WEATHER TO GO TO COLLEGE: INCIDENTAL FACTORS IN THE FIELD

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Abundant research has documented that incidental factors (cognitive and emotional) can influence both judgment and choice. This paper tested such influences in the field, by assessing the impact of weather during the visit of prospective undergraduate students, on their decision to enroll in the visited school. As expected, cloudiness during their visit had a significant effect in enrollment decisions. Statistical analyses rule out endogenous timing of the visits through the year and self-selection as possible confounds. The direction of the effect, however, was surprising; visitors on cloudier days proved *more* likely to enroll. Two main explanations for this relationship are proposed: overcompensation of mood influences and feature priming.

Deciding what college to attend is an incredibly important and difficult decision since a person's social, intellectual and cultural life are forever shaped by his or her *alma matter*. Given its importance, prospective students consult many sources of information before making their decision, including college guides, friends, school counselors and official rankings. In addition, many students choose to visit schools to gain a more subjective and direct source of information.

One drawback of these school visits is that students need to predict based on a very small sample (a stay of usually less than 24 hours) the utility of living and studying in the visited location for several years. In order to properly use the information collected during their visit, students would need to be able to filter out distractive factors that may have affected the utility derived from their visit but which will have no such influence on the utility they will derive from their college experience. These factors might include, for example, feeling tired because of the trip, the attractiveness of the campus tour guide, or the weather they experienced.

In line with abundant research studying the impact of incidental factors on individuals' decisions, I hypothesized that college visitors would not succeed at optimally excluding such irrelevant 'information' collected during their visit.

Using a unique dataset of prospective undergraduate students' visits, I tested this hypothesis by evaluating the impact of weather during their visit on their subsequent decision to enroll.

Based on previous work showing that sunshine increases good mood and that people misattribute the source of their mood to the target they are evaluating (Schwarz & Clore, 1983), I expected sunny weather to increase the likelihood that students would enroll in the visited school. Surprisingly, prospective students were significantly more likely to enroll after visiting on *cloudier* days. This effect was obtained using data from two consecutive years and is robust to several specifications which rule out possible confounds such as seasonality and self-selection.

Two possible explanations for this result arise from previous work on incidental factors: overcompensation for incidental emotions (i.e. students visiting on cloudy days attribute *too much* of the utility of their visit to the weather, erroneously concluding the

visited school was more appealing than it really was) and *feature primi*ng, where cloudy weather increases the weight given to academic attributes, enhancing the appeal of the visited school.

Background

This section summarizes three lines of research relevant to this paper. The first deals with the impact of cloudcover on behavior, the second with incidental emotions and the third with feature priming.

The impact of cloudcover on behavior

Researchers have documented the impact of cloudcover in an incredibly broad range of human behavior; it has been shown to affect tipping (Rind, 1996; Rind & Strohmetz, 2001), ups and downs of the stock-market (Hirshleifer & Shumway, 2003), ease of recovery of patients in hospitals (Beauchemin & Hays, 1996), and the critical decision of committing suicide (Yan, 2000), among others.   Although *the weather* consists of several distinct and somewhat independent variables such as temperature, wind speed, humidity and precipitation, only cloudcover has consistently been found to affect behavior in domains unrelated to the weather. This relationship has been traditionally attributed to the fact that the amount of natural light people are exposed to affects their mood; sunny weather leads to good moods (bigger tips), and cloudy weather to sad ones (more suicides). Few studies, however, have conducted the type of mediation analysis that would merit such conclusion. As we shall see, the results from this paper suggest such mediation analysis is warranted, as weather may impact behavior through purely cognitive mechanisms.

Incidental Emotions

Mood-congruent effects

Incidental emotions have been shown to impact concurrent judgment and decisions through three major independent mechanisms, for a recent review see (Loewenstein & Lerner, 2002). The first of these mechanisms is purely cognitive; as emotions are experienced they spread activation to mental nodes that are associated with

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them (Bower, Monteiro, & Gilligan, 1978; Clark & Isen, 1982). In this sense, moods are no different from all other elements in the associative mental network; *being* happy and *thinking* of happy lead to similar consequences.

The second mechanism by which incidental emotions have an impact on judgment and choice is through the "affect-as-information" heuristic (Schwarz & Clore, 1983, 1996). According to the affect-as-information hypothesis, people rely on their feelings to make heuristic judgments. How they feel at the moment of evaluating a target is used as a proxy for their liking of the target. Although affect-as-information is often an effective heuristic, it is prone –like all heuristics–to systematic biases. Probably the most well known example is Schwarz and Clore (1983)'s seminal study where phone interviewees reported higher levels of overall happiness when phoned on a sunny day. The authors suggested that respondents misattributed the source of their current mood, sunshine, to the target they were evaluating, overall life satisfaction.

The third mechanism through which incidental emotions can have an impact on behavior is by triggering specific appraisal processes (Lerner & Keltner, 2000). For example anger makes negative events appear more predictable while fear makes them appear less predictable.

All three of these mechanisms share the notion that emotions lead to mood-congruent effects: people who are happy have easier access to happy memories, evaluate targets more positively and engage in appraisal processes that are consistent with being happy. In what follows I review studies that look at conditions under which mood-incongruent effects may be observed.

Mood-incongruent effects

Much work has been done on studying moderators for the impact of mood on judgment and choice. Often times these moderators have been shown to be strong enough to reverse the initial impact of mood. Particularly relevant to this paper are studies that investigate when bias awareness is sufficient to debias judgment.

In Schwarz and Clore (1983) study, respondents' self reported happiness was no longer affected by sunshine if before indicating their subjective-well-being they were

made aware of the potential influence of weather on their judgment. The authors interpreted this as evidence of the ability of subjects to aptly filter out the bias induced by mood, once they were made aware of it.

Although awareness is a necessary condition for consciously debiasing judgment, it is not sufficient. Wilson and Brekke (1994), in their review of *mental contamination,* discuss several necessary conditions for judgments to be debiased. They agree with the importance of awareness, but highlight that, among other important conditions, knowledge of the magnitude of the bias is equally important.

Wilson and Brekke (1994) review several studies that attempt to debias judgments by making subjects aware of the existence of the bias, finding mixed results. Interestingly, most studies that succeed at debiasing via awareness ask subjects to generate judgments over targets for which they may have a pre-existing *uncontaminated* assessment.

Most of the failed attempts at reducing biases through awareness, on the other hand, correspond to situations where such uncontaminated estimates are simply not available to respondents, because judgments were elicited over novel targets (e.g. Babcock & Loewenstein, 1997; Fischhoff, 1977; Wetzel, Wilson, & Kort, 1981).

Some studies have not only failed at debiasing subjects through awareness, but have actually reported contrast effects, i.e. mood incongruent bias. Not knowing the true magnitude of the bias, subjects apply too much correction generating a bias in the opposite direction (Lombardi, Higgins, & Bargh, 1987). This is more likely to occur when subjects are allowed enough time to correct (Martin, 1986), are allowed to work undistracted or are motivated to perform (Martin, Seta, & Crelia, 1990), rate higher on need-for-cognition (DeSteno, Petty, Wegener, & Rucker, 2000) or are intrinsically or extrinsically motivated to be accurate (Isbell & Wyer, 1999; Ottati & Isbell, 1996).

Students visiting a university are both highly motivated to be accurate, and uncertain about their judgment in the absence of the weather conditions they experienced. Overcompensation for the impact of weather, therefore, is a possible mechanism for the positive association between cloudiness and enrollment.

Feature priming

Priming is commonly used to describe a variety of phenomena that share the same underlying mechanism. After being exposed to a certain cue (the prime), memories that are associated with such a prime become more available, affecting performance in a target task. Within the abundant literature on priming effects, what has been called feature priming is particularly relevant to this paper. In feature priming studies, subjects are presented with a cue that primes a specific attribute, and this attribute is then weighted more heavily in a multi-attribute decision (Yi, 1990).

Mandel and Johnson (2002), for example, showed that subjects shopping for cars on-line placed more weight on safety when the webpage's background consisted of red and orange flames, and on price when it was covered with green dollars. This replicates Yi (1990) studies where subjects placed higher weights on attributes that had been primed via a printed advertisement.

If cloudiness was associated with attributes relevant for college choice, then it is possible that cloudcover may impact enrollment decisions by exerting a feature priming effect. Simonsohn (2004) provides evidence consistent with the existence of a mental link between cloudiness and academics. Subjects primed with cloudy forecasts were more likely to complete word fragments (e.g. "_ook") with words that had an academic association (*book*) than subjects primed with sunny forecasts. More strikingly, analyzing real university admissions decisions, Simonsohn (2004) reports that admission officials weighted applicants' academic attributes (e.g. GPA and SAT scores) more heavily on cloudy days, and social attributes (e.g. leadership and extracurricular contribution) more heavily on sunny days, consistent with the notion that cloudiness primes academic attributes.

This suggests a second possible mechanism for a positive association between cloudiness and enrollment: students visiting on a cloudy day are primed with academics and hence evaluate the visited school more positively.

Method

In this paper I use a unique dataset of prospective undergraduate students' visits to analyze the impact of weather during their visit on their subsequent decision to enroll. As the results below show, I find that weather does indeed have a reliable impact on college choice. In line with previous work, I find that cloudcover is the only weather variable with a reliable impact on behavior.

The analysis of the data rules out possible confounds such as timing of the interviews on cloudier vs. sunnier periods of the year and self-selection as a response to weather conditions on the day of the interview.

Visitors Data

The college visits data used in this study was provided by the admissions office of a private university in the northeastern United States. It consists of their record of interviews with undergraduate applicants visiting during the admission process for the academic years of 2000-2001 and 2001-2002. [1] Interviews are voluntary and are conducted primarily to help students learn more about the school they are applying to. These interviews are not part of the admission process per-se.

The data includes the date of the interview, whether the applicant was admitted to the university, and (conditional on being accepted) whether s/he chose to enroll or not. In total there are 1,283 observations, which correspond roughly to 5% of all applicants to the university for the two years combined (i.e. 5% of all applicants during those two years had interviews with admissions counselors on campus).

As shown in Figure 1, 44% of the visitors were accepted, and from those accepted, around 46% chose to enroll. Given the self-selection involved, it is not surprising that both of these figures are higher than the overall averages for all applicants, of approximately 38% and 25% respectively. Over 93% of all visits occured between the months of August and December while the remaining seven percent are distributed along the rest of the year. The analysis concentrates on that 93% in order to diminish the

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[1] I originally collected data for one academic year only. Given the surprising nature of the results I collected data for the following year as well.

possibility that weather is spuriously correlated with enrollment through a confound with calendar date of the visit. This possible confound will be discussed in further detail later.

Students who were not admitted must be excluded from the analysis because their preferred choice is not observed. The data size is hence reduced to the 562 students who, out of the 1283 applicants, were accepted (see figure 1). As mentioned before, I also exclude visitors from the months between January and July who may be systematically different from those visiting between August and December (because they are at different stages of the application process), reducing the sample further to 508 observations. Inclusion of these visitors from January-July barely affects the results. Finally, at least one weather variable is missing for 20 observations, leaving a total 488 valid observations.

*** figure 1 around here ***

Weather Data

From the National Oceanic and Atmospheric Administration's (NOAA) website,[2] I obtained daily weather data from 1995-2000. The dataset includes information about maximum, minimum and average temperature, precipitation, wind speed and direction, humidity, atmosphere pressure and, most importantly, cloudcover. I used weather data from the years prior to the visits (1995-1998) to construct 4-year-averages for each of the weather variables previously mentioned. These averages will be used to control for seasonal factors.

Figures 2 and 3 plot temperature and cloudcover through the relevant 5 months of the year 2000. Average daily temperature (unsurprisingly) decreases from August to December while the relationship for cloudcover, while also visually evident, is much less pronounced (see figure 3). Indeed, an OLS regression where the only predictor is "days since August 1st" has an R^2 of 82% ($p<.001$) for temperature and of 8% for cloudcover ($p<.001$). If students who visit on different times of the year differ in their a-priori

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[2] http://www4.ncdc.noaa.gov/ol/documentlibrary/datasets.html

likelihood to enroll, weather could have a spurious relationship with enrollment. The analyses presented bellow control for such a potential confound in a variety of ways.

*** figures 2 and 3 around here ***

Results

Testing the impact of weather conditions on the subsequent decision of enrolling in the visited university is straightforward. I estimated a logit regression where the dependent variable takes the value of 1 if the student enrolled and 0 if she did not, and the explanatory variables are all of the weather variables mentioned earlier. The results from this regression show that enrollment has a negative relationship with temperature ($B=-.092$, $p=.028$) and positive one with cloudcover ($B=.087$, $p=.021$); students who visited on cloudier and colder days were more likely to enroll than those coming on sunnier and warmer ones. The appendix contains a table with all the parameter estimates.

Seasonality concerns.

As mentioned earlier, because the weather has systematic seasonal variations, it is possible that a regression that does not control for time of year will show a spurious relationship between weather and enrollment. In particular, the reported relationship between cloudcover and college choice may be spurious if students who are less likely to enroll tend to interview during the time of the year when days are sunnier. [3]

To assess the likelihood of such a confound, I conducted several additional analyses. In particular I (a) added monthly dummies to the regression, (b) added average weather conditions for the calendar date of the visit as controls, and (c) attempted to replicate the results with weather conditions from two days prior to their visit. Below I describe the results for each of these analyses.

(a) Month dummies: I included in the regression dummy variables for each month in the sample (August-December). Doing so did lower the significance of the

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[3] This is not implausible. Students may, for example, sort the order of the schools they visit from least to most preferred. Interviews during the later part of the year, then, would over-sample students with strong preference for the visited school, generating a spurious relationship between cloudcover and enrollment decisions.

temperature coefficient (B= -0.0826, p=.107) but it increased both the coefficient and the significance of cloud cover (B= 0.0986, p=.011). [4]

(b) Average weather conditions: If weather on the day of the visit is spuriously associated with enrollments decisions due to seasonality, we would expect weather conditions for the calendar date of the visit of any *other* year to have similar predictive power (e.g. cloudcover of September 5th 2000 should predict just as well the decision of a student visiting on September 5th 2000 as of one on the same date in 2001, since the source of the relationship is the calendar date, not the weather per-se). With this in mind, I computed 4-year-averages for all weather variables for every calendar date between August 1st and December 31st in the years 1995-1998. According to the seasonality story, this 4-year-average should be an even better predictor of enrollment decisions as it consists of a less noisy proxy for time-of-year. I first attempted to replicate the effect of cloudiness on enrollment using average weather conditions for the calendar date of the visit *instead* of the actual weather conditions on that day. Contrary to the seasonality story, average weather conditions do not outperform those actually experienced during the visit. Indeed, they do not have any predictive power (global Wald test of all coefficients being equal to 0 has p=0.185).

I also run a regression including *both* the weather conditions on the day of the visit, the average weather conditions for that calendar date and the month dummies. If the effect of cloudiness is being driven by seasonality, then once seasonality is properly controlled for, the effect should disappear. The effect of temperature indeed does disappear, B= -.045, p=0.395, but that of cloudcover is further strengthen both in size and significance B=0.111, p=.007 (the appendix contains a table with all the estimated coefficients).

In sum, adding proper controls for seasonal factors to the regression, far from making the effect of cloudiness on college enrollment disappear, it strengthens it.

(c) Weather conditions two days prior: Finally, I attempted to predict enrollment decisions with weather two days *prior* to the visit. If weather was associated with

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[4] Month dummies are variables that take the value of 1 for each month and of 0 for all others. For example the August dummy takes the value of 1 for all visitors coming in August and of 0 for everyone else.

enrollment solely due to a seasonal confound, this regression should achieve similar results to that of the original regression using weather on the actual visit day. In actuality, weather from two days prior had no predictive power (Wald test of all coefficients being zero has a $p=.709$).

Self-selection into interviews.

A spurious relationship between cloudcover and enrollment could also be the result of the following selection bias: students' ex-ante likelihood to enroll in the visited school affects how they respond to weather conditions on the day of their interview, and in particular, students with lower inclination to enroll are less likely to show up for their interview on a bad-weather day. If this type of self-selection occurred, then days of bad weather would over-represent enthusiastic students (because the data includes only students who show up for the interview) generating a spurious relationship between cloudcover and enrollment.

There are several reasons to doubt that such a process could be behind the results. First of all, the process itself seems implausible: although one may imagine that in the presence of extreme weather conditions (e.g. snowstorms or high winds) students may refrain from attending a pre-scheduled interview, it is unlikely that students would cancel appointments because the sky is notoo gray'. If weather correlates with enrollment rates because unenthusiastic students cancel appointments on bad weather days, then temperature, wind and precipitation would be expected to be the strongest predictors of behavior, not cloudcover.

To empirically test this alternative explanation, it would be desirable to obtain data on students who scheduled interviews and do not show up for them, but this data is regrettably unavailable.[5] There are other predictions from this hypothesis, however, that can be tested given the available data. One of them relies on the *admission* decision. If students who choose to attend an interview conditional on it being a cloudy day differ from those that do so on sunny days, then cloudcover might predict whether a student is

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[5] Through personal conversations with the admissions office, however, I was assured that interviews are very rarely cancelled.

admitted to the university (i.e. the first node in figure 1). To test this possibility I run a regression where admission was the dependent variable and weather conditions on the day of the visit were the explanatory one. Neither cloudcover nor any other weather variable on the day of the visit correlate with the chances of being admitted (all *p-values* greater than 0.4). Furthermore, the global Wald test of all coefficients being zero cannot be rejected, $p = 0.47$.

Perhaps more importantly, if cloudiness affects students' decisions to show up for an interview, total number of interviews per day and cloudcover should be correlated, yet they are not, *corr* = 0.04, *p=0.58*. [6] I hence find no evidence of a selection bias.

Discussion

Analyzing data from prospective students' visits to a private northeastern university, I find a significant relationship between cloudcover on the day of their visit and their decision to enroll in the visited school. Multiple analyses suggest this relationship cannot be accounted for by either a seasonal confound nor by a self-selection bias.

Based on previous studies looking at the impact of weather on mood, I had originally expected cloudcover to have the opposite impact on enrollments than the one ultimately found. That is, I expected sunny-day visitors to enjoy happier moods and hence overpredict the utility they would derive from attending the visited school, and sadder cloudy-day visitors, to underpredict their future enjoyment of attending. In light of the surprising nature of the result I collected data for a second year of visits, yet the results remained unchanged.

There are two main mechanisms that may explain a negative association between cloudiness and enrollment: overcompensation and cognitive priming.

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[6] This last result also eliminates the possibility of a selection bias driven by the decision to apply: We only observe students who interviewed and who later applied to the visited school. If those deciding not to apply after a cloudy day differ from those doing so after a sunny day a selection bias would arise. This, however, would predict a negative correlation between the number of observed interviews and cloudiness.

Overcompensation

Previous work has found that both lack of previous experience with the target being evaluated and motivation to be accurate, can reduce and often reverse the impact of incidental emotions on judgment (DeSteno et al., 2000; Isbell & Wyer, 1999; Martin, 1986; Martin et al., 1990; Ottati & Isbell, 1996).

Both of these moderating elements are likely to apply to prospective college students visiting a university for the first time.   Prospective students would probably have hard time trying to imagine how much they would have enjoyed the visited school had incidental factors been different. Indeed, the very fact that they are visiting hints that they recognize their appraisal to be incomplete. Also, students engaging in school visits are probably motivated to conduct an appropriate evaluation of the visited school in light of the fact that it will have a very important impact on their lives.

One possible explanation for the finding from this paper is that because visitors are both highly motivated to make an adequate assessment, and highly uncertain of their valuation of the visited school, they overcompensate for the impact of cloudcover on their judgment. After over-correcting for the weather, they end up perceiving the visited school as less appealing on sunny days, and more appealing on cloudy ones.

Feature priming

 The previously reviewed work on feature priming suggests another possible mechanism behind the positive relationship between cloudiness and enrollment. Feature priming is the notion that people who have been primed with a certain attribute will weight it more heavily, and therefore evaluate options rich in such an attribute more positively. If, in line with the results reported in (Simonsohn, 2004), cloudiness primes academic attributes, then visitors on cloudy days should appraise the visited school more positively.

At first one may think that a feature priming explanation necessitates the assumption that the visited school is the strongest academic alternative in the choice-set of the visitor. This is not the case however. Note that because feature priming increases

the weight given to primed attributes, the impact of the prime on the overall judgment of the target depends only on the relative goodness of the primed versus non-primed attributes (specially in this case, where schools are evaluated under weather conditions that are independent of each other). Targets whose better attributes are primed fare better, and targets whose weaker ones are primed fare worse, independently of the other options in the set.
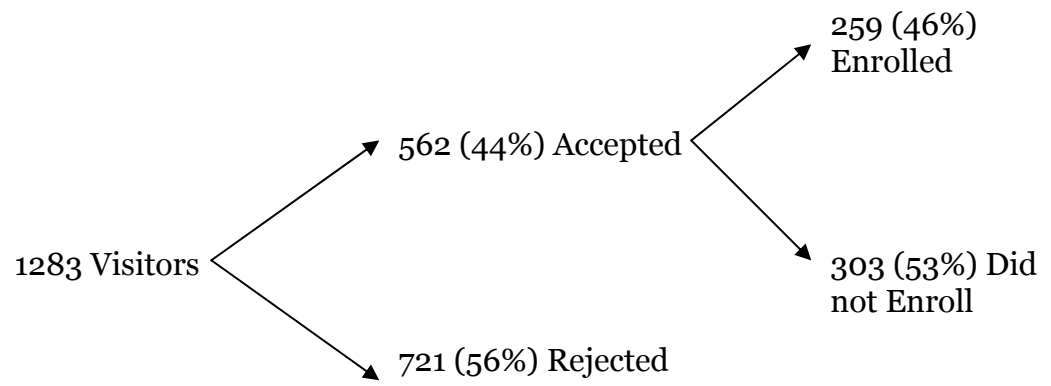
Concluding Remarks

This paper uses evidence from the field to document how a particularly trivial incidental factor, weather, has an impact in the very important decision of college choice. Field studies are typically high in external validity and low in internal validity, and this is no exception. The external validity of the results reported in this paper is hardly questionable since the analysis was conducted on real decisions.
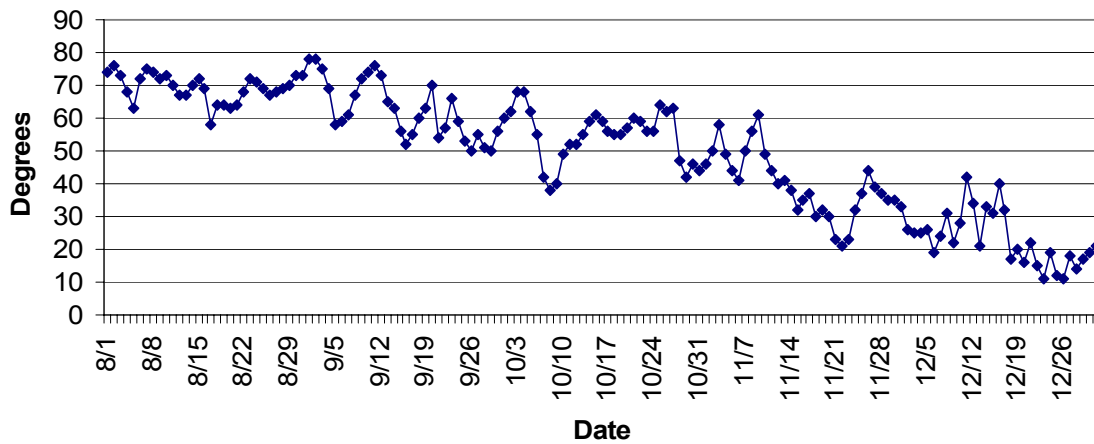
The precise mechanism by which weather is affecting enrollment decisions, however, is unclear. This is highlighted by the fact that the relationship between the two is contrary to what was initially anticipated. Although plausible explanations are suggested: overcompensation for mood and feature priming, the data does not allow us to discriminate between them (or possibly others).

The main goal of this study was to test the impact of incidental factors in real decisions and as such the results are consistent with expectations: incidental factors do matter in important real life decisions. The fact that they matter in non-fully understood ways invites both a re-examination of the interpretation given to previous studies documenting an impact of weather on behavior (up to now always *assumed* to have been mood mediated) and to conduct future studies aimed at better understanding the consequences of incidental factors in naturally occurring conditions.
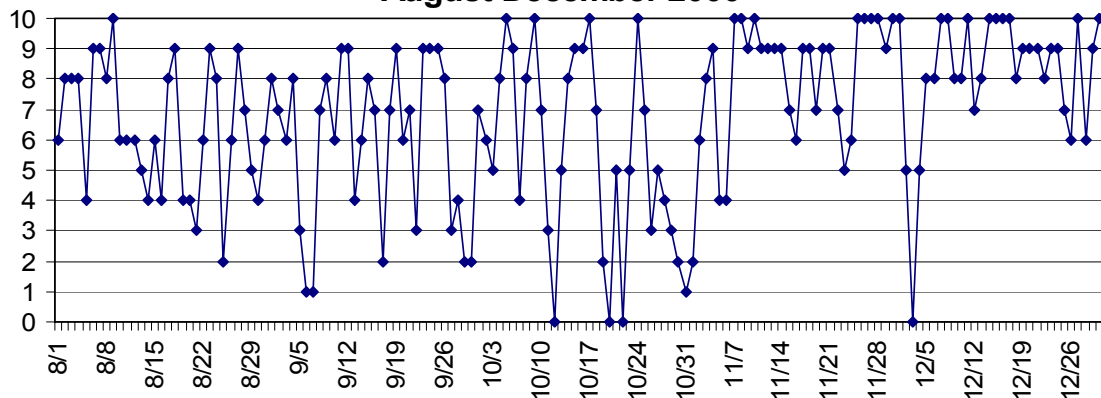
Figure 1. Percentage of Visitors who are Accepted and Enroll

1283 Visitors

562 (44%) Accepted

721 (56%) Rejected

259 (46%) Enrolled

303 (53%) Did not Enroll

Figure 2. Daily Average Temperature.
August-December 2000

Degrees (y-axis: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90)

Date (x-axis: 8/1, 8/8, 8/15, 8/22, 8/29, 9/5, 9/12, 9/19, 9/26, 10/3, 10/10, 10/17, 10/24, 10/31, 11/7, 11/14, 11/21, 11/28, 12/5, 12/12, 12/19, 12/26)

Figure 3. Daily Cloud-Cover.
August-December 2000

(y-axis: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

(x-axis: 8/1, 8/8, 8/15, 8/22, 8/29, 9/5, 9/12, 9/19, 9/26, 10/3, 10/10, 10/17, 10/24, 10/31, 11/7, 11/14, 11/21, 11/28, 12/5, 12/12, 12/19, 12/26)

Appendix

Table 1. Logistic Regression of Decision to Enroll

Dependent Variable: 1 if decided to attend 0 otherwise.

	(1)	(2)
	Baseline	Includes
	No Seasonal	4 year averages &
	Control	month dummies
Intercept	1.319	-30.94
	(1.078)	(34.49)
Cloud Cover (0 - 10)	0.087**	0.110***
	(0.037)	(0.041)
Temperature	-0.092**	-0.045
	(0.042)	(0.053)
Square of Avg. Temperature	0.001**	0.000
	(0.000)	(0.000)
Wind Speed	-0.012	-0.018
	(0.013)	(0.014)
Precipiation	-0.265	-0.535
	(0.391)	(0.446)
4YA of Cloud Cover	--	-0.005
	--	(0.003)
4YA Temperature	--	0.804**
	--	(0.382)
4YA Square of Avg. Temperature	--	-0.005**
	--	(0.002)
4YA Wind Speed	--	-0.025**
	--	(0.010)
4YA Precipiation	--	0.000
	--	(0.001)
Month of Year dummies	*no*	yes
p-value of wald for month dummies	--	(.529)
Number of Observations	488	488
Pseudo R-Square	1.77%	5.01%

Notes: 4YA: 4 year average of the weather variable

Standard Errors are reported in parenthesis bellow parameter estimates

***,**, * indicate significance at 1%,5% and 10% level respectively

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