the pattern of results. Similarly, maybe larger households purchase later in the day and also buy more variety because they have more people. But this is not the case. Including household X category fixed effects controls for the fact that some households prefer more or less variety and that certain households may buy more variety in some categories than others. The fixed effects also mean that we are comparing the amount of variety purchased within each specific category by the same household when it shops at different times of the day (i.e. the effect cannot be explained by different types of households purchasing at different times of day).

Alternatively, one might wonder whether the results could be driven by shopping basket composition (i.e., people buying different categories at different times of day). If people buy low variety categories in the morning, for example, and high variety categories in the afternoon, maybe that could account for the observed pattern. But this is not the case. To test this possibility, we examine the effects within a single category. We focus on the category where people buy multiple items most often, yogurts (though the effects are consistent in other categories). Results are the same, albeit slightly stronger (Table 2, column 5). People buy less variety in the morning than the rest of the day.

Shopping basket size also cannot explain the results. If morning shoppers are doing an emergency or fill-in trip (i.e., just buying a few things) but evening shoppers engage in larger trips, maybe that could account for the results. Results are the same, however, controlling for basket size in a variety of ways, including different bin sizes or a smooth function. We also find the same results when we compare only shopping baskets of the exact same size across the day (e.g., buying 6 items at 9am, 10am, 11am, etc.) and include the full set of fixed effects as before.

Hunger also has difficulty explaining the results. One could argue that people are hungrier in the morning, and so are less picky, choosing multiple of the same thing rather than different things in a category. The fact that there is no similar dip in variety-seeking right before lunch and dinner, however, casts doubt on this possibility. Further, hunger can't explain why daylight exposure (or individual difference in circadian preferences, as shown below) moderates the effect.

*Moderation by Light.* We test the underlying process by examining whether the effect of time of day is moderated by sunlight. Light itself can be stimulating and boost arousal (Badia et al. 1991; Cajochen 2007), so if stimulation plays a role in these effects, as we suggest, then



variety-seeking, and its relationship with time of day, should vary with seasonal changes in day length. To test this possibility, we collected sunrise time for the 761 days in the dataset.

First, we simply examine seasonal variation in variety-seeking. Results indicate that variety-seeking is higher in months where there is more sunlight (e.g., summer; Web Appendix Figure A1). For example, the difference between the lowest sunlight month (December) and the highest sunlight month (June) is 0.0045 ( $p < .001$ ).

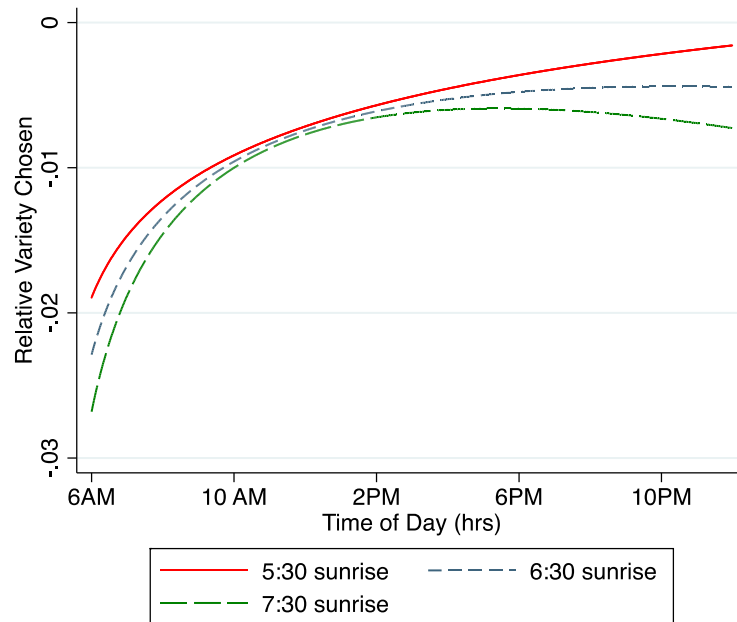
Second, to examine whether the relationship between time of day and variety-seeking is moderated by sunlight, we estimate an alternative regression where we interact log time as well as a within-day linear time trend (measuring time in hours since 5 AM) with sunrise times,  $s_d$  in order to allow for different curvature in the time of day effect depending on the amount of daylight thus far:

$$(3) \quad \text{Var}_{icdt} = \alpha^0 \log(t_{it}) + \alpha^1 t_{it} + \beta^0 s_d + \beta^1 s_d \log(t_{it}) + \beta^2 s_d t_{it} + \gamma D \\ + \xi_m + \zeta_{dom} + \omega_{dow} + \gamma_{N_{icdt}} + \theta_{ic} + \epsilon_{icdt}$$

Finally, we also allow daylight savings time to have an effect in a second specification, indicated by D.

Results show that diurnal variation in variety-seeking is moderated by sunlight ( $\beta^1 = 0.0034$ ,  $p = 0.097$  and  $\beta^2 = -0.0005$ ,  $p = 0.047$ , Table 3, column 1). Morning variety-seeking is higher on days when the sun comes up earlier. The sun sets later on these days, which may explain why evening variety-seeking is higher then as well. Figure 2 shows the combined effects of the time of day, sunrise time, and their interactions. Variety starts lower and increases later in the day on later sunrise days, and then decreases sooner in the afternoon/evening.

**FIGURE 2: SUNLIGHT MODERATES TIME OF DAY'S EFFECT ON VARIETY-SEEKING**



Note: This figure includes the main terms in Table 3 column 1. To improve readability, confidence intervals are not included but household X category-clustered standard errors are reported in Table 3.

Similarly, daylight savings time also has an effect. We include this variable in a second specification, shown in column 2 of Table 3. When the clock falls backward an hour, leading to more sunlight at a given hour in the morning, there is an increase in variety-seeking, as expected ( $\gamma = 0.00179$ ,  $p = 0.072$ , Table 3, column 2). The opposite occurs in the spring.

**TABLE 3: MODERATION BY LIGHT REGRESSION RESULTS**

	(1)	(2)
Log time (hr since 5 AM)	0.01257 (0.01358)	-0.01247 (0.01359)
Time	-0.00269 <sup>+</sup> (0.00165)	0.00270 <sup>+</sup> (0.00165)
Sunrise time (hr)	-0.00343 (0.00229)	-0.00193 (0.00244)
Log time x sunrise time	0.000342 <sup>+</sup> (0.00206)	0.00342 <sup>+</sup> (0.00206)
Time x sunrise time	-0.00050* (0.00025)	-0.00050* (0.00025)
Daylight savings		0.00179 <sup>+</sup> (0.00098)
HH x Cat. FE	Y	Y
# Items FE	Y	Y
Day-of-week FE	Y	Y
Day-of-month FE	Y	Y
Month FE	N	Y
R2	0.1395	0.1395
N	3,478,696	3,478,696

Note: Standard errors are clustered at the household-category level.

## Discussion

Study 1 provides preliminary evidence that variety-seeking varies by time of day.

Looking across over 1 million households, grocery shoppers bought less variety if they shopped in the morning rather than other times of day.

Further, consistent with the hypothesized underlying role of circadian rhythms, the effects are moderated by sunlight. In months where there is more sunlight, and thus people should be more stimulated in general, they purchased more variety. And on days where people should be more stimulated in the morning (i.e., there is more morning sunlight), the decreased preference for variety in the morning was attenuated.

## STUDY 2: MEALS

The results of Study 1 are consistent with our theory, but as is often the case with field data, it is difficult to rule out all alternative explanations. Rather than variation in variety-seeking, for example, one could argue that the results are driven by different shopping purposes at different times. While unlikely, maybe people shop for the entire household in the afternoon, and thus choose variety to accommodate multiple preferences, but buy less variety in the morning because they are just shopping for themselves. Alternatively, though also unlikely, maybe individuals within each household who dislike variety are systematically more likely to shop in the morning.

While these alternatives seem unlikely, to test them more directly, Study 2 looks at individuals' choices throughout the day. In particular, we examine variety across different meals to test whether variety-seeking varies by time of day. We predict that there will be less variation in what people eat for breakfasts over the course of a week compared to what they eat for lunches or dinners in that same time period.

Note that while Khare and Inman (2006) looked at nutrient carryover between meals, this measure may or may not be correlated with variety-seeking. Two Italian dishes (e.g., Chicken Parmesan and Eggplant Parmesan) may seem quite similar, but have very different nutritional profiles. Likewise, two food items may have similar nutrients, but come from quite different cuisines and seem quite varied. Rather than focusing on nutritional profile, we focus on the perceived variety among food items.

## Method

*Participants and Design.* Participants ( $N = 135$  from Amazon Mechanical Turk,  $M_{\text{age}} = 36.4$  years,  $SD_{\text{age}} = 10.84$ , 36.3% female) completed a 10-day study and were compensated for their time.

*Materials and Procedure.* The study started on a Friday, ran through the weekend and the next week, and finished the following Sunday. Our main analyses focus on weekdays (as meals on the weekends are less consistent) but we collected data on weekends to test alternative explanations. Participants provided their email address, time zone (to ensure they received emails at the correct times), and answered demographic questions.

Each day we recorded what participants ate for breakfast, lunch, and dinner. Participants received automated emails after each meal (10am, 2pm, and 8pm) asking them to complete a short survey. They were asked to detail what they ate: “Please describe what you ate and drank in as much detail as you remember. If relevant, please include the type of cuisine (e.g., Italian, American, etc.), the brand of the food (e.g., Cheerios), the restaurant name, the flavor (e.g., Cherry Coke), and all components of the meal (e.g., chicken parmesan, spaghetti with marinara sauce, and steamed broccoli).” Participants also answered a number of questions to test potential alternative explanations (i.e., who they ate with, where they ate the meal, and who prepared the meal).

*Coding the Meal Description Data.* Two independent research assistants, blind to the hypothesis, coded responses to determine the amount of variety consumed across each meal type. Following prior work (i.e., Meiselman and Leshner 2000), we focus on *across-meal* variety and compare each meal type (i.e., lunches) from day to day instead of *within-meal* variety. As noted

previously, given behavior can be quite different on weekdays and weekends, we examined each separately. The coders looked at all occasions of a given type (e.g., weekday dinners) and coded the variety among those meals. Taking weekday dinners as an example, they looked at all dinners eaten by a given participant during the six weekdays, and coded how varied they were (1 = very little variety/all meals are the same within the grouping and 5 = very much variety/all meals are different within the grouping;  $\alpha = .87$ ). Eating the same thing every day (e.g., steak and potatoes) or similar things each day (e.g., some type of pasta with some type of vegetable) would result in a lower variety score for that meal type. Eating completely different things each day (e.g., Chinese food one day, Mexican the next, and Italian the third) would result in a higher variety score for that meal type (see Web Appendix Table A2 for examples).<sup>2</sup>

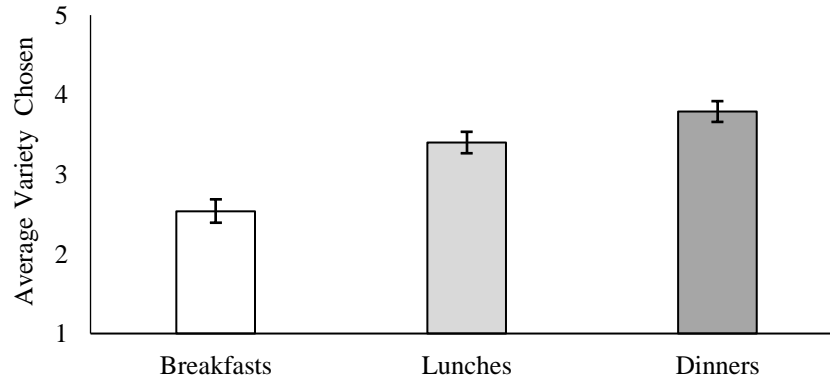
## Results

As predicted, a one-way within-subjects ANOVA indicates that variety-seeking varies over the course of the day ( $F(2, 243) = 80.52, p < .001$ ; Figure 3). Planned follow up tests using the Tukey-Kramer adjustment reveal that, looking across the five days of the week, people ate less variety across breakfasts ( $M = 2.54$ ) than lunches ( $M = 3.40, p < .001$ ) or dinners ( $M = 3.79, p < .001$ ).

### **FIGURE 3: VARIETY-SEEKING IS LOWER FOR MORNING MEALS**

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<sup>2</sup> It is impossible to score variety if there is only one instance of a given grouping. Consequently, if participants reported only one instance of a given meal type (e.g., a single weekday breakfast) that grouping for that participant was not scored and thus not included in the analyses. Similarly, it is difficult to assess variety with only two instances of a given grouping, as even small differences could seem large. To avoid biasing the coding, we only scored and analyzed groupings that had at least three examples for that particular participant.



Note: Error bars are 95% confidence intervals.

*Alternative Explanations.* We conducted a number of ancillary analyses to test the robustness of the effect and rule out potential alternative explanations.

First, rather than time influencing variety-seeking, one could argue that people eat less variety for breakfast than other meals during the week due to time constraints or routine (Khare and Inman 2006). If so, the effect should disappear on the weekends where people have more time to make breakfast. But it does not. Repeating the same within-subjects ANOVA analysis with weekend meals shows that the effect still holds ( $F(2, 186) = 39.61, p < .001$ ). Planned follow up tests using the Tukey-Kramer adjustment reveal that, despite the reduced time constraint over the weekend, people still choose less variety for breakfast ( $M = 3.14$ ) than they do for lunch ( $M = 4.02, p < .001$ ) or dinner ( $M = 4.14, p < .001$ ), which did not differ ( $p = .6$ ). This casts doubt on the possibility that time constraints in the morning during the week is driving the effect.

Second, given people choose more variety in public (Ratner and Kahn 2002), one could argue that people eat more variety for lunch and dinner because they more frequently eat those meals with others. Alternatively, one could argue people eat less variety for breakfast because of

who prepares the meal. It takes effort to cook different things each day, so if people eat out more for lunch and dinner, that could make it easier for them to eat more variety at those times.

To test these possibilities, we measured the proportions of each meal grouping that were eaten alone, eaten at home, and prepared by the self. To create the measure of the proportion of meals eaten alone, for example, we coded whether each meal in each grouping was eaten alone or with others. Someone who ate lunch at home 2 out of the 6 weekdays, for example, would receive a score of .33. We then calculated this proportion for each grouping (e.g., weekday breakfasts) and followed the same process to create the proportion of meals eaten at home and prepared by the self.

None of these measures, however, can explain the effect. Three within-subjects ANOVAs of meal variety by meal type with each of the alternative explanations (e.g., proportion of meals eaten alone, eaten at home, and prepared by the self) included separately as controls and planned follow-up comparisons with the Tukey-Kramer adjustment reveal that the effect of meal type remains the same controlling for the proportion of each meal eaten with others (vs. alone;  $F(137, 242) = 3.49, p < .001$ ;  $M_{\text{breakfast}} = 2.54$  vs.  $M_{\text{lunch}} = 3.40, p < .001$  and  $M_{\text{breakfast}}$  vs.  $M_{\text{dinner}} = 3.77, p < .001$ ), eaten out (vs. at home;  $F(137, 242) = 3.51, p < .001$ ;  $M_{\text{breakfast}} = 2.55$  vs.  $M_{\text{lunch}} = 3.36, p < .001$  and  $M_{\text{breakfast}}$  vs.  $M_{\text{dinner}} = 3.80, p < .001$ ), and cooked for oneself ( $F(137, 242) = 3.57, p < .001$ ;  $M_{\text{breakfast}} = 2.55$  vs.  $M_{\text{lunch}} = 3.39, p < .001$  and  $M_{\text{breakfast}}$  vs.  $M_{\text{dinner}} = 3.78, p < .001$ ). In all three ANOVAs, the main effect of meal was significant (all  $p$ 's  $< .001$ ) and the controls were not (all  $p$ 's  $> .05$ ). The results are also robust to including all three proportions as controls in the ANOVA at once.

Finally, while variety-seeking was higher for weekday dinners than lunches ( $p < .001$ ), this difference disappears on the weekend ( $p = .6$ ) and does not persist across the other studies



(i.e., variety-seeking is not higher in the evening than mid-day). Thus one should not overinterpret the difference in part of this study.

## Discussion

Study 2 provides additional support for our theorizing. Consistent with the notion that variety-seeking varies over the course of the day, there was less variation in what people ate for breakfast than for lunch and dinner. Further, ancillary analyses cast doubt on a host of alternative explanations, such as eating out, public consumption, and time constraints.

While Study 2's findings are consistent with our theorizing, one could argue that the results were somehow driven by cultural norms. Maybe people eat similar things for breakfast not due to lower variety-seeking in the morning, but because there is some norm in American culture about eating the same thing for breakfast. This cannot explain why supermarket shoppers would buy less variety in the morning (Study 1, as they are not necessarily shopping for breakfast foods), but to further test this alternative and to explore the generalizability of the effect, the next two studies examine non-food contexts.

## **STUDY 3: ACTIVITIES**

In Study 3, participants were given a list of activities and asked to choose six that they would like to do over the coming week. We varied the time of day participants completed the survey and predicted that participants who completed the study in the morning would seek less variety (i.e., choose fewer unique activities).

## Method

*Participants and Design.* Participants (recruited through Amazon Mechanical Turk, age and gender were not collected to make the study as short as possible) completed a short survey for monetary compensation. We opened slots for up to 80 people to complete the survey each hour from 5am to 11pm. Sixty-one participants failed to follow directions (i.e., selected an incorrect number of options) and twenty-three reported being awake from the night before, meaning their circadian rhythm might not be synched with time of day. These individuals were removed prior to analyzing the data leaving seven-hundred and forty-nine participants (N = 749).

To examine whether variety-seeking varies over the course of the day, people completed the study at different times. We measured time of day as total minutes since 5am (i.e., the starting point of the study).

*Materials and Procedure.* We used a variety measure adapted from prior work (Etkin 2016; Simonson 1990). Participants were shown a list of six activities (watch a movie, take a walk, cook dinner, exercise, go out to dinner, and go shopping) and asked to pick a total of six they would like to do over the coming week. They could pick six different activities, or the same activities multiple times, so long as they selected six activities total. As in prior work (Etkin 2016; Simonson 1990), variety preference was measured as the number of unique activities selected.<sup>3</sup> Finally, participants indicated their time zone so their data could be matched with their current time of day.

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<sup>3</sup> Note that number of unique items selected is a more appropriate DV here than in Study 1 because here the number of items selected by each participant is the same. In Study 1, that number varied, and thus the number of unique items chosen could be driven simply by a larger basket size.

## Results

As predicted, variety-seeking was positively correlated with logged time of day ( $\beta = .12$ ,  $p = .004$ ,  $R^2 = .0094$ ); people chose less variety in the morning than they did later in the day. Compared to people choosing in the evening (i.e., 5pm-8pm;  $M = 3.68$ ) or mid-day (i.e., 11am-2pm;  $M = 3.66$ ), for example, people who choose in the morning (i.e., 5am-8am) picked less variety ( $M = 3.39$ ). Variety-seeking was also positively correlated with linear time of day ( $r = .06$ ,  $p = .075$ ), but consistent with the patterns observed in Study 1 and 2 and the logarithmic change in physiological stimulation throughout the day, a non-linear relationship fit better.

*Alternative Explanations.* Rather than time of day impacting variety-seeking, one could wonder whether the results are driven by people in the morning simply exerting less effort when completing the variety task. If people are tired in the morning, for example, maybe they are more likely to just pick one type of activity (as that required less effort than thinking through the task) and this makes it look like people are picking less variety in the morning.

But this was not the case. We conducted a chi-square difference test of the percentage of participants who chose only one type of activity across the early morning (5am-8am), late morning (8am-11am), mid-day (11am-2pm), late afternoon (2pm-5pm), evening (5pm-8pm), and night (8pm-11pm). The percentage of people choosing just one type of activity did not differ by time of day ( $\chi^2(4, N = 749) = 3.87$ ,  $p > .250$ ), indicating that simply exerting less effort in the morning does not explain the effect.

Alternatively, one could argue the results are driven by people being more tired or depleted (e.g., Baumeister and Heatherton 1996) later in the day. Note, however, that it is not clear why this would lead to more, rather than less variety-seeking. If anything being depleted

should lead people to reduce effort and select multiple of the same option rather than different options. That said, in the particular choice task used in study 3, one could argue that depletion leads participants to minimize effort by spreading out and picking all six activity options. But this was not the case. We conducted a similar chi-square test of the percentage of participants who chose all six activities across the day. The percentage of people choosing all six activity options did not differ by time of day ( $\chi^2(4, N = 749) = 2.53, p > .250$ ), indicating that the effect is not driven by people simply making cognitively easier selections later in the day, and casting doubt on a depletion based alternative explanation.

These two analyses also cast doubt on an alternative explanation based on defaults. A great deal of research (e.g., Johnson and Goldstein 2003) indicates that people tend to pick default options to simplify decision making or reduce effort. In our context, one could argue that people may be tired or focused on getting to work or school in the morning, and so stick with default options to save energy and time. In this study, the two effort-reducing “default” type choices would be to pick one of every activity, or all of one activity. As noted above, however, these choice patterns did not differ by time of day. Thus a default-based explanation also has trouble explaining the pattern of results.

A satiation-based alternative explanation also has trouble explaining the results. Individuals satiate to repeatedly consuming the same thing (McAlister 1982; Read and Loewenstein 1995), so if people made the same choice again and again in the morning, this might lead them to feel satiated or bored, which could lead them to seek change later in the day. But that is not what is occurring here. People aren’t making repeated choices from the same set throughout the day, they are making choices from the *same* set either earlier or later. Further, our data show that people choose *less* variety in the morning, not none. They don’t pick the same

thing every day for breakfast, just less varied things. They don't pick the same activity all six times when choosing in the morning, they just selected slightly less-varied activities. Thus, rather than picking the same item again and again, people are selecting some variety, casting doubt on the notion that satiation can explain the results.

Finally, one could wonder whether rather than changing variety-seeking, time of day simply shifted which of the six activities people preferred, making it seem like variety preferences changed. Maybe people who completed the study in the morning avoided activities that involved effort, for example, and gravitated to low-effort alternatives. But this was not the case. Time of day had no effect on the number of times people chose the lowest effort activity (i.e., watching a movies;  $\chi^2(24, N = 749) = 21.50, p = .61$ ) or picked higher effort activities (i.e., exercising or taking a walk;  $\chi^2(24, N = 749) = 22.07, p = .58$ ). Similarly, comparing high and low effort versions of the same activity (cooking vs. going out for dinner), showed no difference by time of day ( $t(742) = -.49, p = .63$ ). Thus it is unlikely that preferences for the exact activities listed varying by time of day drove the effect.

## Discussion

Study 3 provides further evidence that variety-seeking varies by time of day and demonstrates the generalizability of the effect. Even in a context that has nothing to do with food, people chose less variety in the morning than later in the day. This casts doubt on alternative explanation based on cultural norms, and ancillary analyses cast doubt on alternatives based on certain study options simply being easier to select.

## STUDY 4: MODERATION BY CHRONOTYPE

Our final study further tests the underlying process, or whether circadian rhythms can explain the effect. People vary in sleep/wake and alertness patterns (i.e., chronotype). Morning-types, or larks, go to bed and wake up earlier, and feel more alert and energized in the morning (Natale and Cicogna 1996; Wilson 1990). If less variety-seeking in the morning is driven by stimulation, as we suggest, morning-types (who are already more stimulated in the morning) should seek greater variety in the morning compared to other individuals.

To test this possibility, Study 4 examined whether time of day's effect on variety-seeking varies by chronotype, or individual differences in circadian rhythms.

### Method

*Participants and Design.* Participants (N = 805, Amazon Mechanical Turk, age and gender were not collected to make the study as short as possible) completed a short survey for monetary compensation.

Participants were recruited either in the morning (5am-8am), mid-day (11am-2pm) or evening (5am-8pm).<sup>4</sup> Twenty-five participants were up from the night before and thirty-seven

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<sup>4</sup> To ensure a range of chronotypes completed the survey at different times of day, we took additional steps to recruit certain individuals at certain times of day. Not surprisingly, consistent with their chronotype, it is harder to find evening types interested in completing a survey early in the morning and morning-types interested in completing a survey in the evening. Consequently, simply allowing the survey to fill naturally would lead to morning-types being under-represented in the evening and evening-types being under-represented in the morning. To avoid this, in addition to the main data collection, we used the Composite Scale of Morningness to pre-screen for morning and evening types the day before and then randomly assigned participants an hour within their non-optimal timeslot to complete the variety-seeking measure (e.g., an evening-type would be randomly assigned to complete the choice task at either 5am, 6am, or 7am the next day).

reported a time zone that didn't match the recorded data, so their circadian rhythms would not be in synch with the recorded time of day. They were removed prior to analyzing the data.

*Materials and Procedure.* First, participants completed a scale that tapped individual differences in circadian preferences (i.e., chronotype). They filled out the 13-item Composite Scale of Morningness (“CSM,” Smith, Reilly, and Midkiff 1989), which includes measures like, “Assuming normal circumstances, how easy do you find getting up in the morning” and “Please indicate to what extent you are a morning or evening *active* individual” ( $\alpha = .93$ ). As in prior work (Smith et al. 1989), anyone scoring more than a 43 is treated as a morning-type, anyone scoring less than a 23 is treated as an evening-type, and anyone scoring in between as an intermediate-type. We plot our results using the mid-points of each of these groupings (treating CSM score as continuous).

Second, we measured variety-seeking. Participants completed the same activity choice task as in Study 3, where the number of unique options chosen served as the measure of variety.

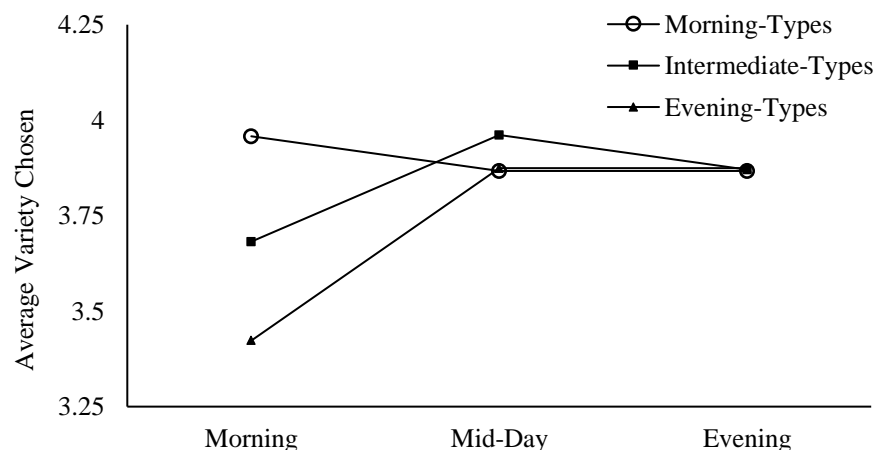
## Results

A series of regressions of variety chosen on Composite Scale of Morningness (continuous), time of day (dummy coded), and their interactions shows the predicted pattern of results.

Consistent with the hypothesized underlying role of stimulation, individual differences in chronotype moderated the time of day effect (Figure 4). While both evening-types (morning vs. mid-day:  $\beta = -.68$ ,  $t(799) = -3.17$ ,  $p = .002$ ; morning vs. evening:  $\beta = -.46$ ,  $t(799) = 2.26$ ,  $p =$

.024) and intermediate-types (morning vs. mid-day:  $\beta = -.28$ ,  $t(799) = -2.57$ ,  $p = .01$ ; morning vs. evening:  $\beta = -.19$ ,  $t(799) = -1.86$ ,  $p = .063$ ) preferred less variety in the morning than other times of day, this pattern was reduced among morning-types (morning vs. mid-day:  $\beta = .14$ ,  $t < 1$ ; morning vs. evening:  $\beta = .09$ ,  $t < 1$ ). Morning-types did not prefer any less variety in the morning than at other times of day ( $\beta = -.07$ ,  $t < 1$ ).

**FIGURE 4: TIME OF DAY'S EFFECT ON VARIETY-SEEKING IS MODERATED BY CHRONOTYPE**



Looked at another way, while there was no difference in variety-seeking due to chronotype in the middle of the day ( $\beta = -.008$ ,  $t(799) = -1.17$ ,  $p = .243$ ) or evening ( $\beta = -.0003$ ,  $t < 1$ ), in the morning, variety-seeking was correlated with morningness ( $\beta = .016$ ,  $t(799) = 2.22$ ,  $p = .027$ ). Consistent with this, the interactions between the time of day dummies and morningness reveal that morningness only moderates the effect in the morning relative to the rest of the day (and not between mid-day and afternoon).

## Discussion



Study 4 underscores time of day's effect on variety-seeking, and provides further evidence for the underlying role of circadian rhythms. People chose less variety in the morning but this was moderated by individual differences in circadian rhythms (i.e., chronotype). While evening and intermediate types preferred less variety in the morning, this effect was reduced among morning-types who are more alert and energized in the morning to begin with.

It is worth noting that while we over recruited morning-types in this study to test the underlying process, such individuals only make up a small portion of the overall population (by some estimate 20%; Posey and Ford 1981). Thus while we do not see an effect of time of day on variety-seeking among morning-types, we do see it among the majority of the population. As shown in studies 1-3, the effect persists when aggregating across all chronotypes in the general population.

## **GENERAL DISCUSSION**

Variety-seeking is an important driver of consumer choice. But while it is clear that individual differences and situational factors shape variety-seeking, less is known about whether the mere time of day someone happens to choose might affect the amount of variety they select.

Four studies, combining an empirical analysis of field data and controlled experiments, demonstrate consistent diurnal variation in variety-seeking. Variety-seeking is lower in the morning than the rest of the day. This occurred whether variation was examined over time, such as eating similar breakfasts multiple days in a row (Study 2), or at one point in time, such as choosing a portfolio of options to consume at a later date (Studies, 1, 3, and 4).

Further, consistent with the potential underlying role of circadian rhythms, the effects were moderated by light and individual differences in circadian preferences. In times when people should feel more physiologically stimulated (i.e., when they've been exposed to more sunlight, Study 1), they prefer more variety, and people who should feel more physiologically stimulated in the morning (i.e., morning-types, Study 4), prefer more variety then as well.

The studies also cast doubt on a number of alternative explanations including depletion, satiation, defaults, and choosing in public. Further, while one could wonder whether the results were driven by different kinds of people completing the studies at different times of day, Study 1 and 2 rule this out, demonstrating that even looking within the same person (or household), choosing at different times of day shaped the variety chosen.

Finally, the fact that we find a consistent effect across different methods highlights its generalizability. Whether examining millions of supermarket purchases (Study 1), meal choices over time (Study 2), or activity choices for future consumption (Studies 3 and 4), we find similar results. Combining controlled experiments with field data enables us to rigorously test causality while also demonstrating external validity.

## Contributions and Future Research

These findings make several contributions. First, the results shed light on drivers of variety-seeking. While prior work has identified several motivators for variety-seeking (e.g., hedging against changing future preferences: Simonson 1990; and social influences: Ariely and Levav 2000; Etkin 2016; Ratner and Kahn 2002), aggregating across people and contexts, the findings demonstrate the important role of time of day. Further, while work on optimal

stimulation or culture suggests different people may prefer more or less variety, our findings suggest that even within a person, variety-seeking varies over the course of the day.

Second, the results further understanding of the biological basis of behavior. Marketing researchers are just beginning to examine how testosterone (Kristofferson et al. 2017), serotonin (Lichters et al. 2016) and other physiological factors may shape consumer behavior. Time of day is a valuable way to examine the effects of these, and other physiological processes. Though it does not allow researchers to isolate the effects of any one process in particular, the ease of measuring, and even manipulating time of day makes it a useful approach.

Along those lines, future work might examine other effects of time of day. Circadian rhythms have a host of downstream effects that might be of interest to consumer researchers. Focusing just on stimulation, for example, time of day might impact novelty seeking, risky choice, willingness to select defaults, or status quo biases. Consumers might be less willing to try new products in the morning, for example, and voters might be more prone to vote for incumbents if they vote in the morning rather than later in the day.

It would also be worthwhile to examine whether circadian changes in stimulation affect variety choices made for others. Do daily fluctuations of our physiologies only affect choices made for our own consumption? Or do we allow our internal states to influence judgments and consumption decisions made for others? Further research could use circadian rhythms to examine how our own internal states influence choices made even beyond ourselves.

Managerial Implications

These findings also have a number of important managerial implications. First, the effectiveness of variety appeals should vary over the course of the day. Ads that appeal to variety, for example, should be more effective in the afternoon or evening than in the morning. Consequently, products that are naturally high (or low) in variety may want to focus their advertising at certain times of day rather than others. Yogurts or lip balms, which naturally evoke variety, for example, may be better served by advertising outside of the morning. Similarly, what features to highlight in marketing communications may also differ. When advertising in the afternoon, a cruise company might want to focus on the variety of activities consumers can do, but when advertising in the morning, they might want to pick a different aspect to highlight.

These findings also suggest tailoring product offerings by time of day. Restaurants, for example, might want to downplay variety on their breakfast menus but highlight variety in their lunch and dinner menus. Radio stations might want to play less varied music in the morning and more varied music in the evenings.

Finally, the results have implications for new product introductions. If time of day also affects novelty seeking, companies may want to be particularly careful about introducing novel, or new seeming, offerings in the morning. Taco Bell often introduces novel food items, for example, but when thinking about what to offer at breakfast, they may not want to introduce things that are too different from what consumers are used to seeing at other quick service establishments.

In conclusion, this research demonstrates that time of day impacts variety-seeking. While variety may be the proverbial spice of life, how much spice consumers' desire may depend on when that choice is made.

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**WEB APPENDIX**

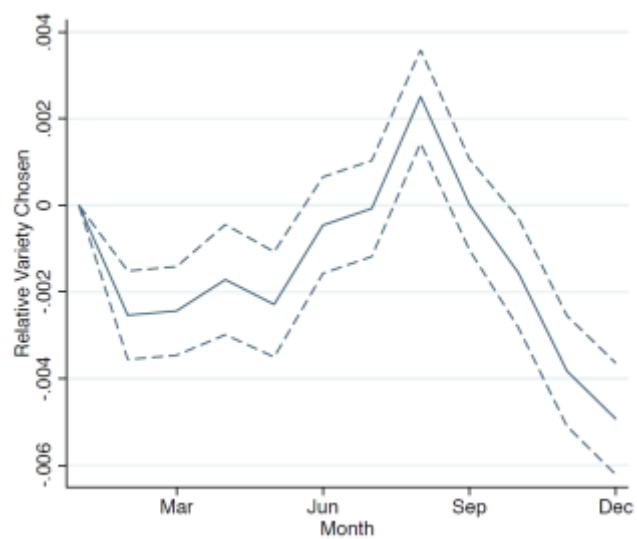
**TABLE A1: CATEGORIES WHERE MULTIPLE ITEMS ARE PURCHASED IN ONE SHOPPING OCCASION**

<u>At least 2 (Category):</u>	<u>Percent</u>	<u>At least 4 (Category):</u>	<u>Percent</u>
Refrigerated Yogurts	6.05%	Refrigerated Yogurts	17.28%
Soft Drinks: Cola	2.51%	Frozen Dinner Entrees	6.44%
Frozen Dinner Entrees	2.51%	Cat Food Wet	4.26%
Cold Cereal	2.28%	New Age Beverages	3.68%
Milk/Milk Substitutes	2.16%	Table Wine	3.28%
Table Wine	1.93%	Soft Drinks: Cola	3.11%
New Age Beverages	1.83%	Baby Food	2.57%
Packaged Ice Cream	1.74%	Ready to Serve Soup	2.22%
Refrigerated Salad Dressings	1.68%	Cold Cereal	2.00%
Salads - Convenience	1.60%	Citrus	1.39%

**TABLE A2: EXAMPLES OF MEAL VARIETY SCORES**

<b>Score</b>	<b>1 (Low Variety)</b>	<b>3</b>	<b>5 (High Variety)</b>
Meal1	Cold cereal with almond milk. Cereal brand was Fruit & Yogurt. Glass of water with lemon juice. 2 cups of black coffee.	Kale salad with cucumbers, tomatoes, bell peppers, garbanzo beans and a homemade vegan ranch dressing made of blended cashews and herbs.	Water, small boneless pork chop, broccoli, mixed vegetables, brownie
Meal2	Glass of water with lemon juice / bowl of cold cereal (fruit & yogurt) with almond milk / 2 cups of black coffee	Baked falafel made of garbanzo beans, almond meal, mushrooms, onions, lemon juice and parsley. Glass of water.	Sweet tea, a piece of white corn on the cob, a bowl of pinto beans and white rice.
Meal3	Glass of water with lemon juice / cold cereal with almond mile (fruit & yogurt cereal) / 1 cup of black coffee	Baked falafel made with garbanzo beans, ground flax seeds, almond meal, mushrooms and onions. Water.	Water, a bowl of oatmeal with a medium sliced banana in it.
Meal4	Glass of water with lemon juice / cold cereal (fruit & yogurt) with almond milk / 1 cup of black coffee	Gluten free Barilla penne pasta and homemade marinara sauce. Water.	Steak, sweet potato, water
Meal5	Glass of water with lemon juice / cold cereal (fruit & yogurt) with almond milk / 1 cup of black coffee	Steamed quinoa with sautéed Kirkland brand frozen stir fry vegetables. Water.	Glass of cherry juice, white potatoes with parsley and bacon bits.
Meal6	Glass of water with lemon juice / cold cereal (fruit & yogurt) with almond milk / 1 cup of black coffee	Spinach salad with garbanzo beans, pecans, and a homemade balsamic vinaigrette. Water.	Lapsang suchong tea and wheat ziti in Prego sauce.

**FIGURE A1: VARIETY PURCHASED BY MONTH (RELATIVE TO JANUARY)**



Note: Month dummy variable estimates are plotted and dotted lines show 95th percent confidence intervals using household X category-clustered standard errors. Earliest sunrise is in June.