

The Impact of Mode and Mode Transfers on Commuter Stress

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SUMMARY AND CONCLUSIONS

This paper reports on a natural experiment which studied groups of commuters who are equivalent in most important demographic respects, and who had equivalent commuting experiences, but were differentially affected by a new and improved mass transit (rail) route to work. These commuters changed a significant aspect of their commute, but did not change other critical aspects of their lives (e.g., the start and end points of the trips, the jobs they go to, the homes they return to), so that commuting changes were not confounded with other life changes. This study also provided the opportunity to experimentally study - and longitudinally follow - the impacts of this major change in travel time and number of mode transfers in a much more controlled fashion than has been possible heretofore. Our study provided a quasi-experimental design with both cross-sectional and longitudinal comparisons, allowing us to look at within subject differences (how responses vary for people whose trip changes) as well as between subject differences (variation among commuters with different home to work trips), and allowing us to compare differences within one time period as well as over time.

In addition to this longitudinal study of actual commuters, we also conducted a true experiment using student subjects as simulated commuters, sending them on trips that were identical to those taken by our real commuter subjects, to see if these effects could be replicated under these controlled, even if somewhat more contrived, conditions.

We hypothesized that (i) **persons who travel on the new Midtown Direct Service will experience less stress and be more satisfied with their commute to work;** (ii) these salutary effects will be **caused one or more of several factors:** a. **enhanced perceived control/predictability** over the commute; b. **less effort expenditure to make the commute;** or c. **reduced time of the commute;** and (iii) **women will experience greater commuting stress than men.**

Hypothesis one was supported. Riders on the new Midtown Direct line had lower stress scores on salivary cortisol, a motivation performance measure, and perception of stress scales. Hypotheses two was partially supported. This relationship between the commuting route and stress was mediated by the reduction in commuting time for the new train line. Predictability was related to stress but did

not mediate the difference between routes. Hypotheses three was not supported. There were no significant differences between men and women. Study two largely replicate these results. Students, simulating the routes of real commuters, also showed less stress on the Midtown Direct route than on the Hoboken-PATH route, as measured by salivary cortisol and proofreading scores. Results are discussed in terms of implications of these findings and needs for further research to expand understanding of these phenomena.

RECOMMENDATIONS

This project is a research study which, although it has implications for practice, had as its main focus the development of improved information on stress in the commuting situation. The recommendations at this stage of research, therefore, have to do with ways to further study these phenomena and gain more in-depth understanding into the relationship between the nature of the commute and human stress responses.

First, it is important to replicate these results and in so doing to overcome some of the limitations of the initial research in terms of sample size and variability of conditions. By increasing sample size and variability we may be able to better understand the role played of some of the potential mediator variables. Increased variability will allow us to better understand the effects of a number of factors, including potentially mediating variables, on commuting stress.

Additional study can also benefit by allowing us to look at differences between commuting modes. This project was not able to directly compare car, car pool, and bus commuters with train commuters, or look at changes in stress among those who switch from one mode of travel to another. Such comparisons are extremely rare in the literature and could be especially valuable to understand commuter choices and responses to trips.

Lastly, this study provided some indications of “spillover” effects of the commute, something that has rarely been addressed in the research literature. There are at least two important foci of spillover effects: the home and the workplace. Spillover effects into the home environment, such as negative carryover of stress to relationships with spouse or children, could be vitally important to the

commuter's overall sense of life satisfaction and well-being. This study hinted at such effects. There is also some indication in the research literature that there are also spillover effects from commuting stress in the workplace. These impacts on such things as absenteeism, productivity and employee satisfaction, for example, could affect economic productivity on the micro and macro scale, as well as commuter well-being. More intensive study of spillover effects in both these spheres is clearly called for.

New Jersey Transit is currently in process of constructing two new transit improvements that closely parallel and compliment the Midtown Direct as a research focus. These are the Montclair Connection and the Secaucus Transfer, both of which will provide significant improvements for commuters in time and ease of trip. Most or all of the above questions could well be addressed by studying commuters affected by these new improvements, again collecting data before as well as after the improvements are made operational. Between them they provide almost optimal conditions for further study. They include improvements that closely parallel the Midtown Direct Service (mostly in the Montclair Connection), as well greater variety of conditions and populations served (mostly in the Secaucus Transfer).

INTRODUCTION

Objectives

There is ample reason to believe that the nature of the trip to work can have a significant effect on the level of stress and overall well-being of the commuter. Indeed, the work commute can encompass a large, and often most time-urgent, part of the commuter's work day. This study reports on a natural experiment in which groups of commuters who are equivalent in most important demographic respects, and who had equivalent commuting experiences, were differentially affected by a new and improved mass transit (rail) route to work. This provided a rare research opportunity to collect ecologically valid data in a setting where critical variables were naturally manipulated. We were able to study a large number of commuters who changed a significant aspect of their commute, but in so doing, did not change other critical aspects of their lives (e.g., the start and end points of the trips, the jobs they go to, the homes they return to). Commuting changes, in this case, were not

confounded with other life changes.

This study also provided the opportunity to experimentally study - and longitudinally follow - the impacts of this major change in travel time and number of mode transfers in a much more controlled fashion than has been possible heretofore. Most other studies of commuting stress do not look at mass transit and, in addition, are correlational and cross sectional in design - comparing people who have different commuting situations. Our study, on the other hand, provides a quasi-experimental design with both cross-sectional and longitudinal comparisons, allowing us to look at within subject differences (how responses vary for people whose trip changes) as well as between subject differences (variation among commuters with different home to work trips), and allowing us to compare differences within one time period as well as over time.

In addition to this longitudinal study of actual commuters, we also conducted a true experiment using student subjects as simulated commuters, sending them on trips that were identical to those taken by our real commuter subjects, to see if these effects could be replicated under these controlled, even if somewhat more contrived, conditions.

Background

Commuting and well being

There are a small number of studies of commuting and human health and well being. Most of the research has focused on what characteristics of commuting, particularly traffic congestion, influence human well being. A few studies have also examined commuting mode and the number of stages or mode transfers as potentially critical factors in the commuting experience. Following a review of these studies, we discuss in some detail problems with this literature and the need for greater conceptual clarity in building a model of what makes commuting stressful.

Studies have demonstrated that commuting by car and by train elevates psychophysiological parameters like blood pressure and neuroendocrine processes indicative of stress relative to resting baseline comparison. ^(1,2)

These markers of psychophysiological stress are important for at least two reasons. First, they provide objective evidence that the commuting experience is stressful. Second, these psychophysiological measures have been directly

implicated in the development of cardiovascular disease and in suppressed immune functioning. ^(3,4)

While these studies and others like them clearly show that commuting whether by train or car elevates cardiovascular and neuroendocrine parameters, they beg the question of what factors in the commuting experience explain its harmful effects. (see ^{5, 6} for reviews) Most attention has been paid to traffic congestion as the primary causal factor leading to elevated stress from commuting. Unfortunately, although the data are clearly supportive of this hypothetical explanation, all of the field studies completed to date are weak cross sectional designs, comparing individuals commuting to work under variable levels of congestion. Several studies have shown correlations between levels of traffic congestion and elevated blood pressure among automobile commuters. ^(7, 8, 9) Evans and Carrere ⁽¹⁰⁾ found elevated blood pressure and neuroendocrine hormones (catecholamines) among urban bus drivers as a function of traffic congestion.

One very important exception to the above cross sectional studies is an experiment in which the same person drove different road stretches for short time periods. The road stretches varied both in traffic volume levels and in number of intersecting roads. Both of these factors elevated skin conductance, a marker of psychophysiological arousal. ⁽¹¹⁾ This is the only longitudinal investigation of commuting stress and as such counters criticisms that the prior field investigations suffer from serious confounding variables, particularly as related to self-selection biases.

Both Knox ⁽¹²⁾ and Novaco and colleagues ⁽¹³⁾ showed that traffic congestion is also related to absenteeism at work. Furthermore, Koslowsky and Krausz ⁽⁵⁾ have linked traffic congestion during the work commute to job satisfaction. Greater congestion is also associated with more negative affect, including feelings of irritation, frustration, anxiety, and general annoyance ^(10, 7, 9) and reduced job, satisfaction ⁽⁵⁾ and residential satisfaction, particularly for women. ⁽¹⁴⁾

Several investigators reasoned that since commuting is stressful, adverse effects might also be manifested immediately following the commute in tasks known to measure motivation or persistence. Measures of stressor aftereffects have long

been employed in the psychological stress literature ⁽¹⁵⁾ and are believed to index deficits in motivation or helplessness, following exposure to a negative, uncontrollable event. ⁽¹⁶⁾ Greater traffic congestion has been associated with decreased task motivation following exposure by Novaco et al., ⁽⁷⁾, Schaeffer et al. ⁽⁸⁾ and Stokols et al. ⁽⁹⁾.

Because commuting by mass transit frequently exposes people to crowding, Lundberg investigated what role crowding on passenger trains might have in influencing the stressfulness of the commute experience. Similar to laboratory and field studies of crowding (see ¹⁷ for a review), the higher the level of density on the train, the greater the levels of both perceived stress and neuroendocrine indicators. ⁽¹⁸⁾ Singer et al. ⁽²⁾ replicated these effects.

Differences among modes of transport

Another characteristic of commuting that may impact its stressfulness is mode of transport. Two studies have compared car pooling to solo driving, finding that driving a car pool leads to the greatest level of stress, comparing solo drivers, car pool passengers, and car pool drivers and that car pool passengers experience somewhat greater stress than car pool drivers. ^(8, 19) Taylor and Pocock ⁽²⁰⁾ found greater levels of absenteeism among car drivers relative to users of mass transportation in London. Both number of days as well as the number of absence spells were greater among car drivers.

A final factor that may contribute to the stressfulness of commuting, particularly mass transportation, is the number of stages of the commute. A stage is defined as any change in the mode of transportation or having to move from one vehicle to another even if within the same mode (e.g., changing trains). Walking for some minimum period (e.g., five minutes in one study) is also considered a stage.

In the most extensive investigation of this topic, Taylor and Pocock ⁽²⁰⁾ examined a large number of office workers in the same London firm. Absenteeism from work was significantly correlated to the number of stages. Those with more than two stages had increased health risk. The average number of stages among this one group of London commuters was 2.84 stages. Similarly, car drivers who had to make more road changes or who used a larger number of highways, had greater absenteeism at work. ⁽¹³⁾

Perceived stress and control

Underlying explanations of commuting impacts have focused on the concepts of perceived stress and control. Novaco and colleagues have shown that objective traffic congestion significantly overlaps but is not isomorphic with perceived traffic congestion; that subjective traffic congestion and objective traffic congestion have varying effects on stress outcomes; and that some of the effects of objective levels of traffic congestion on symptoms are eliminated or substantially attenuated, when subjective measures of perceived traffic congestion are statistically partialled out. (13,14) Koslowsky and Krausz (5) have found similar effects, utilizing a different measure of perceived congestion and job satisfaction as the outcome variable. These findings while interesting are limited to self-report measures which is a major shortcoming in the test of the model. More research has focused on control as an important psychological process involved in the commuting experience.

Singer et al. (2) in their study of train commuters found that the longer someone was on the passenger train in the morning commute, the less their stress levels. This paradoxical finding actually makes sense when one considers that the earlier the passenger gets on the train going to work, the greater the degree of choice s/he has about where to sit. More direct evidence for the role of control comes from studies showing that persons with greater levels of residential choice were less negatively impacted by traffic congestion and that individuals with expectations that they can control their environment (internal locus of control) were more negatively impacted by traffic congestion on their daily commute. (7,9) Schaeffer et al (8) also interpreted their finding that congestion had more negative physiological impact on car poolers than drivers in these same terms. The person who could control the commute was less negatively impacted than the one who could not. Finally, Kluger (21) found a significant interaction of commute predictability and perceived traffic congestion on psychosomatic symptoms. Those with more predictability in their commute (e.g., less variance in daily commute time) were less symptomatic when under heavy congestion than those in unpredictable, congested conditions.

In the above studies, control operates as a moderator, an exogenous factor that alters or moderates the relationship between commuting stress and some

outcome measure. Residential choice, greater seat selection and more predictability in the commute were each shown to significantly buffer the adverse impacts of commuting. ^(2, 9, 21) Although these findings suggest that control is an important component of the commuting stress process, they do not directly show that control is an underlying mechanism that explains why commuting stress causes psychophysiological stress or diminished well being. Evans and Carrere ⁽¹⁰⁾ found that higher traffic congestion directly related to less control. Moreover, when they examined the previously significant relationship between traffic congestion and neuroendocrine elevations on the job, statistically partialling perceived control significantly attenuated the congestion-health link, especially in the case of norepinephrine.

Another potential mechanism of particular salience to the present proposal is effort. Although prior studies have not examined this variable, a parsimonious explanation of the commuting stages effects could simply be effort expenditure. It takes more effort, physical and cognitive, to change trains, park and ride, take a train and then walk several blocks, than it does for example to get in one's car and drive to a lot or take a train directly to work. Several studies of noise and crowding have shown that effort expenditure during exposure to these stressors, potentiates the adverse effects of the stressor, particularly on psychophysiological outcomes. ⁽²²⁾

In addition to examining potential, underlying psychological processes such as perceived commuting stress or control, a small amount of attention has been directed at gender differences in reactions to commuting. For both objective and subjective reasons, women may experience greater psychological stress than men when commuting. However women's psychophysiological reactivity to commuting may be more muted than men's.

Psychophysiological reactivity to acute stressors generally shows that men respond with greater levels but careful analyses of this consistent pattern indicates that it is limited to achievement situations ⁽²³⁾. In fact, when men and women are put in a stressful situation that is more aligned with traditional sex roles (taking a child to the hospital), women showed greater physiological reactivity. ⁽²⁴⁾

Research on commuting stress and gender has not carefully examined psychophysiological responses but research indicates that after work, at home in the

evening women employed outside the home take much longer to return to resting baseline levels of neuroendocrine and cardiovascular functioning in comparison to employed men.^(25, 26) These results have been interpreted in light of research suggesting that employed women have higher total workloads than employed men because of their greater proclivity to have fulfill multiple roles vis a vis domestic, family, and work responsibilities. ⁽²⁷⁾ Women are also believed to have much greater fluidity between work and home, whereas males as the principal breadwinner are traditionally protected from many domestic demands.

Novaco et al. ⁽¹⁴⁾ in a preliminary investigation found some evidence for greater commuting stress in employed women compared to employed men. Women in more congested commutes perceived their commute as more stressful than men on similarly congested routes. Overall women also felt much more rushed to get to work on time, were less satisfied with their commuting experiences, perceived less choice in route selection and felt they had more traffic to contend with vis a vis men. Commuting also had more negative impacts on women than on men. Greater congestion had a stronger impact on women's psychological distress levels, their desires to change residential location and marginally impacted negative mood after work and residential satisfaction. Novaco and colleagues did not collect any physiological data.

Summary

There is clear evidence that commuting can cause stress. There is cross sectional data showing linkages between traffic congestion, crowdedness on trains, mode of commuting, and number of commuting stages with multiple indices of stress. Most of these data are focused on traffic congestion, indicating that with greater congestion when driving, cardiovascular and neuroendocrine parameters are elevated, negative affect is heightened, and motivation to persist in problem solving is diminished. Note however that with one exception, all of these data emanate from cross sectional studies. The data on commuting mode is too meager and unclear to draw any conclusions. Some evidence suggests that when more than two stages or mode shifts occur when commuting, absenteeism at work increases. Unfortunately, research on commuting stage effects has not examined more direct, sensitive indices of stress such as psychophysiological parameters or task persistence.

Preliminary research on underlying mechanisms to account for commuting stress suggests that perceived stress related to traffic congestion may mediate some of the associations uncovered between objective indices of traffic congestion and self reports of negative affect. Note that this mediational research is all cross sectional and depends solely on self-report measures.

Both direct and indirect evidence point to a key role of perceived control in linking commuting to stress. Environmental or programmatic changes that enhance perceived control over the commute generally ameliorate negative impacts. More directly, congestion itself deteriorates perceived control which, in turn, accounts for some of its negative impacts.

Finally, research on stress and gender, in general, and with commuting stress, specifically, suggests the potential for women to experience more psychological stress than men on comparable commutes. Psychophysiological stress in reaction to commuting, however, may be greater in men than women during the commute, given the tendency of men to respond to acute, achievement-related challenges more dramatically than women.

DESCRIPTION OF PROJECT LOCALE

Context - the nature of the commute.

New Jersey Transit (NJT) operates a number of commuter lines running from suburban New Jersey towards or into New York City (see figure 1). Most of these lines, including those from Western New Jersey that were used in this study, terminated in Hoboken. New York City bound commuters, who are the vast majority of these train riders, had to transfer to a subway that travels under the Hudson River (Port Authority Trans Hudson - or PATH trains) to the World Trade Center, at the downtown or southern end of Manhattan, or to 33rd street in midtown Manhattan.

In 1996 NJT completed a connection that allowed these western suburban trains to switch onto Amtrak tracks so that these trains could go directly into Pennsylvania Station, bypassing Hoboken entirely. This service eliminated a transfer at Hoboken to the PATH trains and reduced the total commute to the midtown 33rd/34th street area by 15 to 20 minutes (see figure 2).

STUDY PROCEDURES

Hypotheses

Our basic hypotheses are: (i) **Persons who travel on the new Midtown Direct Service will experience less stress and be more satisfied with their commute to work.**

(ii) These salutary effects will be **caused one or more of several factors: a. enhanced perceived control/predictability** over the commute; **b. less effort expenditure to make the commute;** or **c. reduced time of the commute.**

Both Averill (²⁸) and Glass and Singer (¹⁶) have discussed the high interrelationship between control and predictability. Initially we will try to determine whether this conceptual overlap also operates in the commuting stress situation. There is some reason to believe, however, that predictability may be more powerful than control as an underlying mechanism to account for either number of mode shift changes or the type of transportation mode. Predictability, both objective and subjective, seems likely to change and vary much more as a function of these two variables than does control per se. Even though one's commute may become more predictable with a shift in mode choice, for example, perceived control over what is essentially an uncontrollable stressor seems largely impervious to such changes. Thus we will first investigate the degree of interdependence of these two measures. If they appear distinct, we will evaluate each of them separately as a potential mediator of the effects of mode shift changes. We conceptualize effort as a distinct construct and thus plan to model its underlying mediational properties separately from control.

(iii). With the exception of psychophysiological indicators, we **expect women to experience greater commuting stress than men.** As reviewed above, some preliminary research by Novaco and colleagues has shown this pattern. Moreover because of multiple, competing workloads experienced by women from both domestic and employment sources, plus greater constraints on their commuting times, we expect women to experience commuting more stressfully than men.

We expect a different psychophysiological pattern however given an abundance of research showing that men respond with heightened psychophysiological reactivity to acute stressors, particularly in an achievement

related context. Commuting is seen as part of the work experience and thus men are expected to react more strongly.

Table 1. Study 1 - Quasi-Experimental Research Design		
	Pre-change data collection travel route for commuters (spring, '96)	Post-change data collection travel route for commuters (after Midtown Direct) Winter, Spring 99
Comparison Group (those who took, and continued to take, the Hoboken/PATH route)	NJT trains to Hoboken... PATH mostly to World Trade Center (<i>downtown Manhattan</i>)	NJT trains to Hoboken... PATH to World Trade Center (downtown Manhattan)
Experimental group (those who switched from the Hoboken/PATH to the new route)	NJT trains to Hoboken... PATH, mostly toward 33 rd St (<i>midtown Manhattan</i>)	NJT trains direct to Penn Station (midtown Manhattan)

Table 2. Measures to be used in experiment and survey

Concept to be measured	Types of information and instruments	
demographic/personal information as control factors	age, gender, race, income, job, type, place of residence, place of employment, family composition, personal and family health history (hypertension/ coronary heart disease), rated negative affectivity	
commuting information	start and end points, mode, times, regularity,	
physiological stress indices	resting & commuting salivary cortisol levels,	
motivation	proofreading	
perceived commuting stress	7 & 5-point scales	
congestion	subjective: rated congestion & crowding	
commuting control & predictability	objective: variability of trip time	subjective: perceived predictability, choices of route, mode, times
commuting effort	perceived degree physical & mental effort, impediments,	
spillover	spouse ratings of subject's health, attitude, affect, behavior	



Figure 1 Commuter route to Manhattan via Hoboken

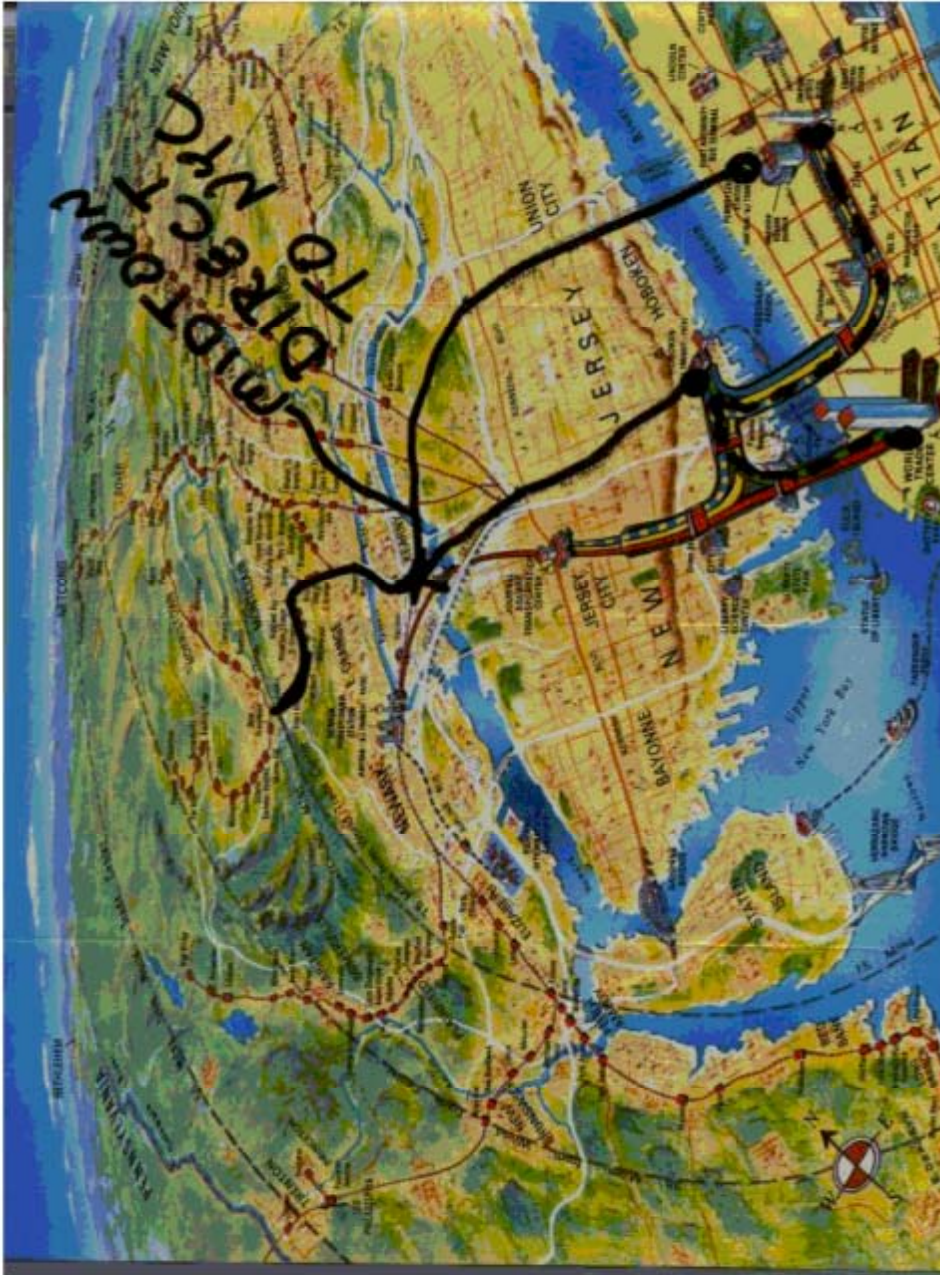


Figure 2. Commuter route to New York via Midtown Direct.

Study 1

Method

Participants

Potential research subjects were recruited from the population of regular home-to-work commuters with flyers and announcements handed out in the New Jersey Transit's Hoboken station. Commuters were asked to sign up for a research project studying the commuting experience and were told that all accepted participants would be eligible for a lottery, for which two prizes would be given - each consisting of 6 monthly passes for New Jersey Transit (potentially worth more than \$700 in total). Subjects had an approximately 1 in 25 chance of winning. Many commuters replied and were initially screened for route (we looked for commuters who took NJ Transit trains daily to Hoboken and, from there, took PATH trains to the World Trade Center or uptown toward 33rd Street in Manhattan). We also screened out subjects with a history of cardiovascular disease or who were regular smokers. A total of 51 subjects were initially chosen and tested in the first stage of testing in June, July and August of 1996. Testing was completed shortly before the new train service to Pennsylvania Station went into operation.

We attempted to contact all subjects a second time, three years later, for the post-change testing. This time, to maximize the number of returning subjects, we offered every participating subject one monthly pass as an inducement. Many subjects, however, had changed jobs (no longer commuted on NJ Transit and/or into Manhattan) or had moved away. A total of 29 of the original subjects were successful recruited for the second testing, and were, therefore, included in the final data analysis. Fifty two percent of these commuters were male, 76% were married, 90% had a college degree, and the median gross income of the sample was above \$85,000.

The data showed no significant differences between the comparison and experimental groups on any of our population variables (type of job, age, gender, income, etc.) , supporting our belief these two groups are more or less randomly drawn from the same population. Even so, and although each participant acted as his or her own control in the longitudinal analysis, concerns about self-selection are

still warranted when true random assignment to the independent variable (experimental versus comparison commuter line) is not possible. Two ways to examine self selection are first, to explore possible differences in the outcome variables prior to the intervention--these data are included in the Results section, and, second, to check on self selection bias by examining the associations between the independent variable and various background characteristics. In fact, the independent variable (the Experimental versus Comparison commuter trip) was unrelated to gender, marital status, educational background, or income level.

Data Collection

For the initial (pre-change) testing, an appointment was made by telephone with all participating commuters to set a date and time at which researchers would meet the subject at the end of the PATH portion of their morning commute. In advance of that day, each subject was mailed a packet with instructions to use on the train the morning of their appointment. The instructions told them to open the envelope at the start of their morning NJT commuting trip to work. The packet instructed subjects to complete the rating scale forms and to open the proofreading envelope upon leaving Newark Broad Street Station (the penultimate stop). They were to work on the proofreading task for 10 minutes, stopping before entering the last station.

When the subjects met the researchers (who were identified by labeled hats and a sign) at the end of their PATH trip, they turned in their completed forms and were handed a salivette - a plastic tube containing an inner tube which held sterile cotton ball. Subjects were instructed to remove the cotton themselves, chew it for 30 seconds, and return it to the tubes, whereupon the researchers labeled it and placed it in cold storage. A second saliva sample was obtained by visiting each subject's home at approximately the same time of day on a non-work day (weekend). Spousal rating scales were mailed to the subjects' houses, for completion and return.

Procedures were the same for the post-change testing, except that the researchers met those using the new Pennsylvania Station line at a designated place inside that station.

Outcome measures

Multimethodological indicators of stress were used. Salivary cortisol, a psychophysiological marker of stress was collected at the same time of day for each commuter on a non-work day and as the commuter disembarked from the train on his/her way to work in the morning. ^(29, 30) The degree of elevation in cortisol while commuting is the marker of psychophysiological stress associated with commuting to work. Salivary cortisol is a sensitive stress index for a period of approximately 30 to 45 minutes. None of the commuting trips were less than 30 minutes. Upon arrival at the final train destination, the participant briefly chewed on a piece of cotton which was then inserted into a plastic tube for subsequent biochemical assay for free cortisol. The radioimmune assay is highly sensitive and reliable. ⁽³¹⁾

Motivation was assessed with a proofreading measure that has been used extensively in the stress literature as a marker of task persistence. ^(15, 16) This measure has been shown repeatedly, both in the laboratory and in the field, to be related to the degree of uncontrollable or unpredictable stressors individuals are confronted with in a task performance situation. Participants were given one of two passages for each commuter trip (i.e., pre and post intervention). The proofreading materials were novel to the participants, consisting of textbook passages from urban sociology and planning materials. The passages were matched for level of difficulty and both type and number of deliberately introduced typographical, spelling, and grammatical errors. The texts are difficult and include challenging theoretical and technical material (see ¹⁶ for details). The percentage of accurate corrections (number of errors detected/total number of errors) is the primary index of motivational performance. Commuters worked on the proofreading task for a ten minute period of their train commute, five minutes prior to disembarking from the train.

Two different indices of perceived commuting stress were assessed. The commuters themselves filled out five point, Likert scales at the end of the train commute while still on the train (e.g., "Commuting to work takes effort", "Overall commuting is stressful for me"). They filled out the perceived stress scale after the proofreading task. The six perceived stress items (alpha=.89) were taken from two

prior studies of commuting stress. (See references ^{13, 14, 19, 21}). The second index of commuting stress consisted of Repetti's (³²) spousal rating scales (1=never - 5=Once a day or more) of marital anger (e.g., "This week my partner took out his [her] frustrations on me", and marital withdrawal (e.g., "This week my partner seemed to have other things on his [her] mind"). Because the two scales were highly intercorrelated ($\alpha=.95$), we collapsed them into one index.

Results

The results are reported in two parts. In part one, we provide descriptive and inferential information on commuter's psychophysiological, motivational behavior, and perceived stress before and after the intervention on the NJ Transit commuter line. Data are presented before and after the intervention for the two separate groups: the comparison group whose commute remained constant and for the experimental group whose commute was altered by the new direct link to midtown Manhattan.

In part two, we examine diminished commuting time, number of mode changes, and perceived predictability, as possible underlying mechanisms that might account for some of the expected reductions in commuting stress created by the new direct link to midtown. For all analyses we first tested for gender interactions, but finding none collapsed all results across gender.

Psychophysiological measure

Salivary cortisol was collected at home on a nonwork day and as the commuter disembarked from the commuter train on a workday. This procedure was repeated on two different occasions, before and after the completion of the new Midtown Direct commuter line. For each occasion the difference score was calculated by subtracting the resting, home baseline measure from the on-the-train commuting measure. Table 3 depicts the home baseline cortisol values and the commuting values for each occasion.

Table 3. Salivary Cortisol (ug/dl) at Rest and Commuting								
Pre-Intervention (before change)					Post-Intervention (after change)			
GROUP	Trip	Home	Commute	Diff. ratio	Trip	Home	Commute	Diff ratio
Comparison group	Hob-PATH - WTC	.29	.63	2.17	Hob-PATH all stops	.37	.74	2
Experimental group	Hob-PATH - 33 rd	.31	.61	1.97	Penn Station	.41	.69	1.68

The difference scores for the comparison and experimental groups at Pre-Intervention are equivalent, $t(24) < 1.0$ as expected. Note two tailed significance levels are reported throughout. At the Post-Intervention the difference scores are significantly smaller for the experimental group who benefitted from the modifications in the commuting train service ($F(1,22)=22.66, p < .001$). Analysis of covariance was used for this analysis, covarying the pre-intervention difference score. The covariance analysis helps control for individual differences in stressor reactivity.

Motivation Performance

Proofreading accuracy, indexed by the percentage of errors correctly found, was determined at the end of the train commute. For the comparison group 56% correct and 55% correct proofreading performance were obtained pre- and post-intervention, respectively. For the experimental group motivation performance was 54% and 61%, respectively (see Table 4). The pre-intervention motivation performance scores are equivalent for the two groups, $t(28) < 1.0$. The post-intervention minus pre-intervention difference scores were compared, indicating significant improvement in motivation performance among the experimental group, relative to the comparison group whose commuting conditions did not change, $t(28)=3.58, p < .001$.

Table 4. Motivation Performance (proofreading)		
% correct.		
	Pre-Intervention	Post-Intervention
Comparison	56%	55%
Experimental	54%	61%

Perceived Stress

Both self-reports and spousal ratings of the commuter's perceived stress were collected before and after the intervention. Self reported stress was evaluated at the end of the train commute and spousal evaluation were done at home on Saturday or Sunday for the prior work week. Initial levels of both indicators of stress were equivalent for the two respective groups prior to the intervention, self-reported stress, $t(27)=1.58$, n.s. and spousal evaluations of the commuter's stress levels, $t(27) < 1.0$ (see Table 5). However following the intervention the difference scores were significantly larger for the experimental group in self reported stress, $t(27)=2.19$, $p < .05$. Although the results are in the expected direction for spousal ratings, there was no significant reduction in stress ratings as a function of the commuting condition, $F(1,18) < 1.0$.

Table 5. Perceived Stress (1=low stress and 5=high stress)			
		Pre-Intervention	Post-Intervention
Comparison	Self	2.95	2.97
	Spouse	2.16	2.10
Experimental	Self	3.39	3.24
	Spouse	2.10	1.81

Underlying Mechanisms

We examined three potential underlying mechanisms to account for the significant reductions in commuting stress associated with the alterations in the NJ Transit commuter line. We tested whether perceived predictability of the commute, the number of commuting mode changes, or reduced commuting time, could account for some of the significant stress impacts of experimental alteration of the one commuting line. Only one of these potential underlying mechanisms, reduced commuting time, significantly changed pre- to post-intervention. From pre-intervention to post-intervention, commuters on the experimental line experienced a reduction of 15.85 minutes whereas the commuters on the comparison line experienced no net change in commuting time, $M = -.25$ minutes. These differences in commuting time saved pre- versus post-intervention were significant, $t(23) = 2.95$, $p < .01$. Note degrees of freedom vary because of missing data.

We tested for mediation by repeating the Phase One analyses above but adding as a statistical control, the change in commute time (pre-intervention commuting time minus post-intervention commuting time). If commuting time is functioning as an underlying mechanism, then the previously significant relation between commuting condition (experimental versus comparison group) and stress indices uncovered in the above analyses would become nonsignificant after statistically partially the amount of change in commute time for each train rider. ^(33, 34)

The previously significant impact of the commuting changes on cortisol became nonsignificant when commuting time savings were included in the analyses as an additional covariate, $F(1,20) = 1.79$, n.s. Proofreading performance was partially mediated by commuting time, as indicated by a marginally significant analysis of covariance, after statistically controlling for time saved, $F(1,20) = 4.08$, $p < .06$. This means that some, but not all, of the effects of the commuting line improvements on motivation are conveyed by time saved. There appears to be both a direct and an indirect (i.e., mediated by time of commute) impact of commuting conditions on motivation. Perceived stress was fully mediated by savings in commuting time pre- to post-intervention, $F(1,20) = 1.47$, n.s.

As noted above, predictability did not mediate the differences between our

experimental and control groups. Predictability was, on average, high in both groups. However, when the data was collapsed across all groups, predictability was related to commuting stress. This relationship was examined by regressing each respective outcome variable onto predictability (statistically controlling for income levels). Both perceived stress and cortisol elevations are significantly higher among those who perceived their commute as more unpredictable (see tables 6 and 7). Home baseline levels of cortisol are not related to predictability. The proofreading scores, although in the expected direction, were not significantly related to predictability.

Table 6. Descriptive data on commute predictability and stress.			
Outcome	Low	Medium	High
Perceived Stress	2.98	3.15	3.22
Cortisol Elevation	.26	.28	.39

Table 7. Regression results for predictability, statistically controlling for income.				
Outcome	b(SE)	R	F(R)	df
Perceived stress	.42 (.16)	.11	7.15**	1,53
Proofreading	-.02 (.04)	.01	<.10	1,52
Cortisol elevation	.16 (.07)	.08	4.24*	1,50

** p<.01

* p<.05

Study 2

Method

As noted above, a potential concerns always exist about self-selection in field studies such as this, where random assignment to the independent variable

(experimental versus comparison commuter line) is not possible. Even though those concerns were addressed in Study 1, methodologically and in the analysis of data, the best response is to replicate the results with a true experiment involving random assignment of subjects to conditions. For that reason, Study 2 repeated the procedures and measures of Study 1, using undergraduate psychology students and high school students as subjects and simulated commuters, randomly assigned to commuting conditions.

Participants

Subjects were recruited from two sources - introductory psychology students completing the experiment as extra credit for their course, and high school juniors and seniors, spending the summer involved in a university-based science and engineering research program, who volunteered to be subjects in this study. Subjects were told that this was a study about the commuting experience and were debriefed as to the research hypotheses after all data was collected. Male and female subjects between the ages of 16 and 20 were used in this study. All participating subjects were entered in a lottery, for which several prizes of a \$25 gift certificate at a music store were awarded.

Procedures

Each subject took two simulated commuting roundtrips from Brooklyn to South Orange, New Jersey, once using a route that used the PATH trains and Hoboken service, and another time using the Pennsylvania Station service. The trips were made on different days, at approximately the same time of day, since cortisol measures are sensitive to time of day changes. Order of trip was varied - half of the subjects took the Hoboken route first and half took it second - so that the data would not be confounded by possible order effects. As subjects arrived for their appointment to make the trip, researchers handed them all necessary tokens/tickets for the trip, clear directions, and instructions/forms for data collection. Subjects completed their trip in Brooklyn where they met a researcher and were given the salivette for the cortisol sample. In order to better simulate the experience of an actual commuter, we attempted to introduce time urgency. Subjects were told trips completed in a briefer time would gain them an extra chance in the lottery. All

student subjects were given packets with rating scales and proofreading tasks to open and complete on the return trip of their “commute,” and were asked for a cortisol sample upon return.

Outcome Measures

We used the same outcome measures as in Study 1, except for the elimination of the spousal stress form. For the students several of the items used in the stress scales for workers did not make sense, so the scale was reduced to two items that were highly correlated (“overall the trip was stressful to me”; “it took a lot of effort to make this round trip”, $\alpha=.77$). These two items were also highly correlated with the six item scale used in the original commuter sample ($\alpha=.88$) suggesting that the two scales are measuring the same thing.

Results

The analyses (two-tailed t-tests) for the simulated commuters (see table 8) show that subjects who traveled on the comparison route (through Hoboken via PATH) demonstrated significantly more stress than did the subjects traveling on the experimental route (through Pennsylvania Station). The salivary cortisol scores show a strong difference ($t=3.53$, $p<.002$), as do the motivation task scores ($t=3.54$, $p<.002$). The perceived stress scale is non-significant, although in the predicted direction.

Table 8. Simulated Commuters - Paired t-tests					
	Group		t	df	signif (p)
	Hob-PATH	Penn			
Cortisol	.13	.25	3.53	19	<.002
Proofreading	34%	59%	3.54	20	<.002
Per. Stress	2.98	2.75	<1.0	20	ns

DISCUSSION

This study took advantage of a rare opportunity to observe the psychological and psychophysiological impact of an infrastructure change that resulted in a significant improvement in the quality of the home-to-work commute for thousands of mass transit riders. Because we made use of this naturally occurring manipulation (the introduction of the Midtown Direct service to Pennsylvania Station, New York), we were able to make comparisons unavailable to previous studies. Our data points tracked commuters across time (before and after the improvement) as well between the different commuting trip options. Because the commuters we studied came from the same population (at time 1, when the all commuters traveled through Hoboken, the data showed no significant differences between these groups), and then diverged into the Experimental (“Midtown”) and Comparisons (“continued Hoboken”) groups, this is both a methodologically sound and ecologically valid quasi-experimental¹ study.

The study was not without difficulties. Because of the high drop-out rate of subjects over the three years between our pre-test to post-test period, our n is small. While the statistical power is appropriate for tests of the main effects of variables, the number of subjects in sub-groups (such as gender) is too small to be confident of positive or null effects. The small n also contributes to the lack of variation in several indices of interest (including predictability and crowding - discussed further below), making it difficult to adequately assess their contributory effects.

The findings clearly demonstrate a relationship between the nature and quality of the commute-to-work on mass transit and psychological/psychophysiological stress, as multiply measured. These findings are further reinforced by the replication in study 2 using “simulated commuters” who were randomly assigned to the same routes.

Several of our major hypotheses were clearly supported:

- *Hypothesis one* - proposing that “persons who travel on the new Midtown Direct Service will experience less stress and be more satisfied with their

¹ the only important distinction between this study and a true experiment is the lack of random assignment of subjects to groups in this study. (³⁵)

commute to work” - was supported. In study 1, the change to the new route which brought commuters to midtown New York without transfers in Hoboken resulted in significantly reduced stress as indicated by physiological measures (salivary cortisol), measures of motivation and persistence (proofreading errors), and by measures of perceived stress.

In study 2 students, acting as if they were commuters, took round trips on the PATH-Hoboken and the Pennsylvania Station route. These subjects also showed significantly reduced salivary cortisol levels and increased proofreading scores on the Pennsylvania Station route as compared to the PATH-Hoboken route. The fact that the results of study 1 was largely replicated in study 2 provides impressive additional support for this finding because: 1) study 2 was a true experiment with random assignment of subjects to conditions, eliminating any remaining concerns over possible self selection biases that could have been a confounding factor in study 1; 2) the subjects in study 2 had the same results without any previous experiences or expectations about these commuting routes or potential changes to the route; 3) the effect was replicated even though the subjects in study 2 were only “simulated commuters” without all the pressures and stresses that may accompany a real trip to work, suggesting that the effect is robust.

- *Hypothesis two* - proposing that “these salutary effects will be caused by one or more of several factors: a. enhanced perceived control/predictability over the commute; b. less effort expenditure to make the commute; or c. reduced time of the commute” - was supported only for the time of commute variable. That is, the only variable that had a significant mediating effect on our stress measures was trip time. When trip time was statistically controlled, by being input as a covariate in an analysis of covariance, the statistical significance of the stress differences between routes disappeared.

Predictability of the trip, however, was significantly and negatively correlated with the level of stress (increased predictability was related to reduced stress), but it did not mediate the measured differences between the routes. That is, entering predictability as a covariate did not eliminate the statistically significant effect of route on stress. Based on findings of previous research, and on widely held

conceptual models of environmental stress, we had expected predictability to be related to stress (as was found) and also to have a mediating effect on any stress differences between the two trips (which was not supported). This seemingly contradictory result may be due to the lack of significant differences in predictability between the two commuting routes. There seems to be something of a “ceiling effect” in that the mean predictability for all groups is rather high. It may be that for highly experience commuters (which most of our subjects were) using well-traveled routes and reliable service, the time of arrival for all commutes, whether a short trip or a longer one, was predictable.

The level of effort expended in the commuting trip did not appear to be related to commuter stress, by any of our measures.

- *Hypothesis three* - proposing that “with the exception of psychophysiological indicators, we expect women to experience greater commuting stress than men” - was not supported. In our sample, women were not significantly different from men on any of the stress measures. This finding does not support results of previous research. Those previous studies, however, largely looked at automobile commuting. It may be that train commuting is a different experience, and that automobile commuting is more stressful to women, as compared to train commuting. However, because of the sample size for the data as broken down by gender (10 men, 16 women) it may be unwise to make too much of this null finding.

Crowding is another variable that could reasonably have been expected to have an impact on the commuting experience, but did not in our studies. Here, too, there was little variation between groups. Crowding was rated high in both conditions, possibly because all subject data was collected during rush hour, when all trains are mostly or very full.

It may be that our measurements of density and crowding were not sufficiently sensitive. We relied on commuter ratings on a LIKERT scale, and were not able to get counts of numbers in a car, or of numbers of standing passengers, for example. There is, in fact, strong anecdotal evidence of differences between the two routes in density and the level of overcrowding (i.e., the number of cars with all seats taken and passengers standing). The new Midtown Direct service was, by many accounts

an overwhelming, though not completely predicted, success. ⁽³⁶⁾ Commuters flocked to the trains on this new route in large numbers. In the first months of service the trains were overwhelmed with ridership and trains on this route still frequently have standing route conditions during peak periods - far more often than do trains on the Hoboken route.

If, indeed, the Midtown Direct service was more crowded than Hoboken trains, one might expect that this would provide additional stress for the commuters on that line, which could reduce or wash out any stress reducing effects resulting from the faster service. The fact that this did not happen, that riders on this route showed reduced stress on all three major measures, even with the purported greater crowding, may be a further argument as to the robustness of the effect. That is, having the shorter, easier and more direct route was stress reducing, even in the face of increased crowding. The relationship of crowding, speed and ease of transit, and stress clearly deserves further study.

Also predicted in previous research but unsupported in this study was a relationship between the number of segments in a commute (that is, how many trains, buses, walking segments in the total trip) and stress or satisfaction. Again, this null effect may be due to lack of variation between conditions. There was very little difference between subjects in the conditions, other than the one additional train taken by Hoboken commuters. Most subjects had either three or four segments to their trip (such as: car - train - train - walk or car-train-walk) - not sufficient variation to show effects, specially with a small sample size.

The results of this research clearly support a relationship between the nature and quality of a mass transit commute and commuter stress. Our data suggest that making the trip easier - psychologically less stressful - most clearly involves making the trip shorter and more predictable. Indeed, it logically follows that if the commuting trip is a stressful experience, then reducing exposure to that experience (making the trip shorter) reduces the resultant stress effects. Predictability of the commute is related to the stress of the trip, but was not, in this case, explanatory of the differences between the two different routes. These effects were shown in the

physiological measure of salivary cortisol, in subjects perception of stress, and in the motivation measure of scores on the proofreading task. Negative spillover effects of this stress at home, as measured by spouse assessments of commuter behavior, were not statistically significant, although they were in the predicted direction (Hoboken commuters showed more stress at home). Since seven of our subjects lived alone, at least by the time of the repeat measurement, the sample size for this variable was especially small.

These findings have potentially important social and personal implications. Other research has suggested that commuting stress can have important negative effects on effectiveness in the workplace. People who experience multiple segments and high congestion in their commute have been found to have increased absenteeism, reduced job satisfaction, and reduced life satisfaction. The impacts of stress on psychological and physical health, including depression and cardiovascular disease has been well documented. Taken from this perspective, the commuting improvement studied here may have wide and potentially powerful benefits for the thousands of commuters, employers and spouses affected.

IMPLEMENTATION

Further Research

While these data provide strong support for the hypothesized relationship between of commuting trip and stress, there is a need for further research to better understand the parameters of those affects and to more closely study important empirical and conceptual aspects of critical variables. There is a need to replicate these results and in so doing to overcome some of the limitations of the initial research in terms of sample size and variability of conditions. The small sample size of this reported study makes it impossible to adequately assess important subgroups, such as whether or not there are significant gender differences among commuters, or whether spouses were affected by commuting stress. By increasing sample size and variability we may also be able to better understand the role played of some of the potential mediator variables. In this initial study, for example, our subject groups were very similar in the number of segments of their commutes, the

predictability of their commutes and the level of crowding on the trains. Increased variability will allow us to look at affects of these factors on stress.

Additional study can also benefit by allowing us to look at differences between commuting modes. This project was not able to directly compare car, car pool, and bus commuters with train commuters, or look at changes in stress among those who switch from one mode to another. Such comparisons are extremely rare in the literature and could be especially valuable to understand commuter choices and responses to trips.

Lastly, this study provided some indications of “spillover” effects of the commute, something that has rarely been addressed in the research literature. There are at least two important foci of spillover effects: the home and the workplace. Spillover effects into the home, such as negative carryover of stress to relationships with spouse or children, could be vitally important to the commuter’s overall sense of life satisfaction and well-being. This study hinted at such effects. There is some indication in the research literature that there are also spillover effects in the workplace. These impacts, on such measures as absenteeism, productivity and employee satisfaction, for example, could affect economic productivity on the micro and macro scale, as well as commuter well-being. More intensive study of spillover effects in both these spheres is clearly called for.

New Jersey Transit is currently in process of constructing two new transit improvements that closely parallel and compliment the Midtown Direct as a research focus. These are the Montclair Connection and the Secaucus Transfer, both of which will provide significant improvements for commuters in time and ease of trip (See Figure 3). Most or all of the above questions could well be addressed by studying commuters affected by these new improvements, again collecting data before as well as after the improvements are made operational. Between them they provide almost optimal conditions for further study. They include improvements that closely parallel the Midtown Direct Service (mostly in the Montclair Connection), as well greater variety of conditions and populations served (mostly in the Secaucus Transfer).

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APPENDICES

Appendix 1) Background screening questionnaire

ALL OF THE INFORMATION COLLECTED IN THIS SCIENTIFIC STUDY IS **CONFIDENTIAL** AND **ANONYMOUS**. This section is necessary to show that we have a representative sample of commuters.

Name _____

Marital/living situation _____

Number of children [total ____] [living in your home ____]

Education Level (check highest level completed)

9 some high school 9some college/AA 9advanced degree

9 high school 9college (BA/BS)

9 technical school 9some graduate work

Occupational field _____ **Job title** _____

Check the category that describes your gross **household income**.

9\$15,000 - \$25,000 9\$45,001 - \$55,000 9\$75,001 - \$85,000

9\$25,001 - \$35,000 9\$55,001 - \$65,000 9\$85,001 - \$95,000

9\$35,001 - \$45,000 9\$65,001 - \$75,000 9 > \$95,000

Race/Ethnicity: _____

African-American Asian American Caucasian Latino/Chicano

Native American Other (please describe)

IMPORTANT: The question below refers to your experience **commuting to work**.

1. When you arrive at your office, generally, how do you feel? Mark the line below with an "X" at the point that reflects how you generally feel when you arrive at work.

VERY SOMEWHAT NEUTRAL SOMEWHAT VERY

tense _____ _____ _____ _____ _____ relaxed

friendly _____ _____ _____ _____ _____ irritable

intolerant _____ _____ _____ _____ _____ tolerant

tired _____ _____ _____ _____ _____ energetic

happy _____ _____ _____ _____ _____ sad

carefree _____ burdened

contented _____ frustrated

TODAY'S COMMUTE For each leg of your commute **to work** today indicate the mode, place, time, and level of occupancy.

- (i). Walking is a mode. Each train change is a separate mode.
- (ii). Provide number of people, when you got on.
- (iii). Indicate total number of seats train/bus holds.
- (iv). Indicate with an "X" if you had **no** seat.

<u>Mode</u>	<u>Place</u>	<u>Time</u>	<u>Number of</u>	<u>Number of</u>	<u>No Seat</u>
		<u>people</u>	<u>seats</u>		

Please describe if anything unusual happened on your commute today that might have affected how you answered this questionnaire.

_____ Nothing unusual.

DATA PICKUP PROCEDURES

POLYTECH TRAIN PICKUP - SPRING 1999

- ___ Collect the questionnaire envelope.
 - ___ Check to make sure all pages of questions and proofreading are in the envelope.
 - ___ Check that times are written on proofreading sheet.
 - ___ Check that name is on envelope.

WORDING OF QUESTIONS TO ASK :

- ___ Did any unusual events happen on today's trip?
- ___ Sometimes people forget the instructions not to eat or smoke. Did you eat
 - or smoke since leaving Poly?
 - ___ How many cigarettes did you smoke?

- ___ Perform salivette test.
 - ___ Label salivette with date, Hoboken or Penn., 1st or 2nd run, and Subject #.
 - Examples : 499 - H - 1 - 01 (4/99, Hoboken, 1st run, subject # 1)
 - 499 - P - 2 - 22 (4/99, Penn. Station, 2nd run, subject # 22)
 - ___ Place salivette in box and into Igloo.

Appendix 3) Proofreading task 1& 2 (with scoring sheets)

PROOFREADING

Instructions

This is a proofreading task. There are errors in the following text. Your task is to proofread the material. You will not be tested on the content of the text. You are only asked to proofread the text as quickly and as accurately as possible. There is a ten minute time limit on the proofreading, and the experimenter will tell you when the time is up. Read each page of the text carefully. Underline the errors you discover in the text, but don't make corrections. Errors may consist of misspellings, grammatical mistakes, incorrect punctuation, capitalizations, and typographical errors. Again, underline the errors, but don't make corrections.

“Slumming and unslumming”

from *The Death and life of a Great American Cities*, by Jane Jacobs, copyright 1961
Random House, Inc.

Slums and their populations are the victims (and the perpetrators) of seemingly endless troubles that reinforce each other. Slums operate as vicious circles. In time, these vicious circles emmesh the whole operations of cities. Spreading slums requires even greater amounts of public money – and not simply more money for publicly financed improvement, or to stay even, but more money to cope with ever widening retreat and regression. As needs grow greater, the wherewithal grows less.

Our present urban renewal laws are an attempt to break this particular linkage in the vicious circles by forthrightly wiping away slums and their populations, and replacing them

with projects intended to produce higher tax yields, or to lure back easier populations with less expensive public requirements. The method fails. At best: it merely shifts slums from here to there, adding its own tincture of extra hardship and disruption. At worst, it destroys neighborhoods where constructive and improving communities exist and where the situation calls for encouragement rather than destruction.

Slum shifting fails because it tries to overcome causes of trouble by dithering with symptoms. Sometimes even the very symptoms that preoccupy the slum shifters are, in the main vestiges of former troubles rather than significant indications of future ills.

Conventional planning approaches to slum and slum dwellers is thoroughly paternalistic. The trouble with paternalists is that they want to make impossible profound changes, and they choose impossibly superficial means for doing so. To overcome slums, we must regard slum dwellers as people capable of understanding and acting upon their own self-interests, which they certainly are. We need to discern, respect and build upon forces for regeneration that exists in slums themselves, and that demonstrably work in real cities. This is far from what is done to day.

Vicious circles, to be sure, are hard to follow. Cause and effect become confused precisely because they do link and re-link one another in such complicated ways.

Yet there is one particular link that is crucial. If it is broken (and to break it is no simple matter of supplying better housing), a slum spontaneously unslums.

The key link in a perpetual slum is that too many people move out of it too fast – and in the meantime dream of getting out. This is the link that has to be broken if any other efforts at overcoming slums are to be of the least avail. This is the link that actually was broken and has stayed broken in places like North End, or the Back-of-the-Yards in Chicago, or North beach in San Francisco, or the unslummed former slum in which I live. If only a

handful of American city slums had ever managed to break this link, we might regard them skeptically as grounds for hope. These places might be freaks. More significant are the great number of slum neighborhoods in which unslumming starts, goes unrecognized, and too often is discouraged or destroyed. The portions of East Harlem in New York which had proceeded far along in unslumming were first discouraged by unavailability of necessary money; then where this slowed the unslumming process but still did not bring aggression to slum conditions, most of these neighborhoods were destroyed outright – to be replaced by projects which became almost pathological displays of Slum troubles. Many areas in the Lower East side which have started unslumming have been destroyed. My own neighborhood, as recently as the early 1950's was saved from disastrous amputation only because its citizens were able to fight city hall and even at that, only because the officials were confronted with embarrassing evidence that the area was drawing in newcomers with money, although this symptom of its unslummed status was possibly the least significant of the constructive changes that had occurred unnoticed.

Herbert Gans, a sociologist at the University of Pennsylvania, has given, in the February 1959 Journal of the American Institute of Planners, a sober but poignant portrait of an unrecognized unslumming slum, the West End of Boston, on the eve of its destruction. The West Ends, he points out, although regarded officially as a slum, would have been more accurately describes as a “stable, low-rent area”. If, writes Gans, a slum is defined as an area which “because of the nature of its social environment can be proved to create problems and pathologies’, than the West End was not a slum. He speaks of the intense attachment of residents to the district, of its highly developed informal social control, of the fact that many residents had modernized or improved the interiors of their apartments – all typical characteristics of an unslumming slum.

Unslumming hinges, paradoxically, on the retention of a very considerable part of a slum population within a slum. It hinges on whether a considerable number of the residents and businessmen of a slum find it both desirable and practical to make and carry out their own plans right there, or whether they must virtually all move elsewhere.

I shall use the designation “perpetual slums” to describe slums which show no signs of social or economic improvement with time, or which regress after a little improvement. However: of the condition for generating city diversity can be introduced into a neighborhood while it is a slum, and if any indications of unslumming are encouraged rather than thwarted, I believe there is no reason that any slum need be perpetual.

The inability of a perpetual slum to hold enough of its population for unslumming is a characteristic that starts before the slum itself starts. There is a fiction that slums, in forming malignantly supplant-healthy tissue. Nothing could be farther from the truth.

The first sign of an incipient slum, long before visible blight can be seen, is stagnation and dullness. Dull neighborhoods are inevitably deserted by their energetic, ambitious, affluent citizens, and also by their young people who can get away. They inevitably fail to draw newcomers by choice. Furthermore, aside from these selective desertions and the selective lack of vigorous new blood, such neighborhoods eventually are apt to undergo rather sudden wholesale desertions by their non-slum populations.

Nowadays, the wholesale desertion by non-slum populations which give a slum its initial opportunity to form, are sometimes blamed on the proximity of another slum (especially if it is a Negro slum) or on the presence or proximity of another slum Jewish or Irish families. Sometimes the desertion is blamed on the age and obsolescence of dwellings, or on vague, general disadvantages such as lack of playgrounds or proximity of factories.

However, all such factors are immaterial. In Chicago, you can see neighborhoods only a block or two blocks in from the Lakefront parkland, far from the settlements of minority groups, well endowed with greenery, quiet enough to make one's flesh creep, and composed of substantial, even pretentious buildings. On these neighborhoods are the literal signs of desertion; "For Rent," or "To Let," "Vacancy" Rooms for permanent and Transient Guests," "Guest Welcome," "Sleeping Rooms," "Furnished Rooms," "Unfurnished Rooms," "Apartments Available." These buildings have trouble drawing occupants in a city where the colored citizens are cruelly overcrowded in their shelter and cruelly overcharged for it. The buildings are going begging because they are being rented or sold only to whites – and whites, who have so much more choice, do not care to live here. The beneficiaries of this particular impasse, at least for the moment, turn out to be immigrating hillbillies, whose economic choice is small and whose familiarity with city life are still smaller. It is a dubious benefit they receive: inheritance of dull and dangerous neighborhoods whose unfitness for city life finally repelled residents more sophisticated and competent than they.

Sometimes to be sure, a deliberate conspiracy to turn over the population of a neighborhood does exist – on the part of real estate operators who make a racket of buying houses cheaply and panicking people and selling them at exorbitant prices to the chronically housing-starved and pushed-around colored population. But even this racket works only in already stagnated and low vitality neighborhoods. (Sometimes the racket perversely improves the neighborhood's upkeep, when it brings in colored citizens more competent in general and more economically able than the whites they replaced; but the exploitative economics sometimes results instead in replacement of an uncrowded, apathetic neighborhood with an overcrowded neighborhood in considerable turmoil.)

If there were no slum dwellers or poor immigrants to inherit city failures, the problem of low-vitality neighborhoods abandoned by those with choice would still remain and perhaps would be even more troubling. This condition can be found in parts of Philadelphia where “decent, safe and sanitary” dwellings go empty in stagnated neighborhoods, while their former populations move outward into new neighborhoods which are little different, intrinsically, from the old except that they are not yet embedded by the city.

It is easy to see where new slums are spontaneously forming today, and how dull, dark and undiverse are the streets in which they typically form, because the process is happening now. What is harder to realize, because it lies in the past, is the fact that lack of lively urbanity has usually been an original characteristic of slums. The classic reform literature about slums does not tell us this. Such literature – Lincoln Steffens’s *Autobiography* is a good example – focused on slums that had already overcome their dull beginnings (but had acquired other troubles in the mean time). A teeming, bustling slum was pinpointed at a moment in time, with the deeply erroneous implication that as a slum is, so it was – and as it is, so it shall be, unless it is wiped away root and branch.

The unslummed former slum in which I live was just such a teeming place by the early decades of this century, and its gangs, The Hudson Dusters, was notorious throughout the city, but its career as a slum did not begin in such bustle. The history of the Episcopal chapel a few blocks down the street tells the tale of the slum’s formation, almost a century ago in this case. The neighborhood had been a place of farms, village streets and summer homes which evolved into a semisuburb that became embedded in the rapidly growing city. Colored people and immigrants from Europe were surrounding it; neither physically nor socially was the neighborhood equipped to handle their presence – no more, apparently, than a semisuburb is so equipped today. Out of this quiet residential area – a charming place, from

the evidence of old pictures – there were at first many random desertions by congregation families; those of the congregation who remained eventually panicked and departed en masse. The church building was abandoned to Trinity parish, which took it over as a mission chapel to minister to the influx of the poor who inherited the semisuburb. The former congregation re-established the church far uptown, and colonized in its neighborhood a new quiet residential area of unbelievable dullness; it is now a part of Harlem. The records do not tell where the next preslum was built by these wanderers.

The reason for slum formation, and the processes by which it happens, have changed surprisingly little over the decades. What is new is that unfit neighborhoods can be deserted more swiftly, and slums can and do spread thinner and farther, than was the case in the Days before automobiles and government-guaranteed mortgages.

PROOFREADING

Instructions

This is a proofreading task. There are errors in the following text. Your task is to proofread the material. You will not be tested on the content of the text. You are only asked to proofread the text as quickly and as accurately as possible. There is a ten minute time limit on the proofreading, and the experimenter will tell you when the time is up. Read each page of the text carefully. Underline the errors you discover in the text, but don't make corrections. Errors may consist of misspellings, grammatical mistakes, incorrect punctuation, capitalizations, and typographical errors. Again, underline the errors, but don't make corrections.

LIFE STYLES IN THE CITY AND SUBURBS

The expansion and growth of cities have altered the ways that people live, behave, and act toward one another. These changes have not occurred all at once, but their cumulative affect has been extensive. Because history has not provided us with any controlled experiments in city culture, we do not know whether the changes we observe are due to urbanisation, population growth, industrialization, selective migration, or some combination of these factors. We do know that the pace, of life in cities and the relationships among people and between people and institutions is markedly different from those in pre-urban settlements, contemporary small towns, and suburbs.

City residents, as compared with suburban and small-town residents, seem colder, more hurried less interested and less willing to become involved in the affairs of others. Institutions and organizations in cities seem more distant from their customers and clients, harder to deal with, and much more bureaucratic than similar institutions in suburbs and

small towns. Hospitals, pharmacies, supermarkets, fund-raising organizations, churches, as well as governmental agencies, are examples of such institutions.

In urban politics the average citizen often feels isolated and excluded from political decision making. The image of the city “boss” or “city hall” as persons or seats of power, unreachable except through the use of contracts, stands in stark contrast to the image of small-town participatory democracy epitomized by the New England town meeting or the suburban assembly in the high school gym. Although the accuracy of both these images is questionable, beyond doubt they convey the common conception of differences in urban and small-town life styles.

Although common images suggest that one style characterizes life in Large cities and another characterizes life in the suburbs and small towns, this is not so. If large cities could be described in a single term, that term would be heterogeneity. Cities, even many suburbs, are occupied by so many different people and institutions, in pursuit of some many different goals that the dominant image is often one of chaos. Large cities are composed by many natural areas in which people exhibit vastly different life styles. In some parts of the city there are concentrations of single people in their twenties, sharing apartments, seeking mates, beginning independent lives away from home or college. Their way of life often finds organizational expression in bars, clubs, and voluntary associations designed to bring these young people together? In other parts of the city, residents are older, married, more permanent settled, and beginning to raise families. The organizations and institutions in these areas focus on families and children. Urban life styles, such as those based primarily on stage in the life cycle, differ along other dimensions as well. Ethnicity, race, and social class are major sources of differences in urban life styles. Sexual orientation and occupation also create homogeneous natural areas in city.

Suburban life is generally thought of to be far less variable than city life. Suburbs are commonly conceived as communities, of families who are homogeneous in class, race, and life-cycle stage. Their activities are thought of as family-centered – raising children, keeping the lawn trimmed, washing the car, and making repairs on the house. Social activities seem centered around block parties, coffee Klatches, and neighborhood dinners. Like other myths, this concept is far too simple to be accurate. There is greater diversity in the suburbs than this image suggests. Apartment complexes where swinging singles or other groups predominate, exist in suburbs as well as in cities. There are suburbs where family-centered activities and neighborhood-based social life are no more common than they are in some areas of the city.

Louis Wirth first attempted to define a city. He said no definition based on size alone would be adequate, because any size one picks is arbitrary. The City is a legal political entity and has legal boundaries. Definitions of a city based on size must use census data, which reflect administrative and political boundaries. Using a legal-political definition means having to assume that urban forms of behavior, interaction, and social organization cease abruptly at the city limits. This, Wirth observed makes no sociological sense at all, for the city dominates an area much wider than its legal boundaries. Even in Wirth's times, the city offered a full range of goods and services to people living both inside and outside the city limits. Thus the urban way of life, which is most typical of people living in the central city, extends well beyond the boundaries of the city. Therefore, studies of urban social life require a definition of the city that is based on some thing other than size.

Even a definition of city based on other criteria, such as population density, gives rise to the same objections. Whether a city is defined as a population settlement with a

density of one person per square mile or ten thousand persons per square mile, the lives of people living well beyond the boundaries of the settlement will be influenced by it.

Wirth was among the first to point out that the Census counts people on the basis of where they live and sleep at night, rather than where they live and work during the day. The census is a nighttime enumeration, and the use of density as a census criterion can distort the findings. The central city is a business district in which the urban way of life is clearly present. Yet people come to work there during the day and leave at night, reducing both the size and density of the population below that observed in other parts of the city. Therefore population density is not a valid criterion for deciding what a city is or for analyzing urban ways of life.

However, any reasonable definition of a city must take into account physical size and population density, as well as variations in institutional structures and types of people living there. Wirth defined the city as “a relatively large, dense, and permanent settlement of socially heterogeneous individuals.

Using this definition of city, Wirth generated several hypotheses about urban life. Though subsequent research has shown them to need modification, these hypotheses have strongly influenced sociologists’ thinking about social life in the city.

Population size and density affect not only the character of the city and the social relationships’ within the city by the extent of heterogeneity in the city’s population. Wirth pointed out that historically the city has been society’s melting pot for people of different races and cultures, because the city tolerates differences and provides economic opportunities for all its residents. Differences in people are the basis of heterogeneity, in the city. However, Because different people must live closer together in the city, they are

forced to interact. This makes them less strange to one another and less different from one another.

In pre-urban society social status was relatively universally and unambiguously defined on the basis of long-term intimate knowledge of other persons. In a complicated, heterogeneous, differentiated urban society, individuals have few opportunities to judge from personal knowledge the social positions of persons with whom they interact. Consequently, urban residents rely on superficial attributes to judge the social status of others – their style of clothing, language, public behavior, and other visible signs. The signs and symbols of status have different meanings to different groups and as a result may be interpreted differently. Thus status may be ambiguous and be defined differently by different groups.

High levels of physical and social mobility in the metropolis guarantee relatively rapid turnover in the membership of all urban groups! When city groups are defined on the basis of neighborhood, high turnover leads to segregation of each locale area on the basis of characteristics other than place of residence. As an area becomes defined as the home of a particular group – people of like race language, ethnic heritage, social or economic status, or life style – those who do not fit the general description tend to move out and those who do move in. Having only superficial characteristics to judge by, people who interact in a segmentally way – that is, engage in secondary relationships – use these characteristics when choosing groups among whom they would like to live?

One way to understand the life styles of cities and suburbs is to concentrate on their major differences, or apparent differences. During the 1950s and early 1960s many social commentators discussed the suburban explosion, the suburban life, and the suburban affect on National character. These commentators, depending on their psychology and point of

view, were either horrified or full of praise. The migrants to the suburbs were seen as living a distinctively suburban way of life that was characterized by concern for the family and for the children, material consumption, status striving, a relatively high level of detachment from the wider society, and increased local involvement. Subsequent research has given us reason to doubt that the patterns of behavior seen in the suburbs are due to suburban residence or even that there is a distinctively suburban way of life.

Appendix 4) Rating Scales

IMPORTANT: All questions refer to your commute to work. We care about your opinion. There are no right or wrong answers.

Please circle **one** answer for each question.

1. Overall, commuting is stressful for me.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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2. I feel there is little or nothing I can do to control the way in which I commute to work.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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3. It takes a lot of effort to commute to work.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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4. I resent the length of my commute to work.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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5. My commute to work rarely varies from day to day.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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6. My commute to work is pretty easy.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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7. I can control how long it will take me to get to work.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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8. My commute affects my productivity on the job.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
--------------------------	-----------------	-----------------------------------	--------------	-----------------------

9. My commute to work each day takes a lot of effort.

**Strongly
Disagree**

**Disagree
nor Disagree**

Neither Agree

**Agree
Agree**

Strongly