VIRTUAL PROGRESS: THE EFFECT OF PATH CHARACTERISTICS ON PERCEPTIONS OF PROGRESS AND CHOICE

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ABSTRACT

Transportation services may be defined as services in which the consumer’s goal is to get transported from one well-defined state (start) to another (destination) state without concern for intermediate states. Examples of transportation services include commuter trains and shuttles, time bound construction contracts and turnkey projects. By definition, the evaluation of such services should depend on the price and the amount of time taken for completion but not on the path taken to reach the final destination.

In this paper, however, we demonstrate that the characteristics of the specific path to the final destination influences its prospective evaluation and choice. Specifically, we argue that obstacles (like idle time and travel away from the final destination) are seen as obstacles in the progress towards the destination. Hence, the presence of such obstacles reduces the anticipated value of the service and hence the likelihood of choosing it. Further, we argue that the earlier such obstacles occur in the service, the lower is the choice probability. We present an analytical model of consumer choice behavior, and test the predictions emerging from it in a series of experiments. Our results show that in choosing between two services which cover the same displacement in the same time (i.e. identical actual progress), consumer choice is driven by the perception of progress towards the goal (i.e. by virtual progress). In a final experiment, we show that the effects of virtual progress may outweigh the effects of actual progress.
In many service situations, consumers are transported from one state to another over a certain interval of time. For example, an airline may transport passengers from Denver to Boston over 4 hours. Or a supplier of machine tools may undertake to deliver and install a new assembly line of 80 machine tools over 20 weeks. In both cases, the service moves the consumer (the passenger or the assembly line) from a start state (Denver, or the absence of the assembly line) to a destination state (Boston, or the existence of an assembly line) over a specified period of time (4 hours, or 10 weeks respectively; we refer to this as the elapsed time). In addition, the service provides utility only by the attainment of the destination state. Specifically, the actual route taken to travel from Denver to Boston during the course of the flight or the rate of arrival of machines during the 20-week period is immaterial as long as the destination is attained in the specified time. We refer to all such services as transportation services, where the consumer’s goal is to get transported from the start state to the destination state without concern for intermediate states (see also Allen 1997).

The most evident relationship between choice probability and the features of a transportation service is that choice probability decreases with an increase in either the elapsed time or the price. Thus, consumers should be indifferent between services where these two quantities were held constant. Consider, however, the following scenario posed to 38 passengers at an international airport:

You need to fly from Denver to Newark and have a choice between two itineraries. The first costs $440, leaves Denver at 10:30a and gets you into Newark at 4:00p (2:00p Denver time). The second costs $260, leaves Denver at 10:30a for Atlanta, GA. where you change to a non-stop that gets you into Newark at 7:10p (5:10p Denver time). Which one would you choose?

Approximately half of the respondents [55.88%] chose to take the cheaper, one-connection flight. A second group of 34 passengers were posed a similar problem, but in their case the second option cost $260, left Denver at 10:30a for Seattle, WA. where they changed into a non-stop arriving in Newark at 7:10p. Amongst these respondents, a significantly smaller fraction chose to take the cheaper, one-connection flight [28.95%, \(\chi^2=5.20, p<0.03\)]. Across the two versions of the scenario, subjects faced an identical tradeoff of paying an additional $180 for a 3 hour 10 minute saving in time. Yet, we see a significant shift in preference away from the cheap option when the connection is made via Seattle. Why did this happen?

We argue in this paper that in addition to factors like the elapsed time and price, the evaluation and the choice of services is driven by the path characteristics of the service. Specifically, certain path
characteristics convey a greater perceived sense of progress and a belief that the elapsed time is utilized efficiently. This perceived progress towards destination represents an additional variable that influences consumer choice. In the example above, the itinerary via Seattle does not seem to convey progress since it starts out in a direction opposite to the final destination, and it can be seen as an inefficient use of the elapsed time.

In this paper, we develop a general behavioral model describing how consumers evaluate transportation services as a function of elapsed time and path characteristics. The paper is organized in three sections. First, we review relevant literature in marketing and decision making, present an analytical model of consumer choice and derive predictions about specific relationships between path characteristics and choice. Second, we present the result of six laboratory experiments designed to test these predictions and to highlight the importance of perceived progress. In the first five experiments, we limit ourselves to choices between service alternatives in which the elapsed time and price is held constant, but in which the path characteristics vary. Here the actual progress (displacement / elapsed time) for both alternatives is obviously the same, but differences in perceptions of progress may cause one alternative to have a higher “virtual progress” and hence a higher likelihood of choice. In a final experiment, we show that virtual progress is not merely an artifactual phenomenon that only comes into prominence when elapsed time is held constant, but that consumers are actually willing to choose longer paths that have a higher degree of perceived progress. Finally, we conclude with a general discussion and propose directions for future research.

THE EFFECT OF PATH CHARACTERISTICS ON EVALUATIONS – A MODEL OF CONSUMER CHOICE

Recent research in behavioral decision making suggests that sequences of events (or dynamic outcomes) provide consumers with an experience (Ariely 1998, Ariely and Carmon, 2000, Carmon and Kahneman 1996). Research has also shown that the evaluation of such experiences is not greatly influenced by the actual duration of the experience (Fredrickson and Kahneman 1993) or by the final outcome (Hsee and Abelson 1991), but rather by some defining features or “gestalt characteristics” of the experience (Ariely and Carmon 2000, Kahneman et al. 1993). These features include the relative value of the outcome as compared to its past values (Loewenstein and Sicherman 1991, Loewenstein and Prelec 1993), the rate of change of the outcome (Hsee and Abelson 1991, Hsee, Salovey and
Abelson 1994), the peak intensity of the experience (Ariely 1998) and the affective experience at the end of the sequence (Ariely and Carmon 2000).

While some of the findings in the above stream of research may generalize to transportation services, it is important to understand the similarities and differences between sequences and transportation choices. One obvious similarity is the fact that consumers in both settings might make judgments based on the entire “experience”. However, we would like to highlight three key differences. First, unlike the sequences studied in the above stream of literature (e.g. changes in stock prices over time, painful experiences), intermediate states between the start and destination states should not - by definition - matter in transportation. For example, a commuter heading to work in the morning does not typically care about which route the shuttle bus takes as long as it gets him to work in time. Second, transportation services are goal oriented. Consumers use these services in order to attain the destination state. And third, the research cited above has studied retrospective evaluations while the focus of this paper is on studying prospective evaluations resulting in choice.

We identify a different path characteristic that is especially relevant for transportation services – its perceived progress towards the destination. Prior research suggests that the achievement of subtasks towards the attainment of a goal often signals a sense of progress that contributes to feelings of well-being and high morale in individuals (Berkhout 1982, Brunstein 1993, Cantor and Kihlstrom 1987). Organismic theories of motivation (Deci and Ryan 1985) suggest that people like to be in situations in which they are constantly making progress towards their goal, and further that progress enhances psychological well-being (Sheldon and Kasser 1995, 1998). This suggests that in situations where consumers are focussed on the goal of reaching the destination, they prefer activities that will help them attaining this goal to other activities that do not help goal attainment (Locke and Latham 1991, Sheldon and Kasser 1998).

**Modeling Consumer Choice:** We first consider service alternatives that have identical start \([O]\) and destination \([D]\) locations. The elapsed time \(T\) represents the time needed to traverse this distance. Note that based on an economic analysis of time based on its opportunity costs (e.g. Becker 1965), the most obvious relationship is that the evaluation of the service is inversely related to the duration (i.e. elapsed time, \(T\)) of the service. We assume the opportunity costs of elapsed time \(T\) as \(c(T)\) where \(c'(T) > 0\) (Becker 1965, Soman 2001).
We next incorporate the effects of perceived progress. A service path is characterized by the rate of progress over time, specifically, a series of velocities \( \{ v_t, t \in [0, T] \} \) where velocity \( v_t \) is a measure of the progress towards destination at any given time \( t \). Velocity \( v_t \) can represent the speed of airplanes, the rate at which machine tools are delivered or the rate of change in a patient’s blood glucose level and it can be positive, zero, or negative. While a positive velocity transports the consumer closer to the destination (resulting in positive displacement), zero velocity keeps the consumer at the same location (idle period), and a negative velocity (a flight traveling in the opposite direction) moves consumer away from the destination (negative displacement).

Consumers evaluate the service episode using a forward-looking approach. Based on prior research, we know that people anticipate utilities from future events (cf. Elster and Loewenstein 1992). Specifically, we propose that consumers anticipate gaining some value \( u(v_t) \) from the velocity \( v_t \) at any time \( t \) and that this value is a function of the difference between the actual velocity and a “reference” velocity (Loewenstein and Prelec 1993). Further, research has shown that future outcomes have a lower impact than current outcomes because people tend to undervalue – or discount - the future (cf. Rachlin and Raineri 1992). We capture this underweighting by a discounting function such that \( u_0(v_t) \), the present anticipated value arising from time \( t \) equals \( u(v_t) \delta \) \([ \delta = \text{discounting factor}, 0 \leq \delta \leq 1 \] \). When \( \delta=1 \), there is no discounting and future outcomes carry as much weight as present outcomes and when \( \delta=0 \), future outcomes play no role in present decisions and only the current outcome matters.

While prior research has attempted to measure implicit discount rates for choices between present and future monetary outcomes or durable purchases (see Loewenstein and Prelec 1992), there is not much research that measures discount rates for the importance of attributes in decision making. However, Soman (2000) recently used the technique of judgment analysis (Cooksey 1996) to infer implicit discount rates for the decision weights associated with delayed attributes. Based on his research, typical values of \( \delta \) are in the range of 0.8 – 0.95 (see also Loewenstein and Prelec 1992). Generally, it appears that individuals definitely incorporate future events into their decision making, but do underweight the future relative to the present (Shiv and Huber 2000, Soman 2000).
We further propose that values are assigned for each part of the service and that the valuation of the entire service \((U)\) is the simple aggregation of such segment-level utilities plus a negative value associated with the length of the elapsed time. Therefore, the predicted value is:

\[
U = \int_0^T u(v_t) \delta t - c(T)
\]

(1)

Note that service valuation also decreases with the elapse time \(T\) (Becker 1965). Equation (1) represents our basic model of consumer decision making.

**Anticipated Value from Progress:** We model the anticipated value arising from the perceived progress towards destination through the deviation of a service route from the consumer’s expected progress over time. A consumer would obtain a positive value when progressing faster than expected, but receive a negative value when moving slower than expected. Let \(R_t\) be the rate of progress that should be achieved at time \(t\). A rich literature has documented that utility (or value) of an outcome is evaluated with reference to some underlying expected level of that outcome (e.g. Hardie, Fader and Johnson 1993, Kahneman and Tversky 1979). We posit that reference progress follows constant velocity \(R_t = \tilde{v}\) where \(t \in [0,T]\). This is consistent with Loewenstein and Prelec (1993), who suggest that consumers develop their reference velocity based on the expectation of following the uniform velocity path from start to destination state. That is, \(\tilde{v} = \bar{v} = D/T\). We also validate this assumption using a series of verbal protocols where subjects were asked to think aloud as they evaluated a number of services with different path characteristics. One of the most prominent themes that emerged from this analysis was a tendency to start the evaluation by computing the average velocity (see also Flint 1998). Even when evaluating a path singly, subjects tended to compare it with some internally generated “control” path of uniform velocity. Thus, while we do not impose restrictions on the value of \(\tilde{v}\), past research and our protocol analysis suggest \(\bar{v}\) as a good approximate for \(\tilde{v}\).

Anticipated difference in progress between a service path and the reference route can be either positive (a “gain” situation) or negative (a “loss” situation). Let \(g(.)\) and \(l(.)\) represent gain and loss function, respectively, then

\[
g(v_t) = \frac{(v_t - \tilde{v}) + |v_t - \bar{v}|}{2} \quad (2)
\]

\[
l(v_t) = \frac{(v_t - \tilde{v}) - |v_t - \bar{v}|}{2} \quad (3)
\]
If a consumer has a gain, then loss $l(v_t) = 0$ and similarly if s/he experiences a loss, then $g(v_t) = 0$. We can then write a consumer’s predicted value from velocity $v_t$ as,

$$u(v_t) = \begin{cases} 
g(v_t) & \text{if } v_t \geq \tilde{v} \\
-\beta l(v_t) & \text{if } v_t < \tilde{v} 
\end{cases}$$

where $\beta$ is the coefficient of loss aversion (Tversky and Kahneman 1991). Consistent with loss aversion, we posit that $\beta > 1$, that is, losses loom larger in decision-making than gains. Note that if there are no gains or losses (i.e. the actual service path is identical to the “reference” path), our proposed model simplified to the special case where only the elapsed time matters in the evaluation of the service.

Figure 1 represents consumer decision-making using a schematic representation of the model. The first panel shows a reference path (dotted line) and the actual path (solid line), while the second panel shows the corresponding velocity profiles. Gains and losses are represented by the shaded areas and labeled as $G$ and $L$ respectively. The third panel shows the effect of intertemporal discounting - areas that are further away from the time of decision-making are shrunk by a greater degree than areas that are closer. The resulting sum of the shrunken areas ($G_{d1} + G_{d2} - L_{d1} - L_{d2}$) represents the contribution of path characteristics to the final evaluation of the service path (the final evaluation also includes the negative value associated with the elapsed time). Note that this simple schematized version of the model treats time discretely in terms of four segments of the service while the model in equation (1) above treats time as a continuous variable.

In this paper, we are particularly interested in path characteristics that hinder the attainment of progress; we refer to these as obstacles. Two such obstacles are a) the presence of idle time during the path and b) movement away from the final destination (or the presence of negative displacement).

a) Presence of Idle Time: A growing body of literature in marketing suggests that consumers are averse to waiting before or during a service (Dube-Rioux, Schmitt and Leclerc 1988, Larson 1987) and that waiting generally reduces service evaluations (Carmon, Shantikumar and Carmon 1995, Taylor 1994, 1995). In transportation services, idle time would allow the consumer to focus on the delay resulting in impatience and frustration. And paths with idle times are likely to be seen as inefficient and hence of low perceived progress. Consumers will be motivated to minimize potential future
frustration and pain (Sawrey and Telford 1971) and hence we expect that they will be more likely to choose services that have no idle time.

FIGURE 1
GRAPHICAL ILLUSTRATION OF THE MODEL

A) Displacement

B) Velocity (G=Gain, L=Loss)

C) Discounted Velocity

Time →
b) **Presence of Negative Displacement**: Feelings of goal impediment and frustration will also occur when the service takes the consumer in a direction opposite to the destination for some portion of the elapsed time. Traveling in the opposite direction is counter to goal directed behavior and hence can be seen as a source of frustration (Locke and Latham 1981, Sawrey and Telford 1971). Hence we propose that the presence of “negative displacement” will reduce the choice likelihood.

To model the presence of idle and negative displacement, without loss of generality, we suppose that a service alternative of elapsed time $T$ consists of an idle period $(t_i, t_i + T_i)$ and a negative displacement of time period $(t_N, t_N + T_N)$). Therefore an idle of length $T_i$ starts at time $t_i$ and a negative displacement of length $T_N$ begins at time $t_N$. We let $-v_N$ ($v_N > 0$) denote the velocity of negative displacement. According to equation (3) and (4), during the service segment of idle, a consumer’s predicted value $u(v_i, 0) = -\beta v_i$. Thus, a consumer’s total predicted value from the entire idle period $(t_i, t_i + T_i)$ (denoted as $U_i$) is

$$U_i = \int_{t_i}^{t_i+T_i} (-\beta v) \delta^i \, dt = -\beta v \frac{1 - \delta^{T_i}}{-\ln \delta}$$  \hspace{1cm} (5)

It can also be shown that a consumer’s total predicted value from the entire period of negative displacement (denoted as $U_N$) is

$$U_N = \int_{t_N}^{t_N+T_N} (-\beta (v_i + v_N)) \delta^i \, dt = -\beta (v_i + v_N) \frac{1 - \delta^{T_N}}{-\ln \delta}$$  \hspace{1cm} (6)

Finally, since a larger magnitude of positive displacement has to occur in a period of time shorter than the elapsed time, the velocity in these segments (assumed constant) $v_p = \frac{D + v_N T_N}{T - T_i - T_N}$. As a result, consumers experience gain during the segment of positive displacement for a reasonable value of $\bar{v}$. We can show that the predicted value from all positive displacement segments is:

$$U_p = \int_{0,T_i(t_i + T_i + T_N, t_N + T_N)} (v_p - \bar{v}) \delta^i \, dt = (v_p - \bar{v}) \frac{(1 - \delta^T) - \delta^{T_i} (1 - \delta^{T_N}) - \delta^{T_N} (1 - \delta^{T_N})}{-\ln \delta}$$  \hspace{1cm} (7)

The predicted value of entire service path is a summation of predicted value of all three types of service segments [$U = U_p + U_i + U_N - c(T)$]. Using (5), (6), and (7) and assuming $\delta=1$ (supposing that discount factor $\delta$ is sufficiently large), we can simplify the predicted value of service to $U = -\beta [\bar{v} T_i + (\bar{v} + v_N) T_N] + (D - \bar{v} T) - c(T)$. Since $\beta > 1$, presence of such obstacles including both
idle and negative displacements would decrease the predicted service valuations for a given $T$. Service paths with idle and/or negative displacements are anticipated to offer lower valuation than the reference path (constant velocity) of the same elapse time. This result holds for sufficiently large values of $\delta$ (including the values typically found in the literature). Obviously, when $\delta$ is very low, the future does not matter much and choice will be heavily influenced by earlier periods.

**Location of Obstacles:** Research in the area of 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). Similarly, there is evidence to support the notion that the pain or negative value associated with performing future effort is underweighted or discounted relative to the pain associated with performing the same task in the present (Soman 1998). In the context of a decision maker who is choosing between options prior to the commencement of service, the presence of a temporally proximal obstacle early in the path will make the anticipated frustration and pain more salient and hence may strongly influence choice behavior. However, if the obstacle occurs late in the path, the anticipated frustration and pain will be discounted and hence the effect on choice behavior will be weaker (Soman 2000).

In our model the location of idle is described by $t_i$. To show how the location of idle affects the predicted service value $(U)$, we derive the marginal effect by taking the first-order derivative,

$$\frac{\partial U}{\partial t_i} = [v_p + (\beta - 1)\tilde{v}] (1 - \delta^{T_f}) \delta^{t_i} 
\geq 0.$$  

The positive derivative indicates that the predicted service value $(U)$ will be higher with larger $t_i$ (later idle). Similarly, we model the location of negative displacement by $t_n$. Following the same approach for the negative displacement, we compute

$$\frac{\partial U}{\partial t_n} = [v_p + (\beta - 1)\tilde{v} + \beta v_n] (1 - \delta^{T_f}) \delta^{t_n} \geq 0.$$  

The positive derivative shows that predicted service valuation is higher with larger $t_n$ (a later negative displacement).

In summary, we predict that:

a) The presence of idle time and negative displacement would reduce the choice likelihood of a service path, and

b) Conditional on the presence of idle time or negative displacement, the choice likelihood is lower if these obstacles occur earlier during the elapsed time.
EXPERIMENTAL EVIDENCE

We report the results of six experiments designed to test the above two predictions and to highlight the importance of virtual progress to consumer decision making. In the first four experiments, we compared sets of service options that were identical in all respects except for either a) the presence of idle time, b) the presence of negative displacement, c) the location of idle time or d) the location of negative displacement. Each of these experiments was conducted using one-page questionnaires in two or three separate domains: a) transport, b) medical treatments and c) supplier selection decisions. Since the basic stimulus materials and the experimental procedure are similar across experiments, we describe them in detail here.

Transport (Flight or Train) Choices: Subjects in the transport domain were asked to imagine that they were planning to make reservations for an upcoming trip between a specified pair of cities. They were then asked to choose from a pair of flights or train routes. The routes were either non-stop, or involved a stop at a third specified city. All cities in a given experiment were selected such that their spatial arrangement was roughly linear. A map showing the relative positions of the cities was provided as part of the stimulus material. Information about the routes was provided using standard “travel agent” or “timetable” formats, in which the arrival and departure times from a given city as well as the distance traveled in each segment was provided.

In all experiments, subjects faced a choice between a control option (uniform velocity between start and destination state) and a test option that included either idle time or negative displacement. All subjects were told that they were not interested in sightseeing and that they could not leave the train or plane when it had stopped (except to make a connection). In some experiments, the control option was priced marginally higher than the test option, therefore subjects had to incur a cost to choose it.

Choosing Medical Treatments: Subjects in this domain made a choice between a pair of treatment plans for high blood glucose. They were told to imagine that after a routine health check-up, their doctor had told them that their blood glucose level was higher [200 mg/dl] than ideal [100 mg/dl].

They were further told; “Having a glucose level of 200 isn’t a serious problem in the short run (the acceptable range is 75 to 225). There are no negative effects and no immediate reactions. However, having a high glucose level over a period of a few years is harmful. Specifically, it can result
in damage to kidneys, vision and sensations. Your doctor says you should start a treatment course that will reduce the blood glucose to 100 within a 50-day period”.

Subjects read that treatments for high blood glucose are based on a combination of injections, medications (tablets) and dietary restrictions. Different treatment plans involve various standard combinations of these three elements. The pattern of change of the glucose level over time depends on the order in which these elements are given. Specifically, glucose levels might rise and fall temporarily during the course of the treatment, but would always remain within the acceptable range.

Finally, subjects faced a choice between two treatment plans, both of which would reduce the glucose level from 200 to 100 over a 50-day period. Information about the anticipated glucose levels over the 50 day period were presented in the form of a plot over time. In the control plan, the blood glucose level reduces uniformly at the rate of 2 per day over the 50-day period. In the test plan, the change is not uniform and had either an idle or a negative displacement. Subjects were told that the charts had been generated from numerous years of patient data and were extremely reliable and accurate. They were also told that once they had selected a plan, they were committed to it and therefore the charts represented a true picture of their future glucose levels based on their choice.

Subjects read that from a medical perspective, both treatments are equally beneficial and that the doctor “encourages you to choose the treatment that you think you are more comfortable with”. Both treatments involved the same number and schedule of visits to the doctor’s office, but the control option was described as “a more rigid program requiring extra effort on your part to carefully monitor and self-administer medications and perform glucose testing using a home kit.” Subjects who chose the control option thus incurred an additional cost of monitoring and testing.

**Building Machines:** Subjects in this domain were asked to imagine that the factory they were working for was in the process of selecting a supplier who would build and install 80 new machine tools that would eventually replace the existing 80 machines. The building and installation work would be carried out over 20 weeks, and would be done in the evening with the new machines occupying designated new areas that would cause no disruption to the day’s work. Subjects were also told that the new machines could not be used till all 80 had been installed since they would all be linked to a common computer.
Subjects then faced a choice between two suppliers, both of which provided delivery schedules for the installation. One supplier (the control option) would build and install at the uniform rate of 4 machines per week and would guarantee completion in 20 weeks. Due to prior commitments, the second supplier (test option) would do the installation with a 4-week recess in the middle. This supplier would contract to work at the rate of 5 machines per week, and therefore would also guarantee completion in a total of 20 weeks. Both suppliers quoted the same total price, however the test supplier offered an extended warranty on the machines (11 years instead of 10). Subjects who chose the control option therefore incurred the opportunity cost of foregoing the extended warranty offer on their machines.

Note that in the medical treatment and building machines domains, the control options as described earlier were identical across all experiments and will not be described separately in the rest of the discussion. In all three domains, the basic information regarding displacement and time was presented using timetables (transportation), line charts (blood glucose) or schedules (machines), while additional detailed information (e.g. rationale for pricing, idling and negative displacement) was provided in the text of the questionnaire.

**Dependent Variables and Other Measures:**

The dependent variable in all experiments was the choice that the subject made between the control and test options. In some cases, the choice measure was augmented or replaced by a relative preference measure on a 9-point scale, with 5 indicating indifference. These choice measures were always collected before any other measures were taken. For the purposes of discussion, we have scaled the choice and relative preference measures such that higher numbers indicate a greater preference for the test option.

In some cases, we also measured the perceived progress (PROG) and the extent to which subjects believed that the provided paths were actually followed (PATH). To measure PROG, we used two items on which subjects indicated their agreement on 9-point scales (1=Completely Disagree, 9=Completely Agree). The first item was “This path used the [elapsed time period] effectively in reaching the destination”; while the second item was “I will experience a sense of progress or accomplishment as I go through the [elapsed time period].” The correlation between the two items was consistently high (ranging from 0.78 to 0.93 across experiments), hence we used the average of
these two items as a measure of perceived progress (PROG). Subjects were also asked to indicate PATH on a 9-point scale “based on the information provided, please indicate whether you believe that the [service] will not progress as per the described [path]”. This measure was collected to rule out the possibility that our results were driven by the inference that the service was more likely to proceed per schedule in the control condition than in the test condition. Both PATH and PROG measures were taken after the choice measure. In experiments using student subjects, we collected these measures in a separate questionnaire after a number of unrelated tasks in order to minimize the possibility of any halo effects causing self-generated validity (Feldman and Lynch 1988).

We next discuss each experiment by referring to an accompanying table that lists details (like subject populations and sample sizes) as well as the results and analysis.

**EXPERIMENT 1**

The objective of this experiment was to test for the effect of the presence of idle. In three domains, subjects made choices between two paths, a uniform velocity path that occupied the total elapsed time (control) or a path that included a period of idle. In the transport domain, subjects chose from two train routes between Boston and New York. Both trains left Boston at 5:00p and arrived in New York at 10:00p and charged the same fare. The control option ostensibly traveled nonstop at a uniform velocity between these stations while the test option traveled faster but had a 30 minute stop at Hartford, approximately midway between the start and destination cities. In the medical treatment domain, the test option reduced at a uniform rate of 2.5 per day for the first 20 days, then stayed constant for a 10-day period and again reduced at 2.5 per day for the next 20 days. And in the machines domain, the test option installed new machines at the rate of 5 machines per week for the first 8 weeks, followed by an idle period of 4 weeks and a final period of 8 weeks at the rate of 5 machines per week. Table 1 provides experimental details and results.
TABLE 1
SUMMARY AND RESULTS: EXPERIMENT 1

<table>
<thead>
<tr>
<th>Domain</th>
<th>Subjects</th>
<th>Number of Subjects</th>
<th>Number Choosing Alternative with Idle</th>
<th>Number Choosing Control</th>
<th>$\chi^2$ Statistic (comparison with Indifference)</th>
<th>p-value</th>
<th>PREF score</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Transport</td>
<td>University of Colorado Undergraduates</td>
<td>80</td>
<td>23 (28.75%)</td>
<td>57 (71.25%)</td>
<td>14.45</td>
<td>p&lt;0.001</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B) Medical Treatment</td>
<td>Patients at a doctor's Office</td>
<td>74</td>
<td>25 (37.84%)</td>
<td>49 (62.16%)</td>
<td>7.78</td>
<td>p&lt;0.01</td>
<td>3.84</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>C) Building Machines</td>
<td>MBA Students</td>
<td>84</td>
<td>22 (26.19%)</td>
<td>62 (73.81%)</td>
<td>19.05</td>
<td>p&lt;0.001</td>
<td>3.74</td>
<td>p&lt;0.01</td>
</tr>
</tbody>
</table>

Note: Subjects in Domains B and C indicated a choice and also indicated a relative preference, PREF, measured on a 9-point scale (1=Definitely choose control, 5=Indifferent, 9=Definitely choose alternative with idle). p-values for PREF are for a test of comparison with Indifference.

Results and Discussion: In the transport domain, the two options were matched in terms of price, as well as start and destination states. As such, subjects should have been indifferent to the two routes. And in the medical treatment and building machines domains, subjects actually had to incur a cost to choose the control option. With the start and destination states being matched, choices should have been driven towards the test option because of the lower monitoring cost and the increased warranty respectively. As Table 1 shows, however, the proportion of subjects choosing the test option in all three domains was significantly lower than indifference. The relative preference scores were also indicative of a significant preference for the control option. Mean PATH scores were not different for the control and test options ($X_{\text{control}} = 2.91$, $X_{\text{test}} = 3.09$, $p > 0.75$ for Medical Treatment, $X_{\text{control}} = 3.11$, $X_{\text{test}} = 3.19$, $p > 0.80$ for Building Machines), suggesting that subjects did not make any inferences that the control path was more “valid” than the test path. Across the three domains, this seemingly irrational pattern of choices could then be explained by the greater perceived progress of the control option.

We measured perceived progress in both the medical treatment and building machines domains (in the latter domain, PATH and PROG were measured in a separate questionnaire after a significant time gap). In both cases, the PROG scores were significantly greater in the control condition than in
the test condition (PROG control = 6.01, PROG test = 5.07, p<0.001 for Medical Treatments; PROG control = 6.74, PROG test = 4.60, p<0.001 for Building Machines). Apparently, the greater perceived progress of the control option drove choices towards it.

**EXPERIMENT 2**

The objective of this experiment was to test for the prediction that *ceteris paribus*, a service with a later idle is relatively more attractive and has a higher likelihood of choice that a service with an earlier idle of the same duration. In all three domains, subjects were randomly assigned to one of three idle conditions, an “early”, “medium” or “late” idle.

In the transport domain, subjects were asked to imagine that they were making an airline reservation between two European cities, Seville (Spain) and Oslo (Norway). Each subject faced a choice between two options, a control option which was a four hour nonstop flight between these two cities and a second one-stop option with an elapsed time of five hours including a one hour long stop (i.e. idle) at an intermediate city. The price of the control option was $300 while that of the one-stop test option was $260 in all conditions. All flights had an identical arrival time of 5:00p in Oslo. In the Early Idle condition, the idle occurred at Madrid which was a 45-minute flight from Seville. In the Medium Idle condition, the idle occurred at Paris which was a 2-hour flight from Seville. In the Late Idle condition, the idle occurred at Copenhagen which was a 3 hour and 15 minute flight from Seville.

In the “medical treatment” domain, the test option reduced the glucose level at a uniform rate of 2.5 per day in the first period of time (the first 10 days for Early idle, 20 days for Medium idle and 30 days for Late idle), then stayed constant for a further 10 days and again reduced at 2.5 per day for the remaining (30, 20 and 10 respectively) days. And in the machines domain, the test option installed new machines at the rate of 5 machines per week for the first period (of 4 weeks for Early idle, 8 weeks for Medium idle and 12 weeks for Late idle), followed by an idle period of 4 weeks and a final period (of 12, 8 and 4 weeks respectively) at the rate of 5 machines per week. Table 2 shows details about the subject population and sample sizes, as well as the results and analysis.
Results and Discussion: For all three domains, subjects across the three conditions faced a choice between a pair of options that were otherwise identical, but differed only in the location of the idle period in the test option. We find a significant main effect of Idle position, such that the test option became relatively more attractive as the idle occurred later on during the elapsed time. Specifically, the choice (or relative preference) for the test option was the lowest in the Early Idle condition, significantly greater in the Medium Idle condition and the highest in the Late Idle condition.

As in the previous experiment, one plausible explanation for these results is the possibility that subjects believed that the paths with later idle times were more likely to proceed as scheduled. In order to rule out this possibility, we measured PATH scores for both the control and test options across the three experimental conditions in the “medical treatment” domain and ran an ANOVA with Idle Position as a between subjects independent variable and Option (Control vs. Test) as a within subjects independent variable. ANOVA results yielded no significant effects (all p’s > 0.45), suggesting that different inferences about the validity of the paths did not drive our results.
We also measured the perceived progress (PROG) in a separate questionnaire for the medical treatment domain. The mean PROG score for the control option did not differ across the three experimental conditions (\(\text{PROG}_{\text{control}} = 6.16\)). However, consistent with our expectation, the mean PROG score for the test option was the lowest in the Early Idle condition (\(\text{PROG}_{\text{early}} = 2.95\)), significantly greater in the Medium Idle condition (\(\text{PROG}_{\text{medium}} = 4.04, p<0.01\)), and the highest in the Late Idle condition (\(\text{PROG}_{\text{late}} = 5.71, p<0.01\)). The increase in choice for the test option as the idle period happened later in the elapsed time seemed to be driven by a simultaneously increasing perception of progress of the test path.

**EXPERIMENT 3**

The objective of Experiment 3 was to demonstrate that the presence of a negative displacement in the path would lower its attractiveness and choice likelihood. In the transport domain, subjects were asked to imagine that they were in a foreign country which had high-speed trains on certain routes, and that they needed to travel from Border to Hughes, two towns that were 300 miles apart. All subjects were told that they had a choice between two options with identical departure time from Border (10:00a) and arrival time at Hughes (2:15p). In addition, all options involved an idle time in the form of a 15 minute train stop at a station 75 miles and 45 minutes from the start state, and an identical fare of 50 Pascoes in the local currency. In the control option seen by all subjects, the train stop was at a town called Warne which was between Border and Hughes. The test option was a second train that initially traveled and stopped at Lillee which was on the line joining Border and Hughes but on the other side of Border as Hughes (see Figure 2). After this stop, the train proceeded non-stop to Hughes as an express train. In the medical treatment domain, the test option initially increased the glucose level at the rate of 3 units per day for the first 8 days. At this time, the blood glucose level was 224 (which was still in the acceptable range). For the remaining 42 days, the glucose level declined uniformly at the rate of 2.95 per day, and finally stabilized at 100 at the end of the 50-day period.

Table 3 shows details and results from Experiment 3.
Results and Discussion: In the transport domain, the control and test options were matched in terms of start and destination states, as well as price. As such, subjects should have been indifferent between the two. And in the medical treatment domain, subjects’ choices should have been driven away from the control option due to the larger monitoring costs associated in it. Yet, table 3 shows that
in both domains, subjects displayed a strong and significant preference for the control option for both actual choice and relative preference measures. This seemingly irrational pattern of choices can be explained by the greater anticipated perceived progress made in the control option as compared to the test option. We asked subjects in the transport domain to indicate PROG scores for both options. The mean PROG score for the control option ($PROG_{control} = 6.12$) was significantly greater than the mean PROG score in the test option ($PROG_{test} = 3.93$, $p<0.001$).

We also interviewed a sub-sample ($n=20$) after they had turned in their surveys and asked them to provide reasons for their choice. A total of 38 choices (average 1.9, range 1-3 per respondent) were coded by three independent coders as relating to either a) Uncertainties associated with the paths (e.g. “trains often break down and if this happens, I’d rather be closer to my destination than further”), b) Progress related (e.g. “It seems to be a waste to go in the opposite direction”, or “I seem to be getting to where I want to go smoothly and without unnecessary excursions”) or c) Personal Preferences and Miscellaneous reasons (e.g. “I prefer riding on express trains”). The coders agreed on 34 items, and the remaining 4 were categorized by discussion. Uncertainties accounted for 21% [8/38], personal preferences for 32% [12/38] while progress related reasons accounted for 47% [18/38] of the provided reasons. While other factors might have had a role to play in decision-making, the anticipated perceived progress made in the control condition seemed to be driving choices towards it.

**EXPERIMENT 4**

In this experiment, subjects chose between two options, one of which (test option) included some negative displacement. Depending on the experimental condition that subjects were in, the negative displacement either happened at the beginning or the end of the elapsed time. We predict that the choice likelihood would be greater if the negative displacement occurs at the end.

In the transport domain, subjects were asked to imagine that they were making a reservation for airline travel between Denver, CO and Lexington, KY. (a net displacement towards the east). The control option was a nonstop flight departing Denver at 3:00p, arriving in Lexington at 8:00p local time and cost $355. In both test options (each costing $238), the consumer left Denver at 10:30a, made a connection with a 20 minute layover and arrived in Lexington at 8:00p local time (6:00p Denver time). In the Early Negative condition, the connection was at Phoenix, AZ. resulting in a negative (westward) displacement for the first segment of the journey. In the Late Negative condition, the
connection was at Philadelphia, PA. resulting in a westward displacement in the last segment of the flight. These cities were selected such that the westward displacement in both cases was approximately 550 miles, the eastward displacement was approximately 1575 miles and the total flight distance in both cases was exactly 2126 miles (see Figure 3).

FIGURE 3

EXPERIMENT 4: DISPLACEMENT-TIME PLOTS FOR TRANSPORT STIMULI

In the Medical Treatment condition, the test option in the Early Negative condition was identical to the one used in Experiment 3. In the Late Negative condition, the treatment reduced the glucose level for the first 42 days at a uniform rate of 2.95 per day. At the end of this period, the glucose level was 76 (still in the acceptable range). For the last 8 days, the glucose increased at a uniform rate of 3 per day and stabilized at the level of 100 at the end of the 50-day period.

Table 4 gives the details and results from Experiment 4.
Results and Discussion: Subjects in the early and late negative conditions faced a choice between otherwise identical pairs of options in which the test option differed only in the location of the negative displacement. We predicted that the relative preference and the choice likelihood for the test option would increase as the negative displacement occurred later during the elapsed duration. As table 4 shows, the results of the experiment for both the transport and medical treatment domains are consistent with this expectation.

As in previous experiments, we asked subjects in the medical treatment domain for their PATH and PROG scores in a separate questionnaire. When analyzed in an ANOVA with the Negative Position as a between subjects factor and control vs. test option as a within subject factor, the PATH yielded no significant effects (all p’s > 0.60) implying that our results could not be explained by differences in beliefs about the validity of the paths. The mean PROG scores, however, are consistent with our theorizing. Specifically, the mean PROG score for the control option was no different across the two experimental conditions (PROG_{control} = 6.23). However, the mean PROG score increased significantly from the Early Negative condition (PROG_{Early} = 2.57) to the Late Negative condition (PROG_{Late} = 5.63, p<0.01).
Experiments 1 – 4 collectively supported our predictions. However, these results still begged two questions. First, we did not know whether the effects of idle and negative displacement and their location interacted with each other. A priori, based on our model, we had no reason to expect any interactions, but a stronger and cleaner test called for a within subjects design in which each subject was exposed to numerous test options in which idle and negative displacement co-existed. Second, we wanted to address the managerially relevant question of whether these differences in predicted utility translate to differences in willingness to pay for the service. Both these questions are addressed next.

**EXPERIMENT 5**

**Subjects and Procedure:** Eighteen students from a state university participated in this experiment (part of several unrelated studies) in exchange for course credit. Subjects received an experimental booklet entitled “Traveling in Longland” in which they were asked to imagine that they were exchange students in a (fictitious) country called Longland. The geography and train network of this country were described (see Figure 4). Subjects were 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 10:00a and arrives in B at 5:00p. However, the fare for this train is 300 Dnuops” (the Dnuop is the local currency, 1 Dnoup = 1 U.S. Dollar). They were further told that there were a number of cheaper options available, all of which left A at 10:00a and arrived in B at 8:00p. They were told that “on each of the following nine pages, you will be shown the itinerary of one option. For each option, please indicate the price (in Dnoups) you would be willing to pay, i.e. a price that you think is a fair price for the itinerary. Remember that once you board the train at A, you cannot leave it until you reach B”. They 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”.

DESCRIPTION OF THE TRANSPORT DOMAIN IN LONGLAND:  
EXPERIMENT 6

**Geography:**

Longland is a fairly narrow and long country. It stretches from East to West for about 900 miles, but it is only about 50-100 miles along the North-South direction. There are two large metropolitan cities, *Arundham* (where your University is) and *Bordham*. There are four other major cities, *Chatham*, *Durham*, *Evatham* and *Frotham*. In this booklet, we will refer to these cities by the first letter of their name (i.e. A, B, C, D, E and F). The following map shows the relative locations of and distances between these cities.

![Map of cities](image)

**Transportation:**

The six major cities are connected by a train system. Trains operate to and fro 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 stopping 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.

**Design:** The nine options were created by fully crossing three levels of the Idle factor with three levels of the Negative Displacement factor. For the Idle factor, there was either no idle, an early idle
between 11:00am and 12:00pm, or a late idle between 6:00pm and 7:00pm. For negative displacement, there was either no negative travel, negative travel of 120 miles at the start (10:00am to 11:00am, from A to D) or negative travel of 120 miles at the end (7:00pm to 8:00pm, from F to B). This experiment employed a 3 (Idle: No, Early, Late) x 3 (Negative Displacement: No, Early, Late) full factorial within subjects design. Table 5 shows the details of each experimental condition.

### Table 5
**Description of Stimulus: Experiment 5**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Idle</th>
<th>Negative Displacement</th>
<th>Location of Idle</th>
<th>Location of Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No</td>
<td>No</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Early</td>
<td>No</td>
<td>C</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Late</td>
<td>No</td>
<td>E</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>No</td>
<td>Early</td>
<td>-</td>
<td>A to D</td>
</tr>
<tr>
<td>5</td>
<td>Early</td>
<td>Early</td>
<td>D</td>
<td>A to D</td>
</tr>
<tr>
<td>6</td>
<td>Late</td>
<td>Early</td>
<td>E</td>
<td>A to D</td>
</tr>
<tr>
<td>7</td>
<td>No</td>
<td>Late</td>
<td>-</td>
<td>F to B</td>
</tr>
<tr>
<td>8</td>
<td>Early</td>
<td>Late</td>
<td>C</td>
<td>F to B</td>
</tr>
<tr>
<td>9</td>
<td>Late</td>
<td>Late</td>
<td>F</td>
<td>F to B</td>
</tr>
</tbody>
</table>

Note: The duration of idle and negative displacement was 1 hour in all conditions. The locations are in reference to the map in Figure 4.

After completing the questionnaire, subjects spend approximately 30 minutes performing other, unrelated tasks. They were then given another booklet entitled “Train Journeys” in which they again saw the nine options and were asked to rate each on perceived progress (PROG).

**Results and Analysis:** In all nine test options, subjects start and end their journeys at identical times, and spend the entire elapsed time in the train. In assessing the WTP for each route, subjects had to tradeoff money (300 Dnoups for control) against the additional time it would take to complete the journey (8 hours for control vs. 10 hours for test option). As such, since the elapsed time for all the test options was identical, an economic analysis of time (cf. Becker 1965) would predict no differences in WTP across the experimental conditions for a given individual (whose cost of time is presumably constant). Virtual progress, on the other hand, would predict that consumers make their WTP decisions
on the basis of perceived progress, such that they will be willing to pay more for those options in which the perceived progress towards the destination is better.

The willingness to pay (WTP) responses were analyzed as a 3(Idle) x 3(Negative Displacement) ANOVA. Results indicated significant main effects of Idle ($F_{2,153} = 47.95, p<0.001$) and Negative Displacement ($F_{2,153} = 125.79, p<0.001$), while their interaction did not approach significance ($p>0.85$). Mean WTP scores are plotted in Figure 5 and are consistent with our predictions. Specifically, for the Idle factor, we find that WTP is highest when there is no idle ($X=193.43$), but significantly lower when there is a late idle ($X=163.89, F_{1,159} = 9.54, p<0.005$) and even lower when there is early idle ($X=134.81, F_{1,159} = 37.58, p<0.001$). Similarly, we find that for Negative Displacement, WTP is highest when there is no negative travel ($X=200.83$), significantly lower with a late negative travel ($X=180.83, F_{1,159} = 7.10, p<0.01$) and even lower when there is early negative travel ($X=110.46, F_{1,159} = 144.97, p<0.001$). Collectively, these results support our predictions.

In a separate set of analysis, we used WTP and PROG data in regression models to test for the mediating effect of perceived progress on the evaluation (WTP) of each option. When WTP was the dependent variable, both Idle ($\alpha=-14.77, p<0.005$) and Negative Displacement ($\alpha=-10.00, p<0.05$) were significant. Similarly, when PROG was the dependent variable, both Idle ($\alpha=-0.50, p<0.01$) and Negative Displacement ($\alpha=-0.42, p<0.05$) were significant. However, when PROG, Idle and Negative Displacement were used as predictor variables for WTP, PROG was significant ($\alpha=24.15, p<0.001$) while the coefficient of the previously significant Idle ($\alpha=-2.69, p=0.26$) and Negative Displacement ($\alpha=-0.06, p<0.96$) both reduced in value and were not significant. These results strongly suggested that perceived progress mediated the relationship between path characteristics and likelihood of choice (Baron and Kenny 1984).
ARE THE EFFECTS OF VIRTUAL PROGRESS REAL?

Results from experiment 5 replicated our previous results in a within-subjects setting and additionally demonstrated that the perceived progress of the option influenced the evaluation and willingness to pay for each option. Collectively, the first five experiments showed that in situations where the elapsed time (and hence actual progress) is held constant, path characteristics systematically influence consumer choice and their willingness to pay for a service. While the results consistently point to the need to pay attention to path characteristics, one criticism of these experiments is the possibility that by holding elapsed time constant, we artificially increased the salience of path characteristics. This criticism was somewhat valid in some of the experiments, but in other cases (Experiments 2, 4 and 5) subjects chose between a control option and a test option that differed both in
elapsed time and path characteristics. Yet, we wanted to establish that path characteristics are more than a marginal factor that operates only when elapsed time is held constant. Experiment 6 was designed with this objective.

**EXPERIMENT 6**

The specific goal of this experiment was to establish that consumers would be willing to choose a path with a greater elapsed time if the degree of virtual progress was higher relative to a path with shorter elapsed time but poorer virtual progress.

**Design and Procedure:** We used a 2 (Elapsed Time) x 2 (Virtual Progress) between subjects design. Non-student subjects (adults recruited at a popular museum in Chicago) were paid $1 to participate. Stimuli were based on the “Traveling in Longland” setup used in Experiment 6, except that subjects chose between two routes connecting cities 600 miles apart. The control option was identical for all subjects (with a uniform velocity over an elapsed time of 7 hours) and the test option differed along the above manipulations. All control and test journeys involved brief stops at two stations. The *elapsed time* of the test option was either 10 hours (short) or 11 hours (long); the virtual progress was manipulated to be either *high* or *low*. In the *high progress* condition, the path was a uniform velocity between start and destination interrupted only with brief stops at two stations. In the *low progress* condition, the journey started off with a negative displacement towards the first stop and was followed by an idle period after which the journey moved at a uniform velocity (interrupted by one brief stop) towards the destination. All segments of each journey happened with the same speed. The four test paths and the control path are shown in figure 6.

After reading the scenario, we asked subjects to indicate their relative preference (PREF) between control option (priced at $400) and test option (priced at $250 in all conditions). Higher PREF scores represent greater preference – and hence higher evaluation - for the test option.

**Results:** The mean PREF scores for each experimental condition are shown in Table 5 (n=30 in all conditions).
As expected, a 2 x 2 ANOVA showed significant main effects of both factors – Elapsed time ($F_{1,116} = 5.58, p < 0.02$) and Virtual Progress ($F_{1,116} = 27.77, p < 0.001$). As can be seen, the Virtual Progress has a higher level of significance than elapsed time and a larger effect. Further, we were specifically interested in a preplanned contrast between the two shaded conditions (2 and 3) in the table above. The contrast shows that the evaluation of the long elapsed time – high virtual progress condition is significantly greater than that of the short elapsed time – low virtual progress path ($F_{1,116} = 4.23, p < 0.05$). This result implies that subjects indicated a higher preference to the path long with...
elapsed time (contrary to the economic “cost of time” argument) if the virtual progress for that path was higher as compared to the shorter path.

**Conclusion:** This suggests that virtual progress / path characteristics influence consumer decisions to the extent that consumers show greater preference for longer paths that have high virtual progress. Thus, consumers are willing to sacrifice time for the sake of a high virtual progress path and hence path characteristics are not simply a marginal factor that only play a role when the elapsed time is held constant.

**GENERAL DISCUSSION AND CONCLUSIONS**

**Summary of Research:**

This paper looks at situations in which consumers chose between services that transport them from a start state to a destination state over a period of time. While an opportunity cost based evaluation of such services would depend only on the price and the elapsed time required for the completion of the services, we argue that certain path characteristics can also influence choice behavior by conveying a perception of progress during the elapsed time. Specifically, we offer an analytical model of consumer choice and experimentally show that the presence of idle time in the elapsed path and the presence of a segment where negative displacement occurs reduce the choice likelihood. Further, this effect is weakened when the idle or negative displacement occurs late in the elapsed time period.

Based on the studies presented in this paper, we conclude that certain path characteristics contribute to a perception about the progress made during the elapsed time and influence choice even though the final outcome might be identical to other services. Since these path characteristics influence only the perception of progress and not actual progress, we refer to it as virtual progress.

Our empirical work showed that the effects of virtual progress were rather robust. We consistently found support for our predictions across three different domains, with between-subjects as well as within-subjects designs, with binary choice measures as well as relative preference measures (that did not force subjects to make a choice), with graphical as well as tabular representation of information and using both student subjects as well as “real consumers” in settings that were realistic and relevant to the choice task. Further, by collecting data from a number of contexts and by measuring the belief that the service would progress as shown as well as perceptions of progress
towards destination (i.e. PATH and PROG measures), we were able to eliminate alternative explanations for our results (e.g. the results are unique to physical transport, subjects might expect the non-stop uniform paths to be more likely to reach on schedule etc.) and also show that perceived progress actually explained choice behavior. The robustness of the phenomenon is a testimony to its theoretical and practical importance.

Theoretical and Managerial Implications.

While a growing body of research on consumer evaluation of experiences has recently evolved, our paper is the first to study perceived progress as a characteristic of such experiences. Research in the area of organizational behavior and social psychology has studied the importance of goals in achieving success and in subjective well-being (cf. Brunstein 1993, Sheldon and Kasser 1995). However, surprisingly little research (and, to our knowledge, none in marketing) has been done on people’s predictions about their experiences as they work to achieve a goal. To our knowledge, the present research is the first to identify perceived progress as a predictor of utility and choice.

Our results in the domain of transportation services may have implications for the well-being of individuals who are working to achieve a goal. We predict that people will like to receive feedback from the environment telling them that they are making progress towards their goal. In the absence of knowing about their progress, people might experience frustration and hence be poorly motivated to work further towards their goal.

While these results are interesting from a purely theoretical standpoint, they have important managerial implications for the design and marketing of services. Results from the experiments suggest that it is important for service providers to ensure that consumers feel that they are moving towards their final destination. Specifically, service providers should attempt to start services as soon as possible, avoid negative displacement, minimize idle times and attempt to “fill” the idle times with perceptions of progress. It is also important to create perceptions of progress in other settings, i.e. for consumers waiting in queues. Our results suggest that a queue discipline in which consumers can actively see the rate of progress (e.g. a queue which physically moves as consumers are serviced) will result in better service evaluations as compared to another in which the rate of progress is not transparent. In short, while the price and elapsed time of a service influence choice behavior, it is important to create a perception of “being on the move” to increase consumer evaluation and choice.
Limitations and Future Research:

The present research was not without limitations. We provided an analytical account and experimental support of consumer choice behavior and showed that a perception of progress mediates the effect of path characteristics on choice. However, an investigation of the psychological antecedents of this perception was beyond the scope of the present paper. Our analytical model is behavioral in nature and is not intended to describe the psychological processes that consumers follow. Based on prior research, the underlying process may be purely affective with consumers experiencing annoyance and frustration during idle times or periods of negative displacement (Larson 1987). Alternately, the underlying process may be perceptual, with the presence of idle time and negative displacement increasing the perceived elapsed time (Osuna 1985). Future research could investigate such psychological antecedents in order to offer a process-based explanation of the virtual progress effect.

Second, we note that the present research is an account of consumer choice made prior to entering the service situation, and we argue that this choice is based on the predicted utility as assessed at the time of making the choice. Prior research in the area of sequences and experiences over time has tended to study retrospective effects. Some of our results seem inconsistent with this prior research at first blush. For instance, Carmon and Kahneman (1996) report that retrospective evaluation is significantly lowered when idle occurs towards the end of a service, while our model and results show that late idle is not as damaging as early idle. One question of interest, therefore is whether the predicted utility actually captures how consumers feel during the course of the service, and at its conclusion.

Researchers have documented, in a variety of different contexts, that people are not very good at predicting their future behavior (cf. Soman 1998), tastes and preferences (Kahneman and Snell 1990). In the domain of transportation services, some recent research has started investigating the relationship between choice likelihood and retrospective and online evaluations. We demonstrate elsewhere (Soman 1999) that obstacles like idle and negative displacement also affect the retrospective evaluation in the same manner as they affect choice. However, while late obstacles are better than early obstacles for anticipated value and choice likelihood (as we showed here), late obstacles reduce retrospective evaluations significantly more than early obstacles (Carmon and Kahneman 1996, Soman 1999). These results seem to suggest that due to low predicted utility, consumers may not choose
services that they would have retrospectively evaluated highly. The predicted utility of a service experience may not be a good indicator of the utility that consumers would actually get from the experience.

Third, we manipulated the perception of progress by holding the goal constant (reaching the destination state without concern for intermediate states) but changing the path characteristics. An alternative approach would be to not only manipulate path characteristics but also the goal. For example, suppose the consumer’s goal was not only to reach the final destination but also to accomplish some work on the train. We would speculate that path characteristics would have less of an effect on choice behavior in this situation. While this approach was beyond the scope of our present investigation, future research should attempt to investigate such implications of our framework in more detail.

Fourth, we did not study the effects of repeated decision making on decision making. The relevant research question is whether the effects of virtual progress weaken with expertise and experience. While we do not have answers to these questions and leave the issue for future research, we would like to offer some speculations. First, it is likely that extremely frequent users of transportation services quickly realize the “non optimality” of using virtual progress in their decision making and hence quickly converge towards an elapsed-time-only model. Examples of such consumers are daily users of the subway trains in large cities like Hong Kong where a number of possible paths are available to travel between certain central locations. However, consumers in infrequent commuting situations (e.g. flights) might still be susceptible to the effects of virtual progress. Second, expert consumers are likely to use a decision-making strategy in which they anticipate how they would feel at the conclusion of the service (Shiv and Huber 2000). As we discussed earlier, this concluding evaluation will be influenced more by late obstacles than early ones. Hence, to the extent that consumers weight their anticipated satisfaction in making choice decisions, we expect that the effects of time discounting in our model will be weakened. However, we would still expect a preference for paths without idle or negative displacement.

Fifth, one interesting extension of this research relates to the study of how consumers structure tasks that have a fixed total quantity but are comprised of a number of parts of varying sizes. Our theoretical development suggests that consumers may like to structure the task in such a manner as to
achieve early perception of progress. Consequently, they may prefer to get a larger number of easier tasks done early and leave the longer ones for the end. Other routine decisions and evaluations like decisions to take a break, renege from a task, speed up performance or refresh and restart the effort are all related to perceptions of progress and represent fruitful avenues for future research.
REFERENCES


**FOOTNOTES**

1 We use the term “transport” to refer to physical transport (e.g. flights, trains) while we use the term “transportation” more generally to include all services that move consumers from one state to another.

2 This illustration is not meant to be a controlled experiment, rather an illustration of the kinds of paths that we believe do not convey a sense of progress.

3 We assume that the basic nature of the experience is not affected by the path characteristics. Specifically, irrespective of the velocity profile of a plane or train journey, the consumer remains seated and is surrounded by a similar environment for the duration of the journey. Similarly, the rate of arrival of new machine tools for a new shopfloor does not change the efficiency and productivity of the current manufacturing shop. And finally, the rate of change of a patient’s glucose level is assumed to not change the overall quality of the rest of his life.

4 Details are available with the authors.

5 Equation (4) reflects constant loss aversion. Alternately, one could consider a more complicated utility function with diminishing sensitivity, but the extra complexity does not change the nature of the results derived later.

6 Detailed proofs of all results are available from the authors.

7 In situations where fictitious train names, distances and timings had to be used to fit stimulus requirements, we took care to select geographic locations that our subject population would have little familiarity with in order to make the stimuli believable. Further, in cases where the arrival and departure cities were in different time zones, information was presented both in local times (to maintain realism) and in the equivalent time of the zone in which data was collected (to avoid any effects due to incorrect time calculations).

8 One of Murphy’s laws is “the other line (queue) always move faster”. People probably choose the queue in which consumers seem to be making more progress, only to find out that this perceived progress was virtual and that other queues were just as good, or perhaps even better.