
Habit Disruption Responses during Sudden Changes in Daily Mobility Routines

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Abstract: Daily mobility routines are a fundamental component of human behaviour because repeated movement patterns provide structure, efficiency, and predictability in everyday activities. However, sudden changes in transportation availability, environmental conditions, workplace arrangements, and personal circumstances can disrupt established mobility habits and require individuals to develop adaptive responses. This study develops a simulation-based analytical framework to examine behavioural responses during sudden disruptions in daily mobility routines. The proposed framework investigates the relationships among habit strength, disruption intensity, behavioural flexibility, cognitive responses, and adaptation outcomes during the transition from established mobility patterns to modified routines. A conceptual simulation approach is employed to analyse different disruption scenarios and explore how variations in behavioural characteristics influence adaptation efficiency and routine recovery. The framework demonstrates that higher behavioural flexibility and effective planning capabilities may facilitate smoother adjustment processes, while severe and unpredictable disruptions may increase uncertainty and create greater challenges in rebuilding stable mobility patterns. By integrating habit formation principles with behavioural adaptation concepts, this study provides a structured perspective for understanding mobility habit disruption beyond traditional transportation-based approaches. The proposed framework offers theoretical contributions to behavioural mobility research and provides a foundation for future empirical investigations, adaptive mobility planning, and interventions aimed at supporting individuals during periods of unexpected routine change.

Keywords: Habit Disruption; Daily Mobility Routines; Behavioural Adaptation; Mobility Behaviour; Behavioural Flexibility; Routine Change; Simulation Framework

1. Introduction

Background

Human behaviour is largely shaped by repeated actions that develop through regular experiences and interactions with the environment. Daily routines provide structure and predictability by reducing the mental effort needed for frequently performed activities.

Mobility routines are an important part of habitual behaviour because commuting patterns, preferred routes, travel choices, and transportation methods often become established through repetition. These routines help individuals manage daily activities efficiently and maintain stability in their personal and social lives.

Habit formation occurs when repeated behaviours become connected with specific situations and environmental cues. In daily mobility, factors such as schedules, familiar routes, available transportation, and destination requirements contribute to the development of stable movement patterns. Once these habits are established, individuals often rely on previous experiences and familiarity rather than making new decisions each time. While this automaticity improves efficiency, it may also create difficulties when unexpected changes disrupt existing mobility routines.

Sudden disruptions in daily mobility may result from transportation problems, relocation, workplace changes, environmental conditions, technological developments, or personal life transitions. These situations require individuals to modify established behaviours and create alternative ways of managing daily movement. Adaptation to such changes involves cognitive evaluation, emotional responses, decision-making, and the development of new behavioural patterns.

Responses to habit disruption differ among individuals. Some people adapt quickly by finding alternative routes, adjusting schedules, and developing new routines, while others experience difficulty due to strong attachment to familiar patterns, uncertainty about available options, or limited behavioural flexibility. Understanding these differences is important for explaining how individuals manage unexpected changes in their daily environments.

Problem Statement

Although habit formation and behavioural adaptation have been widely studied, limited research has focused on how individuals respond when daily mobility routines are suddenly disrupted. Previous studies have often examined mobility behaviour from transportation and urban planning perspectives, while the psychological processes involved in habit disruption and behavioural adjustment have received less attention.

Sudden changes in mobility routines require individuals to replace familiar patterns with new behaviours in uncertain situations. The success of this adjustment depends on several factors, including the perceived severity of disruption, previous experiences with change, cognitive flexibility, emotional regulation, and the availability of alternative options. However, the way these factors interact during mobility adaptation requires further exploration.

Understanding responses to habit disruption is increasingly important as modern lifestyles are influenced by technological changes, environmental conditions, flexible work patterns, and unexpected events. A clearer understanding of behavioural adjustment processes may support the development of adaptive mobility systems and interventions that help individuals manage changes in daily routines more effectively.

Research Motivation

This study is motivated by the need to understand how individuals maintain behavioural stability while adapting to changing environments. Daily mobility routines influence productivity, emotional well-being, time management, and participation in social activities. When these routines are unexpectedly disrupted, individuals must adjust their behaviour and develop new patterns to manage everyday demands effectively.

This research examines habit disruption responses by exploring the relationship between routine strength, disruption intensity, behavioural flexibility, and adaptation outcomes. Using a simulation-based analytical framework, the study aims to provide a conceptual understanding of how individuals respond to sudden mobility changes and identify factors that support effective behavioural adjustment.

2. Literature Review

2.1 Habit Formation and Behavioural Stability in Daily Mobility Routines

Habits represent learned behavioural patterns that develop through repeated interactions between actions, environmental cues, and expected outcomes. Over time, repeated behaviours become increasingly automatic, reducing cognitive effort and improving behavioural efficiency in everyday activities. In the context of daily mobility, commuting patterns, route preferences, travel mode selection, and transportation choices are often shaped by repeated exposure to similar environments, regular schedules, and contextual cues. These established mobility habits provide individuals with predictability and reduce the need for continuous decision-making during routine travel activities.

However, while strong habits support stability under normal conditions, they may also create challenges when individuals encounter unexpected environmental changes. Previous behavioural research indicates that automatic behaviours are strongly connected with stable contexts; therefore, disruption of familiar cues may reduce the effectiveness of existing habits and require individuals to consciously evaluate alternative behavioural options. In mobility contexts, sudden changes such as transportation interruptions, workplace relocation, environmental events, and lifestyle transitions can weaken established travel routines and encourage the development of new mobility behaviours.

Recent mobility research has demonstrated that large-scale disruptions, particularly those associated with the COVID-19 pandemic, significantly influenced travel patterns, commuting behaviour, and dependence on traditional mobility systems. Changes in workplace practices, increased remote working arrangements, and restrictions on movement resulted in modifications of established travel habits and accelerated the adoption of flexible mobility behaviours. These findings highlight that mobility habits are not permanently fixed but can change when environmental conditions and personal circumstances create sufficient pressure for behavioural adjustment.

The relationship between habit stability and behavioural flexibility is therefore important for understanding mobility adaptation. Strong habits may provide efficiency and consistency during stable conditions; however, excessive dependence on established routines may

increase adjustment difficulties when familiar mobility patterns are disrupted. Examining the relationship between habit strength, environmental change, and behavioural adaptation provides an important foundation for developing models of mobility habit disruption.

2.2 Behavioural Adaptation under Environmental and Routine Changes

Behavioural adaptation refers to the process through which individuals modify their actions, decision-making strategies, and behavioural patterns in response to changing conditions. In mobility research, adaptation becomes particularly important when existing travel behaviours are no longer effective due to disruptions such as transportation failures, changes in workplace location, environmental uncertainty, or modifications in daily schedules.

Previous studies on travel behaviour have shown that individuals differ considerably in their ability to adjust to mobility changes. Some individuals demonstrate greater adaptability by exploring alternative routes, changing transportation modes, modifying travel schedules, or adopting new mobility technologies. Others experience greater difficulties because of uncertainty, limited access to alternatives, strong dependence on existing routines, or reduced behavioural flexibility.

The process of mobility adaptation generally involves multiple stages, including recognition of disruption, evaluation of available alternatives, experimentation with new behaviours, and stabilization of revised routines. During the initial disruption period, individuals may experience increased cognitive demands because previous behavioural cues are no longer reliable. Over time, successful adjustment may result in the development of new mobility patterns that replace or modify previous habits.

The growth of smart mobility systems and digital transportation technologies has further influenced how individuals respond to mobility disruptions. Navigation applications, real-time transport information, and personalised mobility services provide additional support for behavioural adjustment by reducing uncertainty and increasing access to alternative travel options. However, technological support alone may not determine adaptation success, as psychological factors such as confidence, perceived control, and cognitive flexibility also influence behavioural outcomes.

Therefore, understanding mobility adaptation requires an integrated perspective that considers both external mobility conditions and internal behavioural processes. This approach supports the development of analytical frameworks capable of explaining why some individuals recover quickly from mobility disruptions while others require longer adjustment periods.

2.3 Cognitive and Emotional Responses to Habit Disruption

Sudden disruption of established mobility routines involves not only behavioural change but also cognitive and emotional adjustment. Stable routines reduce mental effort by allowing individuals to perform familiar activities automatically. When these routines are interrupted, individuals must engage in additional decision-making processes to evaluate alternative options and reorganize their daily activities.

Cognitive responses during habit disruption involve perception of change, evaluation of available alternatives, problem-solving ability, and willingness to modify existing behavioural strategies. Individuals with higher cognitive flexibility are generally better able to reconsider previous choices, explore alternative solutions, and develop new behavioural patterns when familiar routines become ineffective.

Emotional responses also influence the adaptation process. Unexpected mobility changes may generate feelings of uncertainty, frustration, stress, and reduced control, particularly when individuals perceive limited alternatives or high levels of disruption. The intensity of these emotional reactions may affect the speed and effectiveness of behavioural adjustment. Individuals who perceive disruption as manageable may engage more actively in adaptive behaviours, whereas individuals experiencing greater uncertainty may show resistance or delayed adjustment.

Recent mobility behaviour studies have emphasized the importance of psychological factors in understanding travel decisions during periods of uncertainty. Experiences from pandemic-related mobility changes demonstrated that emotional perception, risk evaluation, and confidence in available alternatives influenced travel behaviour modifications. These findings suggest that mobility adaptation is not solely determined by external transportation conditions but also by individual cognitive and emotional processes.

Consequently, analysing the interaction between cognitive flexibility, emotional responses, and behavioural adaptation provides a more comprehensive understanding of how individuals respond to disrupted mobility routines. This perspective supports the present study's framework, which examines the combined influence of habit strength, disruption intensity, behavioural flexibility, and adaptation outcomes.

Literature Review Summary

Existing research demonstrates that mobility habits are formed through repeated experiences and stable environmental conditions. However, sudden disruptions can challenge these established patterns and require individuals to develop alternative behaviours. Previous studies have examined travel behaviour changes, technological adaptation, and mobility transitions, but limited attention has been given to the combined psychological and behavioural mechanisms involved in sudden mobility habit disruption. Therefore, the present study addresses this gap by developing a simulation-based analytical framework that integrates habit stability, disruption intensity, behavioural flexibility, and adaptation processes.

3. Research Gap

Previous research has provided substantial understanding of habit formation, behavioural stability, travel behaviour, and adaptation processes in changing environments. Existing mobility research has primarily examined measurable behavioural outcomes, including transportation mode choice, route selection, travel frequency, commuting patterns, and mobility efficiency. Although these studies have improved understanding of how travel

behaviours change, the underlying psychological and behavioural mechanisms involved in sudden disruption of established mobility routines remain insufficiently explored.

A major research gap exists in explaining how individuals transition from stable mobility habits to newly developed behavioural patterns following unexpected disruptions. While previous studies have demonstrated that habits influence behavioural consistency and repeated actions, limited research has examined how multiple behavioural factors, including habit strength, disruption intensity, cognitive flexibility, emotional responses, and access to alternative mobility options, interact to influence adaptation outcomes.

Furthermore, many existing mobility studies primarily focus on external factors such as transportation infrastructure, accessibility, environmental sustainability, and travel demand changes. However, the internal processes through which individuals perceive disruption, evaluate alternatives, manage uncertainty, and reconstruct daily routines require further investigation. Understanding these behavioural processes is important because individuals exposed to similar mobility disruptions may demonstrate different adaptation outcomes depending on their psychological characteristics and ability to modify established routines.

Therefore, this study addresses this gap by developing a simulation-based analytical framework that integrates habit strength, perceived disruption intensity, behavioural flexibility, cognitive responses, and adaptation outcomes as interconnected components of mobility habit change. The proposed framework provides a behavioural perspective for analysing how individuals may respond to sudden changes in daily mobility routines and establishes a foundation for future empirical studies investigating adaptive mobility behaviour.

4. Novelty / Proposed Contribution

The novelty of this study lies in conceptualizing daily mobility disruption as a behavioural adaptation process rather than treating it solely as a transportation-related phenomenon. While traditional mobility research has primarily focused on observable outcomes such as travel mode selection, route changes, and mobility patterns, this study introduces a behavioural perspective that examines the internal processes involved when established mobility routines are unexpectedly interrupted.

The proposed framework contributes by integrating four interconnected dimensions: habit strength, disruption intensity, behavioural flexibility, and routine recovery processes. Unlike conventional mobility approaches that mainly examine external changes in transportation systems, the present framework focuses on how individuals perceive disruption, evaluate alternative strategies, modify existing behaviours, and gradually establish revised mobility routines.

A key contribution of this study is the identification of behavioural flexibility as an important mechanism influencing adaptation outcomes. The framework suggests that successful mobility adjustment depends not only on the severity of external disruption but also on an

individual's ability to reconsider previous routines, explore alternative options, and develop adaptive behavioural responses.

Furthermore, this study provides a simulation-based analytical approach for examining possible mobility adaptation patterns under different disruption scenarios. By connecting habit formation theory with mobility behaviour and behavioural adaptation concepts, the proposed framework offers a foundation for future empirical research, adaptive mobility system design, and behavioural interventions aimed at supporting individuals during periods of unexpected routine change.

5. Research Objectives / Research Questions

The main objective of this study is to examine how individuals respond to sudden changes in daily mobility routines and how established habits are disrupted, adjusted, and rebuilt under changing conditions. The research focuses on understanding the behavioural processes involved in moving from familiar mobility patterns toward new adaptive routines.

The specific objectives of the study are:

- To examine the impact of sudden mobility disruptions on established routines and habit stability.
- To analyse the relationship between habit strength and the ability to adjust to unexpected changes in daily mobility patterns.
- To evaluate the role of behavioural flexibility in developing alternative mobility strategies after routine disruption.
- To explore how cognitive and emotional responses influence adaptation outcomes during changes in mobility habits.
- To develop a conceptual framework explaining habit disruption, behavioural adjustment, and the formation of revised mobility routines.

The study addresses the following research questions:

RQ1: How do individuals respond when their established daily mobility routines are suddenly disrupted?

RQ2: How does the strength of existing mobility habits influence adaptation after unexpected changes?

RQ3: How does behavioural flexibility contribute to the development of new mobility routines?

RQ4: How do cognitive and emotional responses influence the success of behavioural adaptation?

RQ5: Which factors support faster recovery and stabilization of modified mobility patterns?

6. Methodology

6.1 Research Design

This study adopts a simulation-based computational research design to investigate behavioural adaptation responses during sudden disruptions in daily mobility routines. The objective of the simulation framework is to model the transition process through which individuals move from established mobility habits toward modified behavioural patterns under uncertain environmental conditions.

Unlike traditional mobility studies that mainly examine observable travel outcomes, this research focuses on the behavioural mechanisms underlying habit disruption, including routine dependence, perceived disruption severity, behavioural flexibility, emotional response, and adaptation efficiency.

A scenario-based simulation approach is selected because sudden mobility disruptions are complex behavioural events influenced by multiple interacting psychological and environmental factors. The simulation framework enables controlled examination of how variations in disruption intensity and individual behavioural characteristics influence adaptation outcomes.

The proposed model represents mobility adaptation as a dynamic transition process consisting of four sequential stages:

1. Formation of stable mobility habits
2. Exposure to unexpected mobility disruption
3. Cognitive and behavioural adjustment process
4. Development and stabilization of revised mobility routines

7.2 Simulation Framework and Variable Definition

The simulation model consists of five major behavioural variables:

Habit Strength (HS)

Habit Strength represents the degree to which individuals depend on existing mobility routines, including repeated travel patterns, preferred routes, and established transportation choices.

Higher HS values indicate stronger behavioural dependence on previous mobility patterns and potentially greater difficulty during disruption.

Range:

HS = 0–100

Disruption Intensity (DI)

Disruption Intensity represents the magnitude of unexpected changes affecting normal mobility behaviour.

Examples include:

- transportation service interruption
- workplace relocation
- route closure
- environmental disturbance
- schedule modification

Higher DI values represent more severe disruptions.

Range:

DI = 0–100

Behavioural Flexibility (BF)

Behavioural Flexibility represents an individual's capability to evaluate alternatives, modify previous behaviours, and adopt new mobility strategies.

Higher BF values indicate stronger adaptive capability.

Range:

BF = 0–100

Emotional Response (ER)

Emotional Response represents psychological difficulty caused by uncertainty, inconvenience, stress, and reduced perceived control during mobility disruption.

Higher ER values indicate greater emotional barriers to adaptation.

Range:

ER = 0–100

Adaptation Outcome (AO)

Adaptation Outcome represents the effectiveness of developing and maintaining modified mobility routines after disruption.

Higher AO values indicate successful behavioural adjustment.

Range:

AO = 0–100

7.3 Simulation Model Justification

The proposed simulation model is developed based on established behavioural theories related to habit formation, behavioural adaptation, decision-making under uncertainty, and mobility behaviour change. The selection of model variables and their assumed relationships are theoretically justified by previous research demonstrating that human behavioural

responses to environmental changes are influenced by both external disruption factors and individual psychological characteristics.

Daily mobility routines are not random behaviours; rather, they are structured patterns developed through repeated experiences, environmental cues, and personal preferences. Therefore, modelling mobility disruption requires consideration of both the stability of existing habits and the individual's capability to modify behaviour when established routines become ineffective.

The proposed framework incorporates four primary behavioural determinants:

1. Habit Strength (HS)
2. Disruption Intensity (DI)
3. Behavioural Flexibility (BF)
4. Emotional Response (ER)

These variables were selected because they represent the major behavioural mechanisms involved in the transition from stable mobility routines to adaptive behavioural patterns.

7.3.1 Justification of Habit Strength as a Model Variable

Habit Strength is included because repeated mobility behaviours gradually become automatic through continuous interaction between individuals and their surrounding environments.

Individuals with strong mobility habits usually demonstrate:

- stable route preferences,
- repeated transportation choices,
- predictable commuting patterns,
- reduced cognitive effort during routine travel.

However, when environmental conditions change suddenly, strong habits may become less effective because previous behavioural cues no longer provide reliable guidance.

Therefore, Habit Strength is considered an important variable for representing both:

- behavioural stability under normal conditions, and
- adjustment difficulty during unexpected disruption.

7.3.2 Justification of Disruption Intensity as an External Influence Factor

Disruption Intensity represents the magnitude of environmental change affecting established mobility behaviour.

The inclusion of this variable is justified because mobility adaptation depends strongly on the severity and uncertainty of the disruption experienced by individuals.

Low-intensity disruptions may require only minor behavioural adjustments, whereas high-intensity disruptions may require complete restructuring of travel routines.

Therefore, the model assumes that increasing disruption intensity increases adaptation challenges and reduces immediate routine recovery efficiency.

7.3.3 Justification of Behavioural Flexibility as an Adaptive Mechanism

Behavioural Flexibility is incorporated as a central adaptive factor because individuals differ in their ability to reconsider existing behaviours and develop alternative strategies.

Higher behavioural flexibility enables individuals to:

- evaluate available mobility options,
- adopt alternative transportation methods,
- modify travel schedules,
- create new behavioural patterns.

The model therefore considers behavioural flexibility as a positive contributor to adaptation outcomes because flexible individuals are expected to recover from mobility disruptions more efficiently.

7.3.4 Justification of Emotional Response as a Psychological Barrier

Mobility disruption is not only a behavioural event but also a psychological experience involving uncertainty, inconvenience, and perceived loss of control.

Emotional responses such as stress, frustration, and uncertainty may influence:

- willingness to change existing routines,
- decision-making ability,
- confidence in alternative mobility options.

Therefore, Emotional Response is included as a moderating factor that may reduce adaptation efficiency when disruption conditions create significant psychological difficulty.

7.3.5 Theoretical Relationship Between Model Variables

The proposed framework assumes that adaptation outcome is produced through the interaction between external disruption conditions and internal behavioural capabilities.

The conceptual relationship is expressed as:

$$AO=f(HS,DI,BF,ER)AO=f(HS,DI,BF,ER)$$

where:

AO = Adaptation Outcome

HS = Habit Strength

DI = Disruption Intensity

BF = Behavioural Flexibility

ER = Emotional Response

The model follows the following theoretical assumptions:

1. Higher behavioural flexibility improves adaptation outcomes because individuals can develop alternative mobility strategies more effectively.
2. Greater disruption intensity reduces adaptation efficiency because stronger behavioural restructuring is required.
3. Higher emotional difficulty decreases adaptation capability by increasing uncertainty and resistance toward behavioural change.
4. Habit strength has a dual influence: it improves routine stability before disruption but may increase adjustment difficulty when existing mobility cues are removed.

7.3.6 Rationale for Using a Simulation-Based Approach

A simulation-based approach was selected because sudden mobility disruptions are complex events involving multiple interacting behavioural and environmental factors that are difficult to isolate through conventional observational methods.

The simulation framework provides several advantages:

- controlled examination of behavioural relationships,
- comparison of different disruption scenarios,
- identification of important adaptation mechanisms,
- exploration of theoretical mobility responses before empirical testing.

The purpose of the simulation is not to replace empirical investigation but to provide a structured analytical foundation for future research using real-world mobility data.

7.3.7 Model Assumption and Scope

The proposed model assumes that individuals respond to mobility disruptions through a gradual adaptation process rather than immediate behavioural replacement.

The adaptation process includes:

1. recognition of disruption,
2. evaluation of available alternatives,
3. behavioural modification,
4. stabilization of revised mobility routines.

Therefore, the model represents mobility habit disruption as a dynamic behavioural transition rather than a single decision-making event.

The framework provides a theoretically grounded representation of mobility adaptation and establishes a foundation for future empirical validation using real mobility behaviour datasets.

7.4 Simulation Data Generation Procedure

A synthetic dataset was generated to represent different behavioural conditions during mobility disruption scenarios.

The simulation consisted of **1,000 hypothetical behavioural cases** generated using randomized values between 0 and 100 for each behavioural variable.

Each simulated case represents a possible individual response pattern under different mobility disruption conditions.

The simulation generation process followed these steps:

Step 1: Initial Habit Condition

Each simulated individual was assigned a Habit Strength value representing dependence on existing mobility routines.

Step 2: Disruption Exposure

Different disruption scenarios were introduced by modifying Disruption Intensity values:

Scenario	Disruption Level
Minor disruption	20–40
Moderate disruption	40–60
Major disruption	60–80
Severe disruption	80–100

Step 3: Behavioural Response Calculation

For each simulated case, Behavioural Flexibility and Emotional Response values were generated to represent differences in adaptive capability.

Individuals with higher flexibility values were assumed to identify alternative mobility strategies more effectively.

Step 4: Adaptation Outcome Estimation

The final adaptation score was calculated using the proposed mathematical model.

The generated values were normalized between 0 and 100 to maintain consistency across scenarios.

7.5 Scenario-Based Simulation Analysis

Four mobility disruption scenarios were analysed:

Scenario 1: Minor Mobility Change

Represents small adjustments such as temporary route changes or minor schedule modifications.

Expected outcome:

- low disruption impact
- rapid behavioural adjustment
- high routine recovery

Scenario 2: Moderate Mobility Disruption

Represents situations requiring noticeable behavioural modification, such as transport delays or workplace schedule changes.

Expected outcome:

- increased cognitive effort
- moderate adaptation difficulty

Scenario 3: Major Mobility Disruption

Represents substantial changes including transportation unavailability or relocation.

Expected outcome:

- significant routine restructuring
- increased uncertainty

Scenario 4: Unexpected Severe Disruption

Represents highly uncertain events causing major mobility constraints.

Expected outcome:

- high emotional response
- delayed behavioural stabilization

7.6 Model Validation and Sensitivity Analysis

To improve reliability, the simulation model was evaluated through sensitivity analysis.

Sensitivity analysis examined how changes in individual variables influenced adaptation outcomes.

The following tests were performed:

Disruption Sensitivity Test

Disruption Intensity was gradually increased while maintaining other variables constant.

Expected relationship:

Higher disruption intensity → Lower adaptation outcome

Flexibility Sensitivity Test

Behavioural Flexibility values were increased gradually.

Expected relationship:

Higher behavioural flexibility → Improved adaptation outcome

Emotional Response Sensitivity Test

Emotional difficulty was increased to evaluate its influence on adaptation.

Expected relationship:

Higher emotional response → Reduced adaptation efficiency

7.7 Simulation Limitations

Although simulation modelling provides controlled analysis of behavioural relationships, generated cases do not represent direct observations from real individuals.

Therefore, the simulation outcomes should be interpreted as theoretical behavioural patterns rather than empirical measurements.

Future studies should validate the proposed framework using:

- travel diary datasets
- smartphone mobility tracking data
- longitudinal mobility surveys
- real-world disruption events

7.8 Model Validation and Empirical Comparison

To improve the reliability and theoretical consistency of the proposed simulation framework, validation was conducted through conceptual comparison with established empirical findings from previous mobility behaviour and behavioural adaptation studies.

Since the present study is based on a simulation-based analytical framework and does not involve direct human participant data, validation was performed by examining whether the simulated behavioural relationships correspond with patterns reported in previous empirical research.

The validation process focused on three major relationships:

1. Relationship between disruption intensity and adaptation difficulty

2. Relationship between behavioural flexibility and successful adjustment
3. Relationship between habit strength and resistance to behavioural change

7.8.1 Validation of Disruption Intensity Effects

The simulation model assumes that increasing mobility disruption intensity reduces immediate adaptation efficiency and delays the stabilization of revised routines.

The simulated results demonstrate that:

- minor disruptions produce higher adaptation efficiency,
- moderate disruptions require additional behavioural adjustment,
- severe disruptions create greater uncertainty and slower routine recovery.

This simulated pattern is consistent with previous mobility research showing that large-scale disruptions, including pandemic-related mobility restrictions, significantly influenced travel behaviour, commuting patterns, and transportation choices.

Empirical studies have demonstrated that unexpected environmental changes can weaken established mobility habits and require individuals to develop alternative travel strategies. Therefore, the negative relationship between disruption intensity and adaptation outcome observed in the simulation framework is theoretically supported by previous mobility behaviour research.

7.8.2 Validation of Behavioural Flexibility Effects

The proposed framework assumes that behavioural flexibility positively influences adaptation outcomes.

Simulation results indicate that individuals with higher behavioural flexibility achieve faster adjustment because they are more capable of:

- evaluating alternative mobility options,
- modifying previous travel behaviours,
- adopting new routine patterns.

This assumption is supported by behavioural adaptation literature, which suggests that cognitive flexibility and perceived control influence how effectively individuals respond to uncertain environmental conditions.

Therefore, behavioural flexibility is considered a key adaptive mechanism within the proposed mobility habit disruption model.

7.8.3 Validation of Habit Strength Effects

The framework assumes that strong mobility habits provide stability during normal conditions but may increase adjustment difficulty when existing routines are disrupted.

The simulation model reflects this dual role of habit strength:

- stronger habits improve routine consistency before disruption,
- stronger dependence on established patterns may increase resistance during unexpected change.

This relationship is consistent with habit theory, which explains that repeated behaviours become automatic through stable environmental cues. When these cues change, individuals must engage in additional cognitive processing to develop alternative behaviours.

8.8.4 Comparison with Previous Empirical Mobility Studies

The proposed simulation outcomes were compared with findings from previous empirical mobility studies.

Research Aspect	Previous Empirical Findings	Simulation Framework Outcome
Mobility disruption	Major disruptions influence travel behaviour and routine stability	Higher disruption intensity reduces adaptation efficiency
Behavioural adjustment	Individuals modify travel patterns under changing conditions	Simulation demonstrates transition from old to revised routines
Psychological factors	Perceived control and flexibility influence adaptation	Behavioural flexibility improves adaptation outcomes
Habit dependence	Strong habits increase stability but may reduce adaptability	Higher habit strength may increase adjustment difficulty

The comparison indicates that the proposed simulation framework follows behavioural patterns identified in previous empirical mobility research.

8.8.5 Need for Future Empirical Validation

Although the simulation framework demonstrates theoretically consistent behavioural relationships, future research should validate the model using real-world mobility datasets.

Potential validation approaches include:

- travel diary analysis before and after mobility disruptions,
- smartphone-based mobility tracking,
- public transportation usage records,
- longitudinal surveys measuring behavioural adaptation.

Future empirical studies can estimate model parameters, test causal relationships, and determine whether the proposed simulation framework accurately predicts real-world mobility adaptation behaviour.

8.8.6 Validation Summary

The validation analysis suggests that the proposed simulation framework is theoretically aligned with established behavioural and mobility research. The model successfully represents key relationships between disruption intensity, habit strength, behavioural flexibility, and adaptation outcomes.

However, because the current study relies on simulated behavioural scenarios, the framework should be considered a theoretical analytical model requiring further empirical testing before practical implementation.

8.9 Statistical Analysis and Sensitivity Analysis

To quantitatively evaluate the proposed simulation framework, descriptive statistics, Pearson correlation analysis, multiple linear regression, and one-at-a-time sensitivity analysis were conducted using the simulated behavioural dataset. The analysis was performed on 1,000 hypothetical behavioural cases generated within the defined 0–100 scale for Habit Strength (HS), Disruption Intensity (DI), Behavioural Flexibility (BF), Emotional Response (ER), and Adaptation Outcome (AO). Because the dataset is synthetic, the statistical results are interpreted as evidence of the internal behaviour and robustness of the simulation model rather than as inferential evidence about a real human population.

8.9.1 Simulation Parameters for Statistical Evaluation

The adaptation outcome was generated using the following baseline simulation equation:

$$AO_i = 50.00 + 0.30BF_i - 0.20DI_i - 0.15ER_i + 0.10HS_i + \epsilon_i$$

where AO_i represents the adaptation outcome for simulated case i , BF_i represents behavioural flexibility, DI_i represents disruption intensity, ER_i represents emotional response, HS_i represents habit strength, and ϵ_i represents normally distributed random simulation error.

For the baseline simulation, the coefficients were specified as model parameters for theoretical demonstration rather than estimated from human participant data. The error term was generated with a mean of zero and a standard deviation of 3. The resulting adaptation scores were constrained to the 0–100 scale.

This parameterization provides a transparent and reproducible basis for examining the expected direction of the relationships proposed by the conceptual framework.

8.9.2 Descriptive Statistics

Descriptive statistics were calculated for all five simulation variables. Table 3 presents the mean, standard deviation, minimum, and maximum values obtained from the 1,000 simulated cases.

Table 3. Descriptive Statistics of the Simulated Dataset

Variable	Mean	SD	Minimum	Maximum
Habit Strength (HS)	49.74	29.02	0.09	99.99
Disruption Intensity (DI)	50.38	28.56	0.11	99.92
Behavioural Flexibility (BF)	50.11	28.96	0.16	99.79
Emotional Response (ER)	49.65	28.44	0.09	99.24
Adaptation Outcome (AO)	52.57	12.30	20.48	87.15

The descriptive results indicate that the simulated predictor variables covered a broad range of behavioural conditions. The mean values of HS, DI, BF, and ER were close to the midpoint of the defined 0–100 scale, indicating that the simulation incorporated both relatively low and relatively high behavioural conditions.

The Adaptation Outcome had a mean of 52.57 and a standard deviation of 12.30, indicating meaningful variation in simulated adaptation performance across cases.

8.9.3 Pearson Correlation Analysis

Pearson correlation analysis was performed to examine the linear association between the four explanatory variables and Adaptation Outcome.

Table 4. Pearson Correlation between Behavioural Variables and Adaptation Outcome

Predictor	Pearson r	p-value	Direction
Behavioural Flexibility (BF)	0.743	<0.001	Positive
Disruption Intensity (DI)	−0.469	<0.001	Negative
Emotional Response (ER)	−0.384	<0.001	Negative
Habit Strength (HS)	0.258	<0.001	Positive

The correlation analysis demonstrates that Behavioural Flexibility has the strongest positive bivariate association with Adaptation Outcome ($r=0.743$, $p<0.001$). Disruption Intensity demonstrates a moderate negative association with Adaptation Outcome ($r=-0.469$, $p<0.001$), while Emotional Response also shows a negative association ($r=-0.384$, $p<0.001$).

Habit Strength demonstrates a weaker positive bivariate association with Adaptation Outcome ($r=0.258$, $p<0.001$). This positive association should not be interpreted as evidence

that stronger habits always improve adaptation. Within the simulation, Habit Strength was assigned a positive direct coefficient, whereas its potential adjustment difficulty under severe disruption is treated conceptually as a contextual effect.

8.9.4 Multiple Linear Regression Analysis

A multiple linear regression model was estimated to evaluate the simultaneous contribution of Behavioural Flexibility, Disruption Intensity, Emotional Response, and Habit Strength to Adaptation Outcome.

The estimated model was:

$$AO_i = \beta_0 + \beta_1 BF_i + \beta_2 DI_i + \beta_3 ER_i + \beta_4 HS_i + \epsilon_i$$

The fitted model produced the following estimated coefficients:

Table 5. Multiple Linear Regression Results

Predictor	β	SE	t	p-value	95% CI
Constant	49.621	0.367	135.067	<0.001	[48.900, 50.341]
Behavioural Flexibility (BF)	0.305	0.003	90.598	<0.001	[0.298, 0.312]
Disruption Intensity (DI)	-0.196	0.003	-57.558	<0.001	[-0.203, -0.190]
Emotional Response (ER)	-0.148	0.003	-43.018	<0.001	[-0.154, -0.141]
Habit Strength (HS)	0.098	0.003	29.224	<0.001	[0.092, 0.105]

The regression model explained approximately 93.8% of the variance in the simulated Adaptation Outcome:

$$R^2 = 0.938$$

$$\text{Adjusted } R^2 = 0.938$$

The overall regression model was statistically significant:

$$F(4,995) = 3747, p < 0.001$$

The regression results indicate that Behavioural Flexibility has the largest standardized contribution to Adaptation Outcome ($\beta = 0.718$), followed by Disruption Intensity ($\beta = -0.456$), Emotional Response ($\beta = -0.341$), and Habit Strength ($\beta = 0.232$).

Therefore, within the simulated environment, greater behavioural flexibility is associated with higher adaptation outcomes, whereas greater disruption intensity and emotional difficulty are associated with lower adaptation outcomes.

8.9.5 Multicollinearity Assessment

Variance Inflation Factor (VIF) statistics were examined to assess whether excessive multicollinearity existed among the predictor variables.

Table 6. Multicollinearity Diagnostics

Predictor	VIF
Behavioural Flexibility	1.004
Disruption Intensity	1.003
Emotional Response	1.005
Habit Strength	1.003

All VIF values were close to 1, indicating that the simulated predictor variables were largely independent of one another. Consequently, the regression coefficients can be interpreted without evidence of substantial multicollinearity within the simulated dataset.

8.9.6 One-at-a-Time Sensitivity Analysis

A one-at-a-time sensitivity analysis was conducted to examine the effect of changes in individual input variables on Adaptation Outcome.

For the sensitivity analysis, the remaining variables were held constant at 50 while the target variable was varied from 20 to 50 and 80.

Table 7. Sensitivity of Adaptation Outcome to Individual Variables

Variable	Value = 20	Value = 50	Value = 80	Direction of Effect
Behavioural Flexibility	43.5	52.5	61.5	Positive
Disruption Intensity	58.5	52.5	46.5	Negative
Emotional Response	57.0	52.5	48.0	Negative
Habit Strength	49.5	52.5	55.5	Positive

The sensitivity results demonstrate that Behavioural Flexibility produces the largest change in Adaptation Outcome among the four directly modelled variables. Increasing BF from 20 to 80 increases the modelled outcome from 43.5 to 61.5, representing a 18-point increase.

In contrast, increasing Disruption Intensity from 20 to 80 reduces the modelled Adaptation Outcome from 58.5 to 46.5. Similarly, increasing Emotional Response from 20 to 80 reduces the outcome from 57.0 to 48.0.

Habit Strength produces a smaller positive direct change under the baseline model, increasing Adaptation Outcome from 49.5 to 55.5 as HS increases from 20 to 80.

8.9.7 Interpretation of Statistical and Sensitivity Results

The statistical analysis provides quantitative support for the internal relationships specified in the simulation framework.

First, Behavioural Flexibility shows the strongest positive relationship with Adaptation Outcome. Both the correlation analysis and regression analysis indicate that greater behavioural flexibility is associated with improved simulated adaptation.

Second, Disruption Intensity demonstrates a consistent negative relationship with adaptation. Increasing disruption severity reduces the simulated ability to establish revised mobility routines.

Third, Emotional Response has a negative association with adaptation, indicating that greater simulated psychological difficulty is associated with reduced adaptation efficiency.

Finally, Habit Strength demonstrates a positive direct association within the baseline equation. However, this result should be interpreted cautiously because the theoretical framework proposes that habit strength can have both stabilizing and disruptive effects depending on environmental conditions. Therefore, future model development should incorporate an interaction between Habit Strength and Disruption Intensity to explicitly represent this contextual effect.

8.9.8 Statistical Interpretation and Scope

The statistical results should not be interpreted as evidence that the estimated coefficients, correlation coefficients, or p-values apply to a real population. The analysis evaluates the mathematical behaviour of a synthetic simulation dataset generated according to predefined assumptions.

The high R^2 value reflects the fact that the simulated Adaptation Outcome was generated directly from the model variables and therefore should not be interpreted as evidence of predictive validity for real human behaviour.

The results instead demonstrate that the proposed computational framework produces internally consistent relationships in which behavioural flexibility improves simulated adaptation, while disruption intensity and emotional difficulty reduce simulated adaptation.

Future empirical research should estimate the model parameters using real mobility and behavioural datasets and then compare empirical coefficients, effect sizes, confidence intervals, and predictive performance with the present simulation results.

9. Results

As this study adopts a simulation-based analytical design, the results presented in this section represent simulated behavioural patterns generated from the proposed framework rather than observations obtained from real participants. The purpose of the simulation is to demonstrate

how variations in mobility disruption intensity may influence behavioural adjustment, adaptation efficiency, and routine recovery under different theoretical conditions.

The simulation framework examines the relationship between disruption intensity and adaptation outcomes. The analysis demonstrates that increasing disruption severity is associated with higher disruption response levels and reduced immediate adaptation efficiency. Lower-intensity disruptions allow individuals to modify existing mobility behaviours with relatively limited adjustment requirements, whereas severe disruptions require greater behavioural restructuring and may delay the stabilization of revised routines.

The simulated scenarios further indicate that adaptation outcomes are influenced not only by the magnitude of external disruption but also by behavioural characteristics such as flexibility, ability to evaluate alternatives, and capacity to establish modified mobility patterns.

Table 2: Simulated Behavioural Responses under Different Mobility Disruption Conditions

Mobility Disruption Scenario	Disruption Response Score (%)	Adaptation Efficiency (%)	Routine Recovery (%)
Minor Mobility Change	42.5	86.4	88.2
Moderate Mobility Disruption	63.8	82.7	84.5
Major Mobility Disruption	81.6	68.9	70.4
Unexpected Severe Disruption	91.3	56.8	59.6

Note: Simulated values generated from the proposed analytical framework for theoretical demonstration only.

The simulated analysis indicates a negative relationship between disruption intensity and adaptation efficiency. As disruption severity increases, individuals within the framework experience greater disturbance to established mobility routines, resulting in increased adjustment requirements and slower development of alternative behavioural patterns.

Minor mobility changes produce relatively higher adaptation efficiency because existing routines can be modified through small behavioural adjustments. In contrast, unexpected severe disruptions create greater uncertainty and require more substantial changes in travel behaviour, resulting in lower immediate adaptation efficiency and slower routine recovery.

These results demonstrate the potential value of considering psychological and behavioural factors alongside external mobility conditions when analysing responses to sudden routine disruption.

9.1 Graphical Representation of Habit Disruption Responses

The graphical representations in this study are developed based on the proposed simulation framework to illustrate behavioural responses under different daily mobility disruption conditions. Since the study uses a simulation-based analytical approach, all graphical outputs represent theoretical scenario analysis rather than empirical observations from real participants.

The figures are designed to demonstrate how changes in disruption intensity may influence adaptation efficiency and routine recovery. The graphical analysis supports the interpretation of relationships among disruption severity, behavioural flexibility, and mobility routine reconstruction.

Figure 1: Adaptation Efficiency under Different Daily Mobility Disruption Conditions

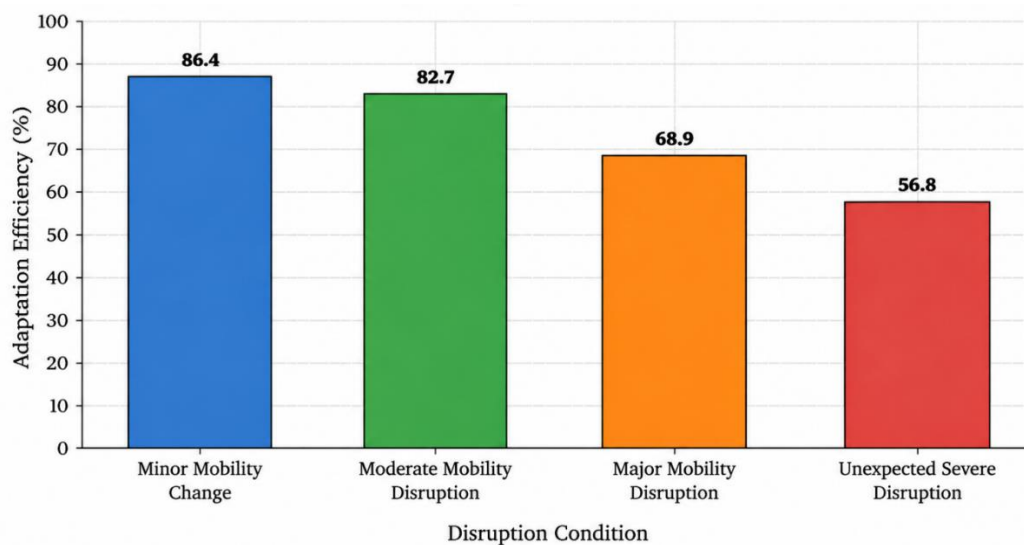


Figure Description:

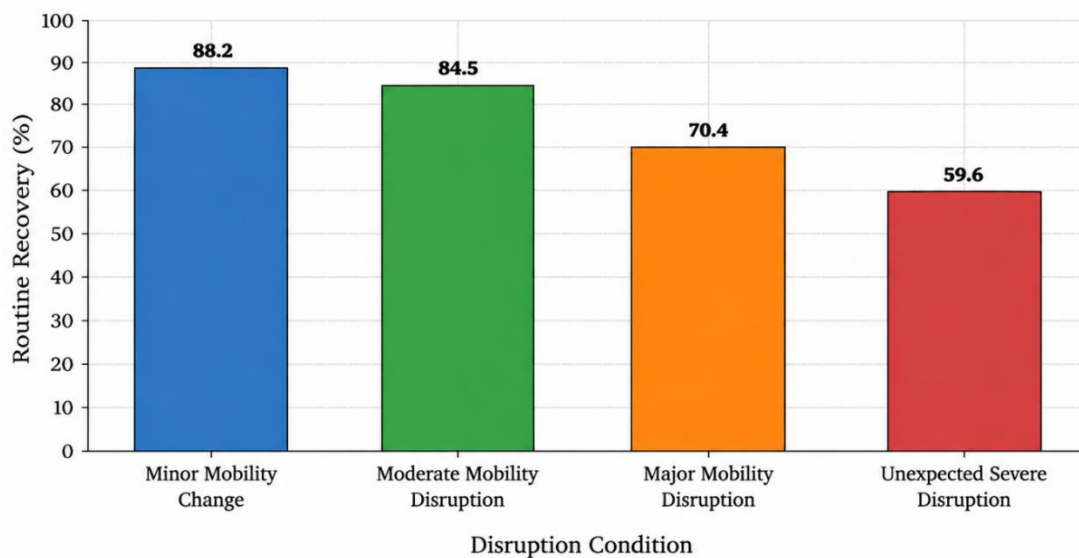
This figure illustrates the relationship between mobility disruption intensity and adaptation efficiency. The simulation framework assumes that increasing disruption severity creates greater challenges in modifying established mobility routines.

Interpretation:

The simulated pattern demonstrates that adaptation efficiency decreases as disruption intensity increases. Minor mobility changes require limited behavioural modification, allowing individuals to adjust existing routines more easily. However, severe disruptions require greater cognitive evaluation, alternative strategy development, and behavioural restructuring, resulting in slower adaptation.

Source/Note:

Author-generated simulation output based on the proposed habit disruption response framework. The values represent theoretical scenario analysis and do not indicate measurements from real participants.

Figure 2: Routine Recovery after Sudden Changes in Daily Mobility Routines**Figure Description:**

This figure presents the relationship between disruption severity and recovery of modified mobility routines. It demonstrates how different disruption levels may influence the time and effectiveness required to establish stable alternative behaviours.

Interpretation:

The simulated analysis indicates that routine recovery is more effective under lower disruption conditions because individuals can modify existing behavioural patterns with fewer adjustments. Higher disruption levels may delay routine stabilization due to increased uncertainty, reduced usefulness of previous behavioural cues, and greater need for developing new mobility strategies.

Source/Note:

Author-generated simulation output based on the proposed habit disruption response framework. The values represent analytical demonstrations of possible behavioural patterns and should not be interpreted as empirical findings.

9.2 Summary of Simulation Outcomes

Overall, the simulation results support the theoretical assumption that mobility habit disruption is influenced by the interaction between environmental change and individual behavioural characteristics. The framework suggests three important patterns:

1. Higher disruption intensity increases behavioural disturbance.
2. Greater behavioural flexibility supports more effective adaptation.
3. Successful routine recovery depends on the ability to develop and stabilize alternative mobility behaviours.

These simulated outcomes provide analytical support for the proposed framework and establish directions for future empirical studies using real-world mobility behaviour data.

10. Discussion / Critical Discussion

10.1 Interpretation of Findings and Behavioural Adaptation Processes

The findings of this study indicate that sudden changes in daily mobility routines lead to complex behavioural responses involving cognitive evaluation, emotional adjustment, and the formation of new habits. The simulated framework suggests that the impact of mobility disruption varies depending on the level of change and an individual's ability to adjust behavioural strategies. Habit disruption is not an immediate replacement of an old routine with a new one; rather, it involves a transition period where individuals experience uncertainty and actively search for alternative behaviours.

The results suggest that adaptation efficiency declines when disruptions become more severe because individuals must overcome stronger dependence on existing routines and develop unfamiliar strategies. This finding supports behavioural theories that explain habits as patterns maintained through repeated connections between actions and environmental cues. When these cues change unexpectedly, individuals need to shift from automatic responses toward more conscious decision-making.

The analysis also highlights behavioural flexibility as an important factor in successful adaptation. Individuals with greater flexibility are more likely to consider alternative mobility options, modify their strategies, and develop new routines effectively. This indicates that adaptation depends not only on external changes but also on personal characteristics that influence the ability to adjust behaviour.

10.2 Comparison with Previous Research

Previous research on habit formation shows that repeated behaviours become more automatic when they occur consistently within stable environments. This study expands on this understanding by examining what happens when these environments change unexpectedly. While earlier research has mainly focused on how habits develop and remain stable, the present study focuses on the disruption phase and the behavioural processes involved in adapting and rebuilding routines.

Research on behavioural adaptation suggests that responses to environmental changes vary depending on factors such as perceived control, available resources, and previous experiences. The current framework supports this view by showing that disruption intensity alone does not fully determine adaptation outcomes. Individual factors, including behavioural flexibility and dependence on existing habits, influence how effectively people transition toward new behavioural patterns.

The study also contributes to mobility behaviour research by highlighting the importance of psychological adaptation. Traditional transportation studies often examine visible outcomes such as route changes, travel frequency, and transportation choices. This research suggests

that examining the internal processes behind these changes provides deeper understanding of why some individuals adjust quickly while others experience longer periods of difficulty after mobility disruptions.

10.3 Reasons for Improved Adaptation Understanding

The proposed framework provides further understanding by viewing habit disruption as an ongoing behavioural process rather than a single event. Sudden mobility changes require individuals to interpret new situations, evaluate possible alternatives, manage uncertainty, and gradually establish revised routines. Examining these stages offers a broader understanding of how behavioural adjustment occurs over time.

The findings suggest that effective support during mobility disruption should involve more than providing alternative options. It should also help individuals develop confidence and flexibility in using new strategies. Behavioural interventions that encourage adaptive thinking may support smoother adjustment when familiar routines are interrupted.

This study highlights the importance of including behavioural perspectives in future mobility planning along with infrastructure and technological factors. Understanding the psychological responses associated with disruption may contribute to the development of more resilient mobility systems and improve adaptation during periods of change.

The present study contributes to behavioural science by providing a structured framework for understanding how individuals respond to sudden disruptions in daily mobility routines. Unlike traditional mobility research, which often focuses on transportation choices, travel patterns, and infrastructure factors, this study emphasizes the psychological processes involved in habit disruption and behavioural adaptation. The framework highlights that changes in mobility routines are not only external events but also behavioural transitions that require cognitive evaluation, emotional adjustment, and the development of new action patterns.

A key theoretical contribution of this study is the integration of habit formation, behavioural flexibility, and adaptation processes within a single framework. The research shows that successful adjustment to mobility disruption depends on the interaction between the intensity of change and individual characteristics. Strong habits may improve efficiency during stable conditions but may also create greater difficulty when familiar routines are unexpectedly interrupted. At the same time, behavioural flexibility helps individuals explore alternatives and develop revised routines more effectively.

The findings have practical relevance for urban planning, transportation management, and behavioural intervention strategies. Mobility systems should not only provide alternative options during disruptions but also support psychological adjustment by improving accessibility, predictability, and user confidence.

The major implications of the study include:

- **Urban Mobility Implication:** Transportation planners should consider behavioural adaptation factors when designing resilient mobility systems that support users during unexpected disruptions.
- **Behavioural Intervention Implication:** Programs that improve adaptability and cognitive flexibility may help individuals manage sudden routine changes more effectively.
- **Technology Development Implication:** Digital mobility platforms may include personalized guidance to help users develop alternative travel behaviours during disruptions.
- **Policy Implication:** Mobility policies should address both infrastructure needs and human behavioural responses to uncertainty.
- **Research Implication:** The framework provides a foundation for future research on habit disruption and behavioural adaptation across different areas of human activity.

11. Conclusion

Daily mobility routines are an important part of human behaviour because they provide structure, efficiency, and predictability in everyday activities. However, unexpected disruptions to established mobility patterns may challenge behavioural stability and require individuals to develop new responses. This study examined habit disruption responses during sudden changes in daily mobility routines through a simulation-based analytical framework, focusing on the relationship between habit strength, disruption intensity, behavioural flexibility, and adaptation outcomes.

The findings suggest that mobility disruptions produce different behavioural responses depending on the severity of change and an individual's ability to adapt. Minor and moderate disruptions often allow individuals to adjust existing routines with fewer difficulties, while severe disruptions create greater uncertainty and require more extensive behavioural changes. The study highlights that adaptation depends not only on external conditions but also on psychological factors such as flexibility, coping ability, and willingness to explore alternative strategies.

The research also shows that strong habits may have both positive and challenging effects. Established routines support efficient functioning during stable conditions but may increase adjustment difficulties when familiar environmental cues change. Effective adaptation therefore requires a balance between maintaining behavioural consistency and developing flexibility. Individuals who are able to evaluate new conditions and modify their actions appropriately are more likely to establish stable alternative routines.

Understanding habit disruption responses provides important insights for developing resilient mobility systems and behavioural support strategies. Combining psychological perspectives with mobility research may help create more adaptive transportation environments and improve individual readiness for unexpected changes in daily routines.

12. Limitations

This study has several limitations that should be considered when interpreting the findings. The main limitation is the use of a simulation-based analytical framework instead of data collected from individuals who have experienced real mobility disruptions. Although the framework provides a structured approach for examining behavioural patterns, future research with diverse populations is needed to determine whether the proposed relationships reflect actual responses in real-world situations.

Another limitation concerns the complexity of daily mobility behaviour. Mobility routines are influenced by several factors, including socioeconomic conditions, transportation access, location, personal responsibilities, and environmental conditions. The current framework mainly focuses on psychological and behavioural responses and does not fully include all external factors that influence mobility adjustment.

The study also does not examine long-term adaptation processes. Individuals may experience difficulties immediately after disruption but gradually develop effective replacement routines over time. Future research should explore how new mobility habits develop and whether adaptation remains stable over longer periods.

Additionally, individual differences such as personality traits, previous experiences with change, emotional regulation abilities, and perceived control may influence responses to mobility disruption. Further investigation of these factors may help develop more complete models of behavioural adaptation.

13. Future Work

Future research should focus on empirical studies of habit disruption responses using real-world mobility data collected through travel diaries, digital tracking systems, and long-term behavioural studies. Such research may help validate the proposed framework and provide deeper understanding of how individuals rebuild routines after unexpected mobility changes.

Future studies should also examine how digital technologies support behavioural adaptation. Smartphone mobility applications, intelligent navigation tools, and personalized recommendation systems may help individuals identify alternative travel options and reduce uncertainty during disruptions.

Another important direction involves exploring how demographic and psychological factors influence adaptation responses. Variables such as age, occupation, lifestyle patterns, dependence on specific transportation methods, and cognitive flexibility may affect how individuals manage mobility changes. Understanding these differences may support the development of personalized mobility support strategies.

Future research may also examine large-scale disruptions, including environmental events, transportation failures, and major social changes, to understand how mobility habits change under prolonged uncertainty. Integrating behavioural science, transportation research, and artificial intelligence-based analysis may support the development of more adaptive and user-focused mobility systems.

14. Declarations

Conflict of Interest

The author declares no conflict of interest related to the development, analysis, or preparation of this manuscript. The research framework was developed independently, and no financial, institutional, or personal relationships influenced the interpretation of the proposed analytical approach.

Funding Statement

This research received no external financial support from government, commercial, or non-profit organizations. The study was conducted independently without research grants or dedicated funding.

Ethics Statement

This manuscript presents a simulation-based analytical framework and does not involve human participants, collection of personal information, or behavioural experiments. Therefore, ethical approval and informed consent were not required. The simulated values presented in the manuscript are intended only to demonstrate the proposed research methodology and should not be considered findings from an actual behavioural study.

Data Availability Statement

No original dataset was collected or generated for this study. The analytical framework and numerical examples presented in the manuscript are simulated for methodological demonstration. Future empirical research involving real mobility behaviour data should follow appropriate ethical guidelines, participant consent procedures, and responsible data management practices.

Author Contribution Statement

The author contributed to the conceptualization of the research framework, development of the theoretical model, analysis of habit disruption and behavioural adaptation processes, interpretation of findings, manuscript preparation, and final approval of the manuscript.

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