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# Exploring the Key Determinants of Bicycle Share Program Use in a Leisure Context

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# EXPLORING THE KEY DETERMINANTS OF BICYCLE SHARE PROGRAM USE IN A LEISURE CONTEXT

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ABSTRACT

Over the past two decades, bicycle share programs (BSPs) have developed rapidly around the world, with studies finding that people use such service not only for commuting but also for leisure. However, compared to utilitarian BSP users, limited research has focused on the factors influencing BSP use for leisure experiences. To begin this limitation in the current cycling literature, this dissertation explores the key determinants of leisure BSP use.

The extended unified theory of acceptance and use of technology proposed by Venkatesh, Thong, and Xu (2012) and the dual-attitudes model conceptualized by Wilson, Lindsey, and Schooler (2000) provided the theoretical framework guiding this research. First, this dissertation developed the Unified Measurement of Bicycle Share Program Use (UMBSPU), an encompassing scale for further investigation of factors influencing an individual's leisure BSP use. The results of the measurement invariance testing and method effect examination indicated that this scale, which includes eight constructs and thirty-three measurement items, is a reliable, valid measurement. Second, this dissertation applied the UMBSPU to examine the influences of performance expectancy, effort expectancy, facilitating conditions, social influence, price value, hedonic motivation, and habit on Taipei citizens' intentions to use BSP and their actual use in leisure time. Among all factors examined, habit demonstrated the strongest predict validity of use intention. Furthermore, behavioral intention outperformed habit and facilitating conditions in explaining the variance of actual use.

Finally, this dissertation used two Single Target Implicit Association Tests (ST-IATs) to explore BSP users' implicit attitudes toward leisure cycling and leisure cyclists. Explicit attitudes toward leisure cycling and social identity with leisure cyclists were also measured and compared with implicit attitudes, the results indicating that implicit attitudes did not significantly predict leisure BSP use. However, social identity exhibited a strong predictability of an individual's public bicycle riding frequency. Future research is needed to cross-validate the UMBSPU in different contexts and to compare the results from the leisure cycling and cyclists ST-IAT across different types of cyclist groups.

## DEDICATION

To my father, Chin-Wen Chen, who encouraged me to chase my dream of achieving a PhD, but sadly will never be able to read this dissertation.

To my mother, Ching-Hsiu Chen, who made all of this possible, for her endless supports and patience.

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# CHAPTER ONE

# INTRODUCTION

## Research Background

A bicycle share program (BSP) is a short-term rental service where bicycles are checked out from one docking station and returned to another, and they have developed rapidly over the past two decades (Fishman, Washington, & Haworth, 2013). At the end of 2016, 1,163 BSPs were in operation around the world (R. Meddin, personal communication, December 22, 2016). The popularity of BSPs may be a result of their benefits to society, including, providing an ecofriendly solution to the “first- and-last-mile” problem in public transportation and bridging the gap between the transportation networks (Shaheen, Guzman, & Zhang, 2010). Their convenience and low cost make them a practical approach for incorporating bicycling into people’s everyday lives and a regular transportation mode (Fishman, Washington, & Haworth, 2013). However, researchers have found that BSPs’ role is larger than daily commuting (Murphy & Usher, 2015; Pai & Pai, 2015; Vogel et al., 2014).

For example, in Dublin, Murphy and Usher (2015) found that during peak hours, 85.6% of riders were commuting, however, during off-peak hours, 48.3% rode for leisure, indicating that the BSP in Dublin has various roles and functions at different times. In France, Vogel et al. (2014) also found that a group of Vélo bicycle users typically use BSPs on weekends and at night, suggesting that their practice is likely for leisure. This phenomenon is not limited to Europe. Pai and Pai’s (2015) found that 28% of the Taipei’s BSP users primarily use such services for recreation. Furthermore, when asked about their intention for future use, 90% of the respondents expressed their willingness to use BSPs as a means of recreation, 10% more than the percentage of people willing to use it for commuting (80%).

These studies indicate that a BSP functions not merely as a public transport service but also serves users with leisure purposes. An intriguing research question that merits further investigation is "Why do people ride public bicycles for leisure?" To answer this question, we need to first understand the fundamental difference between leisure cycling and utilitarian cycling. We, then, can examine the causes that encourage individuals to integrate cycling into their leisure life. As Kelly and Freysinger (2004) suggested, leisure may refer to a product of a decision, a period of time, a process, and/or a state of mind. It can also be viewed as an activity in which people engage with their free will. In most instances, it is pleasurable and able to rejuvenate the individual (Kraus, 1971). In short, leisure can be seen as an activity, separately from the duty of work, family, and society, which individuals perform for either a feeling of freedom, relaxation, diversion, or broadening their knowledge in a relatively unconstrained condition (Dumazedier, 1974). Therefore, individuals choose leisure behaviors for intrinsic satisfaction rather than extrinsic rewards.

For example, individuals may consider cycling as a means of transportation to work or school because they are too young to drive a car or cannot afford other transportation options. People may not intrinsically like cycling for transportation, but have to do it. In contrast, individuals may choose to cycle in their unobligated time because they enjoy cycling. It becomes an activity from an internally compelling love, which is personally pleasing and intuitively worthwhile (Godbey, 1985). In other words, the primary difference between leisure cycling and utilitarian cycling is that leisure cycling is intrinsically motivated; it is valuable for its own sake (Cushman & Laidler, 1990). However, most of the BSP research has focused on the utilitarian factors of public bikes, not on leisure uses (Fishman, 2016), indicating the information in this area is limited.

Previous research has pointed out that not only commuting trips but also leisure BSP trips could provide significant support for local economies (Murphy & Usher, 2015). To maximize the benefits of BSPs, understanding the determinants of leisure use is as important as those for utilitarian trips. Given that the factors influencing these two uses are different, the existing research instruments or methods originally developed to examine commuting use may not be able to fully explain leisure use (Bachand-Marleau, Lee, & El-Geneidy, 2012; Pai & Pai, 2015). Therefore, more research and new instrument development is needed to better understand the key determinates of BSP use in a leisure context.

Furthermore, the East Asia region has been shown to have the strongest bicycle sharing activity in the world (DeMaio & Meddin 2016), but the research on this area is limited compared to the number of studies focused on Europe and North America (Fishman, 2016; Pai & Pai, 2015). The factors influencing leisure BSP use may differ across cultures, geographic limits, and BSP operating models. The research results found for the West may not fully explain this phenomenon in the East. Thus, more research is needed for a better understanding of BSP use especially in the East Asia region. As

YouBike in Taipei Taiwan has been found to be one of the most successful BSPs in Asia (Eco-Business, 2014) with a large number of leisure users (Pai & Pai, 2015; Ting, 2014), this dissertation focused on these users.

## Theoretical Framework

While many studies have examined the factors that either encourage or discourage cycling, they may not have considered the differences between the characteristics of public and private bicycles. Therefore, when analyzing the determinants of BSP use, researchers should clarify the type of activity being investigated, meaning that factors that may only influence BSP use, such as the locations of the bike stations, bicycle availability, and pricing, should also be considered; in addition, factors that may be associated with both types of cycling, such as attitudes or habits, should be modified to fit the BSP investigation.

Pai and Pai (2015) pointed out that factors influencing BSP use can be generally categorized into four dimensions: (1) system characteristics, such as a convenient rental procedures and emergency preparedness and response; (2) environmental characteristics, such as bike lane quality and the convenience of transferring to other public modes of transportation; (3) existing restrictions of cities, such as geographical conditions, climate, social support and cultural influences, and policies; (4) the BSP users' demographic, socioeconomic, and behavioral attributes, such as physiological ability, or credit card ownership. Researchers have also found that convenience (Fishman, 2016; Verma, Rahul, Reddy, & Verma, 2016), easy access to BSP stations (Bachand-Marleau et al., 2012; Fuller et al., 2011), interaction with other transportation modes (Fishman, Washington, &

Haworth, 2012; Kaplan, Manca, Nielsen, & Prato, 2015; Tang, Pan, & Shen, 2011), and safety concerns (Muñoz, Monzon, & López, 2016; Winters, Davidson, Kao, & Teschke, 2011) are the most frequently mentioned determinants of BSP use among commuters.

Although these studies have contributed to our knowledge of utilitarian BSP use, few have attempted to develop a unified theory to explain such use. The lack of a unified theoretical model able to integrate the fragmented research may make capturing the most critical determinates of BSP use difficult and, thus, inhibit the advancement of this field. Specifically, when investigating factors that influence BSP use, researchers may easily encounter a problem in picking "preferred" constructs across various studies. Therefore, formulating a unified theoretical model to investigate and compare the factors influencing such use is both important and needed.

Given that the current operating BSPs typically include the newest technology (e.g. solar-powered stations, GPS tracking, and real-time transit integration), they can be viewed as an innovative non-motorized vehicle; thus, researchers have adopted theories from the information technology (IT) acceptance field to investigate BSP use (Chen, 2016; Chen & Lu, 2015, 2016). Chen and Lu (2015) applied the green technology acceptance model (green TAM) to investigate how perceived usefulness, perceived ease-of-use and user attitude influence BSP users' green intentions, while, Hazen, Overstreet, and Wang (2015) modified TAM to investigate the predictive validity of perceived quality, perceived convenience, and perceived value on an individual's intention to adopt a BSP in Beijing, China. Given that these studies primarily focused on utilitarian BSP use, some factors that significantly influence leisure use might not have been included.

For instance, Fishman, Washington, Haworth, and Mazzei (2014) pointed out that “fun” is an important factor to encourage citizens in Brisbane and Melbourne to use BSPs. However, few studies integrate this intrinsic type of motivation, such as fun or enjoyment, into TAM to investigate BSP use. To more fully understand the leisure user psychology, a further extension of TAM is necessary.

Venkatesh, Thong, and Xu (2012) expanded the unified theory of acceptance and use of technology (UTAUT), which integrated eight theories/models that have been frequently applied in IT acceptance research, to better understand consumer psychology and behavior. The extended UTAUT (UTAUT2) demonstrated significant improvement over the original model in explaining the variance in a consumer’s behavioral intention (56 % to 74%) and technology use (40% to 52%). As a result, it can be viewed as a more encompassing theoretical framework regarding consumer IT acceptance and use behavior.

The determinants of BSP use have been found to be compatible with the framework of the UTAUT2. For instance, Fishman et al. (2013) pointed out that convenience and economic value are the key factors motivating an individual’s BSP use, and these factors are similar to the effort expectancy and price value constructs in the UTAUT2. In Taiwan, Chen’s (2016) research revealed that BSP use might be influenced by positive emotions (e.g., relaxed, happy, or gratified), which parallels “hedonic motivation” in the UTAUT2. Given that the UTAUT2 was developed in a consumer context with a focus on voluntary behavior, thus sharing some of the characteristics of leisure cycling and BSP use, it is employed in this dissertation to explore an individual's acceptance and use of these innovative IT-embedded bicycles.

Although the UTAUT2 is a suitable social cognitive model for exploring an individual's rational decision-making process, researchers have found that human beings are easily influenced by emotional, social, and symbolic factors as well (Nosek, Greenwald, & Banaji, 2005; Sheeran, 2002; Yang, He, & Gu, 2012). Specifically, human behavior is not only influenced by logical thinking, but also by unconcious and automatic reactions (Hofmann, Friese, & Strack, 2009). In psychology, these two fundamentally different modes of cognitive processing, one intuitive and fast and the other deliberative and slow, have been postulated as the dual-processing theory (Frankish, 2010; Hofmann et al., 2009; Kahneman, 2011; Stanovich, 1999).

Parallel with this theory, Wilson, Lindsey, and Schooler (2000) conceptualized a dual-attitudes model for describing how an individual can have two attitudes toward the same individual or issue. One of these attitudes, the explicit attitude, is the deliberate expression of an attitude controlled by the conscious mind, while the implicit attitude is an associative, automatic, and habitual response toward an object. Implicit bias, then, has also been found to play a role in perceptions of cyclists or cycling. For example, non-cyclists may perceive cyclists as ‘‘greenie activists,’’, militant students, or elitists even though cyclists may not act like any of these types of people (Daley & Rissel, 2011). This implicit bias may result from social meanings and the perspectives of various social groups; individuals apply more positive social meanings to their in-groups ("us") and adhere stereotypes to their out-groups ("them") even if they are unaware of it (Fitt, 2015).

Because the influence of both explicit and implicit attitudes is significant to human behavior, this dissertation also uses the dual-attitudes model to explore the key determinants of leisure BSP use. The theoretical framework of this research is visually presented in Figure 1.

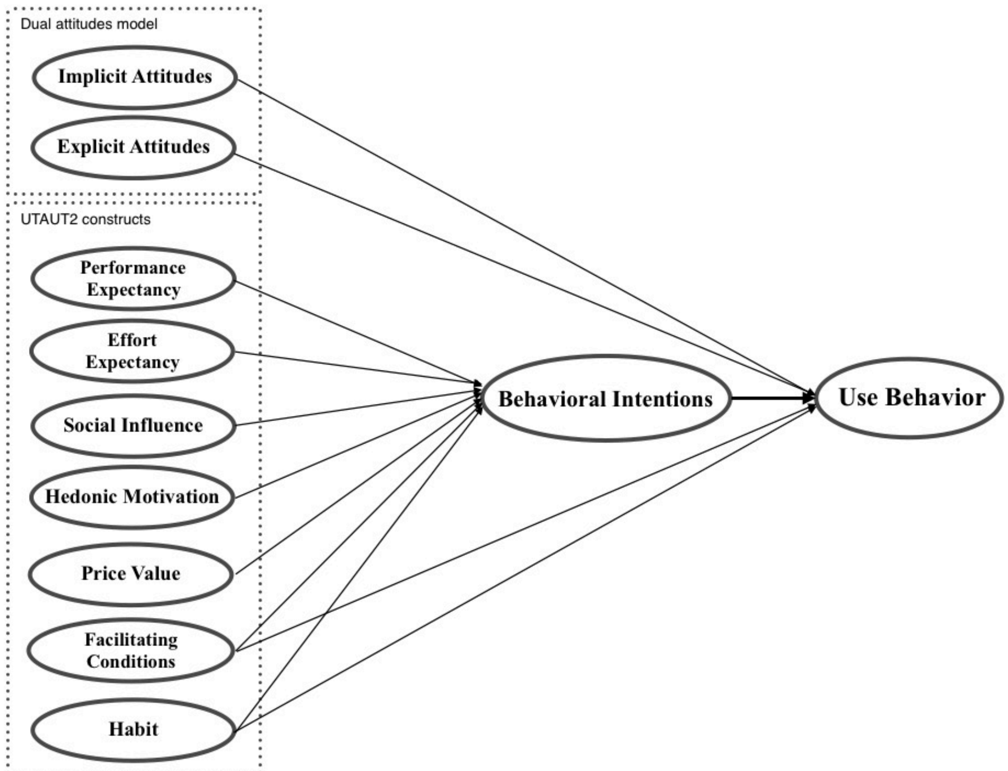


Figure 1. The Theoretical Framework of Leisure BSP Use

## Purpose of the Research Project

This primary purpose of this dissertation is to explore the determinants of BSP use in a leisure context. Specifically, the study adopts the UTAUT2 and the dual-attitudes model as the theoretical framework for exploring individuals' acceptance and use of a BSP in their leisure time. Three main goals guiding this research are: (1) To develop a sufficiently encompassing yet parsimonious measurement scale to study leisure BSP use; (2) To explore the factors influencing the use of an urban BSP for leisure among Taipei citizens; and (3) To assess the influences of implicit and explicit attitudes toward leisure cycling and leisure cyclists on leisure BSP use.

## Significance and Impact of this Study

Over the past two decades, BSPs have expanded rapidly worldwide. Although East Asia has the strongest bicycle share activity, studies conducted in this area are limited (Fishman, 2016). In addition, existing studies primarily focus on commuting cyclists, with only a few emphasizing leisure BSP use. Therefore, it is believed that the contributions of this dissertation are fivefold:

(1) This dissertation examines the key determinants of leisure BSP use by adopting the UTAUT2, a theory that has not previously been applied in cycling-related research;

(2) The integration of cycling behavior into the theoretical framework of the UTAUT2 furthers the generalizability of the theory by applying it in a different context, an important step in advancing a theory;

(3) By incorporating the dual-attitudes model into the investigation, this study suggests that human's implicit attitudes may be another key determinant of BSP use ;

(4) Utilizing indirect measures to explain BSP use addresses the limitations of self-reported data that are sometimes inaccurate due to social desirability; and

(5) Finally, from a practical perspective, the knowledge obtained from this study can help governments or the leisure industry more effectively market BSP as an environmental-friendly, healthy, and pleasurable leisure activity.

## Dissertation Format

This dissertation is structured in the multi-article format, with Chapter One being the introduction, Chapters Two, Three, and Four being completed manuscripts, and Chapter Five is a summary of the overall research project. Each article includes an introduction, a literature review, an explanation of the research method and analysis, the results, and a conclusion and discussion. Chapter Two is a conceptual article that develops the *Unified Measurement of Bicycle Share Program Use (UMBSPU)*, particularly focusing on leisure use. Chapter Three explores factors influencing Taipei citizens' intentions to use BSP (i.e., YouBike) in their leisure time and the key determinants of the frequency of their use. Chapter Four examines an individual's explicit and implicit attitudes toward leisure cycling and leisure cyclists and their influences on leisure BSP use. The final chapter summarizes the primary findings of the three articles as well as discusses future research directions and implications.

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# CHAPTER TWO

# DEVELOPMENT OF A UNIFIED MEASUREMENT SCALE FOR BICYCLE SHARE PROGRAM USE IN A LEISURE CONTEXT

## Introduction

Bicycle share programs, also called bike-share, cycle hire, cycle sharing, and public bicycle systems have become more popular across the world over the past two decades (DeMaio & Meddin 2016; Fishman, Washington, & Haworth, 2013). The first automated bicycle share program (BSP), which refers to a short-term rental service where information and communications technology (ICT) embedded bicycles are made available from one docking station and returned to another, was initiated in Rennes, France, in 1998. Since then, 1,207 programs have emerged throughout the world. Although 144 programs ceased operation from June 1998 to December 2016, currently, 1,163 are still in operation (R. Meddin, personal communication, December 22, 2016). The fundamental function of a BSP is to incorporate cycling into an individual's everyday life so that it can gradually become a regular mode of transportation (Fishman et al., 2013). However, previous studies have found that a BSP's role is larger than daily commuting.

In Lyon, France, some users were found to ride public bicycles only on weekends and at night, suggesting that their practice is for leisure (Vogel et al., 2014). Dublin's BSP shares a similar phenomenon, with Lyon, as Murphy and Usher (2015) discovered that during peak hours, the BSP was dominated by commuting trips; by contrast, during off-peak hours, 48.3% of the users rode only for leisure, indicating that the BSP in Dublin has various roles and functions at different journey times. Studies have also indicated that short-term users have a greater probability to ride public bicycles for leisure. Fishman (2016) investigated CityCycle users in Brisbane and found that 65% of casual users reported leisure or sightseeing as the primary purpose of their last trip. Similarly, 53% of short-term users were found to use the BSP to sightsee and run errands in the Washington, D.C. area (Buck et al., 2013). These studies have revealed that as a public transport service, a BSP serves multiple roles and purposes. Specifically, a BSP can be a recreational activity for locals and tourists.

The important question that merits further investigation is “What are the key determinants of BSP use in a leisure context?” Although there is a growing body of research on BSPs, studies on people who use it for leisure are limited. Fishman’s (2016) review of recently published BSP research found that the majority of studies focused on factors influencing the willingness to commute using public bikes. Since the intentions to cycle for daily commuting purposes and for leisure are influenced by different factors (Chang & Chang, 2009; Sherwin, Chatterjee, & Jain, 2014), the existing research instruments developed to examine BSP use among commuters may not be able to fully explain the factors that affect its leisure use (Bachand-Marleau, Lee, & El-Geneidy, 2012; Pai & Pai, 2015). Furthermore, researchers could gain insight from the factors associated with commuters’ willingness to use a BSP (Pai & Pai, 2015) by applying theories with roots in psychology and sociology to develop a more comprehensive model. The reason for the limited depth in the research is because widespread BSP use is a fairly new phenomenon and most existing studies have remained in the exploratory phase.

However, the lack of a unified model able to integrate fragmented studies, may inhibit the advancement of a theory and fail to capture the most critical determinates of BSP use in a leisure context. Researchers may encounter problems in “picking” constructs across various research areas. Therefore, this study proposes an encompassing yet parsimonious measurement tool to study leisure BSP use, referred to as the Unified Measurement of Bicycle Share Program Use (UMBSPU).

BSPs typically employ the newest technology (e.g., solar-powered stations, GPS tracking, real-time transit integration systems, and smartcard integration), meaning that they cannot simply be viewed as traditional non-motorized vehicles, but rather as an innovative transportation mode (S. -Y., Chen, 2016). Previous studies have pointed out that factors influencing commuters' use and acceptance of these newest information and communications technology ICT embedded public bicycles are different from factors regarding personal bikes (Bachand-Marleau et al., 2012; Pai & Pai, 2015). Thus, researchers have attempted to adopt theories from the field of information systems and technology (IT) to investigate BSP use. Particularly, the technology acceptance model (TAM) has been modified in several studies to explore an individuals' BSP use with fruitful findings (S.-Y. Chen, 2016; S.-Y. Chen & Lu, 2015, 2016; Hazen, Overstreet, & Wang, 2015). Although the applications of TAM have enhanced our understanding that theories from the IT field can be used to explore factors associated with the intention to adopt BSP, it has been suggested that this model includes critical factors that may influence people's decision to cycle in general (Hazen et al., 2015).

The unified theory of acceptance and use of technology (UTAUT), which integrates 32 similar variables across eight theoretical models that have been frequently applied in IT acceptance research, has been found to be one of the most comprehensive social cognitive models for explaining an individual's intentions and behaviors in terms of technology use in an organizational setting (Venkatesh, Thong, & Xu, 2016). However, it has been criticized for its inability to predict the influence of some key elements related to technology use in a consumer-focused context. After comparing studies that applied the UTAUT to investigate consumer behaviors, Venkatesh, Thong, and Xu (2012) incorporated three additional constructs (i.e., hedonic motivations, price value, and habit) into the model. This extended UTAUT (i.e., UTAUT2) has demonstrated a significant improvement over the original model in explaining the variance in consumers' intentions for technology use (56% to 74%) and their actual use behavior (40% to 52%). Given the lack of research on leisure use of BSP and the positive precedent for applying IT acceptance theories to explain BSP use behavior, UTAUT2, which also focuses on voluntary behaviors, was adopted in this study as the conceptual framework for exploring the determinants of BSP use in a leisure context.

The development of a measurement of BSP use with the UTAUT2 framework is valuable for both basic and applied scientific endeavors. Researchers can use this tool to empirically examine the relationships among factors and their influence on the adoption of BSP across different settings and cultures. Additionally, the integration of leisure cycling behaviors into the theoretical model of UTAUT2 furthers the generalizability of this theory to a new discipline, an important step in advancing a theory. Furthermore, since this scale modifies a theoretical model from the field of technology acceptance, it can also be used to explore determinants of the use and acceptance of the newest type of bicycles, such as e-bikes or booster bikes. The BSP professionals and practitioners can also use this tool to evaluate and understand the factors influencing customer behavior and simultaneously improve their service. Therefore, developing a uniform approach to quantify the influence of various factors on an individual's adoption of BSP not only serves to add fullness to the existing literature but it also systematically advances our knowledge about the focal phenomenon and the theory itself.

## Literature Review

While factors that encourage cycling have been studied extensively, the differences between public and private bicycles merit investigation, in particular those characteristics that are unique to BSP programs, such as the locations of the docking stations, the availability of public bicycles, and the rental fee. Since the majority of current operating BSPs are using the third-generation systems, which integrate the newest technologies with public bicycles (Shaheen, Guzman, & Zhang, 2010; Wong & Cheng, 2015), adopting theories from the field of IT acceptance may provide innovative and alternative approaches for exploring these programs and to discovering some crucial factors that have not been examined in previous cycling research more focused on the intention to ride traditional bicycles. Therefore, this section uses the UTAUT2 as framework to synthesize BSP literature in order to lay the theoretical foundation for developing the UMBSPU.

## An Overview of the UTAUT2

The acceptance and use of information technology are two frequently investigated research topics in the IT field, supported by the theoretical models that have been proposed and examined (Venkatesh, Morris, Davis, & Davis, 2003). For example, TAM hypothesizes that when users are presented with a new technology, the factors of "perceived usefulness" and "perceived ease-of-use" will influence their decision to use or not (Davis, Bagozzi, & Warshaw, 1989). In addition, models based on the theory of planned behavior (TPB), which extend from the theory of reasoned action (TRA) by including perceived behavioral control, have also been applied to many studies (Ajzen, 1991).

After comparing and examining the eight models most frequently used in IT research, namely TRA, TAM, TPB, the technology acceptance model and the theory of planned behavior (C-TAM-TPB), the motivational model (MM), the innovation diffusion theory (IDT), the model of PC utilization (MPCU), and the social cognitive theory (SCT), Venkatesh et al. (2003) proposed the UTAUT as a more comprehensive model for examining intention and technology use. This model distilled factors related to behavioral intentions in organizational contexts, categorizing them into the four constructs of performance expectancy, effort expectancy, social influence, and facilitating conditions, and the four moderators of age, gender, experience, and voluntariness.

This theory hypothesizes that performance expectancy, effort expectancy, and social influence affect behavioral intention towards technology use, while behavioral intention and facilitating conditions predict the actual use. Furthermore, individual differences, namely age, gender, experience, and voluntariness, moderate the relationships among the constructs. In a longitudinal study, the UTAUT was able to explain 70% of the variance in behavioral intention and 52% of the variance of technology use (adjusted $R^2$), results that were better than the eight adopted models (Venkatesh et al., 2003).

UTAUT, initially, was developed to explain employee technology acceptance and use in an organizational setting; however, in the context of consumer technology use, where individuals can freely choose products, the original UTAUT does not capture some key elements influencing their IT use intention and behavior. Venkatesh et al. (2012), modified and tested an extended version of the UTAUT, which focused on the consumer context, integrating three new constructs, hedonic motivation, price value, and habit, into the model. Moreover, voluntariness was dropped from the model because it can be seen as a continuum from completely compulsory to completely voluntary, and since most consumer behaviors are voluntary, it added no variance to the construct.

Since its introduction, the UTAUT2 has been applied in various fields. For example in education, it was used to investigate teacher acceptance of learning management software (Raman & Don, 2013) and undergraduate students' adoption of mobile learning models (Yang, 2013); in e-commerce, the model was applied to examine the adoption of mobile payments (Slade, Williams, & Dwivedi, 2014); in the health field, users' intentions to adopt health and fitness apps were analyzed using this model (Yuan, Ma, Kanthawala, & Peng, 2015). The UTAUT2 has also been used in various cultural contexts, for example in studies of hospital quality in Jordan (Alazzam et al., 2015), smartphones use in Brazil (Faria, Giuliani, Pizzinatto, & Pizzinatto, 2014), and online shopping in India (Tandon, Kiran, & Sah, 2016). Researchers also have used the UTAUT2 to investigate different generations, applying it to explain Internet banking use by individuals over 55 (Arenas-Gaitan, Peral-Peral, & Ramon-Jeronimc, 2015). Despite scholars in different fields using this model for investigating various subjects and obtaining fruitful research findings, its application to cycling behaviors and BSP use is limited. This research aims to apply the UTAUT2 in a different context, thus adding to the current knowledge of both the model and BSP use. In the following section, each variable in the UTAUT2 is discussed and modified to fit the context of BSP use.

## Conceptual Framework

### *Performance expectancy*

Performance expectancy refers to the degree to which an individual believes that using a technology will benefit consumers in performing certain activities (Venkatesh et al., 2012), and is conceptualized from five constructs from different theories, extrinsic motivation from MM, relative advantage from IDT, outcome expectations from SCT, perceived usefulness from TAM, and job-fit from MPCU (Venkatesh et al., 2003). This variable is expected to be a strong predictor of employee technology use intention and behavior in a mandatory setting (Venkatesh et al., 2003; Venkatesh & Zhang, 2010). Factors sharing similar concepts with performance expectancy have also been found to be influential in connection with BSP use. For example, Hazen et al. (2015) contextualized the perceived usefulness of TAM, redefining as a possible transportation option for daily commuting, to investigate BSP use among residents in Beijing. They found that this factor was positively associated with the intention to use BSP. In some studies that modified TAM to investigate the intention to adopt green transportation, green perceived usefulness, which refers to the extent to which individuals believe that a BSP increases their environmental commitment, was found as the most important factor associated with users' acceptance of BSP (S.-Y. Chen, 2016; S.-Y. Chen & Lu, 2015, 2016). Synthesizing these studies, performance expectancy in this study is conceptualized as the degree to which people believe that BSP is an attractive transportation mode for their leisure time and is helpful in improving their personal leisure life.

*Effort expectancy*

Effort expectancy is defined as the degree of effort that an individual believes to be associated with using a system (Venkatesh et al., 2012). It integrates three constructs of existing theories, which are complexity (MPCU), ease-of-use (IDT), and perceived ease-of-use (TAM). The effort expectancy construct is hypothesized to be associated with behavioral intention in the early stages of a new behavior. When difficulties are overcome, the influence of effort expectancy is gradually reduced (Venkatesh et al., 2003; Venkatesh et al., 2012; Venkatesh & Zhang, 2010). In the BSP literature, perceived convenience also frequently appears as important factor among those investigated (Fishman et al., 2013; Hazen et al., 2015; Pai & Pai, 2015; Verma, Rahul, Reddy, & Verma, 2016). For example, the effort required by a sign-up process for becoming a member is a critical factor influencing BSP use. As Fishman, Washington, and Haworth (2012) found, an inconvenient sign-up process strongly discourages individual from using a BSP and eventually results in the negative belief that it is not for the general public. In addition, the locations and number of docking stations, the availability of bicycles, and the connectivity with other transits also influence the effort involved in BSP use and impact an individual's intention to use it (Bachand-Marleau et al., 2012; Fuller et al., 2011; Pai & Pai, 2015). Therefore, in the BSP literature, effort expectancy is typically contextualized as perceived convenience or perceived ease-of-use, meaning the time and effort required to use a BSP (Hazen et al., 2015). In this study, effort expectancy refers to the degree to which an individual believes that using a BSP is easy and convenient, specifically in regards to the process of becoming a member, renting and retuning bicycles, and finding stations.

*Social influence*

Social influence in the UTAUT2, defined as the degree to which people perceive that significant others consider they should use the product (Venkatesh et al., 2012), is an integration of the subjective norms in TPB/DTPB, TRA, TAM2, and C-TAM-TPB; the image in IDT, and the social factors in MPCU. Venkatesh et al. (2012) found significant effects for social influence on behavioral intention when individual differences were not included in the model. However, when gender, age, and experience were included in the model, the direct effect of social influences on behavioral intention disappeared. Individual differences moderated the relationship probably because the role of social influence in the human decision-making process is complicated and subject to a broad range of contingent influences (Barnett & Casper, 2001).

Social influence has also been found to have an impact on an individual's transportation choice at different levels (Fitt, 2015). More specifically, social influence may take the form of direct influence from social interactions with partners and families, a less direct influence through friends and colleagues, or an indirect influence from the broader sociocultural context (Sherwin et al., 2014). For example, an individual may cycle more if others views cycling as a normal activity in society, while in contrast, an individual may be intimidated by an aggressively pro-car culture in the workplace and choose not to cycle anymore (Fitt, 2015). Furthermore, conflicts among cyclists, motorists, and pedestrians on shared paths and sidewalks are often seen as barriers to the adoption of cycling (Fishman et al., 2012; Kaplan & Prato, 2016). In this study, social influence is defined as the degree to which an individual believes that using a BSP is directly influenced by significant others or indirectly influenced by the city's cycling culture.

*Facilitating conditions*

Facilitating conditions, which refer to an individual's perceptions of the resources accessible for adopting a new system or performing a certain behavior (Venkatesh et al., 2003; Venkatesh et al., 2012), integrates three theories that share the similar concepts of compatibility from IDT, facilitating condition from MPCU, and perceived behavioral control from TPB. In cycling-related studies, facilitating conditions are often contextualized as the perception of bicycle infrastructures and facilities that make cycling to work or school easier (Kaplan, Manca, Nielsen, & Prato, 2015). Adequate bicycle facilities have been found by many researchers to be essential for encouraging more people to cycle (De Sousa, Sanches, & Ferreira, 2014). In the BSP literature, researchers have also found a strong association between bicycle share activity and the existence and length of bike lanes, even controlling for the influence of docking stations and retail opportunities (Buck et al., 2013; Faghih-Imani & Eluru, 2015). For recreational cyclists, an attractive bicycle lane is one along scenic areas or famous attractions (Chang & Chang, 2009), located in a natural environment with green foliage (Heesch, Giles-Corti, & Turrell, 2014), with a low volume of traffic (Chang & Chang, 2005), and with restaurants and coffee stores (C.-F. Chen & Chen, 2013). In this study, facilitating conditions are operationalized as natural environments or bicycle facilities that increase individuals' willingness to use a BSP in their leisure time.

*Price value*

Unlike the UTAUT, which was developed in a workplace context, the UTAUT2 focuses on customers, who fund and adapt the technology. Therefore, the price of a product may significantly influence consumers' intentions to use a new system (Venkatesh et al., 2012). In addition to price, perceived value is centered on consumer experience as well, involving a tradeoff of giving and getting components. In other words, the willingness to pay a price for a specific good or service is usually determined by the perceived value of this product or service (Zeithaml, 1988). In the UTAUT2, the price value, then, is defined as an individual's cognitive tradeoff between the monetary cost for using the technology and the perceived benefits of it (Venkatesh et al., 2012).

In cycling-related research, the perception of benefits and values has also been found to have important influences on an individual's decision to cycle. These include the perceptions of the health benefits from exercise (Fitt, 2015), the cost saving benefits, the convenience and flexibility of cycling, the timesaving benefits from avoiding traffic congestion (Willis, Manaugh, & El-Geneidy, 2015), and eco-friendly values (Dill & Voros, 2007). In addition to these benefits, researchers have also found that BSP users are cost-sensitive. For example, Fishman et al. (2013) investigated the motivations for BSP use and found that convenience and value for the money are the key factors. Pai and Pai (2015) also found that BSP users pay particular attention to rate and efficiency. Furthermore, those who own bicycles find BSPs attractive as a way to save money on maintenance cost (Bachand-Marleau et al., 2012) and to be free from worries about theft and vandalism (Curto et al., 2016). In general, BSP users are not only focused on the benefits that cycling can provide and are also very mindful of the monetary costs. Therefore, in this study, price value is contextualized as an individual's cognitive tradeoff between the perceived benefits of the BSP and the monetary cost for its use.

*Hedonic motivation*

The UTAUT highlights the significance of utilitarian value and outcome-orientated motivations so constructs linked to usefulness, such as performance expectancy, have been found to be the strongest predictors of the intention to use a new system (Venkatesh et al., 2003). However, in the consumer context, hedonic motivations (e.g., enjoyment and fun) may play an important role in people's behavior. From the perspective of motivation theory, integrating both extrinsic and intrinsic motivations may help better understand human behaviors (Ryan & Deci, 2000). Therefore, hedonic motivation is added to the UTAUT2 model, referring to the perception of fun or pleasure associated with using a technology or performing a behavior.

Perceived fun or pleasure is also linked to cycling. For example, Fitt (2015) investigated the influences of social meanings on everyday transportation practices and found that people's perceptions of leisure cycling are often associated with fun, pleasantness, and cafes. This factor plays a significant role in encouraging BSP use as well. For instance, Fishman, Washington, Haworth, and Mazzei (2014) found that fun was ranked fourth (after convenience, docking station proximity, and health benefits) in attracting people to use BSPs. This perception seems to have no national boundaries or cultural differences as a Taiwanese researcher also found that positive emotions (e.g., happy, excited, glad, and relaxed) and escapism (i.e., forget troubles) have a significant influence on an individual's intention to use BSPs in Taiwan (S.-Y. Chen, 2016). Thus, hedonic motivation should be investigated in the context of leisure BSP use. In this study, it is operationalized as the degree to which an individual believes that riding public bicycles can help him or her obtain feelings of enjoyment, fun, relaxation, and escapism.

*Habit*

Behavioral intention postulated as an indicator of an individual's mental readiness for an act has been investigated extensively in the psychology field. However, its role as the only predictor of human behaviors has been challenged (Rhodes & Bruijn, 2013; Sheeran, 2002a; Verplanken, Aarts, Knippenberg, & Moonen, 1998). Rhodes and Bruijn (2013) conducted a meta-analysis using the guidelines of the action control framework to quantify the intention–behavior gap in the public health field, finding that the overall intention–physical activity gap was 46%. Sheeran's (2002) meta-analysis of meta-analyses found that, on average, behavioral intention explains only 28% of the variance of a given behavior. He further suggested that other factors such as automaticity, past behavior, and habit seem to be another set of factors that predict human behavior, a conclusion supported by Verplanken et al. (1998).

Upon noticing the impact of habit on human behavior, Venkatesh et al. (2012) integrated this factor into the UTAUT2 to “complement the theory’s focus on intentionality as the overarching mechanism and key driver of behavior” (p.158). They conceptualized habit as a repetitive behavior that could be measured as the extent to which an individual believes that the given behavior is automatically performed without deliberation. In the context of cycling, habit has been found to be strongly associated with an individual’s decision to commute by bicycle. For example, De Bruijn, Kremers, Singh, Van den Putte, and Van Mechelen (2009) integrated habit into TPB, finding it was the strongest predictor for cycling. Furthermore, intentions became less relevant in cycling behavior as the strength of habit increased. The habit of cycling is also found to be significantly associated with riding public bicycles for leisure in the daytime (Pai & Pai, 2015). Therefore, habit is integrated into the UMBSPU, contextualized as situation-specific sequences that can be measured as the degree to which an individual believes that BSP use has become so automatic that it occurs without self-instruction.

Although research on individual adoption of BSP as received increasing attention, researchers have suggested that the studies in this area are still in the early phases (Duvall, 2012; Fishman et al., 2013; Zhang, Zhang, Duan, & Bryde, 2015), and very few aim to develop measurement scales to quantify its use. Furthermore, the multidisciplinary nature of BSP research results in fragmentation in the current literature. Existing scales that measure “bikeability” or examine an individual’s BSP use often emphasize commuting behavior and/or particular dimension such as environmental characteristics. Therefore, by adopting a well-established theoretical framework that unifies existing social cognitive theories that have been extensively applied, this study can contribute to the current knowledge in two ways: first, to develop a uniform approach to quantify the influences of various factors that have been shown to influence BSP use, and second, to explore the factors specifically associated with individual’s BSP use for leisure.

## Methods

Developing a reliable measurement scale that provides valid results is crucial for the establishment of any young and growing research field (Slavec & Drnovsek, 2012), and the cornerstone of developing a sound measurement scale is applying a methodologically rigorous procedure (DeVellis, 2016). Slavec and Drnovsek (2012), who conducted an in-depth review of scale development procedures and proposed a ten-step guideline, summarized the crucial phases for developing a new measure. Although strictly following every step in this guideline may reduce the probability of developing poor measures, Churchill (1979) suggested that when developing a new measurement scale, researchers remain flexible and consider alternative techniques to tailor the scale development procedure to match the needs of various research contexts. Therefore, this study follows the guideline that Slavec and Drnovsek (2012) suggested but modifies some techniques to fit in this research. The following sections detail the steps.

## Construct Specification and Item Pool Generation

As Slavec and Drnovsek (2012) suggested, the first phase of scale development includes three steps: (1) specification of the content domain, (2) generation of an item pool, and (3) evaluation of the content validity. Therefore, an interdisciplinary literature review was first conducted to specify the domain of each construct. The original definition of each construct of the UTAUT2 was then operationalized to fit this research. Based on these definitions, an item pool was then generated using two techniques: (1) adopting measurement items from existing scales and (2) using semi-structured interviews.

The measurement items of the UMBSPU were first compiled from various scales related to BSP use. Because the literature on this research topic is relatively limited and some key aspects might be inadvertently omitted if items were only adopted from existing research, the data from semi-structured in-depth interviews were analyzed through a deductive approach to reflect the current study's conceptual framework, see L.-H, Chen, Chancellor, and Ogletree (2016). In their study, convenience and the snowball sampling techniques were used to select individuals who had used BSP in their leisure time, with a predetermined interview protocol being subsequently used to guide the interview process. The interviews proceeded until the data became saturated and no new information was emerging. In total, 10 face-to-face interviews were completed. A list of themes related to BSP use was then compiled after summarizing the influential factors reported by the interviewees (see Table 1).

These themes were then purified and reworded to better serve as additional measurement items. After comparing the additional items and items adopted from existing scales, some repeated and items that did not fit were eliminated. Therefore, the initial measurement scale included 75 items for further testing.

Table 1 A Summary of the Codes in Qualitative Analysis

| Factors Influence BSP Use | Total Counts |
|---|---|
| **Performance expectancy** | **10** |
| Faster than taking other transportations | 3 |
| Useful to connect to other transportations | 2 |
| The customer service can help me solve problems | 2 |
| Better than walking | 1 |
| The website and apps is useful | 1 |
| Public bikes have fair conditions | 1 |
| **Effort expectancy** | **17** |
| Easy to find a docking station and a bike | 12 |
| An easy registration process | 3 |
| Easy to rent and return a bike | 2 |
| **Social influence** | **25** |
| *Friends, family, and colleagues* | |
| Because many friends use it | 3 |
| My colleagues invite me to ride the bikes | 2 |
| My wife wants me to ride public bikes | 3 |
| Because my friends do not have a bike | 1 |
| My parents are worried about me to ride my own bike | 1 |
| *Interaction among road users* | |
| Most of pedestrians will yield space to cyclists | 2 |
| YouBike users are polite to each other | 1 |
| *Image and bicycle culture* | |
| Riding YouBike bikes is a kind of social norm among young people | 3 |
| Nowadays, YouBike is everywhere and everyone knows how to use it | 3 |
| It’s part of Taipei and people’s life | 3 |
| You can see it on the media | 2 |
| It’s very popular and you can see many families will use it in weekends | 1 |
| **Price value** | **20** |
| I use it because it is very cheap | 9 |
| It’s cheap and I can also exercise | 5 |
| Save money for maintenance | 3 |
| It’s a good value for transportation | 2 |
| It's cheap and can increase my physically fitness | 1 |

Table 1 A Summary of the Codes in Qualitative Analysis (Continued)

| Factors Influence BSP Use | Total Counts |
|---|---|
| **Facilitating conditions** | **43** |
| Places without cars and motorcycles make me less pressure to ride | 11 |
| Public toilet or a place to rest is important as well | 6 |
| If there's a bike lane, I will use it | 6 |
| The pavement of bike lanes is improved now | 5 |
| If it's for leisure, I will choose the route that I can enjoy the beautiful scenery | 5 |
| The sidewalks are wide enough. So it's okay to ride a bike | 3 |
| I will choose the place with more tree shades to cycle | 3 |
| So many people ride YouBike bikes along riverside in weekend | 3 |
| It should have bike lanes on the bridges | 1 |
| **Hedonic motivation** | **8** |
| If I want to exercise or relax, I will ride | 3 |
| With a bicycle, I enjoy a sense of freedom | 2 |
| Riding a bike boosts my mood | 2 |
| I ride it just for having some fun | 1 |
| **Habit** | **4** |
| I think it's a habit to ride | 3 |
| Actually I have ridden a bike since childhood | 1 |

## Expert Review

Given the ongoing, iterative nature of the scale development process (Reynolds, 2010; Slavec & Drnovsek, 2012), the expert review occurred twice during this study, the first occurred after the author finalized the 75-item UMBSPU and the second after the pilot test.

*Phase one*

To assess the content validity of the scale, two scholars with expertise in leisure and cycling research further evaluated the definitions of the constructs and their specific items. A questionnaire suggested by Zaichkowsky (1985) was developed to collect the experts' comments on representativeness, clarity, and wording of items. Based on these comments and several face-to-face discussions with the experts, the measurement scale was further revised. The evaluation process resulted in a modification of 20 items, with 15 being reworded and five being re-categorized into a different construct. Additionally, 18 items were removed because of concerns of redundancy and a lack of representativeness. This process ensured that the constructs were precisely and appropriately defined and that the remaining 57 measurement items were relevant to the eight constructs.

*Phase two*

The initial measurement was tested with a small group of BSP users and resulted in identifying 24 items after the pilot test and each of the eight constructs retained three items (see more details in the data analysis section). After assessment of the 24-item measurement, the scale was revised and extended given the following reasons: (1) Because this study seeks to develop a parsimonious but also encompassing measurement, the 24-item measurement may not adequately assess the domain of interest; (2) Harvey, Billings, and Nilan (1985) recommended that the use of at least four items to define a latent construct is needed to allow a model to generate the kind of over-identifying restriction needed when method factors are expected to be included in further analysis. Therefore, two additional scholars with knowledge of psychometrics and tourism were consulted to evaluate all measurement items used in the pilot test. Their feedback was collected through the same questionnaire used in first expert review. Based on their comments and the in-person interviews, the instrument was further revised. The refined scale was reviewed again by an expert on cycling related research. The final instrument comprised 52-items and this process contributed to the establishment of the content validity of the newly added and modified items to be able to capture the essence of the appropriate construct.

## Translation and Questionnaire Evaluation

This research was conducted in Taiwan due to a high portion of users reporting that their BSP use was primarily for leisure (Pai & Pai, 2015), the target population for this study. Since the original scale was developed in English, part of the scale development process involved translating it into Traditional Chinese, the language predominantly used by the local residents in Taiwan.

To preserve the consistency of each item across linguistic boundaries, this study adopted the technique of translation and back-translation that is widely used in cross-cultural studies (Brislin, 1970; Ruvio, Shoham, & Makovec Brenčič, 2008). A professional translator and the author, who is a native Mandarin Chinese speaker, separately translated the original English items into Traditional Chinese. The two translated Traditional Chinese questionnaires were then compared and evaluated. After a face-to-face discussion, the translator and the author came to an agreement on the final Traditional Chinese version of the questionnaire. Another translator was then hired to translate the Traditional Chinese version back into English to confirm the consistency. A second discussion was held using a video call to verify the equivalency between the two linguistic versions.

Before testing a questionnaire, Dillman (2011) suggested that it should be evaluated by a group of people who have specific experience on aspects of questionnaire development. Because the questionnaire was to be administered through the online survey platform, Qualtrics, a group of 32 Taiwanese graduate students with experience in conducting web-based surveys in the field of leisure participated in this evaluation process. The primary goal of this process was to confirm the face validity and to ensure the viability of the questionnaire on various computer operating systems with various Internet browsers. After completing the survey, all evaluators reported their thoughts and provided suggestions to the author through a document shared online. The survey instructions and instrumentation were modified slightly based on this feedback. For example, this panel suggested that an option of "not applicable" should be added to the scale because some survey respondents may not have the relevant experience necessary to answer some of the questions.

## Data Collection

The data collection process consisted of two phases. The first phase was to test the proposed measure and to identify potential problems with the instrument, while the data collection in the second phase included target samples from two cities in order to cross-validate the instrument and to assess the psychometric properties of the new measure.

### *Participants*

In the first phase, a sample of Taiwanese BSP users was recruited from the cycling discussion forum of a terminal-based bulletin board system (telnet://ptt.cc), which is the most influential online community in Taiwan with more than 1.5 million registered users (Busuness Next, 2016). The web-based UMBSPU questionnaire was posted on the cycling forum from April 21 to April 30, 2017. In total, 247 respondents clicked the survey link, of these, 21 respondents were deleted from the sample because they skipped the entire survey. In addition, another 16 were eliminated because they had no previous experience using a BSP for leisure. As a result, the first sample consisted of 210 Taiwanese BSP users who had ridden public bikes for leisure at least once in the past twelve months. Based on the approach proposed by MacCallum, Browne, and Sugawara (1996), the sample size of the pilot test was large enough to reject a Type II decision error (the power estimations are based on alpha = .05, desired power = .80, RMSEA for H0 = .05, RMSEA for Ha = .01).

To further assess the measurement and its reliability and validity, the second phase of data collection was composed of target samples recruited from an online panel. The International Organization for Standardization (2012) defines an assessment panel as a "sample database of potential respondents who declare that they will cooperate for future data collection if selected" (p. 1). These panels may include a large number of individuals sampled at varying level of frequency. Typically, respondents are prescreened to complete a questionnaire on various topics. Currently, an online panel study is utilized for a wide range of social science research (Callegaro et al., 2014). In this study, samples were selected from two cities in Taiwan, Taipei and Kaohsiung because of having different BSP operating systems and the large percentage of citizens reporting that their main reason for using a BSP was for leisure (Huang, 2010; Pai & Pai, 2015; Yu, 2009). The participants were selected from a random sample provided by an online panel company asserting it had more than 500,000 members. In total, 1,600 e-mail invitations were sent to its members who had experience using a BSP in their leisure time. In total, 647 members completed the questionnaire for a response rate of 40.4%, which was higher than the average response rate (34%) for Web surveys (Shih & Fan, 2008). Of the 647 who responded, 348 lived in Taipei and 299 lived in Kaohsiung. In this study the non-response bias was analyzed by comparing early responses with late responses because the demographic data of the non-respondents could not be obtained from the survey company (Ognibene, 1971). A Chi-square test was conducted to examine the differences between the demographic information (age, gender, education, and monthly income) of the two groups, with no significant differences being found.

*Instrumentation*

In the pilot test, a seven-point Likert-type scale was used, with the responses ranging from "Strongly Disagree" to "Strongly Agree". A "not applicable" option was also provided for respondents who had no experience to rate a given item. The results of the pilot test indicated that the majority of the respondents fell between "Slightly Agree" to "Strongly Agree," probably because the survey respondents were chosen based on the criteria that they had experience using a BSP in their leisure time in the past 12 months. As a result, they tended to have a positive attitude towards the items. Therefore, in the second phase of data collection, a nine-point Likert-type scale was used to ensure that participants had multiple response categories for agreement. This also increased the rating scale variation for those pro-cycling individuals who tend to select the positive options for any question.

## Data Analysis

The final phase of the scale development process involved providing evidence of its reliability and validity using statistical analysis (Slavec & Drnovsek, 2012). This study used several steps for this data analysis process.

*Data preparation*

Before conducting the descriptive or factor analysis, all datasets were screened using SPSS 23.0, a preparation process that included univariate and multivariate normality testing and missing value examination. First, all variables were assessed for the two indicators of skewness and kurtosis. According to Curran, West, and Finch (1996), the absolute univariate values close to 2.0 for skewness and 7.0 for kurtosis can be used as reference values for detecting extreme non-normality. No variable exceeded these values. The examinations of multivariate normality were conducted using Mahalanobis Distance and graphical assessment (Arifin, 2015). When the outlier data were detected, they were removed from an individual construct instead of the entire sample. Each construct was examined using this approach.

Of the 210 cases in the pilot test, 4 to 11 observations were removed from the individual construct in which they were found to be extreme, and for Kaohsiung City data, 1 to 6 outliers were deleted from their constructs, while 2 to 6 cases were eliminated from the Taipei City data. The data, then, were examined using Little's missing completely at random (MCAR) test in SPSS having significant results in all samples ($p < .01$). Thus, all missing values were assumed missing at random (MAR), and the expectation-maximization (EM) algorithm was used to impute the incomplete data as it can provide a relatively unbiased parameter estimation (Enders, 2001; Graham, 2009).

*Factor analysis*

For measurement item refinement, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) have been used by many social scientists. EFA is typically used to explore the possible factor structure when there are no adequate theoretical supports to identify a research model (Child, 2006). In contrast, CFA is a statistical technique that allows a researcher to exam the hypothetical model based on theories or empirical evidence (Suhr, 2006). Since a theoretical basis has been established in this study, CFA was a more appropriate method for assessing the measurement. All factor analyses in this study were conducted using statistical package EQS 6.3. A set of fit indices, including the chi-square value, root mean square error (RMSEA), comparative fit index (CFI), and standardized root mean residual (SRMR) were utilized to determine if the differences between predicted values and the data values observed were acceptable. The Lagrange Multiplier (LM) test was used to detect the causes of any misfits. Measurement items were removed from a latent factor when (1) a relatively high error covariance was detected (Byrne, 2013); (2) items were correlated with more than one specific construct (Kline, 2014).

*Measurement invariance testing*

While a model with a good fit is associated with the construct validity of the structural factors, it cannot be concluded that the results can be generalizable (Dimitrov, 2010). The generalizability characteristic of validity can be examined by testing measurement invariance, which tests if the same items and structural constructs can be used across two or more independent samples drawn from the same population (F. F. Chen, Sousa, & West, 2005). This technique aids researchers in examining the construct validity by comparing if (1) the measurement model is group-invariant; (2) the factorial structure of a measurement is equivalent across populations; and (3) the means of latent variables in a model are equivalent across various samples (Byrne, 2013). In other words, these analyses verify that the psychometric properties of the UMBSPU can be duplicated across two or more BSP user groups.

Although most studies test multi-group invariance based on the analysis of covariance structures (simulated data), some researchers suggest these examinations could be based on the mean and covariance structures (real data) in order to compare latent mean differences across groups (Byrne, 2013; Meredith, 1993; Sörbom, 1974). This approach not only includes parameters representing regression coefficients, variances and covariances but also the intercept parameter, meaning the analyses can be considered a strong level testing of multiple-group invariance (Meredith, 1993). In this study, a forward (sequential constraint imposition) approach involving a series of hierarchically nested CFA models was used (Byrne, 2013; Dimitrov, 2010). This process began with the examination of the baseline model (unconstrained). Subsequently, constraints were imposed on specific parameters (e.g., factor loadings and intercepts) across two independent samples. Finally, the resulting nested models were tested against the baseline model by comparing the chi-square value and the CFI. Invariance is accepted when the chi-square difference is not significant ($p > .05$) and the amount of decrease of the CFI is smaller than .01 (Cheung & Rensvold, 2002).

*Method bias examination*

According to Campbell and Fiske (1959), any given psychological measure consists of two essential aspects, one representing the traits that a researcher intends to test, while the other is related to the method being used. If a researcher does not account for the systematic variance caused by the methods used, either through a test, a rating scale, or some other technique, the scores related to the traits are invalid. Podsakoff, MacKenzie, and Podsakoff (2012) pointed out that method effects may come from response styles, proximity and reversed items; the wording of the item; or their context. Furthermore, method bias, which is the variance derived from the measure, not the traits, might substantially affect the validity and reliability of the items and the latent constructs. They further proposed several approaches to control this effect, including the CFA marker technique and the measured response style technique. In this study, the CFA approach was used because of its ability to assess the loadings of the items on the eight proposed traits as stronger or weaker on a method factor, here a self-administered web-based survey. Specifically, three nested models were generated to compare the differences in chi-square values and the CFI. First, a model that included both traits and method factors was generated to provide baseline estimations for subsequent examinations. Then, a model including only the method was built to evaluate the common method bias. Finally, a model including only traits was used to assess the variance that derived from the variables emphasized in this study. The difference between the models (ΔCFI and significant Δchi-square) provided the evidence for determining the convergent and discriminate validity.

# Results

## Model Testing and Measurement Items Confirmation

Three models were tested in the early stages of the analysis process in order to confirm the factor structure and to purify the measurement items of the UMBSPU. Given that all three models had large Mardia's normalized estimate values (> 5.00) reflecting significant positive kurtosis (Bentler, 2006), the robust estimation was performed in EQS and Satorra-Bentler (S-B) scaled statistics were reported in this study (Byrne, 2013). The CFA for the pilot test (N = 210) empirically supported that three items per construct represented a good-fitting model (S-B $\chi^2_{(224)} = 333.999$, $p < .001$; SRMR = .047; CFI = .950; RMSEA = .048 with 90% C.I. = .037, .059). Specifically, the factor loadings of measurement items ranged from .64 to .92. The composite reliability (CR) of each construct was found to be greater than .70, and the average variance extracted (AVE) was larger than .50, confirming the convergent validity of the 24-item UMBSPU (Fornell & Larcker, 1981). A summary of the factor loadings, CR and AVE of first version the UMBSPU is listed in Table 2.

Given that a more encompassing measure is beneficial for future research, the initial UMBSPU was further revised and validated using the data collected from the target sample BSP users in Taipei, Taiwan (N = 348). The results of CFA indicated that the constructs with four items (the only exception being facilitating conditions with five items) achieved the best fit (S-B $\chi^2_{(467)} = 837.691$, $p < .001$; SRMR = .051; CFI = .954;

RMSEA = .048 with 90% C.I. = .043, .053). The second version UMBSPU was subsequently developed. The same factor structure and 33 measurement items were examined again with a second independent sample, the BSP users in Kaohsiung, Taiwan (N = 299), the goodness-of-fit indices of this third model also exhibiting an acceptable result (S-B $\chi^2_{(467)}$ = 898.509, $p < .001$; SRMR = .062; CFI = .929; RMSEA = .056 with 90% C.I. = .050, .061). As Table 3 shows, the CR and AVE of both target sample models exceeded standard values (CR > .70; AVE > .50); therefore, the convergent validity of the second version UMBSPU was confirmed as well (Fornell & Larcker, 1981).

Discriminant validity assesses the variance shared between a variable and any other variable in a model (Fornell & Larcker, 1981). This analysis is conducted by comparing the AVE of two latent constructs and the values of their shared variances. Specifically, the square of the correlation between construct A and B should be smaller than the AVE of construct A and the AVE of construct B (Fornell & Larcker, 1981; Hair, Black, Babin, & Anderson, 2010). Given the measurement error is not taken into account in the correlation matrix generated from SPSS or PRELIS, Farrell (2010) recommended using the correlation matrix from the CFA results to avoid misinterpretation. Therefore, for this study, the correlation estimations from the EQS output were squared and then compared with the AVE of the eight factors tested. Table 4 and Table 5 shows that all AVEs of latent constructs were larger than the squared correlation estimations, providing evidence of discriminant validity among the latent constructs in all tested models. In summary, the CFA models reveal that the UMBSPU has satisfactory reliability and adequate convergent and discriminant validity for future use.

Table 2 A Summary of the Parameters for the Initial UMBSPU

| • Factors and Items | Factor Loadings | CR | AVE |
|---|---|---|---|
| **Performance expectancy** | | .842 | .641 |
| • YouBike helps me reach destinations more quickly. | .788 | | |
| • I find YouBike useful for my leisure. | .856 | | |
| • Using YouBike increases the quality of my leisure | .754 | | |
| **Effort expectancy** | | .912 | .777 |
| • It is easy to become a YouBike member. | .775 | | |
| • It is easy to use the YouBike system. | .963 | | |
| • The renting process of YouBike is understandable. | .896 | | |
| **Social influence** | | .753 | .505 |
| • My friends encourage me to use YouBike. | .651 | | |
| • I believe the pedestrians interact with YouBike users in a friendly manner. | .738 | | |
| • In general, people in Taipei respect YouBike users. | .739 | | |
| **Facilitating conditions** | | .859 | .669 |
| • I am more likely to use YouBike if the station is around scenic areas. | .844 | | |
| • I am more likely to use YouBike in places that have more shades. | .809 | | |
| • I am more likely to use YouBike in places that have less traffic flow. | .801 | | |
| **Price value** | | .783 | .549 |
| • YouBike is an affordable option for exercise. | .811 | | |
| • YouBike is an affordable option to reduce my carbon footprint. | .758 | | |
| • At the current price, YouBike is a good value. | .643 | | |
| **Hedonic motivation** | | .934 | .824 |
| • Riding a YouBike bike is enjoyable. | .909 | | |
| • Riding a YouBike bike is fun. | .921 | | |
| • Riding a YouBike bike is relaxing. | .893 | | |
| **Habit** | | .917 | .787 |
| • Using YouBike is a habit for me. | .855 | | |
| • It is natural for me to use YouBike. | .913 | | |
| • I always use YouBike during my leisure time. | .900 | | |
| **Behavioral intention** | | .912 | .776 |
| • I will always try to use YouBike in my leisure time. | .883 | | |
| • I plan to continue to use YouBike for leisure frequently. | .915 | | |
| • I intend to continue using YouBike for leisure in the future. | .844 | | |

CR = Composite Reliability; AVE = Average variance extracted.

Table 3 A Summary of the Parameters for the Second Version UMBSPU

| Factors and Items | Taipei Users | Kaohsiung Users |
| --- | --- | --- |
| **Performance expectancy** | CR=.913; AVE=.728 | CR=.923; AVE=.751 |
| • PE1: ____[a] helps me reach destinations effectively. | .637 | .722 |
| • PE2: Using ____[a] improves the quality of my leisure. | .890 | .895 |
| • PE3: ______[a] meets my leisure needs. | .949 | .929 |
| • PE4[2]: Overall, _____[a] is helpful in my leisure time. | .901 | .904 |
| **Effort expectancy** | CR=.874; AVE=.637 | CR=.877; AVE=.645 |
| • EE1: It is easy to become a _____[a] member. | .718 | .746 |
| • EE2: The process of renting a _____[a] bike is easy. | .861 | .851 |
| • EE3: Finding a _____ [1]station in ____[b] is easy. | .669 | .681 |
| • EE4: It is easy to use the _____[a] system. | .916 | .913 |
| **Social influence** | CR=.849; AVE=.597 | CR=.875; AVE=.642 |
| • SI1: Members of my household encourage me to use _____[a]. | .767 | .800 |
| • SI2: My friends encourage me to use _______[a]. | .869 | .882 |
| • SI3: People who are important to me think that I should use _____[a]. | .905 | .887 |
| • SI4: _______[a] users are respected in ______[b]. | .473 | .602 |
| **Facilitating conditions** | CR=.923; AVE=.707 | CR=.940; AVE=.758 |
| • FC1: In my community, I am more likely to use ____[a] if there are bike lanes. | .691 | .773 |
| • FC2: I am more likely to use _____[a] in scenic areas. | .884 | .863 |
| • FC3: I am more likely to use _____[a] in the places that have more shades. | .858 | .910 |
| • FC4: I am more likely to use _____[a] in the places that have fewer traffic lights. | .894 | .882 |
| • FC5: I am more likely to use _____[a] in the places that have less traffic flow. | .861 | .917 |
| **Price value** | CR=.928; AVE=.765 | CR=.952; AVE=.831 |
| • PV1: _______[a] is an affordable option for exercise. | .918 | .947 |
| • PV2: _______[a] is an affordable option for maintaining mental health. | .895 | .935 |
| • PV3: _______[a] is an affordable option to protect the environment. | .877 | .897 |
| • PV4: At the current price, _______[a] is a good value. | .804 | .846 |
| **Hedonic motivation** | CR=.941; AVE=.799 | CR=.942; AVE=.803 |
| • HM1: Riding a _______[a] bike is fun. | .850 | .775 |
| • HM2: Riding a _______[a] bike helps me get away from the daily grind. | .866 | .928 |
| • HM3: I have a sense of freedom when riding a _______[a] bike. | .929 | .927 |
| • HM4: Riding a _______ [a]bike helps me relieve stress. | .927 | .944 |

Table 3 A Summary of the Parameters for the Second Version UMBSPU (Continued)

| Factors and Items | Taipei Users | Kaohsiung Users |
|---|---|---|
| **Habit** | CR=.945; AVE=.811 | CR=.958; AVE=.849 |
| • HT1: Using _______[a] is a habit for me. | .864 | .908 |
| • HT2: It is natural for me to use _______[a]. | .924 | .920 |
| • HT3: Riding a _______[a] bike is a usual part of my life. | .930 | .948 |
| • HT4: I use _____[a] without consciously thinking about it. | .882 | .913 |
| **Behavioral intention** | CR=.952; AVE=.831 | CR=.951; AVE=.829 |
| • BI1: I will try to ride _______[a] bikes more frequently in my leisure time. | .882 | .894 |
| • BI2: I plan to ride ______[a] bikes for leisure. | .924 | .934 |
| • BI3: I expect to ride ______[a] bikes for leisure more often in the future. | .936 | .930 |
| • BI4: I will use _____[a] soon. | .904 | .882 |

CR = Composite Reliability; AVE = Average variance extracted; a. Insert the name of BSP in the investigated city; b. Insert the city name.

Table 4 Discriminant Validity of the Pilot Test Measurement Model

| Construct | Correlation Coefficient | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | PE | EE | SI | FC | PV | HM | HT | BI |
| PE: Performance expectancy | **.641** | | | | | | | |
| EE: Effort expectancy | .295 | **.777** | | | | | | |
| SI: Social influence | .112 | .058 | **.505** | | | | | |
| FC: Facilitating conditions | .109 | .287 | .162 | **.669** | | | | |
| PV: Price value | .110 | .222 | .283 | .458 | **.549** | | | |
| HM: Hedonic motivation | .225 | .255 | .204 | .352 | .503 | **.824** | | |
| HT: Habit | .187 | .028 | .403 | .116 | .294 | .278 | **.787** | |
| BI: Behavioral intention | .296 | .309 | .227 | .323 | .533 | .549 | .468 | **.776** |

The values of the average variance extracted are listed in bold font; all other entries are the shared variance (squared correlation).

Table 5 Discriminant Validity of the Target Population Measurement Model

| Construct | Correlation Coefficient | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | PE | EE | SI | FC | PV | HM | HT | BI |
| PE | **.728(.751)** | .320 | .339 | .240 | .461 | .497 | .362 | .477 |
| EE | .340 | **.637(.645)** | .211 | .191 | .225 | .401 | .226 | .238 |
| SI | .292 | .275 | **.597(.642)** | .110 | .378 | .286 | .376 | .441 |
| FC | .275 | .190 | .076 | **.707(.758)** | .269 | .303 | .107 | .191 |
| PV | .448 | .250 | .304 | .181 | **.765(.831)** | .475 | .417 | .536 |
| HM | .503 | .340 | .161 | .329 | .399 | **.799(.803)** | .460 | .506 |
| HT | .402 | .243 | .384 | .100 | .408 | .361 | **.843(.849)** | .607 |
| BI | .484 | .252 | .274 | .238 | .511 | .494 | .542 | **.831(.829)** |

The values of the average variance extracted are listed in bold font; all other entries are the shared variance (squared correlation). Values in parentheses and lower triangular part of table represent data from Kaohsiung group; values in upper triangular part of table represent data from Taipei group.
PE = Performance expectancy: EE = Effort expectancy; SI = Social influence; FC = Facilitating conditions; PV = Price value; HM = Hedonic motivation; HT = Habit; BI = Behavioral intention.

Measurement Invariance Confirmation

To cross-validate the UMBSPU over two independent groups, a series of tests suggested by Byrne (2013) were conducted using EQS, including those for (1) configural invariance, (2) measurement (factor loading) invariance, (3) intercepts of measured variables invariance, and (4) latent factor mean invariance. Since the data were analyzed based on the Robust estimation, the $\chi^2$ difference between models should not be calculated without correction (Byrne, 2013). Therefore, all S-B $\chi^2$ differences in this study were adjusted using approach suggested by Satorra and Bentler (2001).

As the results listed in Table 6 show, the S-B $\chi^2$ difference between the configural (unconstrained) model and the measurement model is not significant ($\Delta$S-B $\chi^2_{(25)}$ = 32.066, $p > .05$); furthermore, the CFI difference is .001, significantly less than Cheung and Rensvold's (2002) proposed criterion ($\Delta$CFI = .01). Therefore, the equivalence of the factor loadings across the two samples is validated. However, the chi-square difference between the intercepts invariant model and the configural model is statistically significant ($\Delta$S-B $\chi^2_{(58)}$ = 169.557, $p < .001$). Based on the results of the LM test, three items (FC2, FC3, and BI2) have statistically significant probabilities ($p < .05$) influencing the chi-square value of the model. Therefore, a modified intercept invariant model was built by freeing FC2, FC3, and BI2, the results indicating only small changes in the chi-square ($\Delta$S-B $\chi^2_{(3)}$ = 5.519, $p > .05$) between the two models. Given that the results of a chi-square difference test are easily influenced by sample size (N = 647), Cheung and Rensvold (2002) encouraged researchers to consider the changes in other fit statistics. In this case, the difference of the CFI between intercepts invariant model and the configural model was found to be less than .01 and the RMSEA remained the same. Thus, the assessment of the latent factor mean could proceed. There were no noticeable differences between Taipei and Kaohsiung respondents on the intercepts of the measured variables.

Kaohsiung respondents were selected as the reference group with the mean of all factors was fixed to zero while the Taipei group was freely estimated. No significant chi-square (i.e., corrected) and CFI differences were found ($\Delta$S-B $\chi^2_{(17)}$ = 15.612, $p > .05$; $\Delta$CFI = .002; $\Delta$RMSEA = .001), meaning there was no statistical difference in the eight factors tested between the Taipei and the Kaohsiung respondents. The results of this analysis support the scalar, metric, and factorial invariance of the UMBSPU for use in future research.

Table 6 Fit Indices for Measurement Invariance Model Testing

| Model | S-B $\chi^2$ | df | CFI[a] | SRMR | RMSEA[a] | $\Delta$S-B $\chi^2$ | $\Delta$df | $\Delta$CFI |
|---|---|---|---|---|---|---|---|---|
| 1. Configural | 1735.053 | 934 | .943 | .057 | .052 | - | - | - |
| 2. Measurement (factor loading invariance) | 1767.981 | 959 | .942 | .060 | .051 | 32.066 | 25 | .001 |
| 3. Intercepts invariance | 1884.520 | 992 | .941 | .060 | .052 | 169.557[b] | 58 | .002 |
| 4. Modified intercepts invariance | 1876.006 | 989 | .941 | .060 | .052 | 158.906[b] | 55 | .002 |
| 5. Latent factor mean invariance | 1736.355 | 951 | .945 | .060 | .051 | 15.612 | 17 | .002 |

a. Value based on robust estimation (Satorra-Bentler scaled $\chi^2$); b. The result is significant at $p < 0.01$; $\Delta$S-B $\chi^2$ was calculated with corrected S-B scaling difference (Satorra & Bentler, 2001).

## Method Effects Examination

The purpose of this examination is to detect for method bias in UMBSPU because of variances derived from the measurement device (a self-administered online survey using a nine-points Likert-type scale). Theoretically, variance derived from traits should be higher than those measured by methods in an assessment model (Campbell & Fiske, 1959). Although both the discriminant and the convergent validity of the UMBSPU were confirmed in previous analyses, the method factor was not included in the model. In this section, the discriminant and convergent validity are analyzed including both the traits and the method (Widaman, 1985).

Four CFA models were tested using a sample of BSP users from Taipei (N = 348). The first model excluded the method factor and included only the traits in the assessment. The goodness-of-fit statistics in Table 7 indicate that this model is good-fitting (S-B $\chi^2_{(467)}$ = 837.691, $p < .001$; SRMR = .051; CFI = .954; RMSEA = .048 with 90% C.I. = .043, .053). The second model tested was the baseline model, which included freely correlated traits and a common method factor in the estimation. The fit statistics indicate this model also fits the data well (S-B $\chi^2_{(434)}$ = 653.280, $p < .001$; SRMR = .038; CFI = .973; RMSEA = .038 with 90% C.I. = .032, .044), in fact better than Model 1. To examine convergent validity, the third model removed all traits, leaving only the common method factor for the assessment. As seen in Table 7, the goodness-of-fit statistics for the method-only model is particularly poor (S-B $\chi^2_{(495)}$ = 3424.911, $p < .001$; SRMR = .107; CFI = .638; RMSEA = .131with 90% C.I. = .126, .135). The fourth model fixed the correlations among the trait factors to 1.0 to assess their discriminant validity of traits. As indicated in Table 7, the goodness-of-fit statistics for this model inadequately fit the data (S-B $\chi^2_{(463)}$ = 2711.956, $p < .001$; SRMR = .078; CFI = .722; RMSEA = .118 with 90% C.I. = .114, .122).

The evidence of construct validity was examined by comparing the differences in the fit statistics among the models. As per Table 7, the comparison between Model 1 and Model 2 indicates that the CFI is improved and S-B $\chi^2$ is significantly reduced when the common method factor was included in the assessment ($\Delta$CFI = .019; $\Delta$S-B $\chi^2_{(33)}$ = 146.452, $p < .01$), providing evidence of method effects. In order to investigate the relative method effect for each trait, the AVE is calculated for every factor in the UMBSPU and for the corresponding dimensions of the common method factor in the baseline model, and the factor loadings for traits and the method are compared. The trait loadings should be significant and larger than the method loadings to confirm convergent validity.

The results show that for four items in the performance expectancy, effort expectancy, and price value construct, the method factor accounts for more variance than traits. Furthermore, when the method factor was included in the model, all AVEs for every trait in the UMBSPU decreased. The factor loadings of the eight factors in the UMBSPU model also decreased when statistically controlled the method (see Table 3 and Table 8). However, the AVE for every trait in the UMBSPU is better than the AVE for every corresponding dimension of the method. Therefore, the eight factors in the UMBSPU are able to explain more variances than the common method. The convergent validity of UMBSPU is supported. According to Widaman (1985), convergent validity can also be examined by comparing the traits and methods of the specified model (the baseline model) with the one with no traits specified (model 3). A significant difference in the chi-square and CFI between these two models ($\Delta$S-B $\chi^2_{(61)}$ = 1402.984, $p < .01$;

ΔCFI = .335) provides evidence of the convergent validity of the UMBSPU as well. These data can be found in Table 8.

To test discriminant validity among traits, the model in which traits are freely correlated (the baseline model) can be compared with the model in which they are perfectly correlated (Model 4), with the larger the difference between the $\chi^2$ and the CFI values, the stronger the discriminant validity (Byrne, 2013; Widaman, 1985). The results show that a statistically significant and a substantial difference in the fit statistics (ΔS-B $\chi^2_{(29)} = 758.555$, $p < .01$; ΔCFI = .251) between these two models, thereby providing solid evidence of the discriminant validity.

Based on these results, it seems reasonable to conclude that the UMBSPU is a reliable and valid measurement in the context of leisure BSP use. However, the evidence of method bias in the sample of Taipei BSP users should be monitored carefully in future use, particularly for the four items exhibiting strong method effects.

Table 7 A Summary of Goodness-of-Fit Indices and Model Comparison

| Model | S-B $\chi^2$ | df | CFI[a] | SRMR | RMSEA[a] | ΔS-B $\chi^2$ | Δ df | ΔCFI |
|---|---|---|---|---|---|---|---|---|
| 1. Hypothesized Model | 837.691 | 467 | .954 | .051 | .048 | - | - | - |
| 2. Freely correlated traits and method-included model (baseline) | 653.280 | 434 | .973 | .038 | .038 | 146.452[bc] | 33[c] | .019[c] |
| 3. No traits and method only model | 3424.911 | 495 | .638 | .107 | .131 | 1402.984[bd] | 61[d] | .335[d] |
| 4. Perfectly correlated traits and method included model | 2711.956 | 463 | .722 | .078 | .118 | 758.555[bd] | 29[d] | .251[d] |

a. Value based on robust estimation (Satorra-Bentler scaled $\chi^2$). b. The result is significant at $p < .01$.
c. Compare with Model 1; d. Compare with Model 2; ΔS-B $\chi^2$ was calculated with corrected S-B scaling difference (Satorra & Bentler, 2001).

Table 8 Average Variance Extracted and Factor Loadings for Baseline Model

| Factors and Items | UMBSPU Traits | Common Method | Factors and Items | UMBSPU Traits | Common Method |
|---|---|---|---|---|---|
| **Performance expectancy** | AVE=.567 | AVE=.191 | **Price value** | AVE=.459 | AVE=.328 |
| • PE1 | .439 | .539[a] | • PV1 | .705 | .583 |
| • PE2 | .779 | .413 | • PV2 | .842 | .422 |
| • PE3 | .931 | .314 | • PV3 | .581 | .669[a] |
| • PE4 | .775 | .447 | • PV4 | .542 | .588[a] |
| **Effort expectancy** | AVE=.366 | AVE=.288 | **Hedonic motivation** | AVE=.650 | AVE=.162 |
| • EE1 | .547 | .469 | • HM1 | .707 | .484 |
| • EE2 | .574 | .646[a] | • HM2 | .850 | .251 |
| • EE3 | .645 | .311 | • HM3 | .805 | .465 |
| • EE4 | .646 | .645 | • HM4 | .854 | .367 |
| **Social influence** | AVE=.573 | AVE=.030 | **Habit** | AVE=.697 | AVE=.151 |
| • SI1 | .722 | .272 | • HT1 | .785 | .354 |
| • SI2 | .846 | .163 | • HT2 | .797 | .481 |
| • SI3 | .914 | .114 | • HT3 | .894 | .346 |
| • SI4 | .470 | .080 | • HT4 | .858 | .358 |
| **Facilitating conditions** | AVE=.411 | AVE=.186 | **Behavioral intention** | AVE=.668 | AVE=.171 |
| • FC1 | .550 | .424 | • BI1 | .730 | .519 |
| • FC2 | .796 | .392 | • BI2 | .839 | .388 |
| • FC3 | .785 | .362 | • BI3 | .861 | .373 |
| • FC4 | .797 | .410 | • BI4 | .834 | .355 |
| • FC5 | .681 | .546 | | | |

a. The method factor accounts more variance than traits. AVE = average variance extracted.

## Discussion and Conclusions

The goal of this study is to explore the primary determinants of BSP use in a leisure context, specifically to develop a uniform measurement for future examination of the relationships among those key factors. Following the guidelines suggested by Slavec and Drnovsek (2012), the UMBSPU was developed by integrating both qualitative and quantitative methods, in hopes that its use will increase the knowledge and understanding of the focal phenomenon. The results of the qualitative investigation (i.e., interviews) revealed that a wide variety of factors are involved in an individual's decision to use BSP for leisure. The subsequent analysis using the quantitative method verified the themes extracted from these interviews and the measurement items adopted from the existing scales. Thus, this study developed a measurement scale for further generalization and systematic examination.

The items of the UMBSPU adopted from existing scales and interviews were tested with BSP users in a pilot test of 210 Taiwanese adults participated in a self-administered, web-based survey. Based on the results of the factor analysis, the initial 24-item UMBSPU was found to be reliable and valid. In order to develop a more encompassing measurement, the three-item per factor version was expanded and revised based on the comments of an expert panel. The second version of the UMBSPU was subsequently examined using a sample of 647 online panel members. The final measurement scale consisting of at least four items per factor performed best in the model. However, most of the items derived from interviews were omitted based on this purification process, perhaps making the UMBSPU a less than comprehensive measurement scale. For example, both the interviewees and the literature pointed out that the interaction among cyclists and other road occupants was a critical factor influencing an individual's decision to cycle (Kaplan & Prato, 2016), whereas the corresponding items in the UMBSPU were removed from the scale due to poor factor loadings. Future research is needed to investigate if this social interaction is more important to cycling commuters than to leisure cyclists.

In order to assess the applicability of the UMBSPU for various locations, a cross-validation with two independent samples was conducted. This step is important in establishing the generalizability of the theory. A sequential confirmatory factor analysis based on real data (mean and covariance structures) aided the measurement invariance testing. As noted earlier, two items in the facilitating conditions construct (FC2: I am more likely to use BSP in scenic areas; and FC3: I am more likely to use BSP in the places that have more shades) and one in the behavioral intention construct (BI2: I plan to ride public bikes for leisure) were found to have noninvariant intercepts. Based on the Item Response Theory (IRT), this noninvariant item intercept may be associated with the level of item difficulty. In other words, the higher the value of an intercept (or item difficulty level), the higher the probability of respondents' endorsing it (Byrne, 2013; Chan, 2000). Furthermore, the weather and the landscape in Kaohsiung and Taipei are somewhat different; therefore, citizens in these two cities may rate the importance of scenery and tree shades slightly different. Future research should further explore the difference using samples from various geographic areas.

Nonetheless, previous research has found that noninvariant factor loadings, which correspond to the item discrimination parameter, are more serious than intercept noninvariant. Intercept differences among groups should not reduce the value of these items in assessing the underlying factors (Byrne, 2013; Cooke, Kosson, & Michie, 2001). Furthermore, the CFI difference test among all models indicated a rejection of noninvariance ($\Delta CFI < .01$). Therefore, it is reasonable to conclude that the UMBSPU can assess the same construct and predict equally across different groups.

Developing a complex and multidimensional measurement scale such as the UMBSPU may include the risk that a substantial amount of variance in the model is derived from method effects. Method bias impacts both the accuracy of the interpretation and the validity of the measure (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The findings of the Multitrait-Monomethod testing indicated that the UMBSPU demonstrated good convergent and discriminant validity, albeit method effects were detected, particularly in items, PE1, EE2, PV3, and PV4. This effect may be derived from the survey-based method that is commonly utilized in behavioral research (Podsakoff et al., 2003; Spector, 2006). As Cote and Buckley (1987) suggested, almost 26.3% of the variance in self-reported studies may result from systematic sources of measurement error such as common method biases. Podsakoff et al. (2003) found that that item social desirability may be one of the primary causes of such bias. The measurement items that have more social desirability associate closely with one another because their social desirability characteristics are more demonstrable than the underlying constructs that they measure. Two items in the price value construct are related to environmental protection and monetary evaluation, both of which suggest a certain social desirability. To address this issue, future research should expressly emphasize the anonymity in the survey instructions and assure the participants that there are no correct answers.

The method effect examination in this study can also create a useful way for refining the UMBSPU by selecting the items that have the largest factor loadings to the underlying constructs. These items remaining after this examination should be able to capture more variances in what they measure than those from common method variances. Future research could develop a UMBSPU short form and compare its performance with the 33-item UMBSPU.

Given the limited research exploring BSP leisure use, this study lays a foundation for further investigations. While the primary goal of the UMBSPU is to study the key determinates of an individual's leisure BSP use, future research can adopt it to assess commuting usage. The existing scales developed to measure bikeability, which primarily focus on environmental features, could also be incorporated into the UMBSPU to add depth to the investigation. Furthermore, the UMBSPU was developed using individuals with previous experiences using BSP in their leisure time; future research may explore the barriers that inhibit this usage, such as the difficulty of finding shower rooms or rest places, mandatory helmet legislation, or safety concerns. As noted earlier, the factors influencing BSP use are very broad and diverse, and the UMBSPU should not be considered a panacea for answering all questions related to public bicycles. Future research can continue expanding the UMBSPU by integrating barriers or other context specific questions to develop a more comprehensive measure. In addition, this study tested the measurement invariance of the UMBSPU and found acceptable results. This examination was based on Taiwanese adults and the UMBSPU should be examined in different cultural contexts to obtain an international level of cross- validation.

From a practical perspective, the UMBSPU can also serve as a valuable tool for BSP practitioners exploring potential markets. Since previous studies have shown that a particular group of users only use BSP in their leisure time, accurately identifying the relevant factors influencing this use is important for BSP managers and marketers.

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# CHAPTER THREE

# EXPLORING THE LEISURE USE OF BICYCLE SHARE PROGRAM: A CASE STUDY OF YOUBIKE IN TAIPEI

## Introduction

Cycling is not only a means of daily transportation but also a popular recreational activity (Han, Meng, & Kim, 2017; Lamont, 2014; Ritchie, 1998), with many marketing analysts characterizing the bicycle industry in the 21st century as "with the zeitgeist" (Harker, 2008). Adventure Cycling Association (2012) reported that Americans spend USD $10 billion on bikes, gear, and accessories and more than USD $70 billion on leisure cycling trips - these sales directly support 772,146 jobs. Additionally, increasing numbers of tourists are participating in road and mountain biking, and cycling events (World Tourism Organization, 2014). In Europe, approximately 2.295 billion leisure cycling trips are taken annually with a value in excess of €44 billion (Weston et al., 2012).

As part of this "bike boom," Taiwan has made a strong commitment to become Asia's cycling hub. Until 2014, Taiwan was the only country in Asia with a strategically built national network of bike lanes (Manibo, 2015). By effectively integrating the development of bicycle infrastructures with the leisure industry, Taiwan was transformed from a world-renowned bicycle manufacturer into one of the best cycling destinations in Asia (Lonely Planet, 2012; The New York Times, 2014) , with cycling becoming Taiwan's most popular recreational activity (H.-W. Chang & Chang, 2003; Lee & Huang, 2014). In addition to constructing a national bikeway system, many cities in Taiwan, including Kaohsiung, Taipei, Taichung, and Changhua, have initiated a bicycle share program (BSP), the short-term rental service through which bicycles are made available at one docking station and returned to another (Fishman, Washington, & Haworth, 2013). The increasing number of such programs has led to a new generation of urban cycling enthusiasts. The discussion of riding public bicycles instead of self-owned, high-end, or famous brands of bikes has become a topic on social media, blogs, and tourism websites (e.g. Taipei Travel Forum of TripAdvisor).

Taipei is viewed as the best Taiwanese location for cycling and BSP use (Koh, 2016). According to the Ministry of Transportation and Communications (2016), in 2015 cycling trips accounted for approximately 4.1% of the country's travel, with Taipei responsible for 20.6% of this 4.1%, making it the city with the highest cycling rate. The substantial amount of governmental infrastructure investment has aided Taipei in its goal to be Asia's cycling capital (Horton, 2017). According to a 2016 report, Taipei City possessed approximately 491 km of bicycle paths, including urban separated bikeways 71.5 km, urban share-used paths 308 km, and riverside bikeways 112 km (Taipei City Government, 2016). In addition to the extensive construction of bicycle paths, the city government also actively promotes its BSP, YouBike, which is operated by the world's largest bicycle manufacturer, Giant Co., Ltd.

Studies have found that 28% of respondents use YouBike for leisure (Pai and Pai (2015). Furthermore, when asked about their intention for future use, 90% of the respondents expressed a willingness to continue using YouBike as a means of leisure, 10% more than the percentage of people willing to use it for commuting (80%). Ting

(2014) also reported similar findings for YouBike use for leisure or entertainment purposes. Wong and Cheng (2015) took advantage of the Open Data Policy in Taipei, and analyzed the YouBike spatial data. They found that a significant number of rental activities were recorded at the edge of the city center, at the outer area of Taipei City, and in proximity to the riverfront parks. They concluded that these groups of users probably use YouBike for recreation during weekends and on holidays.

However, riding public bicycles for leisure is not limited to Taipei as BSPs have appeared across the world over the past decade (DeMaio & Meddin 2016; Fishman, Washington, & Haworth, 2013). For example, a group of Vélo bicycle users typically use the BSP during weekends or non-commuting time (Vogel et al., 2014), and 48.3% of the BSP users in Dublin cycle only for leisure during off-peak hours (Murphy & Usher, 2015). The same phenomenon is also found in Brisbane (Fishman, 2016), Washington, DC (Adventure Cycling Association, 2012), and Montreal (Bachand-Marleau, Lee, & El-Geneidy, 2012). As these studies suggest, a BSP is not just a tool for commuting but also serves a wide range of individuals who use it for leisure purposes. These reports indicate the need for researchers to investigate in-depth such questions as "Who rides public bicycles for leisure?" "What characteristics do these 'special' users share?" "How do they make the decisions to use BSP for leisure?" "What are the key determinants of this leisure BSP use?"

However, cycling for leisure is usually given little attention in transportation planning even though the significance of non-motorized transport in tourism is frequently investigated (Dickinson & Robbins, 2009). Furthermore, research on this topic is also limited. Reviewing recently published BSP research, Fishman (2016) pointed out that the primary stream in BSP literature is related to commuting, with researchers calling for more focus on the differences between BSP commuter and leisure users (Bachand-Marleau et al., 2012). Use of BSP for leisure may be influenced by other (non-commuting related) variables that are not fully captured by current BSP studies (Pai & Pai, 2015). To address these issues, the primary goal of this study is to explore the key determinants of BPS use, especially in a leisure context.

Given that the newest information and communications technology (ICT), such as GPS tracking, real-time transit integration system, and smartcard integration, are integrated in the current BSPs, researchers have begun to apply theories from the information and technology field to investigate user behavior. For instance, the technology acceptance model (TAM) has been applied in various studies (S. -Y, Chen, 2016; S. -Y, Chen & Lu, 2015, 2016; Hazen, Overstreet, & Wang, 2015). However, Hazen et al. (2015) pointed out that some critical factors related to an individual's decision to use a BSP may not be addressed by this model, thus suggesting an extension of this theory. The extended unified theory of acceptance and use of technology (UTAUT2), which integrates eight theories frequently used in technology acceptance studies, has been found to more accurately explain consumers' intentions and technology use (Venkatesh, Thong, & Xu, 2012). Given the success in applying theories from the technology acceptance field in previous BSP research, the UTAUT2, which also focuses on human voluntary behavior, was adopted and further contextualized for this study.

It is expected that this integration of UTAUT2 and BSP use can further the generalizability of the theory itself. The knowledge obtained from this study can help BSP organizations in the leisure and transportation industry better meet consumer needs and develop marketing strategies to promote BSP use among various populations. Furthermore, while the East-Asia region has been found to have the most bicycle sharing activity in the world (DeMaio & Meddin 2016), the research conducted in this area is limited (Fishman, 2016; Pai & Pai, 2015). Thus, this research contributes to our knowledge of individual adoption of BSP across cultural and geographic boundaries.

## Hypotheses and Research Model Development

The popularity of BSP has prompted researchers to examine factors that influence its use. Pai and Pai (2015) categorized the factors into four dimensions: (1) system characteristics, such as bicycle design and quality, the accessibility of docking stations and bikes, a convenient rental procedure, emergency preparedness and response, maintenance programs, and price; (2) environmental characteristics, such as bike lane quality, bike-related facilities, and the convenience of transfer to other public transportation; (3) existing restrictions in cities, such as geographical conditions, climate, social support and cultural influence, and policies; and lastly (4) the BSP users' demographics and preferences, such as gender, socioeconomic status, trip features and physiological ability, credit card ownership, and time restrictions. Among these factors, convenience (Fishman, 2016; Verma, Rahul, Reddy, & Verma, 2016), easy access to BSP stations (Bachand-Marleau et al., 2012; Fuller et al., 2011), interaction with other transportation modes (Fishman, Washington, & Haworth, 2012; Kaplan, Manca, Nielsen,

& Prato, 2015; Tang, Pan, & Shen, 2011), and safety (Muñoz, Monzon, & López, 2016; Winters, Davidson, Kao, & Teschke, 2011) are the most frequently mentioned reasons to use a BSP. Although previous studies add to our knowledge of BSPs, few integrate social cognitive theories to investigate individual leisure BPS use. As the UTAUT2 is a relatively comprehensive framework for explaining human voluntary behavior, in this study it aided in development of the theoretical model and hypotheses.

## Core Constructs

Performance expectancy, effort expectancy, facilitating conditions, and social influence have been identified as the core constructs that primarily form the unified theory of acceptance and use of technology (UTAUT). This theory hypothesizes that performance expectancy, effort expectancy, and social influence may affect individual behavioral intention, while behavioral intention and facilitating conditions directly influencing the actual use. In addition, combinations of individual differences, namely age, gender, experience, and voluntariness, moderate the relationships (Venkatesh, Morris, Davis, & Davis, 2003). In cycling and BSP literature, these four constructs have been found to positively influence an individual's intention to cycle as well.

### *Performance Expectancy*

Extrinsic motivation, which has been studied widely in many social science fields, refers to the external rewards that motivate an individual to be energized or activated toward an act or to attain the separable outcome of avoiding punishment (Ryan & Deci, 2000). It has been found to play an important role in an individual's acceptance of new technology. For example, perceived usefulness in TAM, which refers to an individual's belief that using a new technology or a system would improve job performance, has been examined extensively with the results indicating that it has a positive influence on behavioral intentions (Davis, Bagozzi, & Warshaw, 1989). In the UTAUT2, this extrinsic type of motivation is conceptualized as "performance expectancy." Venkatesh et al. (2012) define it as the degree to which individuals believe that utilizing a particular piece of technology will benefit them in performing certain activities. Its impact has been found to be stronger on one's intention in an organizational setting rather than in the consumer context.

Researchers have explored the positive impact of extrinsic rewards or perceived usefulness on one's intention to use a BSP. According to Shaheen, Guzman, and Zhang (2010), BSPs are planned to provide a low-carbon solution to the "first and last mile" problem, which refers to the distances between an individual's residence/workplace and the transit stations that are too far to walk. Hazen et al. (2015) found that when a BSP is viewed as a useful option for transportation among residents in Beijing, it positively influenced the residents' intention to use it. A modified TAM was used to investigate one's intention to embrace an eco-friendly lifestyle, and green-perceived-usefulness was found to have the strongest predictive validity regarding an individual's plan for using a BSP (S. -Y, Chen, 2016; S. -Y, Chen & Lu, 2015, 2016).

Although a BSP is seen as a practical tool for integrating bicycling into people's commuting, it has also been found to serve people's needs in their leisure time (Buck et al., 2013; Pai & Pai, 2015), as cycling can be associated with characteristics such as fun, sociability, and cafe stops (Fitt, 2015). Thus, performance expectancy in this study is operationalized as the degree to which an individual believes that a BSP is a useful transportation mode in individuals' leisure time, one that will improve his or her personal leisure life. Thus, this study proposes the following hypothesis:

**Hypothesis 1**. Performance expectancy will positively impact the intention of an individual to use a BSP.

*Effort expectancy*

As usability may cause an individual to accept or reject a technology, the level of ease in manipulating such devices is viewed as important. In other words, a new technology is more likely to be accepted if it is believed to be easy-to-use (Davis et al., 1989). In the UTAUT2, Venkatesh et al. (2012) defined "effort expectancy" as the consumer's perception of the ease-of-use of a new piece of technology, finding it to be more influential at the early stage when an individual adopts a new system. Its influence reduces as the difficulties of using a new technology are overcome (Venkatesh et al., 2003).

The importance of "comfort" or "convenience" is frequently mentioned in cycling and BSP research (Fishman, Washington, & Haworth, 2013; Hazen et al., 2015; Pai & Pai, 2015; Verma et al., 2016). For example, the review of BSP research conducted by Fishman et al. (2013) found that BSP users are most often motivated by convenience. From a negative perspective, an inconvenient process for renting a public bicycle, accessing docking stations, or becoming a BSP member may have a negative impact on BSP use. For instance, the YouBike pilot program in Taipei experienced low usage due to poor service quality, the cancelation of the free ride policy, and most importantly, the scarcity of docking stations, all of which made the accessibility of public bikes an issue. When asked their opinions of how to improve of YouBike service, respondents repeatedly mentioned the facilities related to the convenience of use, such as location, number of docking stations, shortage of bikes to borrow and the lack of empty docks for returning bikes (Lai, 2012).

The CityCycle pilot program in Brisbane faced challenges as well. While the citizens consistently expressed a high level of interest in the program, the inefficient sign-up process discouraged many. Eventually, the public viewed the program as "not for them" (Fishman et al., 2012). As these findings suggest, in the context of BSP use, effort expectancy can be operationalized as perceived convenience (Hazen et al., 2015), meaning the degree to which an individual believes that using a BSP for leisure is easy and convenient. Therefore, this research proposes:

**Hypothesis 2.** Effort expectancy will positively impact the intention of an individual to use a BSP.

*Social influence*

The importance of the social reality and the social processes of people's transportation decisions have been investigated extensively. From the social representation perspective, Dickinson and Dickinson (2006) found that individuals' choice of transportation is made in light of the social reality they live in, while Fitt's (2015) investigation of the social meaning behind transportation choices found that 92% of the research participants expressed that their transportation practice was influenced by their social environments. Furthermore, 20% of the participants stated that social meanings were the primary influences for their decisions. Barnett and Casper (2001) pointed out that such influences can be "experienced" at various levels, including kinships, neighborhoods, working places, communities, cities, and regions. In other words, social influences may directly come from one's household members and less directly from peers, friends and colleagues, or even from the society as a whole and its culture (Sherwin, Chatterjee, & Jain, 2014).

The UTAUT2 has a narrower definition of this factor defining it as the point at "which consumers perceive that important others (e.g., family and friends) believe they should use a particular technology" (Venkatesh et al., 2012, p. 159). In addition, it has been found to have an indirect effect on behavioral intention when age, gender, and experiences are included in the model (Venkatesh et al., 2012). However, in the cycling literature, social influences have been found to come from multiple strata not just family and friends. For example, Titze, Stronegger, Janschitz, and Oja (2008) conducted a cross-sectional survey of adults aged 15 to 60, finding that a supportive social environment is a possible influence on an individual's decision to cycle. They further emphasized that this support comes not only from friends or family members but also from observing others cycling. Similarly, Sherwin et al. (2014) pointed out that social influence is the primary factor for some people who decide to cycle regularly; and it may come from a spouse, family, friends and/or society. They suggested that making bicycling more visible to the society might increase the probability that more citizens will cycle. Therefore, this study operationalizes social influence as the degree to which an individual believes that using

BSP for leisure is directly influenced by family and friends, or indirectly influenced by the cycling culture in Taipei. This study hypothesizes:

**Hypothesis 3.** Social influence will positively impact the intention of an individual to use a BSP.

*Facilitating conditions*

Facilitating conditions refer to the degree to which a person perceives the technical infrastructure is accessible enough to support the acceptance of a new system (Venkatesh et al., 2003; Venkatesh et al., 2012). In other words, does the support provided by existing resources help an individual perform a certain behavior easily or are there barriers that need to be removed. The facilitating conditions in the UTAUT are assumed only to have a significant influence on behavior because when both performance expectancy and effort expectancy constructs are also included in the model, facilitating conditions are no longer significant in predicting intention (Ajzen, 1991; Venkatesh et al., 2003); however, in the consumer context, this construct is hypothesized to influence both behavior and behavioral intentions (Venkatesh et al., 2012). That is, the belief that he or she has support may increase an individual's intention as well as his or her likelihood of performing an act.

In cycling-related literature, bicycle infrastructure, including the connectivity, length, and width of bicycle lanes, have been extensively investigated. Dill and Voros (2007) found that an individual's perception of the quality and accessibility of bicycle lanes has a significant influence on the decision to cycle. Specifically, places with easily accessible and well-connected bicycle lanes, and streets with low traffic are more likely to increase one's intention to be a regular or utilitarian cyclist. According to Buck et al. (2013), the relationship between the existence of bicycle lanes and the level of BSP activity is statistically significant — even when the opportunity for shopping around stations and the influences of population are controlled in the model. Except for bike lanes, Winters, Brauer, Setton, and Teschke (2013) found that people are much more likely to cycle on routes away from traffic noise and air pollution. Their results also revealed that individuals who perceive that the scenery on the cycling route was beautiful and that the route was separated entirely from traffic are more likely to go cycling. Given the influence of weather on Taiwanese decisions to cycle, Zhan & Su (2008) highlighted that adequate shade is one of the most importance indicators for constructing a bicycle lane in Taipei. Thus, in this study, facilitating conditions are defined as bicycle infrastructure and the environmental conditions that support individuals' use of a BSP in their leisure time. This study proposes:

**Hypothesis 4a.** Facilitating conditions will positively impact the intention of an individual to use a BSP.

**Hypothesis 4b.** Facilitating conditions will positively impact the leisure use of a BSP.

## Additional Key Constructs

The UTAUT highlights the significance of utilitarian value and outcome-orientated motivations; thus, the constructs linked to utility, such as performance expectancy, have been found to be the strongest predictors of the intention to use a new system (Venkatesh et al. 2003). However, in the consumer context, Venkatesh et al. (2012) found that additional predictors and mechanisms should be included in the model, specifically hedonic motivation, price value, and habit. Empirically, the extended UTAUT2 demonstrated a significant improvement over the original model, UTAUT, in explaining the variance in consumer behavioral intention and actual use. The details of these three additional key constructs are discussed in the following sections.

*Price value*

Because the UTAUT2, was developed based on a consumer context, the price of a product becomes another important factor that attracts or deters consumers' acceptance of a new technology (Venkatesh et al., 2012). In addition to the cost, the perceived quality and value also play significant roles in a consumer's decision to purchase a service or a product. The consumer's willingness to pay a certain price involves a cognitive tradeoff between giving a certain monetary cost and receiving the expected value of the product (Zeithaml, 1988). Thus, Venkatesh and his colleagues (2012) define price value as the "consumers' cognitive tradeoff between the perceived benefits of the applications and the monetary cost for using them (p.161)." In other words, when the perceived value of using a product or a service is believed to be higher than the price, the consumer is more likely to pay for it. Therefore, price value is a predictor of behavioral intention in the UTAUT2.

The price of a bicycle rental service is a primary motivating factor for individuals taking a short-term cycling trip. For example, H.-L. Chang and Chang (2009) found that a reasonably priced bicycle rental is associated with an individuals' level of satisfaction with the leisure cycling experience among Taiwanese adults. "Low cost" is also frequently mentioned as the reason for utilitarian cycling. According to Heinen, Maat, and Van Wee (2011), the advantages of cycling, including convenience, low cost, and health benefits, are important factors influencing Dutch citizens' choice of a bicycle as a mode of transportation. Further, the literature has shown that individuals who are BSP users are 2.5 times more likely to perceive benefits in using a BSP, such as bicycle maintenance, freedom from parking issues, low cost and no anxieties about vandalism and theft, than regular private bicycle riders (Curto et al., 2016).

In addition to cost-effectiveness, the perception of various benefits of cycling is another important theme in cycling literature. For example, Willis, Manaugh, and El-Geneidy's (2015) review of cycling research published between 2005 to 2012 found that the decision to cycle is affected by the perception of cycling benefits, including perceptions of the health benefits from exercise, low cost, convenience, flexibility, speed, the ability to avoid traffic congestion, and environmental benefits. Similarly, Fitt (2015) pointed out that cycling is commonly associated with ecofriendly values and is often described as an activity that maintains or improves physical fitness. Furthermore, cycling as a form of physical activity also benefits mental health by reducing the levels of depression, stress, and anxiety, as well as improves mood, self-esteem, premenstrual syndrome, and body image (Scully, Kremer, Meade, Graham, & Dudgeon, 1998). Based on this analysis, this study operationalizes price value as an individual's cognitive tradeoff between the monetary cost for BSP use and the perceived benefits from using it, including the benefits of physical activity, mental health, and environmental values. This study hypothesizes:

**Hypothesis 5.** Price value will positively impact the intention of an individual to use a BSP.

*Hedonic motivation*

In contrast with extrinsic motivation, intrinsic motivation refers to performing an act purely for the pleasure and the internal satisfaction of the activity itself rather than for its external rewards (Ryan & Deci, 2000). Found to be more important than performance expectancy in the UTAUT2, intrinsic motivation is conceptualized as "hedonic motivation," meaning the consumer's perception of the fun or enjoyment associated with the technology use (Venkatesh et al. 2012).

Hedonic motivation is also important for an individual's satisfaction with recreational cycling trips. H.-L. Chang and Chang (2009) explored the motivations driving Taiwanese high-tech workers and non-high-tech workers to go cycling, and discovered that the primary motivations for the high-tech workers included entertainment, stress-release, and the social networking opportunity. For the non-high-tech worker group, motivations include the cycling itself, family time, and the enjoyment of nature. This type of motivation not only influences individuals to go recreational cycling but also is associated with BSP use, with S. -Y Chen's (2016) finding that perceived fun-to-use is positively connected to continued use of a BSP.

In fact one the most important images of cycling, is that it is fun. Daley and Rissel (2011) interviewed 70 Australians, finding that the themes linked to images of cycling included "clean and green," and "healthy and fun." Fitt's  (2015) study also found that the general public frequently connected images of fun and sociability with leisure cycling. In some cases, cycling is perceived as "kids' activity, " suggesting that people do it just for fun, not for transportation (Handy, Xing, & Buehler, 2010). Thus, hedonic motivation is operationalized as the degree to which an individual believes that riding a public bicycle is enjoyable, fun, and relieves stress. It is hypothesized that:

**Hypothesis 6.** Hedonic motivation will positively impact the intention of an individual to use a BSP.

*Habit*

In the UTAUT, experience, which refers to prior behavior, functions as an important moderator in the model. In the UTAUT2, Venkatesh et al. (2012) further categorized prior behaviors at two different levels, experience and habit. For them, experience refers to “an opportunity to use a target technology and is typically operationalized as the passage of time from the initial use of a technology by an individual (p.161),”while, habit is operationalized as prior behavior that is automatically performed without the need for self-instruction. They concluded that experience is necessary but may not be adequate to form a habit, which is postulated to significantly influence both behavioral intention and actual use.

In the cycling literature, habit has also been found to have an impact on both intention and behavior. For example, Ducheyne, De Bourdeaudhuij, Spittaels, and Cardon (2012) examined the relationships among individual social and physical environmental factors and their influences on cycling to school. Their results indicated that a strong habit is associated with 18% more cycling among Belgian children. In addition, De Bruijn, Kremers, Singh, Van den Putte, and Van Mechelen (2009) also found that habit is the strongest predictor of the length of cycling time. It moderates the intention- behavior relationship, meaning that as the strength of habit increased, the intention for bicycle use became weaker in the research model.

Since these previous studies found that habit had a strong influence on an individual's decision to cycle, it is integrated into this study's theoretical model and operationalized as the degree to which individuals believe that BSP use has become an inseparable part of their life so much so that its use is automatic. This study proposes:

**Hypothesis 7a.** Habit will positively impact the intention of an individual to use a BSP.

**Hypothesis 7b.** Habit will positively impact the leisure use of a BSP.

Finally, an individual's intention to use a BSP in this study is measured by how much an individual is willing to ride public bicycles in their leisure time. In addition, it is also assessed by how likely an individual will engage in such use in the near future. It is hypothesized that:

**Hypothesis 8.** Behavioral intention will positively impact the leisure use of a BSP.

Use is measured by the frequency of an individual's BSP use in his or her leisure time as well as how many times such use occurred in the past 30 days. Figure 2 below presents the theoretical model for this study, showing the eight primary constructs and their relationships.

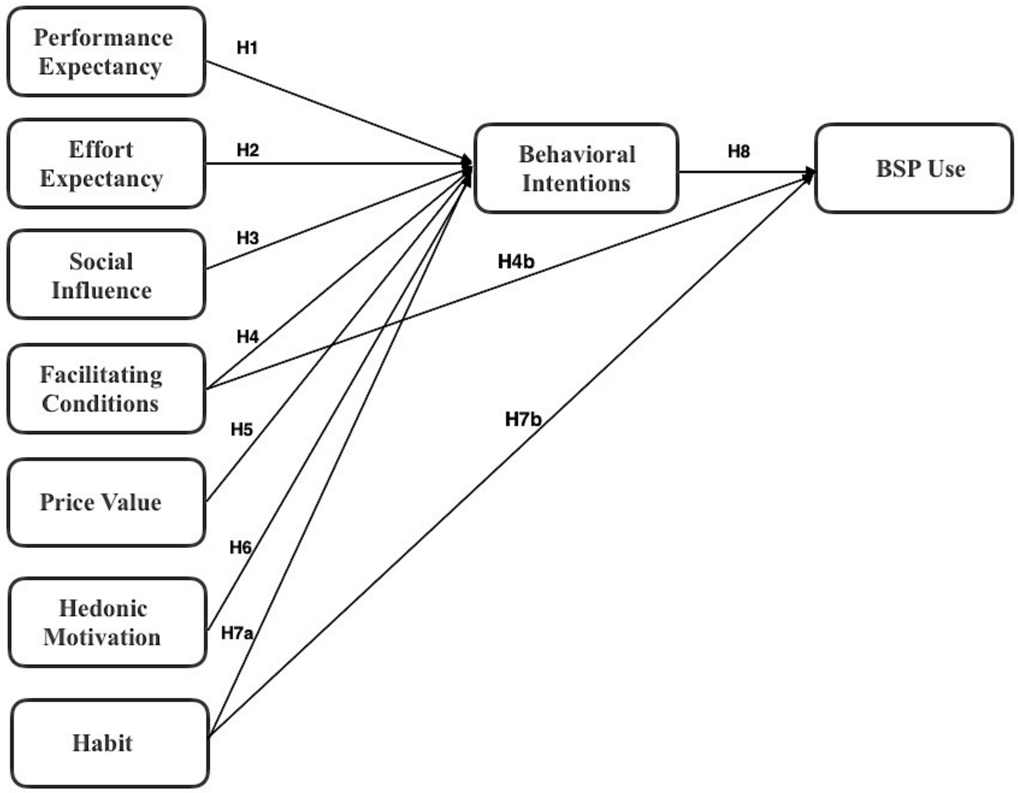


Figure 2. Conceptual Model

## Methods

### Participants and Data Collection Procedure

The target population for this study includes current users of YouBike who ride public bicycles in their leisure time. The sample was recruited from an online panel. According to the International Organization for Standardization (2012), an assess panel is a "sample database of potential respondents who declare that they will cooperate for future data collection if selected" (p. 1). An online panel study is a common practice in today's consumer research. Furthermore, the advantage of an online survey panel is that the profiles of the respondents can be prescreened to ensure they fit the needs of the research. As a result, the questionnaire can be distributed more efficiently and the number of invalid responses is lower than for a freely accessed online survey (Callegaro et al., 2014; Primm, 2017). The validity concern of an online survey resulting from a low rate of Internet access is not an issue in the case of Taiwan. According to the Taiwan Network Information Center (2015), 80.3% of the total population of Taiwan has access to the Internet, and the access rate of the population aged 18 to 30 is 100%.

The data used in this study were obtained from an online panel company, chosen due to its large number of members (over 500,000). In total, 900 e-mail invitations were sent to its members who have used YouBike for leisure in the past 12 months. There were 348 members who completed the questionnaire for a response rate of 38.7%, which is higher than the average (34%) for online surveys (Shih & Fan, 2008). According to MacCallum, Browne, and Sugawara (1996), the sample size used in this study was large enough to reject a Type II decision error (the power estimates are based on alpha = .05, desired power = .80, RMSEA for H0 = .05, RMSEA for Ha = .01).

## Instrumentation

This study employed an online questionnaire to investigate the relationships among the eight proposed factors and their influences on an individual's BPS use in a leisure context. The questionnaire was developed following the Slavec and Drnovsek (2012) ten-step guideline. The initial measurement items were adopted from cycling and BSP literature (see Table 9 for details). Subsequently, qualitative data from ten semi-structured interviews (see L. -H, Chen, Chancellor, & Ogletree, 2016) were used to adjust the initial measurement to ensure it fit the context of this research. An expert panel consisting of four faculty members with expertise in leisure, cycling, tourism, and psychometrics evaluated the applicability of the measurement items. Because the research was conducted in Taiwan, the initial English questionnaire was translated into Traditional Chinese using the translation and back-translation method (Brislin, 1970; Ruvio et al., 2008). Because some pro-cycling participants may tend to select more positive options on any given question, a nine- point Likert-type scale (1 = ”Extremely Disagree” to 9 = ” Extremely Agree”) was used to measure each item. This range increases the variation of the rating scale and ensures respondents have multiple agreement response categories from which to select.

The questionnaire was divided into three sections. First, the respondents were asked to evaluate their perceptions of 33 items related to the eight proposed factors. Second section questions related to respondents' BSP use and cycling behaviors followed by questions related to the respondents' BSP use and cycling behaviors. The last section of the survey asked about demographic characteristics and the socio-economic status of the respondents.

Table 9 Construct and Items of the Measurement Model

| Factors and Items | References |
|---|---|
| **Performance expectancy** | |
| • PE1: YouBike helps me reach destinations effectively. | Titze et al. (2008) |
| • PE2: Using YouBike improves the quality of my leisure. | S. -Y Chen and Lu (2016) |
| • PE3: YouBike meets my leisure needs. | |
| • PE4[2]: Overall, YouBike is helpful in my leisure time. | |
| **Effort expectancy** | |
| • EE1: It is easy to become a YouBike member. | S. -Y Chen and Lu (2016) |
| • EE2: The process of renting a YouBike bike is easy. | Hazen et al. (2015) |
| • EE3: Finding a YouBike station in Taipei is easy. | Fishman et al (2014) |
| • EE4: It is easy to use the YouBike system. | |

Table 9 Construct and Items of the Measurement Model (Continued)

| Factors and Items | References |
|---|---|
| **Social influence** | |
| • SI1: Members of my household encourage me to use YouBike.<br>• SI2: My friends encourage me to use YouBike.<br>• SI3: People who are important to me think that I should use YouBike.<br>• SI4: YouBike users are respected in Taipei. | Titze et al. (2008)<br>Verma et al. (2016)<br>Pai and Pai (2015) |
| **Facilitating conditions** | |
| • FC1: In my community, I am more likely to use YouBike if there are bike lanes.<br>• FC2: I am more likely to use YouBike in scenic areas.<br>• FC3: I am more likely to use YouBike in the places that have more shades.<br>• FC4: I am more likely to use YouBike in the places that have fewer traffic lights.<br>• FC5: I am more likely to use YouBike in the places that have less traffic flow. | De Sousa, Sanches, and Ferreira (2014)<br>Titze et al. (2008)<br>Hazen et al. (2015) |
| **Price value** | |
| • PV1: YouBike is an affordable option for exercise.<br>• PV2: YouBike is an affordable option for maintaining mental health.<br>• PV3: YouBike is an affordable option to protect the environment.<br>• PV4: At the current price, YouBike is a good value. | Titze et al. (2008)<br>S. -Y Chen (2016)<br>Hazen et al. (2015) |
| **Hedonic motivation** | |
| • HM1: Riding a YouBike bike is fun.<br>• HM2: Riding a YouBike bike helps me get away from the daily grind.<br>• HM3: I have a sense of freedom when riding a YouBike bike.<br>• HM4: Riding a YouBike bike helps me relieve stress. | S. -Y Chen (2016)<br>Titze et al. (2008) |
| **Habit** | |
| • HT1: Using YouBike is a habit for me.<br>• HT2: It is natural for me to use YouBike.<br>• HT3: Riding a YouBike bike is a usual part of my life.<br>• HT4: I use YouBike without consciously thinking about it. | Venkatesh et al. (2012) |
| **Behavioral intention** | |
| • BI1: I will try to ride YouBike bikes more frequently in my leisure time.<br>• BI2: I plan to ride YouBike bikes for leisure.<br>• BI3: I expect to ride YouBike bikes for leisure more often in the future.<br>• BI4: I will use YouBike soon. | Titze et al. (2008)<br>Hazen et al. (2015) |
| **Use** | |
| • U1: How many times do you use YouBike for leisure in the past 30 days?<br>• U2: On average, how often do you use YouBike in your leisure time? | S. -Y Chen and Lu (2016) |

## Data Analysis

The initial data screening was conducted using SPSS (version 23.0) and included calculations for missing values, leverage, kurtosis, and skewness. For univariate normality, the absolute values close to 2.0 for skewness and 7.0 for kurtosis were used as reference for detecting extreme non-normality (Curran, West, & Finch, 1996). No variable in this sample violated this assumption. Mahalanobis Distance and graphical assessment were employed to examine multivariate normality (Arifin, 2015). Of the 348 cases in the pilot test, two to six outliers were removed from the constructs, a process resulting in missing data. Given the relatively unbiased parameter estimation, the expectation-maximization (EM) algorithm was used to impute the incomplete data (Enders, 2001; Graham, 2009). Descriptive statistics were also employed to develop sample profiles.

Given that a theoretical basis has been established in this study, confirmatory factor analysis (CFA) using Mplus 7.4 rather than exploratory factor analysis (EFA) was employed to assess the measurement (Suhr, 2006). A two-step CFA was conducted, as suggested by Anderson and Gerbing (1988), to evaluate each construct first and then to examine the overall measurement model. Finally, the hypothesized model was tested using structural equation modeling (SEM).

## Results

### Respondents' Profiles

The sample (N = 348) is slightly skewed toward male (53.2%), with the majority (37.4%) being between 30 and 39 years old. The respondents have low personal incomes, with 21.8% reporting monthly personal incomes from NT $30,000 (approximately US $990.5) to NT $39,999 (approximately US $1320.64). Nearly 61.8% have completed either a 2- or 4-year college education, with approximately 22.4% completing a graduate degree. The demographic characteristics of the study sample can be seen in Table 10.

Table 10 Demographic Attributes of the Respondents

| Demographic categories | Frequency | Percentage (%) | Demographic categories | Frequency | Percentage (%) |
|---|---|---|---|---|---|
| **Gender** | | | **Monthly Personal Income (TWD[a])** | | |
| Male | 185 | 53.2% | Less than $10,000 | 46 | 13.2% |
| Female | 163 | 46.8% | $10,000 - $19,999 | 26 | 7.5% |
| **Age** | | | $20,000 - $29,999 | 51 | 14.7% |
| 18-20 | 29 | 8.3% | $30,000 - $39,999 | 76 | 21.8% |
| 20–29 | 118 | 33.9% | $40,000 - $49,999 | 57 | 16.4% |
| 30-39 | 130 | 37.4% | $50,000 - $59,999 | 34 | 9.8% |
| 40-49 | 53 | 15.2% | $60,000 - $69,999 | 16 | 4.6% |
| Over 50 | 18 | 5.2% | $70,000 - $79,999 | 15 | 4.3% |
| **Education level** | | | More than $80,000 | 27 | 7.8% |
| High School | 49 | 14.1% | | | |
| College | 215 | 61.8% | | | |
| Master Degree | 78 | 22.4% | | | |
| Doctorate Degree | 6 | 1.7% | | | |

a. 1 New Taiwan Dollar (TWD) is approximately equal to .03 U.S. Dollars.

Regarding the attributes of the respondents' cycling behavior, the majority (54.6%) owns a personal bicycle. The preferred cycling season is spring (28.1%), while the preferred riding time is weekends (daytime 13.8%; nighttime 14.1%). The two primary transportation modes are public transportation (46.8%) and mopeds (26.7%). Almost half (50.9%) of the respondents also have experiences of commuting by YouBike. Approximately 44.3% had never ridden a bicycle in Taipei before YouBike launched. Of the respondents, 38.5% prefer riding YouBike bikes with friends, followed by riding with family (23.6%). The descriptive behavioral characteristics of the respondents can be seen in Table 11 below.

Table 11 Behavioral Attributes of the Respondents

| Preference | Frequency | % | Preference | Frequency | % |
|---|---|---|---|---|---|
| **Bike ownership** | | | **Riding time** [a] | | |
| Yes | 190 | 54.6% | Weekday before 9:00 | 216 | 11.2% |
| No | 158 | 45.4% | Weekday 9:00-12:00 | 205 | 10.6% |
| **Riding Season** [a] | | | Weekday 12:00-5:00 | 216 | 11.2% |
| Spring | 310 | 28.1% | Weekday after 5:00 | 259 | 13.4% |
| Summer | 233 | 21.1% | Weekend daytime | 265 | 13.8% |
| Autumn | 310 | 28.1% | Weekend evening | 271 | 14.1% |
| Winter | 251 | 22.7% | Daytime in notional holidays | 257 | 13.3% |
| **Frequently used transportation mode** | | | Evenings in notional holidays | 238 | 12.4% |
| Walking | 23 | 6.6% | **Riding companion** | | |
| BSP | 31 | 8.9% | Family | 82 | 23.6% |
| Private bike | 10 | 2.9% | Friends | 134 | 38.5% |
| Moped/Motorcycle | 93 | 26.7% | Both family and friends | 61 | 17.5% |
| Car | 28 | 8.0% | Alone | 71 | 20.4% |
| Public transports | 163 | 46.8% | **Commuting by public bikes** | | |
| **Cycling behavior before YouBike's launch** | | | Yes | 171 | 49.1% |
| | | | No | 177 | 50.9% |
| Riding personal own bike | 140 | 40.2% | | | |
| Riding rental bike | 32 | 9.2% | | | |
| Riding friends' bike | 22 | 6.3% | | | |
| Never biking before | 154 | 44.3% | | | |

a. Respondents can choose multiple answers.

Considering the reasons for riding YouBike bikes, 15.3% reported "connects to public transports" as the main reason, followed by "exercising" (13.5%), "to get to leisure activities" (13.5%), and "relaxing" (13.3%). It seems that YouBike has been used to achieve various purposes in Taipei citizens' leisure time. The details are presented in Table 12.

Table 12 Purposes of YouBike Use in Leisure Time

| **Reason for use** | Frequency | % | **Reason for use** | Frequency | % |
|---|---|---|---|---|---|
| Exercising | 260 | 13.5% | Avoid finding parking spot | 248 | 12.8% |
| Go shopping | 224 | 11.6% | Avoid theft and vandalism | 230 | 11.9% |
| Give it a try | 225 | 11.6% | To get to leisure activities | 260 | 13.5% |
| Connects to public transports | 295 | 15.3% | Invited by friends or family | 247 | 12.8% |
| Relaxing | 257 | 13.3% | No other travel means | 219 | 11.3% |
| Avoid traffic congestion | 231 | 12.0% | Protect the environment | 237 | 12.3% |

Respondents can choose multiple answers.

## Confirmatory Factor Analysis

Since a theoretical structure of measurement and a model (see Figure 2 and Table 9) are proposed, the first step in the analysis is to validate the proposed model structure (Kline, 2014). Because the chi-square test is sensitive to sample size, a set of incremental fit indices including the comparative fit index (CFI), the nonnormed fit index (NNFI or TLI), and the root mean squared error of approximation index (RMSEA) was used in this study to assess the goodness of all imposed covariance estimations (Bentler & Bonett, 1980; Browne & Cudeck, 1993). According to Muthén and Muthén (2012), the non-normality data should be assessed by MLM in Mplus, which refers to "maximum likelihood parameter estimates with standard errors and a mean-adjusted chi-square test statistic that are robust to non-normality (p.603)." Thus, this study used Satorra-Bentler (S-B) scaled statistics.

The result of the CFA suggested that the measurement model fit the data fairly well (S-B $\chi^2_{(467)} = 908.588$, $p < .001$; SRMR = .050; TLI = .943; CFI = .950; RMSEA = .052 with 90% C.I. = .047, .057). Factor loading of the measurement items ranged from .473 to .954, exceeding the cutoff value of .45 as suggested by Tabachnick and Fidell (2007). Thus, it was concluded that the measurement items fit the underlying constructs.

The composite reliability (CR) of the eight constructs tested was larger than .7, indicating satisfactory reliability. Furthermore, the constructs' average variance extracted (AVE), which is used to assess the overall variance attributed to the underlying construct in relation to the variance attributed to measurement error, was larger than .50. Therefore, the convergent validity of the proposed measurement model was confirmed (Fornell & Larcker, 1981; Hair, Black, Babin, & Anderson, 2010). A summary of the factor loadings, CR and AVE of the measurement model is listed in Table 13.

According to Fornell and Larcker (1981), discriminant validity, which estimates the variance shared between a factor and any other factor in the model, can be assessed by comparing the shared variance (squared correlation) between each pair of factors against their AVE (Fornell & Larcker, 1981; Hair et al., 2010). In other words, the value of the square roots of the AVE should be greater than the correlation between the two constructs.  As Table 14 shows, the off-diagonal elements in the rows and columns are smaller than the square roots of the related AVEs, which supports that any given construct in this model is correlated less with the other constructs than with its measurement items. Therefore, discriminant validity was supported.

Table 13 Measurement Model Results

| Constructs | Items | Mean (Standard Deviation) | Factor Loading (Standard Error) | Composite Reliability | AVE |
|---|---|---|---|---|---|
| Performance expectancy | PE1 | 7.21 (1.192) | .636 (.042) | .913 | .727 |
| | PE2 | 7.03 (1.306) | .890 (.016) | | |
| | PE3 | 6.93 (1.335) | .949 (.008) | | |
| | PE4 | 7.06 (1.387) | .901 (.013) | | |
| Effort expectancy | EE1 | 6.88 (1.379) | .718 (.032) | .873 | .636 |
| | EE2 | 7.21 (1.257) | .861 (.022) | | |
| | EE3 | 6.88 (1.281) | .669 (.030) | | |
| | EE4 | 7.14 (1.178) | .916 (.015) | | |
| Social influence | SI1 | 6.18 (1.557) | .767 (.026) | .849 | .597 |
| | SI2 | 6.00 (1.600) | .869 (.021) | | |
| | SI3 | 5.66 (1.734) | .905 (.015) | | |
| | SI4 | 5.30 (1.731) | .473 (.055) | | |
| Facilitating conditions | FC1 | 7.22 (1.352) | .691 (.036) | .923 | .707 |
| | FC2 | 7.44 (1.245) | .884 (.016) | | |
| | FC3 | 7.42 (1.268) | .858 (.020) | | |
| | FC4 | 7.46 (1.256) | .894 (.017) | | |
| | FC5 | 7.69 (1.188) | .861 (.020) | | |
| Price value | PV1 | 7.27 (1.296) | .918 (.014) | .929 | .765 |
| | PV2 | 7.11 (1.323) | .896 (.012) | | |
| | PV3 | 7.45 (1.233) | .877 (.013) | | |
| | PV4 | 7.14 (1.475) | .804 (.019) | | |
| Hedonic motivation | HM1 | 6.93 (1.349) | .850 (.018) | .941 | .799 |
| | HM2 | 6.47 (1.503) | .866 (.015) | | |
| | HM3 | 6.77 (1.430) | .929 (.011) | | |
| | HM4 | 6.69 (1.450) | .927 (.010) | | |
| Habit | HT1 | 6.09 (1.604) | .861 (.017) | .955 | .843 |
| | HT2 | 6.47 (1.581) | .924 (.011) | | |
| | HT3 | 6.11 (1.668) | .954 (.008) | | |
| | HT4 | 6.24 (1.672) | .930 (.009) | | |
| Behavioral intention | BI1 | 6.90 (1.367) | .882 (.015) | .952 | .831 |
| | BI2 | 6.60 (1.491) | .924 (.012) | | |
| | BI3 | 6.60 (1.515) | .936 (.009) | | |
| | BI4 | 6.62 (1.547) | .904 (.014) | | |

All items loaded on significantly to their respective constructs at $p < .001$; AVE = Average variance extracted.

Table 14 Discriminant Validity of the Measurement Model

| Constructs | Correlation Coefficient | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | PE | EE | SI | FC | PV | HM | HT | BI |
| PE: Performance expectancy | **.853** | | | | | | | |
| EE: Effort expectancy | .565 | **.797** | | | | | | |
| SI: Social influence | .582 | .459 | **.773** | | | | | |
| FC: Facilitating conditions | .490 | .437 | .331 | **.841** | | | | |
| PV: Price value | .705 | .633 | .535 | .550 | **.875** | | | |
| HM: Hedonic motivation | .679 | .474 | .615 | .519 | .689 | **.894** | | |
| HT: Habit | .601 | .475 | .613 | .327 | .678 | .646 | **.918** | |
| BI: Behavioral intention | .691 | .488 | .664 | .437 | .711 | .732 | .779 | **.912** |

The value on the diagonal line is the square root of AVE for the latent variable. The value should be higher than the value on the non-diagonal line.

## Hypotheses Testing

As Table 15 shows, the model supported seven of ten tested hypotheses. The model demonstrated an acceptable fit, S-B $\chi^2_{(529)} = 1055.238$, $p < .001$; SRMR = .050; TLI = .943; CFI = .949; RMSEA = .051 with 90% C.I. = .046, .056. However, a close examination of results indicated that the direction and significance of effort expectancy in relation to behavioral intention as well as facilitating conditions in relation to leisure BSP use were not as expected. The parameters showed negative and non-significant relationships. Furthermore, the relationship between facilitating conditions and behavioral intention was also shown to be non-significant. These findings did not support the positive relationships hypothesized by this study, perhaps because the survey respondents, who were familiar with YouBike, have either compromised their expectations or solved the difficulties of adoption of such programs. Therefore, facilitating conditions and effort expectancy did not influence their intention to use or their actual use of this BSP.

Table 15 Results of the Hypothesis Testing

| Hypothesis Paths | Standardized Path Coefficient | Standard Error[a] | Two-Tailed *p*-value | Results |
|---|---|---|---|---|
| H1: Performance expectancy →Behavioral intentior | .148 | .055 | ** | Supported |
| H2: Effort expectancy → Behavioral intention | -.044 | .044 | ns. | Not supported |
| H3: Social influence → Behavioral intention | .160 | .047 | ** | Supported |
| H4a: Facilitating conditions → Behavioral intention | .029 | .038 | ns. | Not supported |
| H4b: Facilitating conditions → Leisure BSP use | -.038 | .046 | ns. | Not supported |
| H5: Price value → Behavioral intention | .133 | .062 | * | Supported |
| H6: Hedonic motivation → Behavioral intention | .198 | .057 | ** | Supported |
| H7a: Habit → Behavioral intention | .385 | .056 | *** | Supported |
| H7b: Habit → Leisure BSP use | .300 | .074 | *** | Supported |
| H8: Behavioral intention → Leisure BSP use | .321 | .073 | *** | Supported |

* $p < 0.05$; ** $p < .01$; *** $p < .001$; ns = not significant. a. Entries are standardized estimates.

Except for these paths, the remaining hypotheses were supported with no values suggesting improper solutions. It was hypothesized in the model that the performance expectancy would stimulate individuals' intention to use a BSP in their leisure time. The path between these two constructs was found to be statistically significant ($\beta = .145$, $p < .01$), suggesting that a stronger expectation of the usefulness of YouBike increases the user's willingness to ride these public bikes. The results provide evidence for the positive effect of the usefulness of a BSP on an individual's decisions to ride, supporting earlier studies (Willis, Manaugh, & El-Geneidy, 2015).

Social influence, which was hypothesized to be positively related to BSP use intention, was supported in this study ($\beta = .160$, $p < .01$), with the results indicating that greater social support and a more bicycle-friendly culture positively influenced the individual's assessment of BSP use. This study confirmed that when promoting cycling, marketers should remember that the social environment plays a significant role in people's decision to cycle (Sherwin et al., 2014); furthermore, this influence may come from the direct support of family and friends (Fishman, Washington, Haworth, & Mazzei, 2014) and from the indirect support of a bicycle-friendly society (Fitt, 2015).

This study further examined the impact of price value on the intention to use a BSP, hypothesizing that the more value and economic benefit people receive from a BSP, the more likely they are to use it during their leisure time. This assumption was supported with a significant standardized path coefficient in the model ($\beta = .133$, $p < .05$). Thus, BSP use intention increases .133 for every unit increase in price value, suggesting that the cost and value of a BSP are important to the users. As Pai and Pai (2015) mentioned, BSP users are cost-sensitive and interested in the benefits that the program can provide.

As intrinsic motivation is significant in one's decision making process (Ryan & Deci, 2000), hedonic motivation was hypothesized in this study to be positively related to an individual's intention to use a BSP, and the results support this hypothesis ($\beta = .198$, $p < .01$). More specifically, as the enjoyment perceived by an individual increased, the probability that he or she would ride public bicycles for leisure also increased. In other words, the pure pleasure and the satisfaction derived from cycling itself stimulated the participants to try BSP use. In this study, the relationship between hedonic motivation and use intention was greater than performance expectancy, social influence, and price value, indicating that the nature of leisure cycling, fun and happiness, more strongly influenced people to become involved in this activity than other factors. This resonates with the findings of Chen (2016) who found that the desire to use a BSP is influenced by positive emotions and attitudes such as happy, excited, satisfied, and, relaxed.

The relationship between habit and behavioral intention was particularly strong ($\beta = .385$, $p < .001$) in this model, showing that the BSP users' intention to ride increased .385 units for every unit increase of habit. This finding supports Kaplan et al. (2015) who suggested that cycling chosen as a habitual transport mode choice during daily life significantly influences tourist intentions to use an urban BSP on holiday. Furthermore, habit also strongly predicted individuals' leisure BSP use ($\beta = .300$, $p < .001$), suggesting that the stronger the habit, the more positively it affects the frequency of an individual's BSP use. This study provided empirical evidence that habit should be included in a theoretical model examining cycling behaviors as De Bruijn et al. (2009) suggested. Taken together, these two results lead to the conclusion that habit has both a direct and an indirect effect on leisure BSP use.

Behavioral intention was also a strong predictor in this model ($\beta = .321$, $p < .001$) as it directly influenced the frequency of an individual's BSP use, suggesting an individual's mental readiness plays an important role in their behavior. Although behavioral intention as an indicator of people's behavior has been challenged (Rhodes & Bruijn, 2013; Sheeran, 2002; Verplanken, Aarts, Knippenberg, & Moonen, 1998), its role in individual leisure use of a BSP was found important in this study.

Squared multiple correlation ($R^2$) was used to determine how much variance of the latent dependent variable (i.e., behavioral intention and leisure use) was explained by the exogenous variables. The $R^2$ value of use intention was .739, which means 73.9% of the total variance of use intention was explained by performance expectancy, social influence, price value, hedonic motivation, habit, and behavioral intention. Furthermore, behavioral intention and habit combined accounted for 32.6% of the total variance in explaining BSP use ($R^2 = .326$). Although three hypothesized paths were not supported in this study, the results indicate adequate predictive validity of the model.

## Discussion and Conclusion

To expand the limited research examining leisure BSP use, this study adopted the UTAUT2 as the conceptual framework for exploring the determinants of its use. The results partially supported the predictive validity of the model. Five factors, including performance expectancy, social influence, price value, hedonic motivation, and habit, significantly impacted people's intention to use a BSP for leisure. Furthermore, habit and behavioral intention significantly influenced the frequency of this leisure use among Taipei citizens. Some practical and theoretical implications can be drawn from these findings.

Habit was the strongest predictor of behavioral intention and explained a large amount of variance of actual use. This result confirms previous findings from Sheeran's (2002) meta-analysis of the predictive validity of behavioral intention, with results showing that on average, behavioral intention explains only 28% of the variance in a given behavior. He concluded that past behavior or habit seems to be another important factor in predicting human behavior. Verplanken et al. (1998) further explained that habit sets the boundary for the application of intentionality in predicting people's choice of a travel mode, with the results of their study indicating that behavioral intention could predict behavior only when habits have not been shaped. Therefore, future investigation of cycling or leisure behavior should consider the significance of habit and include it in the research model.

This study also found that BSP's utility and leisure functions attract Taipei citizens to use it during their leisure time. As Table 15 shows, both the performance expectancy and hedonic motivation constructs significantly predicted BSP use intention. The descriptive analysis also exhibited similar findings as BSP is not only used as a means of transportation but serves various functions for its users. For example, motivations related to the utility of BSP as "connects to public transports" or "get to leisure activities" were the top two reasons why Taipei citizens use YouBike, while "for relaxing" and "exercising" were also selected by many respondents as the main reasons to ride public bicycles in their leisure time (see Table 12). Therefore, the study confirms that BSP can play multiple roles in people's lives, functioning not only as a means of transportation but also a tool for leisure as suggested by previous research (Murphy & Usher, 2015).

From a theoretical perspective, the standardized path coefficient for hedonic motivation ($\beta = .198$, $p < .01$) was slightly larger than performance expectancy ($\beta = .148$, $p < .01$) in the hypothesized model, indicating that the intrinsic motivation was more important than extrinsic motivation regarding BSP use in a leisure context. Thus, future BSP research may need to explore this difference and try to integrate both extrinsic and intrinsic types of motivation in one research model to increase the predictive validity (Ryan & Deci, 2000). Furthermore, the government and the cycling advocacy groups should promote BSPs or cycling through various marketing strategies. Commuting by bike should not be the only focus. Based on this study, advertising public bicycles as a pleasurable and fun activity may persuade more people to try it.

This study revealed that price value is important to BSP users. According to Curto et al. (2016), the most important factors attracting people, even those who have their own bicycles, to use a BSP are the avoidance of theft, vandalism, bicycle maintenance, and the low cost. However, price value is not the only reason why people use a BSP in their leisure time. Individuals also value its health and environmental benefits, and these results provide further support for the role of perceived value in cycling intention. Specifically, it seems that not only individuals who ride private bicycle are influenced by perceived health benefits (Heinen et al., 2011) and environmental value of cycling (Gatersleben & Appleton, 2007) but also leisure BSP users (Kaplan et al., 2015). In summary, the value of BSP is viewed by its users as a combination of low cost, health, and environmental benefits.

Future research should examine how the price and other benefits of cycling are weighted and influence BSP-use patterns. Researchers may investigate, for example, at what degree do health benefits and environmental values start to influence an individual's willingness to pay. These data are also important for practitioners. For instance, since YouBike canceled the first 30-minutes-free riding policy, the numbers of travel trips have dropped by more than six million per annum (Chi, 2016, April 25). The subtle balance between an individual's willingness to pay and the perceived value of a BSP may significantly determine the success of a BSP.

This study compared the influences of bicycle infrastructure, ease of BSP use, and social influences on use intention. The results were contrary to previous research. For example, Buck et al. (2013) found that bike sharing activity and the existence of bike lanes exhibit a statistically significant relationship. In addition, Titze et al. (2008) pointed out that connectivity of bicycle lanes was positively linked with bicycle commuting. Kaplan and Prato (2016) also found that bicycle lanes were perceived as essential by both utilitarian and recreational cyclists. However, this does not appear to apply to leisure BSP use. In this study, the facilitating conditions have a non-significant and negative relationship with use intention ($\beta$ = -.029, $p > .05$), as does the ease of BSP use ($\beta$ = -.044, $p > .05$). Although previous studies have been found that sufficient docking stations (Fuller et al., 2011), an easy sign-up procedure (Fishman et al., 2012), and a simple renting and returning process (Pai & Pai, 2015) are important motivating factors for people to use BSP, there is no relationship found between leisure BSP use intention and effort expectancy in this study.

In the UTAUT, Venkatesh et al. (2003) found that effort-oriented constructs are significant only during the initial introduction of a technology, becoming non-significant over extended and continued usage. They further explained that effort expectancy is more salient at the beginning of a new behavior. When the obstacles of adopting new systems or performing a new behavior are overcome, instrumentality concerns become the user's priority focus. Therefore, in the future, researchers may compare if effort-oriented constructs are more important to people new to using a BSP than long-term users who have formed the habit of its use. A longitudinal research study should also be conducted to document the changes in the significance of effort expectancy in a city that initially launches a new BSP until the program is accepted as a part of its citizens' lives. For example, when the BSP began to appear on Brisbane's streets, citizens indicated a high level of interest in use but the time-consuming sign-up process discouraged many of them (Fishman et al., 2012). It appears that a simple, easy operating BSP may attract more new users but is not necessarily important to regular users.

Similarly, in the UTAUT, resource-orientated constructs are significant at the early stages of introducing a new system, but their influence on intention disappears after the system becomes established. Furthermore, the influence of the support infrastructure becomes non-significant when both performance expectancy and effort expectancy constructs are included in the model (Venkatesh et al., 2003). Therefore, future research may investigate if the presence of bicycle lanes, beautiful scenery, shade, and traffic volume are more important in attracting new users than for long-term BSP users. Furthermore, Venkatesh et al. (2012) pointed out that age and gender might influence the importance of facilitating condition on intention, finding, for example, older women value the availability of resources, knowledge, and support for new technology more than other age groups. Deenihan and Caulfield (2015) also found that younger male bicycle tourists who own personal bicycles are more likely to cycle on routes without bicycle facilities, while older female tourists who do not have personal bicycles are more willing to cycle on routes with bicycle lanes away from the flow of traffic. Thus, in the future, demographic characteristic can be included in the model to investigate the influence of age and gender on the perception of facilitating conditions.

In contrast to the non-significant and negative path of effort expectancy and facilitating conditions toward intention, social influence was found to positively influence Taipei citizens' intention for leisure BSP use ($\beta = .160$, $p < .01$). It seems that for BPS leisure users, social support is more important than bicycle infrastructure or the operating system of the BSP. Based on the descriptive analysis, 12.8% of the survey respondents reported that the reason why they use BSP in their leisure time is simply because of being invited by their friends and family to do so. This finding provides further support for the importance of the sociocultural environment factor in BSP use intention, a result corresponding to Liao's (2016) call for associating the social environment with bicycle share activities to further our understanding of this relationship. These results suggest that the government and other organizations should not only focus on the construction of the bicycle infrastructure but also include efforts promoting a bicycle-friendly culture. As Dickinson and Dickinson (2006) explained, "It is important not to ignore wider social processes and the societal pressures in which individuals make decisions" (p. 205).

Since the leisure use of BSP is a worldwide phenomenon (Murphy & Usher, 2015; Pai & Pai, 2015; Vogel et al., 2014), further investigation of such use is needed. It is expected that this study serves only as a steppingstone in the examination of the determinants of people's leisure BSP use. Developing a unified model that integrates various psychological factors known to affect cycling decisions may shed some light on this field. Future research may extend this model to investigate various cyclists groups, further contributing to our understanding of BSP use. Furthermore, the model indicated that performance expectancy, social influences, price value, hedonic motivation, and habit significantly predict individual behavioral intention and behavioral intention significantly predicts actual use. Future research may explore the mediation effect in the model, discovering the strength of indirect effect of performance expectancy, social influences, price value, hedonic motivation, and habit on the actual use.

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# CHAPTER FOUR

# EXAMINING THE EFFECTS OF EXPLICIT AND IMPLICIT ATTITUDES ON USING PUBLIC BICYCLE SHARE FOR LEISURE

## Introduction

SmartBike, introduced in Rennes, France, in 1998, is considered the first citywide information-technology based bicycle share program (BSP). Since then, it has attracted enormous interest and stimulated the rapid growth of similar programs worldwide (DeMaio, 2009; Parkes, Marsden, Shaheen, & Cohen, 2013; Shaheen, Guzman, & Zhang, 2010). According to Shaheen et al. (2010), the BSP has made a significant positive impact on society by providing a low-carbon transportation mode to help solve the “first and last mile” public transportation problem and bridging the gap between current transport networks. However, the literature has shown that its use is not limited to being a means of transportation (Vogel et al., 2014). In Taipei, 28% of BSP users ride public bicycles only for leisure (Pai & Pai, 2015), while in Brisbane, 65% of CityCycle casual users reported leisure or sightseeing as the primary purpose of their last trip (Fishman, 2016), and in Montreal, 6% of BIXI users cycle only for recreational purposes (Bachand-Marleau, Lee, & El-Geneidy, 2012).

However, researchers have not yet discovered why people ride public bicycles for leisure. Although the factors that cause people to engage in such behavior remain unclear, the cycling literature may provide some insights about their reasons. Sherwin, Chatterjee, and Jain (2014) interviewed 61 individuals across England to explore the significance of social influence on the decision to begin cycling, concluding that social networks and their influences played an important part in people’s transportation choice. Similarly, Heinen, Maat, and Van Wee's (2011) survey of Dutch citizens found that the attitude towards the benefits of cycling positively and significantly link with the decision to cycle. Although these qualitative and quantitative studies contribute to the knowledge of cycling behavior, researchers also point out that self-reported methods may not be able to fully capture the influences of emotional or symbolic drivers in the human decision-making process (Nosek, Greenwald, & Banaji, 2005; Sheeran, 2002; Yang, He, & Gu, 2012).

To understand why people sometimes act irrationally and to better analyze the causes, researchers have proposed the “dual process theory” that postulates human beings may possess two fundamentally different modes of cognitive processing, one intuitive and fast, the other deliberative and slow (Frankish, 2010; Hofmann, Friese, & Strack, 2009; Kahneman, 2011; Stanovich, 1999). Reflecting such theory, Wilson, Lindsey, and Schooler (2000) conceptualized a dual-attitudes model to explain how and why an individual may have two opposite attitudes toward the same object (e.g., bicycle). One, the explicit attitude, is the deliberate expression of an overt judgment controlled by our conscious mind and can be measured through self-reported questionnaires, while the other, the implicit attitude, is an automatic, habitual response that is difficult to assess using standardized survey instruments. Over the past several decades, scientists have developed alternative measures to detect these unconscious (implicit) attitudes. Among these measures, the Implicit Association Test (IAT) is the most widely used (Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005). It primarily asks participants to categorize four sets of stimuli (either words or pictures) as quickly as possible using two response keys. In this way, researchers are able to analyze participants' response times for the assigned task and to indirectly measure the associative strength between two opposite concepts (Greenwald & Banaji, 1995; Greenwald, McGhee, & Schwartz, 1998).

An IAT criticism is that the requirement of bipolar attributes (e.g., good–bad) may induce systematic error variance and reduce the validity if the research target has no clear opposite category (Penke, Eichstaedt, & Asendorpf, 2006). For example, the implicit attitudes of tourists toward a popular destination are somewhat difficult to assess using the IAT, as researchers must assign a second location as the opposite category. Measurement errors may be introduced if participants are attracted to both destinations or do not feel strongly against one or the other (Lee & Kim, 2016). Furthermore, IAT effects can also be understood oppositely. For example, in the classic flower-insect IAT (Greenwald, McGhee, & Schwartz, 1998), a negative IAT score of insects can be interpreted as the participant has a positive implicit preference for the flower instead of having an implicit bias against insects. Therefore, the IAT effect leads to a relative interpretation, which in some cases may create equivocal arguments and, thus, challenge the validity of the conclusions. To address this concern, researchers developed the Single Target Implicit Association Test (ST-IAT), modifying the IAT to assess the evaluative associations with a specific attitude object when the research target has no clear counterpart category (Wigboldus, Holland, & van Knippenberg, 2004).

Research has found that individuals may be influenced by a stereotype or an implicit bias towards cycling and, thus, choose not to cycle. For instance, Handy, Xing, and Buehler (2010) found that people who consider cycling a fun activity only for kids were less likely to cycle, while Fitt (2015) suggested that cycling is occasionally characterized as a specialist or elitist activity, requiring certain skills, expensive equipment, and special clothing, rather than a common transportation mode for the general public. Therefore, some view cycling implicitly as an "other people's activity," a perception that discourages people from cycling. Although previous research has found that a connection between an individual's implicit bias and their cycling behavior, few studies quantify this relationship. As riding public bicycle for leisure can be seen as one type of cycling activity, an intriguing question that merits further examination is "How does the implicit attitude toward cycling influence individual leisure BSP use?" To better understand such influence, this study applied ST-IAT to assess this relationship.

Furthermore, researchers have found that people perceive cycling and cyclists differently. For example, some may link positive words such as "clean and green," "healthy and fun" with cycling whereas others link negative terms such as "risk takers," "law breakers," and "status and sub-cultures" with cyclists (Daley & Rissel, 2011). In order to capture the differences between an individual's implicit attitude towards both cycling and cyclists, two ST-IATs were developed to yield a more holistic picture.

In addition to implicit bias, researchers have also found that individuals' explicit attitudes may positively influence his or her intention to cycle. For example, Curto et al. (2016) applied the Theory of Planned Behavior (TPB) to investigate cycling intention, finding that attitude and perceived behavioral control were the most influential factors affecting bicycle use for commuting purposes. In addition, Chen and Lu (2015) found that a BSP user's attitude has the highest mediation effect on an individual's BSP use intentions. Fitt (2015) further explored why individuals might hold positive or negative attitudes toward a certain mode of transportation, concluding that the formation of attitudes might be derived from social meanings and the perspectives held by various social groups. Namely, individuals perceive more positive social meanings in their in-groups (us) and attach stereotypes to their out-groups (them), even if they are unaware of doing so. Thus, this study also assesses the influence of individuals' explicit attitudes towards leisure cycling and their social group identity on leisure public bicycle riding.

It is expected that incorporating a dual-attitudes model in the investigation of leisure cycling behavior will contribute to the current knowledge. Furthermore, the use of the ST-IAT to explain the effects of implicit social cognition on using BSP for leisure may provide more comprehensive information for leisure cycling and BSP practitioners as well as introducing a new direction for future work.

## Literature Review

### Dual Process Theory and Its Influence on Leisure Behavior

Although humans have the ability to deliberate and plan future behavior, they also act impulsively at times. For example, people occasionally engage in irrational behavior contrary to their long-term goals for instant hedonic fulfillment (Hofmann et al., 2009). Understanding this aspect of human nature may provide insights on leisure behavior.

Social scientists have recently introduced the dual process theory, which posits that there are two distinct systems of cognitive processing that control human behavior (Hofmann et al., 2009; Kahneman, 2011; Stanovich, 1999). Stanovich (1999) used the generic terms System 1 and System 2 to describe these two sets of properties. However, Evans and Stanovich (2013) criticized such terms such as System 1 or heuristic system as being inaccurate and misleading because they imply that what is being indicated to is a particular system. In fact, the term System 1 should be plural because it suggests a set of systems in our brain. Therefore, they suggest using the terminology Type 1 and Type 2 processing because these terms both specify qualitatively different forms of processing and indicate that multiple neural or cognitive systems may trigger them.

Though different terminologies have been used to label these two modes of thinking, these theories share a common assumption that one is fast and autonomous, whereas the other is slow and capacity-limited. Specifically, Type 1 processing is unconscious, meaning it is fast, automatic, and involuntary. Information processed through this path lacks precise details and context. Furthermore, Type 1 is associated with a human's implicit attitudes and, thus, cannot be controlled. On the other hand, Type 2 is an evolutionary and uniquely human system, which is slow, deliberate, and voluntary. It is the source of our capability for abstract thinking in accordance with logical social norms, and it is associated with explicit attitudes and responsive to verbal instruction (Frankish, 2010; Kahneman, 2011).

Iso-Ahola (2015) argued that most human behavior is driven by environmental cues and that people tend to avoid cognitive and physical demanding tasks, pointing out that Type 1 thinking operates best during casual leisure (i.e., watching TV) because people typically exhaust their limited working memory at work, thus leaving little to nothing for strenuous cognitive or physical leisure activity. Rational thinking, the Type 2 process, on the other hand, negatively affects the sense of freedom suggested by leisure since it reminds people that they should be engaged in activities that benefit them (i.e., you must exercise or else…) but which require significant energy to complete. Subsequently, leisure becomes an incubator for the Type 1 process and a difficult setting for the Type 2 to dominate. Because the studies applying the dual process theory to leisure are limited, he called for more empirical examination of these assumptions. This study responds to his call, applying the dual process theory by comparing individuals' implicit and explicit attitudes toward leisure cycling and leisure cyclists.

## Dual Attitudes and the Indirect Measures

Recent research in social psychology indicates that human beings possess two sets of attitudes: one, the explicit attitude, is a verbalized, overt, and self-aware assessment of a particular group, individual, or issue, while the other, the implicit attitude, is a difficult to control, non-verbalized, and spontaneously activated evaluation of objects, which can sometimes function without an individual's awareness (Greenwald & Banaji, 1995; Perez, 2013). Specifically, explicit attitudes demand more mental effort to articulate than implicit attitudes (Eagly & Chaiken, 1993).

In leisure research, explicit attitudes are typically measured using self-report approaches. When respondents reply to a questionnaire, they perform a series of high-level cognitive functions formulating their answers. First, they need to understand the inquiry: what does this question mean? Then, based on their interpretation, they need to retrieve memories that match their responses with the available answer categories. Last, the respondents need to organize and report their opinions on the survey (Perez, 2013). At times, they may adjust their answers due to the social desirability effect (Fisher, 1993), another cognitive activity. All of these steps require considerable energy, effort, and self-awareness. If the respondents fail to introspectively assess their thoughts precisely, the self-reported information may be inaccurate and biased (Kollmuss & Agyeman, 2002).

To address the bias caused by an individual's less than perfect introspective capability, researchers have developed alternative measures to assess attitudes as they attempt to address the limitations of self-reported measures. These indirect measures examine the existence of attitudes not by what respondents express but by the rapidity with which they complete a set of tasks (Calitri, Lowe, Eves, & Bennett, 2009; Greenwald et al., 1998; Nosek et al., 2005; Perez, 2013). Because implicit attitudes are affective evaluations and, hence automatic, they can be better captured through these reaction-time methods, which circumvent individuals' introspective abilities. Among these latency-based implicit measures, the IAT is the most widely used for evaluating an individual's implicit aptitudes (Greenwald & Banaji, 1995; Greenwald et al., 1998).

In a typical IAT, participants are asked to respond to certain words or pictures using a computer keyboard.  For example, participants are requested to rapidly sort several words relating to concepts (e.g., flower, insect) or to attributes (e.g., good, bad) into categories that appear on the left and right side of a computer screen. When the concepts and attributes are assessed as congruent by the participants (e.g., flower + good words), the implicit mind will guide them to press the corresponding keys faster than when the concepts and attributes are evaluated as incongruent, such as insect and good words (Greenwald et al., 1998).

While researchers recognize the value of the IAT, it has been criticized for delivering equivocal answer to some inquiries, such as the assessment of a target concept for which the counter-category is difficult to define (Bluemke & Friese, 2008). Taking leisure cycling as an example, researchers can use leisure driving, leisure hiking, or many other leisure behaviors as the counter-category; however, given leisure cycling is not absolutely opposite to leisure driving or leisure hiking, the results of the IAT are problematic and cannot be clearly interpreted. Therefore, modified versions of the IAT, including the Multi-Dimensional IAT (MD-IAT), the Single-Target IAT (ST-IAT), the Single-Attribute IAT (SA-IAT), and the Single-Category IAT (SC-IAT), have been developed (Bluemke & Friese, 2008; Karpinski & Steinman, 2006; Penke et al., 2006; Wigboldus et al., 2004), with the ST-IAT being the most widely used method for evaluating associations of only one target (Lee & Kim, 2016). Furthermore, researchers have also found that several ST-IATs can be combined in one study to compare multiple concepts and still exhibit good discriminant validity (Bluemke & Friese, 2008), supporting the strength of the ST-IAT for examining leisure behavior for which it is difficult to define an opposite category.

## Distinctive Attitudes toward Cycling and Cyclists

Although research shows that the health benefits of cycling outweigh the risks of a crash, the most commonly mentioned reason for not cycling is fear (Fishman, Washington, & Haworth, 2012). When researchers further explored the formation of fear of cycling in places with a pro-car culture, the results implied that this emotion might be derived from an individual’s implicit bias against cyclists, not cycling (Fitt, 2015).

Daley and Rissel (2011) interviewed non-riders, occasional riders, and regular riders, finding opposite perceptions of cycling and cyclists. Themes linked to images of cycling were typically good words, such as "serious business," "healthy and fun," and "clean and green," while negative terms such as "law breakers," "status and sub-cultures" and "risk takers," were frequently associated with cyclists. They also found that the perceptions of cyclists vary across rider groups, with non-riders generally expressing less favorable opinions about cyclists than occasional and regular riders. Fitt (2015) explained this phenomenon from social meanings and social groups perspectives, saying individuals apply more positive social meanings to their in-groups (us) and more negative stereotypes to their out-groups (them).

Lois, Moriano, and Rondinella (2015) also pointed out that an individual's intention to commute by bicycle is associated with the person identifying as "a cyclist." Specifically, this identification is a symbolic result derived from individual's self-perception as a member of a particular group. Based on this identity, individuals can make a quick social judgment about people who are not part of their "in-group" and act irrationally against them. For example, Kaplan and Prato (2016) found that at locations where motorcyclists and cyclists compete for road space, negative terms (e.g., fear and anxiety, anger, annoyance, or contempt) were frequently expressed by research participants against the other group, even if no real conflict occurred. However, this bias has primarily been seen in relation to commuting cyclists, not the leisure cyclists. People may see utilitarian cyclist as ‘‘hazardous’’ but see a leisure cyclist as person who has a good quality of life (Daley & Rissel, 2011). These distinctive perceptions may influence people's choice of cycling. Research comparing the differences between individuals' implicit attitudes and explicit attitudes toward cycling and cyclists and quantifying their influences on cycling behavior is limited. To address this limitation, this study explores this relationship, proposing the following hypotheses:

**Hypothesis 1**: The implicit attitudes toward leisure cycling will positively influence an individual's leisure public bicycle riding frequency.

**Hypothesis 2:** The implicit attitudes toward leisure cyclists will positively influence an individual's leisure public bicycle riding frequency.

**Hypothesis 3:** The explicit attitudes toward leisure cycling will positively influence an individual's leisure public bicycle riding frequency.

**Hypothesis 4:** An individual's social identification with a leisure cycling group will positively influence his/her leisure public bicycle riding frequency.

The hypothetical model of this study is presented in Figure 3.

## Research Methods

### Participants

The recruitment of participants for this study involved two phases. Convenient sampling was used in the first phase of the study for stimuli selection. A total of 78 Taiwanese adults participated in the survey with 27 invalid responses. The remaining 51 participants (male = 10, female = 41) were between the ages of 18 and 56 (average = 30.59, SD = 9.19). The majority of these participants had completed college (47.1%), followed by those with high school degrees (25.5%), master's degrees (23.5%) and doctorate degrees (3.9%).

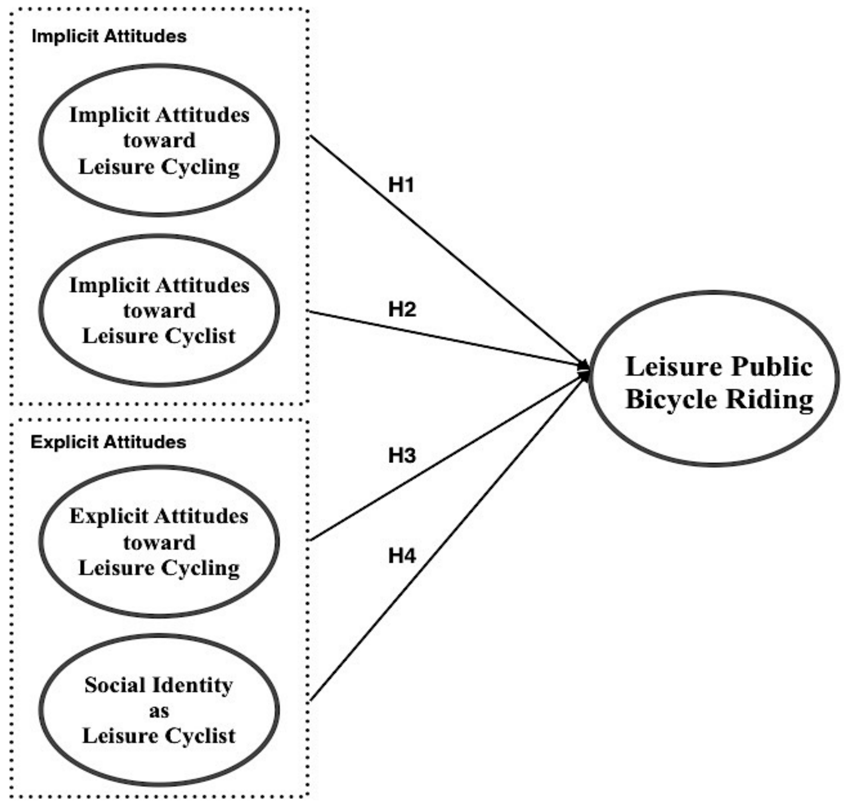


Figure 3. Theoretical Model

Participants in the second phase (N = 260) were primarily recruited from a cycling discussion forum of a terminal-based bulletin board system (telnet://ptt.cc), which is the most influential online community in Taiwan, with more than 1.5 million registered users (Busuness Next, 2016). There were more females (60.8%) than males (38.5%) in this sample, and the majority of the respondents were in the 20 to 29 age group (43.8%), followed by the 30-39 (36.2%). Of the 260 respondents, 19.2% had personal monthly incomes in the range of NT$30,000 (approximately US $990.5) to NT $39,999 (approximately US $1320.64). Most of the respondents were well-educated, with 46.2% having a college degree and another 46.2% with master's degrees. More than 81.5% of the respondents did not commute by public bicycles, with a majority using a moped or a motorcycle (48.5%) as their primary mode of transportation. The sample size for phase two was based on a power analysis conducted using the approach proposed by MacCallum, Browne, and Sugawara (1996). The sample size of the ST-IAT was large enough to reject a Type II decision error (the power estimates are based on alpha = .05, desired power =.80, RMSEA for H0=.05, RMSEA for Ha.01). The detailed profile of the respondents is presented in Table 16.

Table 16 Respondents' Profile

| Demographic categories | Frequency | Percentage (%) | Demographic categories | Frequency | Percentage (%) |
|---|---|---|---|---|---|
| **Gender** | | | **Monthly Personal Income (TWD[a])** | | |
| Male | 100 | 38.5% | Less than $10,000 | 64 | 24.6% |
| Female | 158 | 60.8% | $10,000 - $19,999 | 16 | 6.2% |
| No Response | 2 | 0.8% | $20,000 - $29,999 | 30 | 11.5% |
| **Age** | | | $30,000 - $39,999 | 50 | 19.2% |
| Less than 20 | 10 | 3.8% | $40,000 - $49,999 | 42 | 16.2% |
| 20–29 | 114 | 43.8% | $50,000 - $59,999 | 22 | 8.5% |
| 30-39 | 94 | 36.2% | $60,000 - $69,999 | 20 | 7.7% |
| 40-49 | 36 | 13.8% | $70,000 - $79,999 | 16 | 6.2% |
| Over 50 | 6 | 2.3% | **Frequently used transportation mode** | | |
| **Education level** | | | Walking | 12 | 4.6% |
| High School | 16 | 6.2% | BSP | 6 | 2.3% |
| College | 120 | 46.2% | Private bike | 20 | 7.7% |
| Master Degree | 120 | 46.2% | Moped/Motorcycle | 126 | 48.5% |
| Doctorate Degree | 4 | 1.5% | Car | 34 | 13.1% |
| **Commuting by public bikes** | | | Public transports | 62 | 23.8% |
| Yes | 48 | 18.5% | | | |
| No | 212 | 81.5% | | | |

a. 1 New Taiwan Dollar (TWD) is approximately equal to .03 U.S. Dollars.

## Selection of Stimuli

To select stimuli representing the leisure cycling and leisure cyclist categories, a Qualtrics-based survey facilitating a sorting task was developed. Since no IAT relevant to the topic investigated here has been developed, ten candidates for verbal stimuli for each category as well as good words and bad words were first chosen from an online search engine and the cycling literature (Daley & Rissel, 2011; Fitt, 2015). Participants were asked to categorize these terms and rate their ease of classification. The final set of stimuli was determined based on the correct percentages of reactions to each of them, with each stimulus word resulting in at least a 96% agreement in categorization. The sorting task produced six verbal stimuli for the categories of leisure cycling and leisure cyclists and the attributes, i.e. good words, and bad words. The details can be seen in Table 17 and Table 18 respectively.

Table 17 Results of Stimuli Sorting Task for Categories

| Stimulus Terms | % Categorized as Leisure Cycling/Leisure Cyclists | Mean of Easiness for Classification | Standard Deviation |
|---|---|---|---|
| 騎自行車 (Bicycling) | 98.08% | 4.47 | 0.75 |
| 騎腳踏車 (Cycling) | 98.04% | 4.31 | 0.85 |
| 騎單車 (Biking) | 98.04% | 4.73 | 0.53 |
| 騎自行車 (Go cycling) | 98.04% | 4.14 | 1.14 |
| 腳踏車 (Bicycle) | 98.04% | 4.27 | 0.95 |
| 自行車 (Bike) | 98.12% | 4.14 | 0.93 |
| 腳踏車騎士(Cyclist) | 98.12% | 4.22 | 0.96 |
| 自行車騎士(Bicyclists) | 98.12% | 4.53 | 0.72 |
| 單車騎士(Biker) | 100% | 4.67 | 0.55 |
| 騎單車的人(Bike Rider) | 96.08% | 4.61 | 0.63 |
| 騎自行車的人(People who cycle) | 98.04% | 4.22 | 0.96 |
| 騎腳踏車的人(Bicycle Rider) | 98.04% | 4.31 | 1.00 |

All the candidate terms are synonyms for cycling and cyclists in Chinese.

Table 18 Results of Stimuli Sorting Task for Attributes

| Stimulus Terms | % Categorized as Good/Bad | Mean of Easiness for Classification | Standard Deviation |
|---|---|---|---|
| 強壯 (Strong) | 100.00% | 4.35 | 0.86 |
| 成功 (Success) | 100.00% | 4.10 | 0.89 |
| 健康 (Healthy) | 100.00% | 4.22 | 0.96 |
| 快樂 (Happy) | 98.04% | 4.41 | 0.89 |
| 自信 (Confident) | 98.00% | 4.27 | 0.97 |
| 幸福 (Happiness) | 100.00% | 4.08 | 0.86 |
| 愛炫耀 (Flaunting) | 100.00% | 4.08 | 0.88 |
| 粗魯 (Rude) | 100.00% | 4.45 | 0.75 |
| 討厭 (Disgusted) | 100.00% | 4.39 | 0.84 |
| 煩人 (Annoying) | 100.00% | 4.27 | 0.82 |
| 危險 (Dangerous) | 98.00% | 4.35 | 0.79 |
| 遊手好閒 (Idle rich) | 98.00% | 4.39 | 0.77 |

## Research Instruments

*ST-IAT design*

The ST-IATs were created with open-source web-based codes (Chakroff, 2013) and uploaded to Qualtrics, a protected online survey platform, for data collection and storage. As Figure 4 shows, the leisure cycling ST-IAT was presented as a focal category of leisure cycling on one side of a computer monitor paired with good or bad, with stimulus words continually appearing in the middle of the screen (e.g., cycling, biking, healthy, dangerous). The participants were asked to correctly sort the stimuli into the appropriate category. If the participant miscategorized the stimulus word, a red “X” appeared on the screen, and the next stimulus terms continued to appear. The leisure cyclist ST-IAT adopted a similar procedure, but with the focal category, leisure cyclists.

Each ST-IAT included a set of instructions for the categorization task and the appropriate key responses. The first trial started 1.5 seconds after the participant pressed the space bar. If a stimulus word that shared similar attributes with the target concept appeared on the left of the monitor, the participants responded with the "A" key, while if the stimulus word shared the same attribute with the concept on the right of the monitor, the participants responded with the "L" key. Stimulus words remained on the monitor until the responses were made. The interval between the response and the next stimulus word was 30 milliseconds. A faster response suggested a more automatic association consistent with the participant's attitudes, while a longer response time indicated a smaller or no association, suggesting an implicit bias against the target concept. Each ST-IAT was comprised of two practice blocks and four formal task blocks. The detailed task sequences are presented in Table 19 and Table 20.


Figure 4. Example of Tasks for the Leisure Cycling ST-IAT

Table 19 Single-Target IAT for Leisure Cycling: Task Sequence

| Block | Trials | Block Description | Left Response | Right Response |
|---|---|---|---|---|
| 1 | 18 | Practice block | Leisure Cycling + Good word | Bad words |
| 2 | 36 | First compatible experimental block | | |
| 3 | 36 | Second compatible experimental block | | |
| 4 | 18 | Practice block | Good word | Leisure Cycling + Bad words |
| 5 | 36 | First incompatible experimental block | | |
| 6 | 36 | Second incompatible experimental block | | |

Table 20 Single-Target IAT for Leisure Cyclist: Task Sequence

| Block | Trials | Block Description | Left Response | Right Response |
|---|---|---|---|---|
| 1 | 18 | Practice block | Leisure Cyclist + Good word | Bad words |
| 2 | 36 | First compatible experimental block | | |
| 3 | 36 | Second compatible experimental block | | |
| 4 | 18 | Practice block | Good word | Leisure Cyclist + Bad words |
| 5 | 36 | First incompatible experimental block | | |
| 6 | 36 | Second incompatible experimental block | | |

*Explicit attitudes measures*

The explicit attitudes measure included five sections: 1) two semantic differential scales for measuring the general preference for leisure cycling and leisure cyclists; 2) an explicit attitudes measurement with five items related to leisure cycling; 3) a social identity measurement with five items related to leisure cyclist, 4) two current BSP use behavior questions, and 5) selected demographic questions. The semantic differential scales asked participants to rate the adjectives displayed in terms of "good-bad" in relation to their perceptions of leisure cycling and leisure cyclists on a scale ranging from 1 to 10, with 1 representing negative adjectives (i.e., bad) and 10 representing positive adjectives (i.e., good).

The scale measuring the explicit attitudes toward leisure cycling included five items modified from cycling literature (Chen & Lu, 2015; Handy et al., 2010; Verma, Rahul, Reddy, & Verma, 2016), with participants responding to them using a 7-point Likert-type scale ranging from strongly disagree to strongly agree. These items included "Cycling is a good leisure activity for me"; "Leisure cycling is worth encouraging"; "Cycling is a cool option for leisure"; "Cycling for leisure is a wise decision for me"; and

"I like cycling in my leisure time." For the social identity scale, the measurement items, which were adapted from the studies of Lois et al. (2015) and Cameron (2004), included "I identify myself as a leisure cyclist"; "I can envisage myself as a leisure cyclist"; "In general, I am glad to be a leisure cyclist"; "I feel good about being one of leisure cyclists"; and "I hope I can be a leisure cyclist."

The current BSP use behavior measure contained two questions. The first one, "How many times did you use YouBike for leisure in the past 30 days," was answered using a range from "never" to "more than 30 times." The second question, "On average, how often do you use YouBike in your leisure time," was answered using a range from "used only once," "once per year," "once per half year," "once per three months," "once per month," "once every two weeks," "once per week," "once every three days," "once a day" to "more than once a day."

## Procedure

When participants entered the online ST-IAT website, they first saw a set of instructions and a consent form, informing them that their participation was completely voluntary and assuring them of the anonymity of their responses. Only after the participants clicked the agreement button could they proceed to the ST-IAT. The leisure cycling ST-IAT was presented first, followed by the leisure cyclist ST-IAT. After completing both ST-IATs, the participants answered the questionnaire measuring explicit attitudes toward leisure cycling and leisure cyclists. Once the participants completed the questionnaire, the data were stored in a database that only the researcher had access to in order to protect the their anonymity and to reduce self-presentation concerns. The response times for ST-IATs were recorded on the website server regardless if an incorrect or correct response was given for each term.

## Data Analysis

*Data extraction and scoring*

Greenwald et al. (1998) introduced a scoring procedure (i.e., the conventional algorithm) to calculate IAT effect that compares the difference between the first combined blocks (Block 2) and the first reverse combined blocks (Block 5). This calculation procedure includes the following 5 steps: (1) The first two trials of the test trial blocks are removed because participants usually record longer response times; (2) Response times shorter than 300 msec or longer than 3,000 msec are recoded as 300 msec or 3,000 msec, respectively; (3) The raw data are log-transformed before calculation in order to use a statistical method that satisfies the distribution of variance for data analysis purposes, (4) The error-trials are also recorded in the analysis; and (5) The data with an error rate higher than 25% in any single experimental trial block are deleted. These conventional procedures typically produce the largest effect sizes (Gawronski & Payne, 2010).

Since the conventional algorithm needs more theoretical justification to differentiate it from other scoring approaches, Greenwald, Nosek, and Banaji (2003) introduced an improved IAT scoring process, the D measure. The main differences between the D measure and the conventional algorithm include that (1) 600 msec is added to an incorrect response as an error penalty and (2) the individual standardization procedure is similar to that for Cohen's effect size measure d (Teige-Mocigemba, Klauer,

& Sherman, 2010). This study modified the D measure to calculate the ST-IAT effects. Open-source R scripts developed by Hilgard (2015) were used to analyze the data using the following procedure:

(1) Data were extracted from Blocks 2, 3, 5, and 6.

(2) The data from the participants who responded more quickly than 300 msec over 10% of trials were eliminated;

(3) The means of the correct latencies of each block were computed for the final ST-IAT effect size calculation;

(4) The pooled standard deviation for all trials in Block 2 and Block 5 was calculated as well as for Block 3 and Block 6.

(5) The reaction times for incorrect trials within each block were replaced with that block's mean reaction time plus 400 ms (the penalty for an incorrect response for the ST-IAT);

(6) The average of the resulting values for each of the four blocks was recalculated;

(7) The mean difference between Block 2 and Block 5 was divided by the pooled Block 2 and Block 5 standard deviation as well as for Block 3 and Block 6;

(8) The equal-weight average was calculated from Step 7 results. A larger score indicated a favorable implicit attitude toward leisure cycling or leisure cyclists. Equation 1 represents the formula used to develop the ST- IAT effect score.

$$\frac{\left[\frac{MeanBlock5-MeanBlock2}{SD(Block\ 2+Block5)}+\frac{MeanBlock6-MeanBlock3}{SD(Block\ 6+Block3)}\right]}{2} \quad (1)$$

According to Chequer (2014), IAT scores are significantly influenced by the measurement error, thereby affecting an accurate estimation of the underlying attitudes. Therefore, in addition to calculating the D score for the overall ST-IAT effect, this study used confirmatory factor analysis (CFA) to examine the reliability and construct validity of the ST-IAT scores and to control for the confounding influences of measurement error. As using a single D score to represent an entire latent construct is not ideal for the latent modeling approach, several scores should be extracted from the trials to estimate a latent factor. While generating scores with 144 paired congruent and incongruent reaction times for each participant is theoretically achievable, the process is cumbersome and may result in creating too many variables for one latent construct (Chequer, 2014). Thus, to provide sufficient yet manageable sets of ST-IAT scores for one latent variable, the data were sorted into six equal parcels based on the stimulus terms. This approach allowed for the control and estimation of the confounding influences of stimuli. Using the leisure cycling ST-IAT as an example, the implicit attitude construct was comprised of six mini ST-IAT scores based on six sets of stimulus terms: leisure cycling 1, good words 1, bad words 1, leisure cycling 2, good words 2, and bad words 2 as seen in Figure 5. All mini ST-IAT scores were calculated using this procedure.

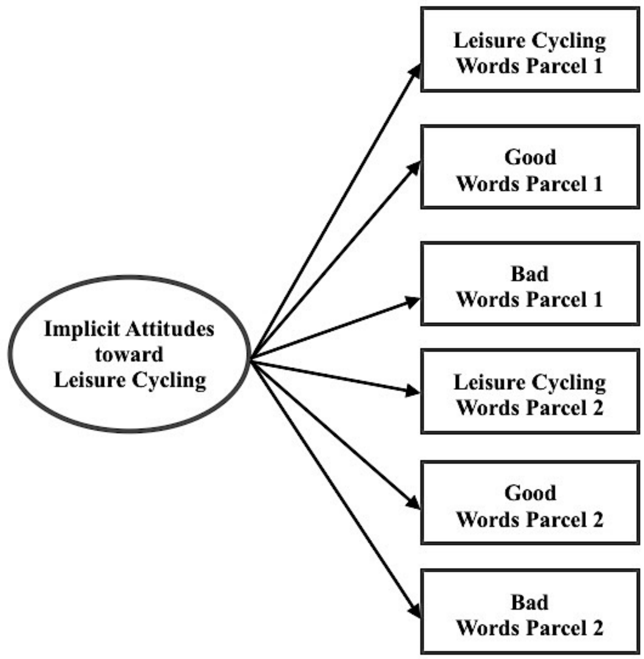


Figure 5. An Example of a Latent Implicit Attitude Factor

*The relationships testing*

To exam the direction of the overall ST-IAT effect and the explicit attitudes, a correlational analysis of the relationship was conducted using SPSS 23.0. A larger D score on the ST-IAT is expected to have a positive correlation with favorable attitudes toward leisure cycling and with a stronger social identification with leisure cyclists. Furthermore, a series of paired samples t-test was conducted to compare the differences among these four attitudes.

The CFA was performed using Mplus 7.4, based on the two-step approach suggested by Anderson and Gerbing (1988), evaluating each latent construct first and then examining the overall measurement model. According to Gorsuch (1983), a factor loading of .32 is the cutoff value for a meaningful relationships between an item and a latent construct. Furthermore, a set of model fit indices such as chi-square, the comparative fit index (CFI), the standardized root mean square residual (SRMR) and the root mean squared error of approximation index (RMSEA) were used to assess the goodness of all imposed covariance estimations (Bentler & Bonett, 1980; Browne & Cudeck, 1993). The hypothesized model was tested using the structural equation modeling (SEM).

## Results

### Implicit and Explicit Attitudes Toward Leisure Cycling and Cyclists

Table 21 shows the descriptive results for the explicit and implicit attitudes towards leisure cycling and cyclists. The averages of the implicit attitudes toward leisure cycling and cyclists were found to have positive values for both ST-IATs, which indicates that overall, the participants have positive implicit attitudes towards both leisure cycling and leisure cyclists. The average value of the explicit attitudes toward leisure cycling was relatively lower than expected, suggesting that the participants might explicitly hold a negative to neutral attitude toward leisure cycling (mean=3.35, SD=1.463). However, the participants gave a highly favorable assessment to leisure cyclists (mean=7.71, SD=1.939), suggesting that this sample has a positive explicit attitude toward leisure cyclists.

To compare the implicit and explicit attitudes of leisure cycling and leisure cyclists, a series of paired sample t-tests was conducted, the resulting relationships being summarized in Table 22. The results indicated the ST-IAT scores between two implicit attitudes were significantly different (t = 8.962, $p < .001$), suggesting the implicit attitude was more positive toward leisure cycling than leisure cyclists. However, the explicit attitudes measured by the semantic differential scale indicated the opposite, these results suggested that the participants hold significantly more positive attitudes towards leisure cyclists than leisure cycling (t = 30.211, $p < .001$).

Table 23 provides the correlations among the ST-IAT scores and the semantic differential ratings toward leisure cycling and leisure cyclists. As this table shows, there was a correspondence between the ST-IATs (r = .330, $p < .01$), suggesting that the implicit attitudes towards leisure cycling and leisure cyclists were positively related. An individual who implicitly supports leisure cycling may also favor leisure cyclists. However, the ST-IAT scores were not significantly related to the measures of the explicit attitudes toward leisure cycling and leisure cyclist. These results, therefore, indicate that no significant relationship exists between an individual's implicit and explicit attitudes. Furthermore, the explicit attitudes toward leisure cycling and cyclists exhibit no correlation.

Table 21 Descriptive Results of Explicit and Implicit Attitudes

| Items | Mean | SD |
|---|---|---|
| Overall ST-IAT effects for leisure cycling | .280 | .322 |
| Overall ST-IAT effects for leisure cyclist | .083 | .290 |
| Semantic differential scale for leisure cycling | 3.35 | 1.463 |
| Semantic differential scale for leisure cyclist | 7.71 | 1.939 |

SD = Standard deviations.

Table 22 The Results of Paired Samples Test

| Items | Mean Difference | SD | t-value | df | Sig. (2-tailed) |
|---|---|---|---|---|---|
| IMCYCLING vs. IMCYCLISTS | .197 | .355 | 8.962 | 259 | .000 |
| EXCYCLING vs. EXCYCLIST | -4.362 | 2.328 | 30.211 | 259 | .000 |

IMCYCLING = Overall ST-IAT effects for leisure cycling; IMCYCLISTS = Overall ST-IAT effects for leisure cyclist; EXCYCLISTS = Semantic differential scale for leisure cycling; EXCYCLIST = Semantic differential scale for leisure cyclist.

Table 23 Correlations Between Implicit and Explicit Attitudes

| Measures | IMCYCLING | IMCYCLISTS | EXCYCLING |
|---|---|---|---|
| IMCYCLISTS | .330** | | |
| EXCYCLING | .047 | .056 | |
| EXCYCLIST | .116 | .047 | .085 |

IMCYCLING = Overall ST-IAT effects for leisure cycling; IMCYCLISTS = Overall ST-IAT effects for leisure cyclist; EXCYCLISTS = Semantic differential scale for leisure cycling; EXCYCLIST = Semantic differential scale for leisure cyclist. ** $p < .01$.

## Confirmatory Factor Analysis

Indirect measures, such as the IAT, provide an alternative and valuable approach for evaluating an individual’s implicit attitudes that are difficult to capture using traditional survey measurements. However, previous research has expressed concern about its poor psychometric properties. According to Chequer (2014), high error variances likely contribute to IAT effects significantly, which should be taken into account to avoid inaccurate and bias estimation of implicit attitudes. Therefore, this study applied CFA to assess the reliability and construct validity of the ST-IATs.

The use of a two-step CFA resulted in two parcels from the leisure cycling ST-IAT, four parcels from the leisure cyclist ST-IAT, one item from the leisure cycling explicit attitudes scale, and two items from the leisure cyclist social identity scale being omitted due to insufficient and insignificant factor loadings. The remaining measurement model fit the data properly ($\chi^2_{(56)}$ = 113.998, $p < .001$; SRMR = .058; CFI = .965; RMSEA = .063). Factor loadings ranged from .404 to .942, higher than the minimum value of .32 suggested by Gorsuch (1983). Thus, the remaining measurement items fit the underlying latent constructs well. The composite reliability (CR) of the two explicit measures and the leisure cyclist ST-IAT construct were greater than .6, indicating satisfactory reliability (Hair, Black, Babin, & Anderson, 2010). Furthermore, the average variance extracted (AVE) of these constructs, measuring the variance accounting for the underlying construct in relation to the measurement error, was larger than the suggested value of .50 (Fornell & Larcker, 1981; Hair et al., 2010), implying good convergent validity. Even though the AVE for the leisure cyclists ST-IAT was lower than the minimum value, the reliability of this construct was close to the suggested value. For the purpose of comparison, this construct was kept and used in the following test. A summary of the factor loadings, CRs and AVEs of the four-factor dual attitudinal model are presented in Table 24.

The discriminant validity of the hypothesized model was estimated by comparing the shared variance between each pair of constructs with their respective AVEs (Fornell & Larcker, 1981; Hair et al., 2010). As seen in Table 25, all square roots of the AVEs are larger than the off-diagonal elements in the related cells. However, the correlations among constructs differ from the previous estimation, these results indicating that the leisure cycling ST-IAT score correlated with the leisure cyclist ST-IAT and the leisure cycling explicit measurement; however, the results from the previous analysis showed no correlation between both implicit attitude measures and any explicit attitude.

Furthermore, the leisure cycling explicit measurement correlated with the leisure cyclist explicit measurement, which are different results than the previous analysis. This difference may be due to measurement error or the different explicit measurement items. Thus, the results should not be treated as similar, and the interpretations should differ.

Table 24 Measurement Model Results

| Constructs | Items | Mean (Standard Deviation) | Factor Loading | Composite Reliability | AVE |
|---|---|---|---|---|---|
| Implicit attitudes toward leisure cycling | Cycling1 | .310 (.573) | .488 | .584 | .263 |
| | Bad1 | -.036 (.631) | .581 | | |
| | Cycling2 | .322 (.561) | .561 | | |
| | Bad2 | .001 (.624) | .404 | | |
| Implicit attitudes toward leisure cyclist | Cyclist1 | -.022 (.684) | .666 | .666 | .500 |
| | Cyclist2 | -.123 (.595) | .746 | | |
| Explicit attitudes toward leisure cycling | ATT1 | 6.100 (1.291) | .547 | .891 | .678 |
| | ATT2 | 5.923 (1.116) | .926 | | |
| | ATT3 | 6.146 (.939) | .848 | | |
| | ATT4 | 5.808 (1.231) | .915 | | |
| Explicit attitudes toward leisure cyclist | IDEN1 | 4.292 (1.638) | .763 | .888 | .727 |
| | IDEN2 | 4.839 (1.605) | .843 | | |
| | IDEN3 | 4.885 (1.474) | .942 | | |

Cycling 1= First cycling stimulus words parcel; Bad 1= First bad stimulus words parcel; Cycling 2= Second cycling stimulus words parcel; Bad 2= Second t bad stimulus words parcel; Cyclist 1= First cyclist stimulus words parcel; Cyclist 2= Second cyclist stimulus words parcel; ATT1= Cycling is a good leisure activity for me; ATT2= Leisure cycling is worth encouraging; ATT3= Cycling for leisure is a wise decision for me; ATT4= I like cycling in my leisure time; IDEN1= I can envisage myself as a leisure cyclist ; IDEN2= I feel good about being one of leisure cyclists; IDEN3= I hope I can be a leisure cyclist.

Table 25 Discriminant Validity of Measurement Scales

| Constructs | Correlation Coefficient | | | |
|---|---|---|---|---|
| | IM1 | IM2 | EX1 | EX2 |
| IM1: Implicit attitudes toward leisure cycling | **.513** | | | |
| IM2: Implicit attitudes toward leisure cyclist | .426 | **.707** | | |
| EX1: Explicit attitudes toward leisure cycling | .205 | .071 [a] | **.823** | |
| EX2: Explicit attitudes toward leisure cyclist | .055[a] | .114 [a] | .744 | **.853** |

The value on the diagonal line is the square root of AVE for the latent variable; the value should be higher than the value on the non-diagonal line; a = not significant.

## Hypotheses Testing

The influence of the implicit and explicit attitudes on an individual leisure public bicycle riding was estimated using SEM. The structural model in this study resulted in a good fit ($\chi^2_{(76)}$ = 194.400, $p$ < .001; SRMR = .054; CFI = .941; RMSEA = .077). The parameters of both implicit attitudes towards public bicycle riding showed negative and non-significant relationships, findings that do not support the positive relationships hypothesized here. However, an individual's explicit attitudes towards leisure cycling and social identity with leisure cyclists were found to positively predict leisure public bicycle use. Thus, the hypothesized model developed for this study was partially supported by the data. These results are summarized in Table 26.

Table 26 Results of the Hypothesis Testing

| Hypothesis Paths | | Standardized Path Coefficient | Standard Error | Two-Tailed *p*-value | Results |
|---|---|---|---|---|---|
| H1: | IM1→ Public bicycle riding | -.018 | .073 | ns. | Not supported |
| H2: | IM2→ Public bicycle riding | -.086 | .054 | ns. | Not supported |
| H3: | EX1→ Public bicycle riding | .210 | .088 | * | Supported |
| H4: | EX2→ Public bicycle riding | .810 | .094 | *** | Supported |

IM1= Implicit attitudes toward leisure cycling; IM2: Implicit attitudes toward leisure cyclist; EX1: Explicit attitudes toward leisure cycling; EX2: Explicit attitudes toward leisure cyclist; *$p$ < .05;
*** $p$ < .001; ns = not significant.

## Discussion and Conclusion

Over the past decade, BSPs have expanded rapidly worldwide, with previous studies finding that people use such programs for commuting and leisure (Pai & Pai, 2015). Although researchers have explored the determinants of BSP use and leisure cycling with fruitful results, few investigate the influence of dual attitudes on cycling behavior. This study appears to be one of the first to empirically apply a dual-attitude model to examine cycling behavior, and its findings contribute to our understanding of the impact of implicit and explicit attitudes on individuals' use of BSPs for leisure. Furthermore, the application of CFA to examine the construct validity and reliability also provide an alternative direction for examining the measurement error resulting from IAT effects.

More specifically, several practical and theoretical implications can be drawn from the study. First, the overall ST-IAT effects for leisure cycling (Mean = .280, SD = .322) and leisure cyclists (Mean = .083, SD = .290) exhibit positive values, suggesting that in general, people have favorable implicit attitudes toward both leisure cycling and leisure cyclists. However, the results of the paired sample t-tests indicated that these positive aptitudes are significantly different (Mean difference = .197, $p < .001$). Implicitly, people hold more positive attitudes towards leisure cycling than leisure cyclists. This result supports the findings from Daley and Rissel's (2011) study indicating that people perceive cycling and cyclists differently. However, the results from the semantic differential scales indicated a different relationship, with people explicitly holding more positive attitudes toward leisure cyclists (Mean = .7.71, SD =1.939) than leisure cycling (Mean = .3.35, SD =1.463). This difference is also statistical significant (Mean difference = 4.362, $p < .001$). These findings confirm that people have different attitudes toward the same object, individual, or events (Wilson et al., 2000). While individuals may explicitly hold a positive attitude towards leisure cyclists, they may implicitly feel the opposite. Future research should continue exploring this difference, perhaps applying multiple ST-IATs to examine if this difference is found among utilitarian cycling, commuting cyclists, leisure cycling, and leisure cyclists.

This study also investigated the correlations among implicit and explicit attitudes. Based on the results of the Pearson correlation coefficients, the overall ST-IAT effects only significantly correlated with one another, not with the explicit attitudes measured with the semantic differential scales. However, after controlling for the influences of the stimulus terms and the measurement error, the leisure cycling implicit attitude construct was significantly correlated with the leisure cyclist implicit construct as well as the explicit leisure cycling construct. Furthermore, explicit leisure cycling attitudes were positively associated with an individual's social identity with leisure cyclists, providing further evidence supporting Chequer's (2014) findings that to some extent, IAT scores are influenced by measurement error, affecting the resulting estimation. In the future, a meta-analysis should be conducted to compare the degree of the influence of the measurement error on IAT scores and the correlation between the implicit and explicit measurement scores.

In addition to the methodological examination, this finding also supports that an individual's social identity is positively associated with his or her explicit attitudes towards leisure cycling. According to Daley and Rissel (2011) and Fitt (2015), individuals exhibit more positive attitudes toward a behavior associated with their in-groups (us) but apply stereotypes to their out-groups (them). When an individual identifies as part of the leisure cyclist group, they also hold a more positive opinion of leisure cycling. Cycling advocacy groups and practitioners can use these findings as they develop their marketing strategies, for example promoting the concept of being a leisure cyclist as an identity that people can be proud of and developing group-orientated activities to increase cyclists' sense of belonging.

This study attempted to examine the reliability and validity of the ST-IAT scores by applying CFA, the results indicated that implicit constructs tend to exhibit poor reliability and validity in this model compared to explicit constructs. Future studies should apply advanced analytic techniques such as the Multitrait-Multimethod analysis (Campbell & Fiske, 1959), to examine the method effect of IATs. Furthermore, the results also indicated that stimulus terms in relation to focal categories (i.e., leisure cycling and leisure cyclists) could better reflect the implicit attitudes construct. Most factor loadings of the attribute terms (i.e., good and bad) were lower than the minimum value (.32) and thus were dropped from the model. Although previous research has examined the effect of stimulus terms on IAT scores (Foroni & Bel-Bahar, 2010), few applied CFA to examine this effect. Further comparison should be documented to advance IAT techniques.

The relationships among implicit and explicit attitudes and an individual's leisure public bicycle use behavior were also investigated in this study. A close examination of the hypotheses testing indicated that social identity was the most influential factors driving individuals to cycle ($\beta$ = .810, $p$ < .088), further supporting that the leisure and BSP industry should promote the significance and benefits of being a leisure cyclist to increase the cycling rate. Furthermore, the positive explicit attitudes towards leisure cycling also significantly predict cycling behavior ($\beta$ = .210, p < .05). As Curto et al. (2016) pointed out, in addition to environmental influences, attitude can be an important factor in bicycle commuting.

Although neither implicit attitude measures were not found to have a significant relationship with people's leisure public bicycle use, it is believed that this study could lay the foundation for further investigations applying a dual-attitudes model to human cycling behavior. The current study was conducted in Taiwan with BSP users; thus, further examination in other contexts is needed in order to determine if the results are applicable to other regions, cultures, and types of cyclists. In addition, this study used an online survey platform to collect data instead of the controlled laboratory setting typically used in IAT experiments. A laboratory setting would control for distractions, and although participants were asked to complete the IAT in a distraction free environment, if they did not, distractions could have affected the data. Thus, future research should conduct similar tests under more controlled conditions and compare the results with this study. Based on this study, continuous exploration of the ST-IAT effect is beneficial to the field, and more work needs to be done to advance the IAT paradigm.

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# CHAPTER FIVE

# CONCLUSION

This dissertation explored the key determinates of individual leisure bicycle share program (BSP) use. The extended unified theory of acceptance and use of technology (UTAUT2) and the dual-attitudes model were employed as theoretical frameworks guiding this research project. Three research goals were achieved: (1) In Study One, the *Unified Measurement of Bicycle Share Program Use (UMBSPU)* was developed, which included eight constructs and 33 measurement items; (2) in Study Two, the UMBSPU was employed to examine the influences of performance expectancy, effort expectancy, facilitating conditions, social influence, price value, hedonic motivation, and habit on individuals' intention to use BSPs and actual BSP use for leisure among Taipei citizens; and (3) in Study Three, using two Single Target Implicit Association Tests (ST-IATs), BSP users' implicit attitudes toward leisure cycling and leisure cyclists were measured and compared with their explicit attitudes. This chapter summarizes the major findings of each study as well as the research imitations and implications for researchers and practitioners.

## Summary of Major Findings

### Study One

Following Slavec and Drnovsek's (2012) recommendations for scale development, the UMBSPU was developed in this study. The integration of both qualitative and quantitative data provided a depth of knowledge on the major factors influencing BSP use in a leisure context. The results of the qualitative investigation indicated that a wide variety of reasons are involved in an individual's decision (Table 1). The thirty-three-items UMBSPU was cross-validated using two independent samples, Kaohsiung and Taipei citizens. This process established the generalizability of the UMBSPU, the findings showing the equivalence of all factor loadings, the majority of the intercepts, and the latent factor means across two samples. Furthermore, the discriminant and convergent validity of the UMBSPU was confirmed through a series of confirmatory factor analysis (CFA). Although trivial method bias was detected, the UMBSPU can be viewed as a reliable and valid measurement. Given the limited research on developing a measurement scale for leisure BSP use, the UMBSPU provides a steppingstone for further investigations.

Study Two

Using the UMBSPU, ten hypotheses were examined to explore the key determinants of leisure BSP use among YouBike users in Taipei, Taiwan. Overall, the research model explained 73.9% of the variance of use intention and 32.6% of the actual use. Performance expectancy, social influence, price value, hedonic motivation, and habit were found to significantly influence people's intention to use BSP for leisure. Furthermore, habit and behavioral intention were found to significantly impact the frequency of use. Among all the factors examined, habit was found to be the strongest predictor regarding behavioral intention ($\beta = .385$, $p < .001$). It also significantly predicted the frequency of Taipei citizens' leisure BSP use ($\beta = .300$, $p < .001$). This evidence supports the conclusions of De Bruijn, Kremers, Singh, Van den Putte, and Van

Mechelen's (2009) study that habit should be included in a theoretical model that examines cycling behavior.

In addition, both extrinsic motivation (i.e., performance expectancy) and intrinsic motivation (i.e., hedonic motivation) motivate Taipei citizens to use YouBike in their leisure time, confirming findings from previous BSP studies that BSP is not only seen as a means of transportation but also satisfies its users' leisure purpose (Murphy & Usher, 2015; Pai & Pai, 2015; Vogel et al., 2014). In addition, the price value and social influence outperformed the impact of facilitating conditions and effort expectancy in this study, suggesting that a reasonably priced, high-value-added BSP attracts users more than bicycle infrastructures and the ease-of–use of the operating system. Furthermore, social support and a thriving bicycle culture significantly influence leisure BSP users. These findings partially contradicted previous research (Buck et al., 2013), indicating that the characteristics of leisure BSP users are different from other cyclist groups. Therefore, marketing strategies and future research should be tailored to fit the distinctiveness of leisure BSP users.

## Study Three

This study developed leisure cycling and leisure cyclist Single Target Implicit Association Tests (ST-IATs) to examine the influence of an individual's implicit attitudes on leisure BSP use. Furthermore, scales that measured explicit attitudes toward leisure cycling and the social identity of leisure cyclists were employed to compare the differences between an individual's perceptions of a leisure activity and those actually engaged in it. The results indicated that on average, Taiwanese have favorable implicit attitudes toward both leisure cycling and leisure cyclists; however, these perceptions are not exactly the same. Implicitly, people hold more positive attitudes towards leisure cycling than leisure cyclists (Mean difference = .197, $p < .001$), a result supporting Daley and Rissel's (2011) study that people perceive cycling and cyclists differently. However, the results from the semantic differential scales indicated that people explicitly hold more positive attitudes toward leisure cyclists than leisure cycling (Mean difference = 4.362, $p < .001$), confirming Wilson, Lindsey, and Schooler's (2000) dual-attitudes model indicating that people can hold different attitudes toward the same object, individual, or events. In other words, people may explicitly express positive opinions toward leisure cyclists, but implicitly they may hold other attitudes. Given that this study was conducted in Taiwan, the effects of social desirability might influence the results of semantic differential scales. As Stadler (2011) suggested, people are normally reluctant to display negative emotions or opinions because politeness is greatly esteemed in East Asian societies.

This study also used CFA to control the influences of the stimulus terms and the measurement error on the ST-IAT scores. The results showed that the overall IAT effects might be influenced by the measurement error as the average variance extracted (AVE) of the implicit attitude constructs are below .6. The results of hypotheses testing showed that social identity was the most influential factor motivating individuals to use BSP in their leisure time ($\beta = .810$, $p < .088$). Furthermore, only explicit attitudes predict Taipei citizen's leisure BSP use ($\beta = .210$, $p < .05$). Both implicit attitude constructs have non-significant relationships with BSP use. This study lays the foundation for further investigation of human's cycling behavior using the dual-attitudes model.

## Future Research Directions and Practitioner Implications

The results of this dissertation were primarily obtained from quantitative analysis. In the future, qualitative research can be conducted to investigate the leisure BSP use to add richness and depth of our knowledge. For example, most measurement items related to the interaction among cyclists and other road occupants were omitted from the UMBSPU. However, according to previous research, such interaction is critical to an individual's decision to cycle (Kaplan & Prato, 2016) and in-depth interviews may aid researchers in further understanding of leisure BSP user's perceptions of such interactions. Furthermore, facilitating conditions and effort expectancy were found insignificant in Study Two. Future research may interview individuals who give low ratings to the measurement items of these two constructs but frequently use BSP for leisure to determine the reasons for this discrepancy.

Given the limited BSP research conducted in the East Asia region, this dissertation focused on Taiwanese adults to add to our knowledge of BSP use in this area. In the future, the UMBSPU can be tested in different cultural contexts to obtain an international level of cross-validation. Furthermore, the leisure cycling and cyclists ST-IATs can also be tested with other types of cyclist groups, such as utilitarian cyclists or bicycle tourists, and non-cyclists to compare the difference in implicit attitudes across different social groups.

The social influence construct in Study Two and social identify construct in Study Three were found significant for leisure BSP use. Cycling advocacy groups and relevant departments in the government may develop promotional strategies based on these findings. A supportive social environment and a friendly culture can be achieved through educational programs as well as strict enforcement of traffic laws. Furthermore, promoting the sense of belonging and branding leisure cyclist groups can also attract more individuals to leisure cycling. Improving the acceptance of cycling should not only focus on infrastructure construction but also the advancement of a cycling culture. Making cyclists visible in workplaces, in our neighborhood and in the society is the best way to promote cycling (Sherwin, Chatterjee, & Jain, 2014).

## Limitations

The data for this study was primarily obtained through an online survey. Thus, the researcher cannot completely confirm the qualifications of the survey respondents. Although a skip-logic question and an online panel company were employed to select the target group (i.e., leisure BSP users), it is still uncertain whether the participants were qualified to answer the questionnaire. Furthermore, the ST-IAT is typically conducted in an environment without disturbances. Because this dissertation used an online survey platform to collect the data, it did not have the capability to document the distractions, if any, that occurred during the data collection process.

Furthermore, this dissertation measured leisure BSP use using two indictors related to current behaviors. However, the behavioral intention construct primarily asked about an individual's intention to engage in certain behaviors in the future. Thus, a longitudinal study is more suitable for examining the predictability of the research model.

Study One and Study Two were developed using a social cognitive model and the results were primarily obtained from self-reported data. The model explained only 32.6% variance of actual BSP use. As Yang, He, and Gu (2012) suggest human behavior is not simply influenced by the rational decisions but also the emotional or symbolic factors. Based on self-reported data, the research findings may somehow negate the influence of unconcious thinknig on the human behavior. In the future, "big data" that records BSP users' riding patterns can also be analyzed to compare the differece between "self-reported" behavior and the actual cycling behavior.

## Final Reflection

Although most leisure scholars agree that leisure choices are made freely, some argue that this freedom has its limitations. For example, Bramham (2006) pointed out that only certain individuals, such as the middle and upper classes, male, or the Caucasian , have freedom to choose their leisure, the other disempowered and marginalized populations are never truly have that freedom. Rojek (1995) also pointed out that our leisure world is shaped by the limitations of the tools that we have access to use; thus, we do not actually have unrestricted options to choose any leisure activity. Cycling for leisure sometimes is viewed as an activity that only elitists can be involved in (Daley & Rissel, 2011). This "special" activity requires certain skills, expensive equipment, and unique clothing; therefore, it may be categorized by the general public as "other people's activity" (Fitt, 2015).

In contrast, the low cost and convenience of BSPs provides a practical approach that integrates bicycles into our regular life. Riding public bicycles for leisure is not an activity that only belongs to elitists or specialists, as BSPs are used by almost every class and generation (Table 10) and for various purposes (Table 12). It provides a economic and ecofriendly approach that encourages more people to cycle for leisure. It may also potentially normalize the image of leisure cycling created by traditional leisure cyclists who wear Lycra clothing and ride high-end bicycles. BSPs may increase the general public's acceptance of leisure cycling and also contribute to social equity. Individuals, who cannot afford to purchase an expensive bicycle, can cycle for leisure for a reasonable rental fee. BSPs potentially break the boundaries of social class and bridge the leisure cycling gap between the rich and the poor.

As Pieper's (2009) critique, "Leisure, it must be remembered, is not a Sunday afternoon idyll, but the preserve of freedom, of education and culture, and of that undiminished humanity which views the world as a whole" (p.53).

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APPENDICES

## Appendix A

## English and Traditional Chinese Measurement Items Used in Expert Review

**A. Performance Expectancy**

- I find YouBike useful for my leisure.
- 我發現公共自行車在我的休閒生活中是有用的
- Using YouBike increases the quality of my leisure
- 使用公共自行車豐富了我的休閒品質
- YouBike helps me connect to public transport quickly.
- 使用公共自行車能幫助我更快速地連結其他大眾交通工具
- YouBike helps me reach destinations more quickly.
- 使用公共自行車能幫助我更快速到達目的地
- YouBike is an affordable form of transportation to a leisure activity (i.e., movies, shopping).
- 公共自行車是一個能讓我到達目的地（例如:看電影或逛街) 的便宜交通方式
- The customer service of YouBike is useful.
- 公共自行車的顧客服務專線是有用的
- The real-time app of YouBike is useful.
- 公共自行車的即時應用程式(app)是有用的
- YouBike bikes are well maintained.
- 公共自行車系統出借的腳踏車均維護良好
- YouBike bikes are of high quality.
- 公共自行車系統出借的腳踏車都有一致的品質保證

**B. Effort Expectancy**

- It is easy to become a YouBike member.
- 我認為成為公共自行車的會員是簡單的
- It is easy to use the YouBike system.
- 用公共自行車系統是簡單的
- The renting process of YouBike is understandable.
- 租借公共自行車的過程是簡單易懂的
- I can easily find a YouBike station in Taipei.
- 我能簡單地找到公共自行車的租借站
- Using YouBike is convenient if the distance between my living places to the rental station is appropriate.
- 使用公共自行車是很方便的，只要我居住 的地方離租賃站的距離不遠
- Using YouBike is convenient if there are enough bicycles available in the rental station at all times (i.e., 24 h a day, 365 days per year).
- 使用公共自行車是很方便的，只要租賃站總是有腳踏車可出租（一年 365 天及 24 小時）

**C. Social influence**

- Members of my household frequently use YouBike.
- 我的家庭成員總是使用公共自行車
- I use YouBike because my partner encourages me to use it.
- 我會使用公共自行車是因為我的伴侶鼓勵我使用它
- My friends encourage me to use YouBike.
- 我的朋友們鼓勵我騎公共自行車

- I use YouBike because my friends use it.
- 我使用公共自行車是因為我的朋友也使用它
- I believe the motorcycle riders interact with YouBike users in a friendly manner.
- 我相信摩托車騎士對自行車騎士的互動是友善的
- I believe the pedestrians interact with YouBike users in a friendly manner.
- 我相信行人與自行車騎士的互動是友善的
- It is popular to use YouBike.
- 騎乘公共自行車是一種潮流
- In general, people in Taipei respect YouBike users.
- 大致上來說，台北的民眾是尊重公共自行車騎士的

**D. Facilitating Conditions**

- Having a map at YouBike station is important.
- 在租賃站有地圖是很重要的
- I am more likely to use YouBike if a separate bike lane is provided around the stations.
- 如果附近有自行車道，會增加我使用公共自行車休閒的意願
- I am more likely to use YouBike if the sidewalk is wider.
- 如果人行道比較寬敞，會增加我使用公共自行車休閒的意願
- I am more likely to use YouBike if the surface of bike paths or sidewalks is better.
- 如果路面品質好一點，會增加我使用公共自行車休閒的意願
- I am more likely to use YouBike more if there are bike lanes on bridges or underpasses.
- 如果天橋或是地下道有自行車道，會增加我使用公共自行車休閒的意願
- I am more likely to use YouBike more if there are bike lanes in my community.
- 如果我的社區有自行車道，會增加我使用公共自行車休閒的意願
- I am more likely to use YouBike if the station is around scenic areas.
- 如果租賃站在美景環繞之處，會增加我使用公共自行車休閒的意願
- I am more likely to use YouBike in places that have more shades.
- 我會選擇在樹蔭較多的地方騎乘公共自行車休閒
- I am more likely to use YouBike in places that have cafés or restaurants.
- 我會選擇在有咖啡廳（車）或是餐廳的地方騎乘公共自行車休閒
- I am more likely to use YouBike in places that have fewer traffic lights.
- 我會選擇在紅綠燈較少的地方騎乘公共自行車休閒
- I am more likely to use YouBike in places that have less traffic flow.
- 我會選擇在車輛較少的地方騎乘公共自行車休閒

**E. Hedonic Motivation**

- Riding a YouBike bike is fun.
- 騎乘公共腳踏車是好玩的
- Riding a YouBike bike is enjoyable.
- 騎乘公共腳踏車是令人享受的
- Riding a YouBike bike is entertaining.
- 騎乘公共腳踏車是有娛樂性的
- Riding a YouBike bike is interesting.
- 騎乘公共腳踏車的經驗是有趣的
- Riding a YouBike bike is relaxing.
- 騎乘公共腳踏車能使我放鬆心情

- Riding a YouBike bike makes me forget my troubles temporarily.
- 騎乘公共腳踏車能使我暫時忘記煩憂
- Riding a YouBike bike makes me feel free.
- 騎乘公共腳踏車能讓我感到自由自在

**F. Price Value**

- At the current price, YouBike is a good value.
- 就當前的價格而言，公共自行車提供了良好的價值
- YouBike is an affordable option to increase my physically fitness level.
- 騎乘公共自行車是一個能讓我保持良好身材的好選擇
- YouBike is an affordable option for exercise.
- 騎乘公共自行車是個幫助運動的經濟選擇
- YouBike is an affordable option to reduce my carbon footprint.
- 騎乘公共自行車是個能減低碳排放量的經濟選擇
- YouBike is an inexpensive way for me to enjoy nature.
- 騎乘公共自行車是個能讓我享受大自然的便宜方法
- YouBike is affordable because I don't need to spend money on maintaining a bicycle.
- 騎乘公共自行車是個經濟實惠的好選擇，因為我不需要負擔維修的費用
- YouBike is a good option for leisure because I don't need to worry about vandalism and theft.
- 騎乘公共自行車是個經濟實惠的好選擇，因為我不需要擔心盜竊或破壞的問題

**G. Habit**

- Using YouBike is a habit for me.
- 使用公共自行車對我來說已經變成一個習慣
- I always use YouBike during my leisure time.
- 我在空閒時，總是使用公共自行車
- I am addicted to using YouBike.
- 我使用公共自行車成癮
- I must use YouBike in my leisure time.
- 在休閒時間，我必定會使用公共自行車
- It is natural for me to use YouBike.
- 使用公共自行車對我而言是很一件自然的事

**H. Behavioral Intention**

- I intend to continue using YouBike for leisure in the future.
- 我打算未來繼續使用公共自行車來休閒·
- I will always try to use YouBike in my leisure time.
- 在我的休閒時間，我會試著多多使用公共自行車·
- I plan to continue to use YouBike for leisure frequently.
- 我打算繼續常常使用公共自行車來休閒·
- I will recommend that others use YouBike for leisure.
- 我會推薦別人也使用公共自行車來休閒·

## Appendix B

## English and Traditional Chinese Measurement Items Used in Target Sample Survey

**Performance Expectancy**

- YouBike helps me connect to other public transports
- 公共自行車能幫助我連結其他大眾交通工具
- YouBike helps me reach destinations effectively
- 公共自行車能幫助我有效地到達目的地
- YouBike helps me reduce travel time
- 公共自行車能幫助我節省交通時間
- Overall, YouBike is helpful in my leisure time
- 大致上，公共自行車在我的休閒時間中是有用的
- Using YouBike improves the quality of my leisure
- 使用公共自行車增進了我的休閒品質
- YouBike meets my leisure needs
- 公共自行車能滿足我的休閒需求

**B. Effort Expectancy**

- It is easy to become a YouBike member
- 成為公共自行車的會員是簡單的
- The process of renting a YouBike bike is easy
- 租借公共自行車的操作過程是簡單的
- The process of returning a YouBike bike is easy
- 歸還公共自行車的操作過程是簡單的
- Finding a YouBike station in Taipei is easy
- 在台北找到公共自行車的租借站是簡單的
- There are sufficient bicycles available in the rental stations
- 租借站總是有足夠的腳踏車可借
- There are sufficient docks in the rental stations to return bikes
- 租借站總是有足夠的空車柱可還車
- It is easy to use the YouBike system
- 大致上，使用公共自行車系統是簡單的

**C. Social influence**

- Members of my household encourage me to use YouBike
- 我的家庭成員鼓勵我騎公共自行車
- I use YouBike because of members of my household use it
- 我使用公共自行車是因為我的家人使用它
- My friends encourage me to use YouBike
- 我的朋友們鼓勵我騎公共自行車
- I use YouBike because of my friends use it
- 我使用公共自行車是因為我的朋友們使用它

- People who are important to me think that I should use YouBike
- 我重視的人認為我應該使用公共自行車
- Motorcyclists interact with YouBike users politely
- 摩托車騎士與公共自行車騎士的互動是有禮貌的
- Pedestrians interact with YouBike users politely
- 行人與公共自行車騎士的互動是有禮貌的
- Drivers interact with YouBike users politely
- 汽車駕駛與公共自行車騎士的互動是有禮貌的
- YouBike users are respected in Taipei
- 在台北， 公共自行車騎士是被尊重的

**D. Facilitating conditions**

- I am more likely to use YouBike if there are separate bike lanes.
- 在有專用自行車道的地方，我會比較願意使用公共自行車
- I am more likely to use YouBike if the sidewalk is wider.
- 如果人行道寬敞一點，我會比較願意使用公共自行車
- I am more likely to use YouBike if the surface of bike paths or sidewalks is in good condition.
- 如果人行道或自行車道的路面品質良好，我會比較願意使用公共自行車
- In my community, I am more likely to use YouBike if there are bike lanes.
- 如果我的社區有自行車道，會增加我使用公共自行車的意願
- I am more likely to use YouBike in scenic areas.
- 我比較願意在景色優美的地方使用公共自行車
- I am more likely to use YouBike in the places that have more shades.
- 我比較願意在遮蔭較多的地方使用公共自行車
- I am more likely to use YouBike in the places that have fewer traffic lights.
- 我比較願意在紅綠燈較少的地方騎乘公共自行車
- I am more likely to use YouBike in the places that have less traffic flow.
- 我比較願意在車流較少的地方騎乘公共自行車

**E. Hedonic motivation**

- Riding a YouBike bike is fun.
- 騎乘公共腳踏車是好玩的
- Riding a YouBike bike is enjoyable.
- 騎乘公共腳踏車的過程是令人享受的
- Riding a YouBike bike helps me get away from the daily grind.
- 騎乘公共腳踏車能幫助我逃離日常的勞碌
- I have a sense of freedom when riding a YouBike bike.
- 騎乘公共腳踏車能讓我感到自由自在
- Riding a YouBike bike helps me relieve stress.
- 騎乘公共腳踏車能幫助我紓解壓力

**F. Price value**

- YouBike is an affordable option for exercise.
- 騎乘公共自行車是個經濟實惠的運動方式

- YouBike is an affordable option for maintaining mental health.
- 騎乘公共自行車是個保持心理健康的經濟實惠方法
- YouBike is an affordable option to reduce my carbon footprint.
- 騎乘公共自行車是個能減低碳排放量的經濟實惠方式
- YouBike is an affordable option to protect the environment.
- 騎乘公共自行車是個能做環保的經濟實惠方式
- Riding a YouBike bike is an inexpensive way for me to enjoy nature.
- 騎乘公共自行車能讓我享受大自然
- YouBike is an affordable form of transportation.
- 公共自行車是一個便宜交通方式
- At the current price, YouBike is a good value.
- 就當前的費率而言，公共自行車提供了良好的價值

**G. Habit**

- Using YouBike is a habit for me.
- 使用公共自行車對我來說已經變成一個習慣
- I always want to ride YouBike bikes.
- 我總是想騎公共自行車
- Riding a YouBike bike is a usual part of my life.
- 騎公共自行車是我生活中習以為常的一部分
- I use YouBike without consciously thinking about it.
- 我不需要經過深思熟慮就會去使用公共自行車
- It is natural for me to use YouBike.
- 使用公共自行車對我而言是很一件自然的事

**H. Behavioral Intention**

- I intend to use YouBike in the future.
- 在未來，我打算使用公共自行車．
- I will try to ride YouBike bikes more frequently in my leisure time.
- 在閒暇時，我會試著多多使用公共自行車．
- I plan to ride YouBike bikes for leisure.
- 我計畫騎公共自行車來休閒．
- I expect to ride YouBike bikes for leisure more often in the future.
- 我希望能在未來更頻繁地騎乘公共自行車來休閒．
- I will use YouBike soon.
- 我會在近期內使用公共自行車．