CHOICE – SATISFACTION PREFERENCE REVERSALS: HOW YOU EVALUATE A SERVICE DEPENDS ON WHEN YOU EVALUATE IT.

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ABSTRACT

Recent research on consumer evaluation of service experiences shows that obstacles in a service path (like idle time and negative displacement) will lower the choice likelihood, especially when they occur early during the service (and not to a great extent when they occur towards the end). However, other research shows that obstacles occurring late in the path were especially damaging to consumer evaluations made retrospectively. The present research reconciles these seemingly disparate findings by arguing that the effect of obstacles on evaluation is influenced by the temporal proximity of these obstacles to the time of making the evaluation. Specifically, I propose a model of consumer evaluation in which the velocity at any given point in time during the path is a measure of the progress made at that time. Velocities at temporally distant times are underweighted (discounted) relative to velocities that are temporally proximal, and the model suggests that the evaluation depends on the integral of these discounted velocities over the entire service paths. I use the model to predict a choice-satisfaction preference reversal and test for this reversal (and other model implications) in three separate experiments. Results support the proposed model not only for paths with obstacles, but more generally for paths with varying velocities during the elapsed time.
Consumer evaluations of products and services are measured in a number of ways. The most obvious evaluation comes through observing choice. The greater the choice for a particular service, the higher is the consumer evaluation of that service. In the laboratory, researchers use Likert type scales to measure absolute or relative purchase intentions. And after consumers have chosen and experienced a service, marketers often survey them to ask how satisfied they were with the service. While satisfaction is measured for a number of reasons (Jones and Sasser 1995), one objective is to give the service provider a measure of how consumers evaluate the service and therefore how likely they and others would be to choose the service (cf. Kitaeff 1993, Yi 1990).

The obvious assumption running through the above discussion is that consumer evaluation of a service is invariant to the response mode. Specifically, both choice and satisfaction behaviors are assumed to be directly related to some underlying intrinsic quality perception of the service, or its utility. Further, the factors that influence the utility of the product are assumed to have an identical effect on both choice and satisfaction judgments.

In the present research, this assumption is investigated in the domain of transportation services; services that transport individuals or organizations from a given state to another state over a specified period of time without concern for the intermediate states. An example in the domain of physical transport is a train that moves passengers from their start station to destination station over the duration of the journey (referred to as the elapsed time). Soman (1997, Soman and Shi 2000) argued that while intermediate states should be irrelevant to a rational evaluation of such services, the intermediate path characteristics significantly influenced choice likelihood by conveying a perception of progress towards the destination. Specifically, this research showed that obstacles like idle time or negative displacement (i.e. movement away from the destination) reduces the perception of progress and hence reduces choice likelihood (Soman and Shi 2000, see also Carmon, Shanthikumar and Carmon 1995). This past research still begs an important question: will obstacles have the same effect on the evaluation at the conclusion of the service (i.e. satisfaction) as they do prior to commencing the service (i.e. choice)?

Consider the following hypothetical scenario:
Mr. A and Mr. B are both on a (separate) train between New York, NY and Boston, MA that (each) makes one 30 minute stop. Mr. A’s train leaves the platform at Penn Station on schedule at 10:00A but makes its first stop at Stamford, CT. between 10:20A and 10:50A almost immediately after leaving New York. It arrives in Boston at 3:00P. Mr. B’s train also leaves at 10:00A. However, it makes its stop between 2:10P and 2:30P at Providence, RI. right outside Boston. It arrives in Boston at 3:00P. Which train would you prefer to be on leaving New York? Which one would leave you more satisfied at the end of the journey at Boston?

In a preliminary experiment, a group of 330 individuals - passengers waiting for a train at a busy U.S. metropolitan station and visitors to a popular museum - were presented with a richer version of this scenario. First, 120 respondents were asked whether they would choose to be on the train with Mr. A, Mr. B or were indifferent. 90 respondents (75%) indicated a preference for Mr. B’s train, 20 respondents were indifferent while 10 preferred Mr. A’s train. Consistent with Soman and Shi (2000) there was a greater choice for the train that had a stop near the end of the elapsed time.

Second, 110 respondents were asked to imagine that they had undergone the train rides that Mr. A and Mr. B had, and were asked to indicate which of these two men they thought would be more satisfied with their journeys as they alighted (or whether they would be equally satisfied). 92 respondents (83.6%) believed that Mr. A would be more satisfied, 9 respondents believed that Mr. B would be more satisfied while the remaining 9 believed that both men would be equally satisfied. These data indicate a greater satisfaction for the journey that had a stop near the beginning of the elapsed period.

Two features of the data presented above are noteworthy. First, in neither the choice nor the satisfaction task did the data support the rational prediction of indifferent judgments between the two journeys. The second feature is a “preference reversal” between the two journeys as a function of the response mode (i.e. choice or satisfaction). Mr. A’s journey was judged poorly in choice but favorably in satisfaction. Conversely, Mr. B’s journey was judged very favorably in choice but very poorly in satisfaction. Obviously, the choice and satisfaction measures seemed to be capturing different aspects of the intrinsic utility of the service.

In the present research, I first develop a behavioral framework for understanding consumer evaluations of transportation services. Next, I build on Soman and Shi’s (2000) model to predict the
choice - satisfaction preference reversal and test for it experimentally. Finally, I discuss theoretical and managerial implications of the research.

**CONSUMER EVALUATIONS OF SERVICE EXPERIENCES**

Transportation services may be defined as those in which the goal of the consumer is to attain the destination state without concern for intermediate states. Given this goal, a rational evaluation of such services (say, using the cost of time approach, Becker 1965) should be a function of the elapsed time and the price, and should not be influenced by the characteristics of the path linking start and destination state. However, an emerging stream of research has shown that path characteristics are responsible for the creation of an experience (Ariely 1998, Ariely and Carmon forthcoming, Carmon and Kahneman 1996). Further, research shows that some “gestalt characteristics” of these experiences (Ariely and Carmon forthcoming) influence their evaluation more strongly than the duration of the experience (Fredrickson and Kahneman 1993). Examples of gestalt characteristics include the peak intensity, the fluctuation, the rate of change of intensity and the affective state at the end of the experience (Ariely 1998, Carmon and Kahneman 1996, Hsee and Abelson 1991).

In the context of transportation services, Soman and Shi (2000) identified another global characteristic of the experience that impacted its evaluation at the time of choice. Specifically, they argued that the path characteristics of the transportation path conveyed a perception of progress towards the destination state. Some paths (e.g. a uniform velocity path linking start and destination) convey that the elapsed time is being used efficiently and that progress is being made towards the destination all through the journey. Other paths (e.g. a journey that starts off in the opposite direction, or with a period of idle time and then recovers to reach the destination) might convey a poor perception of progress and an inefficient use of the elapsed interval. Their research specifically identified two obstacles – idle periods and negative displacement (i.e. displacement away from the destination) – that are detrimental to evaluation. They further showed that these obstacles are especially detrimental if they occurred early during the elapsed time. For example, consumers were
highly averse to taking a train journey when the train had a stop (idle) shortly after departure (e.g. Mr. A’s train) but not as averse if that stop was towards the end of the journey (Mr. B’s train).

These results seem inconsistent with other research (cf. Carmon and Kahneman 1996, Larson 1987). Larson (1987) pointed out that delays at the end of a service experience (such as waiting for baggage after a flight) were the most painful and impacted evaluations significantly. And Ariely and Carmon (forthcoming) showed that concluding episodes in an experience were overweighted in evaluations. While these results seem inconsistent at first blush with Soman and Shi (2000), one major difference between their approaches was that this past research talked about retrospective evaluations measured after the experience had been completed while Soman and Shi’s (2000) model was on the basis of predicted utility and they measured choice. Based on this apparent inconsistency in evaluation (and the results of the preliminary study), it appeared that the location of obstacles had different effects depending on when the evaluation of the service was measured.

Why might early obstacles influence choice to a greater degree than satisfaction and later obstacles influence satisfaction more than choice? Research in psychology and behavioral decision making shows that consumer decision making is influenced by visceral factors like irritation and frustration when these painful events occur within temporal proximity rather than when they are temporally delayed (Loewenstein 1996). Additionally, this effect of time on the evaluation of unpleasant events occurs both when the event is in the future, or has occurred in the past. The literature is rich with demonstrations of the “pervasive devaluation of the future” (Ainslie and Haslam 1992, p. 59, see also Ainslie 1992, Akerlof 1991, Mischel and Staub 1965, Thaler 1981) and the “adaptation and acclimatization to past events” (Helson 1964, Kahneman and Varey 1991).

Specifically, there is evidence to support the notion that the pain or disutility associated with a future action is underweighted or discounted relative to the pain associated with the same action in the present (Soman 1998). Additionally, prior research also shows that the retrospective evaluation of pain associated with past actions is mitigated when the evaluation is made significantly in the future (Kahneman, Wakker and Sarin 1997); i.e. when the painful event has already occurred in the
past. Individuals adapt to previous outcomes and incorporate them into their status-quo over time (Helson 1964, Kahneman and Varey 1991) such that the pain or perceived aversiveness of past negative events gradually declines with the passage of time (cf. Gourville and Soman 1998). Also, memories of past painful events decay gradually over time such that the retrospective pain reduces gradually (Woodworth and Schlosberg 1954).

In evaluating different transportation services, the above discussion suggests that the temporal proximity of an obstacle to the time of making the evaluation will have a strong influence on that evaluation. Prior to entering into the service situation, the perceived progress right after commencement of the service will loom large in evaluation as consumers will anticipate large amounts of frustration and annoyance if they run into obstacles straightaway. And no matter how smoothly the service had progressed, an obstacle at the end of the service will increase annoyance and dissatisfaction at the end.

Proposition 1: For choice evaluations made just prior to the commencement of the service, early obstacles are highly detrimental while for satisfaction measures taken at the conclusion of the service, obstacles late in the elapsed time are more detrimental.

A MODEL OF CONSUMER EVALUATION

In this section, I propose that during the course of a service experience, the velocity at any given instant is an indicator of the progress towards the final destination (either anticipated or recalled) made at that instant. Further, while making an evaluation, a consumer looks at the entire service experience (in anticipation while making a choice, and in retrospect while making a satisfaction judgment) and makes a global evaluation of the perceived progress by summing the instant-by-instant progress over the entire path \(^3\).

Path Characteristics

Consider service alternatives that all have a start state at 0, destination state at \(D\) and an elapsed time of \(T\). Displacement \(d(t)\) measures the net movement up to time \(t\) (measured from the start). In this paper, \(d(0) = 0\) and \(d(T) = D\) for all alternatives. At any given time \(t\), the velocity \(v(t)\) is a measure of the progress towards destination \([v(t) = \Delta d(t) / \Delta t]\). Velocity can be the speed that
airplanes travel towards their destination, the rate at which machine tools are delivered and installed or the rate of change in a patient’s blood glucose level over time. Note that $v(t)$ can either be positive or negative, where a positive velocity is in the direction of the vector connecting the start to the destination, while a negative velocity moves consumer in a direction opposite to this vector.

Three path characteristics in terms of the direction of the vector originating at the start state and terminating at the destination are formally defined as follows. During **positive displacement**, velocity $v(t)>0$ and hence $d(t)$ increases. **Negative displacement** occurs when a service segment moves consumer opposite to this vector, e.g. taking a flight westwards to connect to a final destination in the east. Here, velocity $v(t)<0$ and hence $d(t)$ decreases. **Idle time** refers to a time interval during which there is no displacement. Here, velocity $v(t)=0$ and $d(t)$ remains unchanged.

A service path can thus be characterized either by a series of velocities $\{v(t), t\in[0, T]\}$ or by the displacement $\{d(t), t\in[0, T]\}$. The displacement $d(t)$ and its corresponding velocity function $v(t)$ for a number of service paths are graphically illustrated in Figure 1, where the horizontal axis denotes time $t$. In the figure, the solid line in panel A represents displacement over the elapsed time, and the dashed line is its corresponding (uniform) velocity function. Panel B shows a profile with varying velocities. The solid line in panel C represents a path, which has an early idle while the dotted line represents its corresponding velocity function. Similarly panels D, E and F show paths with late idle, early negative displacement and late negative displacement.

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Insert Figure 1 here

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In this paper, the velocity profile $v(t)$ will be used to model the evaluation of services.

**The Effect of Location of Obstacle**

In order to incorporate the effect of temporal proximity of an obstacle, I turn to previous literature to identify suitable mathematical relationships for the evaluation of temporally distant events (especially negative ones). First, consider the evaluation of future events (obstacles). Prior
research has modeled such evaluation using intertemporal discounting functions (cf. Loewenstein and Prelec 1992) in which the impact of the event falls off sharply in the temporal proximity of the event and gradually at distant time periods. Mathematically, this discounting has been represented by a power function, or by hyperbolic discounting (Herrnstein 1981, Mazur 1987) such that:

\[ U_t = \frac{U_0}{1 + kt} \]  

(1)

where \( U_t \) = the perceived value of the event at time interval \( t \) prior to its occurrence, \( U_0 \) = the actual value of the future event and \( k \) is the rate of discounting\(^4\).

Second, consider retrospective evaluations of events. Research in adaptation suggests that - like discounting of the future - the value of a negative event is high soon after its occurrence (when the pain has immediately been experienced), falls off to a much lower level shortly afterwards (when the actual pain has gone but is vividly remembered) and then falls off gradually (when only dispassionate memories remain). This decay over time, or "depreciation" (Gourville and Soman 1998) has previously been modeled by a power function of time (cf. Greenlee, Georgeson, Magnussen and Harris 1991), by exponential functions (Gourville and Soman 1998) or by hyperbolic discounting functions (Rachlin and Raineri 1992)\(^5\).

The common thread running through the literature on intertemporal choice is that irrespective of whether the evaluation is made in anticipation or in retrospect the value of an event falls off rapidly in time intervals immediately preceding or following the event, and then falls off gradually. The present research thus uses the hyperbolic discounting function presented in Equation 1 to model the effects of the location of obstacles on consumer evaluation of transportation services.

The Evaluation of Services

Following Soman and Shi (2000), I propose that the velocity \( v(t) \) at time \( t \) is a measure of the progress made towards the destination. Note that progress could have been modeled as a monotonically increasing function of \( v(t) \) \([\text{progress} = f\{v(t)\}]\). However this will not change the conclusions of the model and hence progress is represented by the value of the velocity \([i.e. f\{x\} = \)
x]. Further, because of the temporal separation of \(v(t)\) from the time the evaluation is made, \(v(t)\) is discounted in order to arrive at the perceived progress as follows:

\[
\omega(t) = \frac{v(t)}{1 + k\tau}
\]  

(2)

where \(\omega(t)\) is the perceived progress at any time \(t\) as seen from the time of making the evaluation, \(k\) is the rate of discounting and \(\tau\) is the temporal separation between the time of making the evaluation and \(t\). Thus, for choice evaluations made just prior to starting the service, \(\tau = t - 0 = t\); and for satisfaction evaluations made right at the conclusion of the service, \(\tau = T - t\). Note that \(\tau\) measures the absolute value of the temporal separation, i.e. \(\tau > 0\). This is because prior research shows that time discounting effects are similar both for the discounting or future events as well as the depreciation of past events.

The perceived utility of the entire experience at any point in time can be obtained by integrating \(\omega(t)\) over the duration of the entire experience. Thus,

\[
U = \int_0^\tau \omega(t) \, dt
\]

(3)

Equation (3) gives the perceived utility for the service experience as seen from any point in time.

Equation (3) can further be rewritten separately for choice and satisfaction evaluations by noting that for choice, \(\tau = t\) and for satisfaction \(\tau = T - t\):

\[
U_{\text{choice}} = \int_0^\tau \frac{v(t)}{1 + k\tau} \, dt
\]

(4)

\[
U_{\text{satisfaction}} = \int_0^{T-t} \frac{v(t)}{1 + k(T-t)} \, dt
\]

The utilities underlying choice and satisfaction associated with a service of a given velocity profile can be obtained by solving equation 4.
The model in equation (4) was arrived at using simplifying assumptions (e.g. identical
discount rates for past and future). When these assumptions do not hold, $U_{\text{choice}}$ and $U_{\text{satisfaction}}$ might
not correspond to the absolute values of the ratings obtained by measurement, rather they may
measure underlying utility that will be monotonically related to the measured ratings.

**THE CHOICE - SATISFACTION PREFERENCE REVERSAL**

The goal of this section is to use the model proposed in Equation 4 to make some testable
predictions. My approach will be to consider two specialized cases and solve equations 4 to draw
inferences about the relative choice and satisfaction evaluations.

**Case 1:** The velocity profile is symmetric around the midpoint of the time interval

Consider a velocity profile like Panel B in Figure 1. Here, the profile is symmetric around
the midpoint of the elapsed time such that $v(t) = v(T-t)$. For this case, we can substitute:

$x = T - t; \therefore \delta x = - \delta t$. When $t=0$ then $x=T$ and when $t=T$ then $x=0$.

$$U_{\text{satisfaction}} = \int_0^T \frac{v(x)}{1 + kx} (-\delta x) = -\int_0^T \frac{v(x)}{1 + kx} \delta x = \int_0^T \frac{v(x)}{1 + kx} \delta x = U_{\text{choice}}$$

(5)

This result is intuitively appealing. The theoretical framework suggests that choice and satisfaction
evaluations are different because the velocity profile looks different when viewed in anticipation
from $t=0$ as compared to when viewed in retrospect from $t=T$. When the profile is symmetric, these
views are identical.

**Proposition 2:** In cases where the service involves a velocity profile that is symmetric
around the midpoint of the elapsed time, the underlying utilities that determine choice
and satisfaction evaluations are identical.

**Case 2:** Comparing pairs of profiles that are mirror images of each other.

Next, consider a pair of velocity profiles (referred to as profiles 1 and 2) such that profile 1
is a mirror image of profile 2 along the time dimension. Examples of such pairs are panels (C and
D) and (E and F) in Figure 1.

For such a pair of profiles:

$v_1(t) = v_2(T-t)$ and
\[ v_1(T-t) = v_2(t) \]  \hspace{1cm} (6)

where the subscripts refer to the profile, both of which have an identical elapsed time T. From equations (6) and (4), it can be shown that:

\[
U_{1\text{choice}} = \int_{0}^{T} \frac{v_1(t)}{1 + kt} dt
\]

\[
U_{2\text{satisfaction}} = \int_{0}^{T} \frac{v_2(t)}{1 + k(T - t)} dt = \int_{0}^{T} \frac{v_1(T - t)}{1 + kt} dt = \int_{0}^{T} \frac{v_1(t)}{1 + kt} dt = U_{1\text{choice}}
\]

Similarly, it can be shown that

\[ U_{2\text{choice}} = U_{1\text{satisfaction}} \]  \hspace{1cm} (7)

Intuitively, these results are consistent with the idea that the "view" of profile 1 from t=0 is identical to the view of profile 2 from t=T and vice-versa.

**Proposition 3**: For a pair of profiles that are mirror images of each other, the utility underlying the choice evaluation of each profile will be identical to the utility underlying the satisfaction evaluation of the other profile.

In order to demonstrate the choice-satisfaction preference reversal, we analytically prove that if Choice\(_1\) > Choice\(_2\), then it follows that Satisfaction\(_1\) < Satisfaction\(_2\). From equations (7), Choice\(_1\) = Satisfaction\(_2\) and vice versa. Hence, it follows that:

if Choice\(_1\) > Choice\(_2\), then Satisfaction\(_1\) < Satisfaction\(_2\)

if Choice\(_2\) > Choice\(_1\), then Satisfaction\(_2\) < Satisfaction\(_1\)

These conditions suggest that the service path that is relatively superior in choice evaluation is relatively inferior in satisfaction evaluation.

**Proposition 4**: The location of obstacles in a service path can create preference reversals between choice and satisfaction evaluation. Paths that are superior in choice evaluation may be inferior in satisfaction, and vice versa.

I next describe a series of three experiments designed to test these propositions.
EXPERIMENT 1

The objective of Experiment 1 was to find support for the four propositions in the domain of physical transport. Specifically, the objective was to show that the evaluation of a transportation service depends on when the evaluation was collected (i.e. choice vs. satisfaction), that there was no differences between choice and satisfaction when the velocity profile of the service path was symmetric; and further to find choice-satisfaction preference reversals.

Subjects and Procedure: Sixty-eight students from a state university participated in this experiment (part of several unrelated studies) in exchange for course credit. The stimulus materials used in this experiment were adapted from those used in Soman and Shi (2000). Subjects received an experimental booklet entitled “Traveling in Longland” in which they were asked to imagine that they were exchange students at a university in a (fictitious) country called Longland. This country was described as “long and narrow”, spanning about 900 miles east to west, but only about 50-100 miles from north to south. There were two large metropolitan cities, Arundham (where the University was located) and Bordham. There are four other major cities, Chatham, Durham, Evatham and Frotham. These cities were referred to by the first letter of their names (i.e. A, B, C, D, E and F). Figure 2 shows the map that subjects saw in the experimental booklet.

The train system in Longland was next described as follows:

The six major cities are connected by a train system. Trains operate in both directions between D and F either as regular speed (about 40-70 m.p.h) trains or high speed trains (about 90-120 mph). The same train sometimes operates at different speeds during different segments of the journey. Within a given segment, however, a train will run with a roughly constant speed. Also, due to logistical reasons, trains do not stop at all stations. For instance, sometimes you could have a train that starts from D, travels eastwards as a regular speed train to A, then travels as a high speed train to F, and on its return journey stops at B and E. If you were a passenger on this train and wanted to go from A to B, you could get on the train, travel to F, stay on the same train on its return journey and get off at B. While such train journeys might seem cumbersome, you do not have to leave the train once you have boarded.
Subjects were next told that “you need to go from A to B to get some paperwork done regarding your trip back to the USA. The quickest way to do this is to catch a high-speed non-stop train from A to B (called the “AB Express”) which leaves A at 9:00a and arrives in B at 4:00p. However, the fare for this train is 300 Dnoups (the Dnoup is the local currency, 1 Dnoup = 1 U.S. Dollar). Since this sounds expensive, you look for other alternatives. You come across nine alternate routes that each cost 200 Dnoups but take longer.” Each of these cheaper options left A at 9:00a and arrived in B at 7:00p. Half the subjects (n=34) who were in the “choice” condition read the above scenario verbatim, while for the remaining half (n=34) who were in the “satisfaction” condition, the scenario was written in the past tense. All subjects were also reminded that “trains travel at roughly a constant speed between two stations” but that the same train could be a regular speed train for one segment and an express for another segment of the journey. Subjects were also instructed to “look carefully at all the available options before writing down your responses”.

Each option was depicted with a series of 11 “snapshots” one hour apart showing the position of the train on the map from the start state to the destination state. In the choice condition, the scale measuring evaluation was presented on the top of each page and the snapshots were presented immediately below it. In the “satisfaction” conditions, the snapshots were presented above and the scales appeared immediately below it. Figure 3 shows an example of one series of snapshots (depicting a journey that had an early negative displacement and a late idle).

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Insert Figure 3 here
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Design: The nine options were created by fully crossing three levels of the Idle factor with three levels of the Negative Displacement factor. There were three levels of Idle; no idle, an early idle (between 10:00a and 11:00a), or a late idle (between 5:00p and 6:00p). The three levels of negative displacement were no negative travel, negative travel of 120 miles at the start (9:00a to 10:00a, from A to D) or negative travel of 120 miles at the end (6:00p to 7:00p, from F to B). This experiment thus employed a 3 (Idle: No, Early, Late) x 3 (Negative Displacement: No, Early, Late)
x 2 (Evaluation Mode: Choice, Satisfaction) full factorial mixed design in which the Evaluation Mode was between subjects and Idle and Negative Displacement were within subject factors. 

*Dependent Variable:* Subjects in the “choice” condition were told that “on each of the following nine pages, you will be shown the itinerary of one option. Each of these routes costs 100 Dnoups less than the AB Express but also takes 3 hours longer. For each option, please think about how attractive it is to you, and consequently how likely you are to choose that option instead of the expensive AB Express option. Remember that once you board the train at A, you cannot leave it until you reach B”. On each page, subjects answered the question “Please rate how likely you are to choose the travel plan below as compared to the high-priced non-stop AB Express” on a 9-point scale (1=Definitely Choose AB Express, 9=Definitely Choose [This Train]).

Subjects in the satisfaction condition were instructed “Each of the following nine routes costs 100 Dnoups less than the AB Express but also takes a longer time. Imagine that you took each of the options as described on the following pages. Think of how you would evaluate the journey on reaching your destination, B.” On each page, subjects answered the question “If you chose the above travel plan instead of the high priced, non-stop AB Express, please indicate how satisfied and pleased you would feel at the end of the journey” on two separate 9-point scales (Satisfaction: 1=Extremely Dissatisfied, 9=Extremely Satisfied; Pleased: 1=Extremely Displeased, 9=Extremely Pleased). The correlation between these two scales was fairly high (0.89, p<0.0001) and hence the average of the two scales was used as the evaluation.

*Results and Analysis:* For the purpose of analysis, the design is effectively a 2(Evaluation Mode) x 3(Idle) x 3(Negative Displacement) mixed design with subjects nested in Evaluation Mode and crossed with Idle x Negative Displacement. The average scores in each experimental condition are plotted in Figure 4 and the ANOVA table is shown in the left panel of Table 1.
As Table 1 shows, there were significant main effects of Idle and Negative Displacement, as well as significant two-way interactions of Idle with Evaluation Mode, and of Negative Displacement with Evaluation Mode. The main effect of the Evaluation Mode did not approach significance. This pattern of results can be explained by looking at the means in Figure 4.

First, consider the effects of Idle. When the “choice” and “satisfaction” conditions were analyzed separately, there was a main effect of Idle in both cases (p’s < 0.001). Consider the “choice” data (solid lines in Figure 4). For each level of negative displacement, the evaluation in the “no idle” condition (X=5.65) is significantly greater than the evaluation in the “late idle” condition (X=4.78), which in turn is significantly greater that the evaluation in the “early idle” condition (X=3.76, all p’s < 0.01). For subjects in the “satisfaction” condition (dashed lines), however, the means showed a different pattern. Specifically, the mean evaluation was highest in the “no idle” condition (X=5.48), followed by the “early idle” condition (X=4.77) and lowest in the “late idle” condition (X=3.85, pairwise p’s < 0.01). In both choice and satisfaction evaluations, the presence of an idle period significantly reduced the evaluation, however the location of the idle had different effects. Consistent with proposition 1, early idle was especially detrimental to choice evaluation while late idle was especially detrimental to satisfaction evaluation.

A similar pattern was observed for Negative Displacement. For subjects in the “choice” condition, for each level of Idle, the evaluation is the highest when there is no negative displacement (X=5.39), is significantly lower when it is late (X=4.87), and lowest when it is early (X=3.93, all p’s < 0.03). For subjects in the “satisfaction” condition, mean evaluation was highest when there was no negative displacement (X=5.42), second when the negative displacement was early (X=4.85) and lowest when it was late (X=3.83, pairwise p’s < 0.01). Consistent with expectation, negative displacement was especially detrimental to choice evaluation when it was early, and to satisfaction evaluation when it was late during the elapsed time.

Next, the following analyses of preplanned contrasts were done to test propositions 2 - 4.
The uniform velocity path: Consider the uniform velocity path that has no idle and no negative displacement. As figure 4 shows, the choice evaluation (X=6.35) was not significantly different from the satisfaction evaluation (X=6.40, p>0.75). This is consistent with proposition 2.

Comparing pairs of mirror-image paths: Table 2 lists four pairs of service paths in which the velocity profiles are mirror images of each other. A series of preplanned contrasts shows that there are no significant differences between the choice of one path from the satisfaction evaluation of its mirror image in all the eight comparisons in this table (p's range from 0.11 to 0.91). This is consistent with Proposition 3.

Preference Reversals: For paths where obstacles are located either predominantly at the beginning or the end, the model will predict preference reversals. This condition is true for the first three out of the four pairs of paths shown in table 2. As the table shows, these pairs display strong choice - satisfaction preference reversals. Specifically, the choice for Service 2 is significantly greater than the choice for Service 1 (p's < 0.05) while the satisfaction for Service 1 is significantly greater than for service 2 (p's < 0.05). This is consistent with Proposition 4.

In a second set of analysis designed to demonstrate the underlying similarities between the choice and satisfaction evaluations, the raw data were recoded along the Idle and Negative Displacement factors. The original coding scheme classified both Idle and Negative Displacement as either "none", "early" or "late" in the elapsed time period. The new scheme classified both as either "none", "proximal" or "distant" from the time of making the evaluation. This new coding scheme was identical to the old scheme for the choice condition (i.e. proximal = early and distant = late). However, the new coding scheme differed from the old one for satisfaction measures in which the temporal distance was now measured from the end of the service. In this case, proximal = late and distant = early. The results of the ANOVA run with the recoded data are shown in the right panel of Table 1, and the means are plotted in Figure 5. These results show main effects of Idle and Negative
Displacement only - the two-way interactions that were present in the original ANOVA run are not significant with the recoded data. The main effect of Idle [Negative Displacement] is caused by the fact that evaluations are the highest when there is no idle [negative displacement], significantly lower when there is a distant idle [negative displacement] and the lowest when there is a proximal idle [negative displacement] (all p's < 0.02). As Figure 5 shows, the differences in the pattern of data between choice and satisfaction evaluations disappeared with the recoding with proximal obstacles being highly detrimental and distant obstacles being less detrimental for evaluations.

Discussion: The results from Experiment 1 supported all four propositions, and showed that the temporal proximity of an obstacle to the time of making an evaluation influences the degree of its impact on the evaluation. Support for the proposed choice - satisfaction preference reversal was found, and results also showed that choice and satisfaction evaluations were inherently the same. Discrepancies arose only due to differences in temporal arrangement of obstacles in the service path.

As compelling as these results were, some minor questions remained. First, the evaluation mode manipulation was done between-subjects. This is not a primary concern (it would have been had I looked at only one profile and asked separate sets of subjects to evaluate choice and satisfaction. However, because each subject evaluated 9 separate profiles in a fully crossed design, I was able to capture systematic differences in judgment strategy for the two groups). However, it would be more compelling to demonstrate the choice-satisfaction reversal within subjects. Second, it is not clear whether these effects are unique to physical transport or extend to other service domains as well. And third, do these results generalize to situations in which there are no obstacles but rather paths with varying velocities? These concerns are addressed next.

**EXPERIMENT 2**

The objective of this experiment was to demonstrate the choice - satisfaction reversal with evaluation mode as a within subjects factor.

*Subjects, Procedure and Design:* Sixty business students at a state university served as subjects in this study. All subjects attended two separate sessions three weeks apart to participate in a set of
unrelated studies. Of interest to the present experiment, each subject made one choice evaluation and one satisfaction evaluation in two separate domains (stimuli adapted from Soman and Shi 2000).

In the medical treatment domain, subjects were asked to imagine that they had an elevated blood glucose level (200 mg/dl as compared to an optimum of 100 mg/dl) and that their doctor has recommended that they take treatment to bring it down to a level of 100. Subjects read that treatments comprised some combination of injections, pills and diet; and that the temporal arrangement of these influenced the rate of change of blood glucose during the course of the treatment. Subjects made a relative evaluation between two treatments that both reduced the glucose level from 200 to 100 over a 40-day period and were equivalent from a medical perspective. Treatment A reduced glucose gradually at first (at a rate of 1 per day for the first 20 days) and rapidly later (at the rate of 4 per day for the last 20 days). Treatment B was rapid at first (4/day) and gradual later (1/day). Both treatments were otherwise identical.

In the supplier selection domain, subjects were asked to imagine that two suppliers were in contention for a project that involved the installation of 100 machines that would form a new assembly line in the manufacturing division of their company. Subjects were told that the machines were of no use until all 100 had been installed, and further that the installation process would not interfere with daily work. Both suppliers undertook to complete installation of 100 machines over 40 days, quoted an identical price and supplied an installation schedule. The velocity profile of the installation schedule of the two options was numerically identical to the two options in the medical treatment domain, specifically option A installed machines gradually for the first 20 days (1/day) and rapidly thereafter (4/day), while option B installed rapidly at first (4/day) and gradually later (1/day).

In both domains, subjects thus saw one option that had “early low velocity” [A] and another with “early low velocity” [B]. In the choice problem, subjects were asked to imagine that they faced the choice between the two treatments [suppliers] and were asked to indicate their choice on a 9-point scale (1=Definitely Choose A, 5=Indifferent, 9=Definitely Choose B). In the satisfaction
problem, subjects were told that a colleague was thinking about this decision and asks them how they would have felt had they gone through both experiences. "The colleague asks you to put yourself in a situation where both these treatments (services) have just ended and think about which of the two would leave you more satisfied". Subjects responded on a 9-point scale (1=A Definitely More Satisfying, 5=Both Equally Satisfying, 9=B Definitely More Satisfying). The evolution of the service over time was shown on a time - displacement plot (see Figure 6).

Each subject responded to one choice and one satisfaction problems, one in each session. To minimize the possibility that subjects recalled and reproduced their response from the first session, the choice problem was in one domain while the satisfaction problem was in the other domain. Half the subjects saw a choice problem in the medical treatment domain and the satisfaction problem in the supplier selection domain, while the other half saw the reverse assignment. Further, the order in which subjects saw the problems was also counterbalanced, with half the subjects seeing the choice problem in the first session and the satisfaction problem in the second session, while the other half saw the opposite order. The experimental "design" this involved a 2(Assignment) x 2(Order) between subjects counterbalancing, and a 2(Evaluation Mode: Choice vs. Satisfaction) repeated measure factor.

Results and Analysis: The relative evaluation data were analyzed using an ANOVA. Results indicated a significant main effect of the within-subjects Evaluation Mode (F_{1,56} = 163.76, p<0.001). There were no significant main effects of Assignment (F_{1,56} = 2.10, p=0.15) or Order (F_{1,56} = 1.10, p=0.30), nor did their interaction approach significance (F_{1,56} = 0.90, p=0.35). The Evaluation Mode had no significant interaction effects with any of the counterbalancing manipulations [p=0.6926 for Evaluation Mode*Assignment, p=0.0729 for Evaluation Mode*Order, p=0.3857 for Evaluation Mode*Assignment*Order].
The main effect of Evaluation Mode arose because the mean choice score across the sample (\(X=6.50\)) is significantly greater than the mean satisfaction score (\(X=3.82\)). The mean choice score indicates a relatively greater preference for Option B, i.e. the option with early high velocity, however the satisfaction scores represent a greater relative preference for the option with early low velocity.

*Discussion:* Results from Experiment 2 again showed evidence for the proposed choice – satisfaction preference reversal, this time when the evaluation mode was within subjects. In comparing two service paths (one with early high velocity and the other with early low velocity), the average subject evaluated the early high velocity more positively in choice but the early low velocity more positively in satisfaction. Admittedly these two evaluations were done in two separate domains. However, domain-specific effects can be ruled out because subjects were randomly assigned to the domains, and also randomly assigned to one of two different orders and there were no main or significant effects involving these counterbalancing manipulations. Thus, irrespective of the domain or whether they had seen the choice or satisfaction problem first, the preference reversal was obtained. And finally, even though the domains for choice and satisfaction were different, the underlying velocity profiles (and stimulus material) were identical. Results suggested that the choice – satisfaction preference reversal is a real phenomenon – an individual might prefer one of two options when choosing, but prefer the other option in retrospective satisfaction evaluations.

Between Experiments 1 and 2, there was strong support for the four propositions. However, one potential area of concern and an additional question of interest remain unanswered. First, in both these experiments, the choice task faced by subjects paralleled something they would do in real life. However, in evaluating satisfaction, subjects were instructed to imagine that they had undergone the experience and then to report their satisfaction. It could be argued, therefore, that due to the artificiality of the task subjects placed a greater emphasis on events at the end of the elapsed time. This is highly unlikely as a sole explanation – a large body of previous research has documented findings similar to my results on retrospective satisfaction (cf. Ariely 1998, Ariely and Carmon *forthcoming*, Carmon and Kahneman 1996, Larson 1987). However, I wanted to confirm
the validity of these findings by putting subjects in situations where they had just undergone a service experience and ask them to evaluate satisfaction. Second, while I showed that the same service could have very different evaluations depending on whether it was made before or after the service, a marketing executive could ask, “So what?” In addition to being of theoretical interest, does the preference reversal have any implications for marketing practice? Specifically, will the preference reversal be observed in repeat choice situations? Is satisfaction with a service a good predictor of future choice?

These issues are addressed in the next experiment.

**EXPERIMENT 3**

This experiment differed from the previous ones in two significant ways. First, subjects went through an actual experience before reporting satisfaction evaluations. Second, after providing satisfaction measures for one of two randomly assigned services, they provided a choice evaluation between these services for a second occasion. Thus, I was able to assess whether satisfaction with the experience significantly influenced future choice.

*Subjects, Procedure and Design:* Subjects were 43 undergraduate students enrolled in an advanced marketing course that covered marketing research. They participated in a study ostensibly to pretest a market research instrument (about popular brands of soft drinks) for a research agency. They were told that the market research session would have two parts with responses from one part used to design the questionnaire in the second part. Their role would be to participate in the market research sessions and then to answer a number of questions about their experience that would help the agency to revise and improve the administration of the research.

On arrival, subjects were randomly assigned to one of two experimental conditions. In the first condition (early idle), subjects first answered a short (one-page) questionnaire that took about 5 minutes, then were asked to wait (for 15 minutes) while their responses were processed and then given a longer (8 pages) questionnaire that took approximately 40 minutes to answer. In the second condition, subjects first answered the long questionnaire, then waited for 15 minutes and finally answered the short questionnaire. Both questionnaires asked subjects to rate several brands of soft
drinks on a number of attributes. All participants thus spent approximately one hour on the research instrument, but differed on the location of the 15-minute "idle" period during this elapsed time.

After completing the questionnaires, subjects were given a questionnaire entitled "Feedback" in which they were asked to rate their overall experience with the market research instrument (referred to as the SATISFACTION evaluation). They were asked "Please let us know how you feel about your experience on each of the following two scales" [First scale: 1=Very Dissatisfied, 9=Very Satisfied; Second scale: 1=Bad Experience, 9=Good Experience]. Subjects next performed an unrelated task, and were then described the two different conditions in terms of their temporal sequencing. They were then asked "We would like to pretest a similar set of market research instruments next week in the packaged foods category. Please indicate on the scale below which of these two conditions you would like to be assigned to" (the CHOICE evaluation). Subjects responded on two 9-point scales [First scale: 1=Definitely Condition 1, 9=Definitely Condition 2; Second scale: 1=Condition 1 sounds like a better experience, 9=Condition 2 sounds like a better experience]. The CHOICE data are scaled such that higher numbers indicate a greater preference for the "late idle" condition. The two sub-scales in both Satisfaction and Choice responses were highly correlated (0.83 and 0.89 respectively) and hence their mean is used as the Choice and Satisfaction response.

**Results and Analysis:** First, consider satisfaction scores. Subjects in the early idle condition had experienced an idle that was temporally distant from the time of making their satisfaction judgment while subjects in the late idle condition would have only recently experienced the idle. The model predicts that the satisfaction would be higher in the early idle condition, and results are consistent with this (SATISFACTION _early-idle_ = 6.19, SATISFACTION _late-idle_ = 3.64, t _41_ = 5.30, p<0.001). This replicates a finding from Experiment 1.

The response to the CHOICE questions could have been guided by several considerations. First, subjects might use their retrospective satisfaction ratings to help them choose. If so, we would expect subjects in the early-idle condition (who were satisfied) to again choose early idle (i.e. a low CHOICE score). And we would expect subjects in the late-idle condition (who were dissatisfied) to
now choose early idle (i.e. a low CHOICE score). Second, choice might have been driven by the desire to try / experience the other option. If so, we expect subjects in the early idle condition to choose late idle (i.e. a high CHOICE score) and subjects in the late idle condition to choose early idle (i.e. low CHOICE score). Third, choice might be driven by considerations of perceived progress and the temporal proximity to obstacles. According to this, irrespective of the condition that subjects had just experienced, they should choose the late idle option because the obstacle is temporally distant (i.e. a high CHOICE score for both conditions).

The mean choice scores for both the early idle (CHOICE \textit{early-idle} = 6.43) and the late idle (CHOICE \textit{late-idle} = 6.27) are high and not significantly different from each other (t\textsubscript{41} = 0.36, p=0.72). These results are consistent with the model of consumer decision making and support the choice-satisfaction preference reversal. Specifically, subjects who had the early idle experience were more satisfied than those who had the late idle experience. However, irrespective of their satisfaction, all subjects indicated a significant (and equal) preference for the late idle option. Obviously, in this experiment, satisfaction with an experience did not guarantee that it was chosen again in the future.

**GENERAL DISCUSSIONS AND CONCLUSIONS**

**Summary of Research:** Recent research has modeled choice between transportation service in terms of a global measure of anticipated progress towards destination made during the service (Soman and Shi 2000). This research predicted that obstacles in a service path (like idle time and negative displacement) will reduce the choice likelihood especially when they occur early during the service (and not to a great extent when they occur towards the end). These results were seemingly inconsistent with prior work (Carmon and Kahneman 1996, Larson 1987) suggesting that obstacles occurring late in the path were especially damaging to consumer evaluations.

The present research reconciles these seemingly disparate findings by arguing that the effect of obstacles on evaluation is influenced by the temporal proximity of these obstacles to the time of making the evaluation. Specifically, I extend Soman and Shi’s (2000) model and propose that the velocity at any given point in time during the path is a measure of the progress made at that time.
Velocities at temporally distant times are underweighted (discounted) relative to velocities that are temporally proximal, and the model suggests that the evaluation depends on the integral of these discounted velocities over the entire service paths. I used the model to predict a choice-satisfaction preference reversal and tested for this reversal (and other model implications) in three separate experiments (plus a fourth, preliminary study). Results support the proposed model not only for paths with obstacles, but more generally for paths with varying velocities during the elapsed time. The preference reversal was very robust – it was obtained in within-subjects and between-subjects studies, with student subjects as well as “real” consumers, with pictorial descriptions of services as well as actual experiences and in a number of separate contexts (transport, choosing treatments and suppliers, and evaluating a market research instrument).

Theoretical and managerial implications of this research are discussed next. In this discussion, several limitations of the research are raised and avenues for future research are proposed.

**Theoretical Implications and Applications:** This research adds to the growing stream of recent research on how consumers evaluate experiences over time (cf. Ariely 1998, Ariely and Carmon forthcoming). The literature has previously offered several intriguing findings on different aspects of such evaluations. The present research provides an integrative framework for consumer evaluation of transportation services and serves to reconcile seemingly disparate findings in the literature. I discuss some specific issues below:

*Choice vs. Satisfaction – Are They Different Concepts?*: While early satisfaction researchers believed that satisfaction was a good predictor of choice, there has never been much debate that psychologically, choice and satisfaction are different evaluations. The differences might arise from the fact that each of these two evaluations used different information and focuses on different aspects of the service. For instance, choice might focus more on utilitarian attributes like price and elapsed time while satisfaction might focus more on experiential attributes.

In the present research, I controlled for utilitarian factors (price and elapsed time) and yet found a choice – satisfaction preference reversal. However, after re-conceptualizing the the
temporal location of obstacles (i.e. converting “early” and “late” obstacles into “proximal” and “distant” obstacles), no significant effects of evaluation mode were found. Apparently, at least in the domain studied here, choice and satisfaction were the same basic psychological construct, and they differed only because of the different relative location of obstacles relative to the time of making the evaluation. While this finding is intriguing, I do not mean to offer it as a conclusion. Clearly, much research needs to be done to investigate the psychological antecedents behind choice and judgment evaluations.

**A New Kind of Preference Reversal:** A number of different kinds of preference reversals have been documented in the decision making literature (cf. Goldstein and Einhorn 1987, Hsee and LeClerc 1998, Slovic and Lichtenstein 1968, Tversky and Thaler 1990). The present research demonstrates another reversal. Unlike previous research, however, I also argue that the underlying preference “apparatus” for choice and satisfaction is identical and the reversal occurs due to different temporal arrangements of the elements of the experience.

**Online evaluations:** While the proposed model was used to study consumer evaluations at the beginning and the end of the service, the model would also be used to make predictions about how consumers evaluate the service at any point in time during the service episode. Not much research has looked at online, real time evaluations *during* experiences (see, however, Carmon and Kahneman 1996, Redelmeier and Kahneman 1996). Obviously, one way of studying such online experiences would be to obtain real time ratings of subjects’ evaluations as the experience unfolded. This approach is fraught with the dangers associated with any intrusive methodology (e.g. thinking about the rating might actually change the evaluation). On the other hand, eliciting choice and satisfaction ratings is common practice. Hence, such ratings may be used to generate the parameters in a model similar to Equation 4, which can then be used to simulate evaluations over the duration of a service. Future research could explore this line of investigation, which is not only theoretically meaningful but also managerially relevant.
**Practical Implications:** While interesting from a purely theoretical perspective, the model of consumer evaluation presented in this paper has a number of practical applications. I discuss some of these below:

*The Management of Obstacles:* In many services, obstacles are inevitable. Restaurants need time to cook food ordered by patrons, consumers have to wait in queues for servers to become available and airlines (under the hub-and-spoke routing system) often have to route consumers through hubs that are not on the path connecting their departure and destination airports. Given that some obstacles cannot be avoided, the service provider is faced with the question of deciding when during the elapsed time to schedule the obstacle. The present research suggest that depending on where the obstacle is located, the consumer will be relatively unhappy at some point in time during the experience. In making this scheduling decision, however, the service provider should ensure that the consumer is happy at certain critical portions of the service that have consequences for the bottom line. A store in a shopping center should ensure that the early portion of the shopping experience is “obstacle free” to prevent consumers from shopping next doors. Conversely, a waiter in a restaurant should ensure that the second half of a meal is “obstacle free” to ensure a good tip. The above principle generalizes to any situation in which an experience has “good” parts and “not-so-good” parts. For instance, one movie producer who heard about this research recognized that a film made for TV should have a good beginning in order to prevent people from flipping channels, and hence increase advertising revenue through ratings. Conversely, a film made for theaters should have a good ending in order to create positive word of mouth, and hence increase ticket revenue.

*Choosing Routes:* Choosing a route to travel from one place to another is a routine activity undertaken by most people. Consider a person who wants to travel from A to B; points located on opposite corners of a rectangle. There is no road “as the crow flies” and the consumer must travel along the sides of the rectangle (say with a uniform velocity). While departing A, will she first travel along the short side of the rectangle or the long side? On arrival at B, will she be happier had she traveled the short side first or the long side? Because of the trigonometry associated with this layout, it is easy to show that traveling along the short side results in a smaller projected
velocity in the direction of the destination (i.e. the diagonal), while traveling along the long side results in a larger projected velocity. Based on the model proposed here, consumers should choose a path starting with the long side, but will be retrospectively happier if they completed the short side first. In a field study in which a small number of subjects were required to actually walk between two points on a college campus, directional support for this prediction was obtained.

This underlying phenomenon has important implications for airlines and other transportation services that need to plan routes through a “hub” city. If the objective is to maximize choice, this suggests that the airline should attempt to complete the long leg first. If the airline has a monopoly and maximizing choice isn’t an immediate motive, it could put the long leg at the end to maximize the quality of the experience for the consumer.

*The Satisfaction Metric:* The research also opens up several important measurement implications. Since retrospective satisfaction measures may not be the best predictors of choice (and hence market performance), the research calls for the development of alternative measures of satisfaction. Some of these measures might be developed from the “online satisfaction” indices described by the model, while others might need to specifically explore choice implications. In general, this research calls for a more multidimensional approach to measuring and interpreting customer satisfaction.
REFERENCES


Behavior and Human Decision Processes, 65(3), 272-292.


### TABLE 1
ANOVA RESULTS: EXPERIMENT 1

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<tr>
<th>Source</th>
<th>df</th>
<th>F-value</th>
<th>p-value</th>
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<th>F-value</th>
<th>p-value</th>
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Note: Significant effects are italicized.
### TABLE 2

CHOICE AND SATISFACTION SCORES FOR MIRROR-IMAGE PATHS: EXPERIMENT 1

<table>
<thead>
<tr>
<th>Mirror Image Profiles</th>
<th>Evaluation of Profile 1</th>
<th>Evaluation of Profile 2</th>
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<tr>
<td></td>
<td>Choice 1</td>
<td>Satisfaction 1</td>
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<td>Early Idle, No Negative Displacement</td>
<td>Late Idle, No Negative Displacement</td>
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<td>3.88</td>
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</table>
FIGURE 1
EXAMPLES OF DISPLACEMENT AND VELOCITY PROFILES DURING THE COURSE OF A TRANSPORTATION SERVICE

Panel A

Panel B

Panel C

Panel D

Panel E

Panel F

Notes: Horizontal axis represents time, vertical axis represents displacement and velocity. The scale on the vertical axis is arbitrary and the plots are only used to illustrate basic concepts. S represents start state and D is the destination state.
FIGURE 2
MAP SHOWING THE LOCATION OF CITIES IN LONGLAND: EXPERIMENT 1

D  A  C  E  B  F

120 miles 120 miles 120 miles 120 miles

WEST  EAST

600 miles
### FIGURE 3

“SNAPSHOT” REPRESENTATION OF THE SERVICE PATH

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
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<tr>
<td>9:00a</td>
<td><strong>Leave</strong> A heading westwards for D</td>
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<tr>
<td>10:00a</td>
<td>10:00a Arrive at D, stop momentarily, leave eastward for E</td>
</tr>
<tr>
<td>11:00a</td>
<td>11:00a Traveling eastwards</td>
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<tr>
<td>12:00p</td>
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<tr>
<td>4:00p</td>
<td>4:00p Traveling eastwards</td>
</tr>
<tr>
<td>5:00p</td>
<td>5:00p Arrive at E, stop for one hour</td>
</tr>
<tr>
<td>6:00p</td>
<td>6:00p Complete stop at E, leave eastwards for B</td>
</tr>
<tr>
<td>7:00p</td>
<td>7:00p <strong>Arrive</strong> at B from E</td>
</tr>
</tbody>
</table>
FIGURE 4
CHOICE AND SATISFACTION SCORES AS A FUNCTION OF IDLE AND NEGATIVE DISPLACEMENT: EXPERIMENT 1

Evaluation

No Idle

Late Idle

Early Idle

No Negative

Early Negative

Late Negative

Negative Displacement
FIGURE 5
CHOICE AND SATISFACTION SCORES AS A FUNCTION OF IDLE AND NEGATIVE DISPLACEMENT CODED AS PROXIAL AND DISTANT: EXPERIMENT 1
FIGURE 6
DISPLACEMENT - TIME PLOTS OF THE EARLY HIGH VELOCITY AND EARLY LOW VELOCITY SERVICE PATHS: EXPERIMENT 2

Option A

Early Low Velocity

Blood Glucose Level

Number of Machines Installed

Days

Option B

Early High Velocity

Blood Glucose Level

Number of Machines Installed

Days
Note that the elapsed time between the departure from the train from New York (10:00A) and arrival at Boston (3:00P) were identical for both trains. The fare was also described to be the same. A rational evaluation would therefore imply that consumers should be indifferent between the two trains.

We use the term “pain” to refer to any psychological or mental anguish associated with an unpleasant event. The term is not used in its medical sense.

I thank an anonymous reviewer on a related manuscript for stimulating my thinking in this direction.

More general forms of Equation 1 have been proposed in which either the whole denominator (Loewenstein and Prelec 1992, Prelec 1989) or its second term (Mazur 1987) is exponentiated. The simple form in Equation 1, however, explains a substantial portion of the variance while the exponentiation typically adds little at the margin (Rachlin and Raineri 1992).

Rachlin and Raineri (1992) point out that hyperbolic discounting applies to a number of retrospective evaluation situations. For instance, Lincoln cars “irrationally” depreciate 22% during the first year, after which they depreciate at the rate of 10% of the previous year’s price.

In the present paper, we assume that the rate of discounting (k) is the same for the evaluation is done in anticipation or in retrospect. This is a simplifying assumption and may not necessarily be true. For instance, an individual may likely discount the future to a much greater degree than s/he discounts the past (i.e. k anticipated > k retrospective). Another individual may have k anticipated < k retrospective. These differences can be modeled by specifying $\alpha = k_{\text{anticipated}} / k_{\text{retrospective}}$. In the present analysis, we assume $\alpha=1$. It can be shown that our basic results are unchanged if this assumption is relaxed as long as $\alpha$ is constant for a given individual and the distribution of $\alpha$ is identical for randomly drawn samples.

Soman and Shi (2000) presented a reference-dependent model in which the utility was modeled as the integral of deviations (gains and losses) from a reference path. In the present paper, we avoid reference dependence in order to simplify the exposition. Our results will hold even with a reference dependent model similar to Soman and Shi (2000).

Subjects were not allowed to bring in any materials into the experimental room. Also, since subjects were run in small groups, they were isolated from each other. The 15 minute wait was therefore a source of much frustration and annoyance.