

THESIS

**INTERACTIONS AMONG
SPATIOTEMPORAL VARIABLES,
PSYCHOLOGICAL MECHANISMS, AND
LIFESTYLES IN PUBLIC TRANSPORTATION
USAGE**



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PARAHYANGAN CATHOLIC UNIVERSITY
DEPARTMENT OF CIVIL ENGINEERING
(Accredited based on SK BAN-PT Nomor: 1788/SK/BAN-PT/Akred/S/VII/2018)

BANDUNG
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STATEMENT OF ORIGINALITY

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I, Patricia Hartieni (2017410024), hereby declare that my thesis titled as '**Interactions Among Spatiotemporal Variables, Psychological Mechanisms, and Lifestyles in Public Transportations Usage**' is a work of my own under guidance of supervisor and co-supervisor. I did not do any forms of plagiarism or unethical citing. Should there be found infringement or formal/non-formal indictment regarding the originality of this work, I am willing to bear any forms of penalty directed towards me, including revoking my academic degree given by Parahyangan Catholic University.

Bandung, February 12, 2021



Patricia Hartieni (2017410024)

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**BANDUNG
JANUARY 2021**

ABSTRACT

Lifestyle has been revealed to indirectly affects the use of a particular mode through built environment. It is suspected to also associate with usage of a certain travel mode through psychological mechanism such as motivation, commitment and intention, and past behavior. Furthermore, lifestyle was hypothesized to be able to explain the impact of psychological mechanism regarding other antecedents such as attitude and social norms. Integration among lifestyle, psychological mechanism, and spatiotemporal variables is supposed to describe the difficulty in shifting people to public transportation. However, studies about it has yet to be done. Using multilevel structural equation modelling (SEM), this study showed supports to that suspicion and was able to pinpoint that lifestyle significantly impacted public transportations time use both directly and indirectly through psychological mechanism determinants alongside with spatiotemporal variables.

Keywords : public transportation, lifestyle, space-time prism, travel behavior

**INTERAKSI ANTARA VARIABEL RUANG-WAKTU,
MEKANISME PSIKOLOGIS, DAN GAYA HIDUP
DALAM PENGGUNAAN
MODA TRANSPORTASI UMUM**

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ABSTRAK

Gaya hidup (*lifestyle*) diketahui memengaruhi penggunaan moda transportasi tertentu secara tidak langsung melalui variabel lingkungan binaan (*built environment*). Gaya hidup juga diduga memengaruhi penggunaan moda tertentu melalui faktor mekanisme psikologis seperti motivasi, komitmen dan intensi, serta pengalaman masa lalu. Lebih dari itu, keberadaannya pun dianggap mampu menjelaskan pengaruh mekanisme psikologis seseorang terhadap faktor pendahulunya, seperti pembawaan (*attitude*) dan norma sosial di sekitarnya. Integrasi antara gaya hidup, mekanisme psikologis, dan variabel ruang-waktu diduga kuat mampu menjelaskan sulitnya tantangan untuk meyakinkan masyarakat agar menggunakan moda transportasi umum. Akan tetapi, penelitian tentang hal tersebut masih sangat terbatas bahkan belum pernah dilakukan sebelumnya. Dengan menggunakan *structural equation modelling* (SEM) bertingkat, penelitian ini berhasil menunjukkan keterlibatan gaya hidup dalam memengaruhi waktu penggunaan moda transportasi umum baik secara langsung maupun tidak langsung melalui susunan mekanisme psikologis individu bersama dengan variabel ruang-waktu.

Kata kunci : transportasi umum, gaya hidup, *space-time prism*, perilaku berkendara

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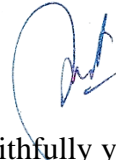
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Bandung, February 12, 2021



Faithfully yours,
Patricia Hartieni



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LIST OF NOTATIONS AND ABBREVIATIONS

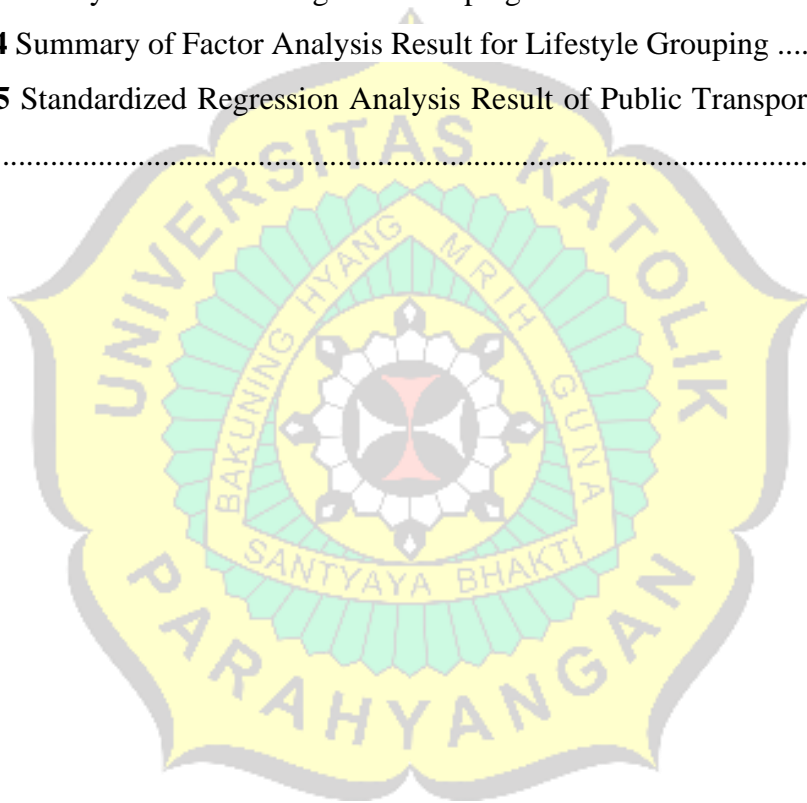
α	= intercept value of nlme package
β	= independent variable coefficient in regression analysis model
ϵ	= random error term of regression analysis model
u	= residual value of regression analysis model
X	= independent variable in regression analysis equation
Y	= dependent variable in regression analysis equation
A	= Attitude (toward public transportation)
AE	= Anticipated Emotion(s) (toward public transportation)
AIC	= Akaike Information Criterion
BD	= Behavioral Desire (toward public transportation)
BE	= Built Environment
BV	= Behavioral Volition (toward public transportation)
BIC	= Bayesian Information Criterion
BMA	= Bandung Metropolitan Area
CBD	= Central Business District
EMGB	= Extended Model of Goal-directed Behavior
GD	= Goal Desire (toward public transportation)
L	= Lifestyle categories
lme	= linear mixed effect, function in nlme package from R-studio
nlme	= linear and non-linear mixed effect model, package from R-studio
PB	= Past Behavior (toward public transportation)
PBC	= Perceived Behavioral Control (toward public transportation)
PT	= Public Transportation(s)
SC	= Sociodemographic Characteristics
SEM	= Structural Equation Modelling
SN	= Social Norms (toward public transportation)
STP	= Space-Time Prism
Time-Act	= Time use and Activity Participations
TPB	= Theory of Planned Behavior
TRA	= Theory of Reasoned Action

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PART I INTRODUCTION

1.1 Background Introduction

Over the years, various studies have been made to determine how a person realize their travel – in which would be referred as ‘travel behavior’ – and its driving forces. Dharmowijoyo et al. (2015, 2018), Dijst et al. (2008), Gärling & Axhausen (2003), and van Acker et al. (2010) stated that psychological mechanism combined with space-time variables contributed to people’s travel behavior (e.g. time-use for out-of-home social and recreational activities, perceived accessibility, travel mode choice). The inclusion of psychological mechanism reveals how travel is a product of complex interactions among instrumental characteristics (e.g. travel mode, travel cost, travel time), non-instrumental characteristics (e.g. will, habits, motivation) and environmental variables (Dharmowijoyo et al., 2015, 2018; Dijst et al., 2008; Lewin, 2008; van Acker et al., 2010). Complexity of social psychology in each individuals was found to affect various aspects of decision-making process, which involves personal motivation, volition, and habits (Dharmowijoyo et al., 2018). Adding the impact of space-time prism variables and psychological mechanism uncovers the uniqueness of individuals beyond socio-demographic variables. It explained that individuals’ travel behavior is not only influenced by gender, age, and income, but also defined by interactions of their personal and social roles within society, and how society also shapes people’s activity-travel patterns which creates different constraints and needs among individuals. Moreover, social psychology also discover subjective characteristics which might define different needs for every individuals. However, there are many individuals’ subjective factors that have not been revealed yet in explaining people’s activity-travel patterns.

Van Acker (2015) and Van Acker et al (2010) introduced another long-term subjective characteristics, called lifestyle. In her study, Van Acker (2015) referred lifestyle as “...*behavioral patterns, mainly in consumption and leisure, through which an individual elucidates his or her social position towards others.*” The study indicated indirect impact of a person’s lifestyle variables on motorized mode usage through built environment variables. Car usage is concluded to be affected by not only simply blunt reason (e.g. price, comfortability, speed) but also deeper factors

(e.g social relationships, personal attitudes, social status, preferences, possible constraints), which resembled elements of lifestyles (Van Acker, 2015).

The interaction of spatiotemporal variables and psychological mechanism was used to explain people's participation in various travel mode. Lifestyle has been revealed to indirectly affects the use of a particular mode through medium-term variables such as built environment. However, studies about possible link between lifestyle and psychological mechanism or whether the two concepts are irrelevant with each other has not been done. Lifestyle is suspected to also associate with usage of a certain travel mode through psychological mechanism such as motivation, commitment and intention, and past behavior. Lifestyle was further hypothesized to be able to explain the impact of psychological mechanism regarding other antecedents (e.g attitudes, perceived behaviour controls (PBC), and social norms).

Integration among lifestyle, social psychological mechanism, and spatiotemporal variables is supposed to describe the difficulty in shifting people to public transportation. Within severe traffic congestion particularly in cities in developing countries (Chakrabarty & Gupta, 2014; Shamsheer & Abdullah, 2015), the presence of public transportations has been mentioned in numerous studies to be one of the solutions for traffic congestion (Aftabuzzaman et al., 2010; Le & Trinh, 2016; Stopher, 2004), thus increased the initiatives to promote its usage. So far, research in travel behavior has been focusing on shifting motorized mode users to public transportations without considering the effect of psychological mechanism and space-time prism variables. The fact that main market for transport mode users is the individual which explains the reason why travel behavior has to address the psychological and human time allocation, as a form of understanding market demand (Batty et al., 2015; Tuan, 2015). Some studies concerned about accessibility effects of public transportations that might influence the tendency of its usage (Bocarejo & Oviedo, 2012; Curtis & Scheurer, 2017; Hernandez, 2018; Woldeamanuel & Cyganski, 2011). However, extention of public transportations research also includes the impact of usage satisfaction (Budiono, 2009; Ingvardson & Nielsen, 2019). Dharmowijoyo et al. (2015) claimed that habits affect travel mode selection process. It is quite common in areas with poor public transportations

facilities to be more contemplated about their travel mode, thus results to habits formed from feeling of success in making effort to eschew possible obstacles. Impacts of built environment such as living in well-built areas with better access to public places (e.g. educational institution, workplace, supermarket) and variative travel mode choices tend to decrease dependency toward private motorized vehicle use (Fagnant & Kockelman, 2014; Handy et al., 2005; Kockelman, 1997). Moreover, they also indicated higher tendency in using public transportations without eliminating the potential of owning private motorized vehicle.

Considering lifestyle aspect might reveal why some people are difficult to shift to public transportations and some people are not. Interaction among lifestyles, spatiotemporal variables, and psychological mechanisms could provide insight on designing transport policies to shift people from other modes to public transportations. As lifestyle is a long-term variable, effect of the proposed transport policies can also alter people's lifestyle to convince them in shifting to public transportations.

1.2 Problem Statement

Studies have shown that lifestyle might indirectly influence activity-travel participations through hierarchical decision theory (Van Acker, 2015; Van Acker et al., 2016a; Van Acker & Witlox, 2010). However, it can also be argued that lifestyle could influence activity and travel participation through psychological mechanism (Dharmowijoyo et al., 2015, 2018), although how those variables affiliated with each other are still limitedly known. Psychological mechanisms refer to response towards subjective needs that should be fulfilled. Then, an action has to be taken to realize that psychological mechanism. As most of psychological mechanisms are related to fundamental necessities such as feeling hunger, employed actions will be done regularly, thus would later form a habit. That habit will then form lifestyle, which can possibly influence travel behavior (Dharmowijoyo et al., 2018). Lifestyle could have also influenced travel behavior through behavior volition or habit, or even be considered as leading factor – alongside with attitude, perceived behavior control, anticipated emotions, and goal-oriented behavior – that affects behavioral desire.

This thesis is an attempt to discover the correlation among spatiotemporal variables, lifestyles, and psychological mechanisms in altering travel behavior. Aligned with the significance of travel behavior that has been well-recognized, many studies had been done in attempting to uncover every possible factors that may influence travel behavior itself. Furthermore, travel behavior might be the key to resolve transportation issues that has been increasing lately. By attempting to investigate another possibility regarding travel behavior, it is believed that progress to reach complete apprehension of travel behavior is one step closer than before.

1.3 Thesis Objectives

The purposes of this study are:

1. To find bivariate analysis the correlation of lifestyle on various psychological mechanisms and lifestyle on public transportation usage.
2. To discover the interaction among spatiotemporal variables, psychological mechanism and lifestyle on public transportation usage.

1.4 Scope and Limitations

The scope and limitations regarding this study are :

1. This thesis is made based on the travel diary dataset acquired in 2013 and 2017 lifestyle dataset from Bandung Metropolitan Area (BMA) as the second largest metropolitan in Indonesia, and has been previously used in several studies (Dharmowijoyo et al., 2015, 2018). Until this thesis was written, there has been no significant changes in transport-related regulations in Indonesia, but during that time there are possibilities that people's travel behavior has changed in parallel to current trends (e.g. emerging trend of online-based taxi such as Go-jek and Grab).
2. The acquired activity diary data covered individual activities for 24-hours (one full day) in 3 weeks time, by dividing it into 96 15-minutes daily inputs. This method enables researchers to have better insight on what every participants did during survey time every 15 minutes, as it could capture more diverse and detailed list than hourly inputs. But, it could be flawed as well because of its

inability to capture any activities that went on for under 15 minutes and was deemed insignificant personally (e.g. going to a nearby convenience store).

3. The survey was completed based on personal opinion of participants. As the basis of preference is personal opinion, this method is obviously beneficial in determining participants' stance in situations relating transportation services. The only concern about this method is that the dynamic of human emotion can be biased by diverse causes. For starter, different person would have different expectations of various aspects in life, which will affect their reaction towards the reality of that aspect (Berger, 1988). Furthermore, studies claimed that prior experience contributes in a person's mood (Cuijpers et al., 2007; Rehm, 1978), therefore could unintentionally give biased response towards the survey.

1.5 Methods

The main focus of this thesis is to discover the correlation between psychological mechanism impacts on lifestyle and/or vice versa in travel behavior scope. It is done based on 2013 and 2017 dataset acquired from participants in Bandung Metropolitan Area (BMA). The dataset covers participation in activity and travel, personal stance on travel-related matters and out-of-home activity, and individual lifestyle (socio-demographic and travel behavior routine). Multiple attempts of literature reviews from various credible and relevant resources (e.g. journals, academic papers) were also done in order to guarantee the best interpretation of the dataset itself.

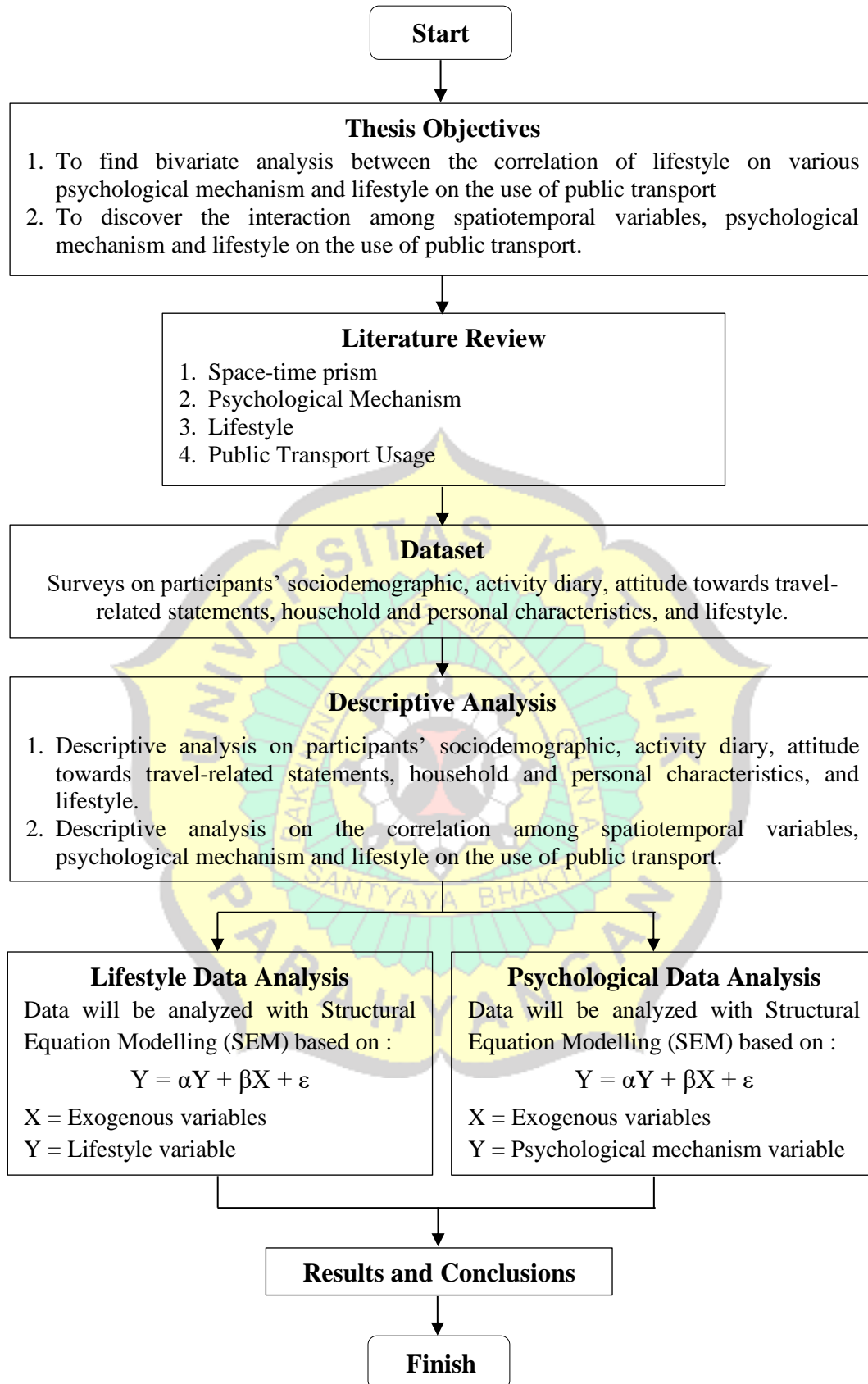


Figure 1.1 Flowchart of the Proposed Thesis

