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碩 士 論 文

探索說服女性從事單車活動之設計策略

Investigating Persuasion in Female Cycling Design

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摘要

隨著近年來全球暖化、能源短缺的環保意識逐漸高漲，自行車在全球許多國家扮演著生活方式中重要的角色，在擁有「自行車王國」稱號的台灣也跟上了全球化的自行車熱潮。過去被視為代步工具的自行車也隨著節能減碳與新生活型態的興起重新被重視發展。然而在單車熱潮中，不均的男女單車族群比例顯示著女性對於自行車活動有較多的疑慮或考量。隨技術逐步快速發展的網路系統、隨身電腦手機裝置等，透過系統人機互動的勸誘設計，許多改變人們態度或行為的機會因應而生。為了促進更多女性投入活動，本研究藉由使用者研究調查並對應女性單車活動中勸誘系統設計的特徵，提出勸誘設計策略給予研究與設計團隊針對勸誘台灣女性從事單車活動的議題，進一步發展勸誘系統設計。

本研究以日誌調查法(Diary Study)與深度訪談(In-depth Interview)進行使用者研究，分別調查未參與和參與單車活動的兩組女性受測者，從一週的紀錄中首先了解他們生活中沒有以及擁有單車活動的價值觀。其次，目的方法鏈(Means-end analysis)將他們從事活動的資料基於手法與目的分類並表示其中的關聯；另一方面，針對兩組受測者對於單車活動的需求期待、挫折不便以及投入活動的經驗進行資料的分析歸納。最後針對其中一組女性受測者投入單車活動經驗，邀請系統設計者進行焦點團體法(Focus group)歸納這些單車經驗中顯著的系統設計勸誘特徵(Persuasive features)，以不同等級分數對應分配至各個單車活動屬性，亦透過矩陣方式加以表示。

最終提出六項以勸誘特徵、感受、價值觀三者連結建立而成的說服策略(Persuasion strategy)。就從事單車活動女性受測者提出的單車投入經驗，歸納出針對女性單車議題最顯著的勸誘設計策略。其次比較兩組受測者的研究結果，以相同的價值觀下手發展影響途徑，就未參與者既有的價值觀提出相應的說服策略。最後在針對研究中觀察到的參與單車活動的挫折，由從事單車活動女性提出的正面感受研擬說服策略。藉由不同觀點，本研究最終提供了包含勸誘手法以及核心價值的一套策略，給予進行勸誘系統的設計團隊發想時，鎖定問題並發展勸誘設計的基礎。藉由實際有系統的規劃進行使用者研究，使得勸誘議題、使用者、勸誘手法與設計師在勸誘設計的流程中各自擁有明確的定位，幫助進行勸誘設計前的探索與引導。

關鍵字：
說服力設計、行為改變、使用者研究、說服力策略、女性單車活動、方法目的鏈

Abstract

According to conscious of environment has arisen with issues of global warming and energy deficiency recently, cycling plays an essential role as a lifestyle in many countries all over the world. Not only regarded as transportation, riding bikes is getting important as one of the popular exercises and recreations in leisure times. With the well-developed facility and policy providing for plenty populations of cycling, the phenomenon of imbalanced participant population between gender deserves further investigation to persuade female participate in cycling through developing a persuasive system design. The purpose of this research is to proceed a user study process and conduct the results through means-end analysis and assigning persuasive features of system for delivering persuasion strategies before undertaking concept development.

The research is undertaken through diary study and in-depth interview included in user study to investigate two groups of participant with a group of female participants and the other one who do not participate in cycling activity. Based on a week of diary studies, their values are reflected in two different results. Through means-end analysis, their daily activities with and without cycling are classified and connected systematically. Expectations, needs, problems and practical experiences are also extracted and conducted in results. According to the cycling experiences, different grades of persuasive features are assigned to each cycling attributes through the focus group formed of senior system designers and producers.

The finding is delivered with six persuasion strategies which are defined with a systematic chain formed with persuasive feature, consequences and values for persuading female participate in cycling. Through discussing in different perspectives, the most emphasized persuasive features are proposed based on appreciated female cycling experiences firstly. Also, employing the identical values are proposed the more acceptable influence approach as persuasion strategies. Finally, the persuasion strategies are proposed with breakthroughs based on focusing on the frustrations on the sequence of participating cycling.

The research findings reveal persuasion strategies are proposed through systematic user study process with discovering specific user groups and approaches for conducting study results with implications. Persuasion strategies are proposed to provide persuasive features and core values to help with developing persuasive system design. This research extends a systematic persuasion strategy from user

study process, which bridges the connection among persuasion issue, users, persuasive tools and system designer and also supports clarifying problems and scope for developing system design.

Keywords:

Persuasive Design, Behavior Change, User Study, Persuasion Strategy, Female Cycling, Means-end chain

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能夠進到交大應藝所學習三年然後畢業，我覺得自己既幸運又幸福。首要感謝口試委員莊老師、李老師與鄧老師抽空翻閱我厚厚一本論文，並給予我許多精闢又寶貴的建議，使我有更進一步的機會去理解與思考。

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在應藝所認識的同學也是我最大的收穫。在你們的身上我學到很多過去不知道的，無論是課業、設計、或是其他方面哈。太多太多人要感謝所以從最親近的開始，遠在東京形影不離的親密小老師千慧、一起打氣一起畢業才回到星國的秒咪國佳欣老師、在我心目中永遠是神的最佳夥伴翁神、善良又聰明貼心的巧克力歐佩、喜歡笑咪咪一點也不凶狠的大姊頭陳姵、像爸爸一樣叮嚀指導的可愛課課長、一起渡過無數辛苦日子耐心鼓勵我的大碰友瑞大、總是幫助我加油的細心王佳志、一起過生日一起為了計劃案跑兩年的沉陷少、照顧我很多的 iF 嘉、樂觀可愛的粘 b；采芳、士堯、鵬鵬、可薰、螞蟻等平易近人的好學長姊照顧，和聰明王、夏神、菁妏、科虎與如薇一起努力的難忘時光。真的好慶幸我有 IAA 這麼好的大家一起走過一千多個日子，也包括這段時間認識的 Yahoo！夥伴們、華惘學姐和 Sean 學長，很開心擁有這麼多不捨又珍貴的回憶:D

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周雨虹　謹誌

中華民國九十九年五月

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Chapter 1
Introduction

With the intention to change user's attitude or behavior or both, a persuader sends persuasive messages to an audience in a communication process of persuasion traditionally. Along with the development of science and technology rapidly nowadays, applications of computer technology are taking on the role of persuader to influence people and help people change their behaviors through the design of interaction which is referred as human-computer persuasion. Information technology systems and services are appeared generally to apply and design for persuasive purposes, such as commerce, education, environmental preservation, healthcare, fitness, in different domains and applications in late 20th century. For the great development of cycling in Taiwan, the persuasion of getting female onto participating biking in their life is focused and investigated to propose persuasive strategies when developing system design in our research.

1.1. Background

Influenced by the global warming issues, activities for sustainability with energy saving and carbon reduction are arisen. To actualize these activities, cycling is one of the ways to go green for helping environment all over the world. The policies with rewards and public environments are constructed with encouragements in the well-developed countries of cycling in Netherlands, Denmark, France, Japan and Australia. According to an investigation in Fig.1-1, there are about 11.5% Taiwanese indicating that biking is the most common exercise in their lives (He, 2008).

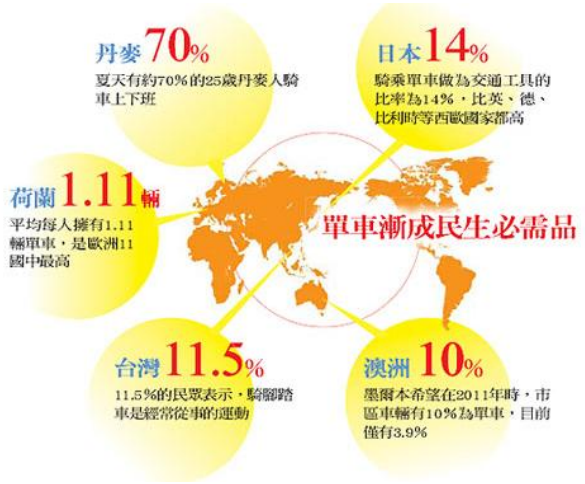


Fig. 1-1 The well-developed countries of cycling which is regarded as necessity in lives

With the growing number of purchasing and utility rate of bicycles, our government also has paid much attention to cycling recently in Taiwan. According to the investigation, the quantity of bicycle sales reached 1400 thousand, and the cycling population was 10.3 million out of 23 million until 2009. Exercises, recreations and travelling are the primary cycling activities in 60.5% while daily activities are secondary in 26.4%. For facilitating the population of cycling with friendly supplying and supports in their activities, the large growing number of bike lanes is about 48.4% from 2008 to 2009 among cities in Taiwan (MOTC, 2010).

Fig. 1-2 Participation of cycling activity in Taiwan

From eco life to healthy recreation, cycling provides people another choice for enlivening their life in a health way. Having varied purposes in large cycling population in Taiwan, however, cycling uses are different from gender. The participation of Taiwanese male in cycling is more over 30% than female (Social indicators, 2005). The gender imbalance in cycling in Taiwan suggests a potential issue for cycling providers, sustainable supporters and health promoters to investigate and further increase female's participation in cycling. The female's problems or frustrations toward cycling should be investigated and

proposed with solutions.

To understand the persuasion of female cycling, there has already a great variety of development for discovering human behavior change. In the field of social science and psychology, the traditional behavioral theories were well-developed for explaining what human perceived of cognitive process during behavior change. Based on varied aspects of research field, different theories have been proposed to apply in education, health care, fitness, environmental preservation and many other issues. They proposed different strategies to influence and try to change people's attitude or behaviors to reach their purposed issue. It's also used in commerce and marketing field to influence consumer to accept and further purchase their products or services. For example, the provider, *Polar*, presents series monitoring devices for helping people to get fit and improving their physical performance of cycling or jogging; while *Nike*+iPod plus is the similar product providing to monitor and train in jogging or physical activity. *WiiFit* is another example of persuasive technology on the video game platform with exercise activity (Fig. 1-3).

Fig. 1-3 Applications of persuasive design: Polar CS600X-Maximize road cycling performance (top left), WiiFit: video game with exercises (top right), Nike iPod plus: monitoring and training devices for jogging and activity (down right), QUITNET web service for helping people quit smoking online (down left)

According to the recent decades of development with computer science, a variety of persuasive design cases in Human Computer Interaction (HCI) field also have applied the social psychological theories in their design strategy. Special interest in exploring the domain of computers and persuasion appeared at CHI97, which is called "captology". It was later defined "captology focuses on the design, research, and analysis of interactive computing products created for the purpose of changing people's attitudes or behaviors," which is the overlapped area of technology and persuasion with the graphic in Fig. 1-4 (Fogg, 2003, p.5)

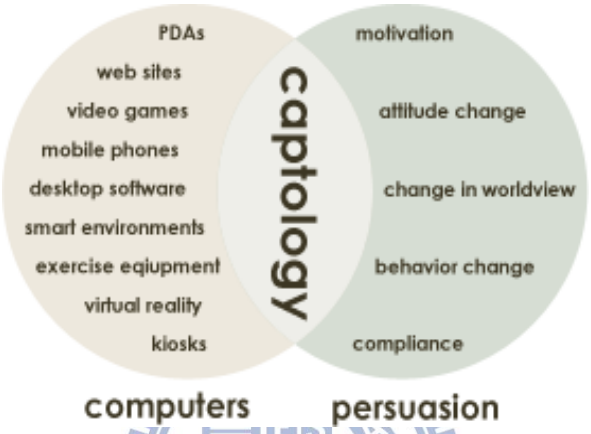


Fig. 1-4 The shaded area called Captology, which is overlapped by both technology and persuasion (Fogg, 2003, p.5)

The applications of HCI technologies provide an interactive and ubiquitous approach with persuasion in widely developments. The Web, Internet, mobile and other ambient technologies provide a reachable path for users to interact with. The design technology gives influence and tries to change attitudes and behaviors on target audiences with health diet, fitness, and environmental preservation through the process of human-computer interaction. Fogg proposed that there are three functional roles in computing technologies persuade: as a tool, media, and as social actors (Fogg, 1998). For example, computer can be tool or instrument to provide personal health information for better diet decision making. The technology can be a personal health information tracker, or computerized software with analysis and supportive advices to motivate exercises or jogging through Nike+iPod and Nike plus systems.

1.2. Motivations

Since cycling contributes to health, social and environmental benefits with low cost, it's advocated

for wide population of both male and female in different age. It is promoted as health and environmental activities, cycling for transport, recreation and exercises. However, the participation in varied developed countries is different with gender. "*In the U.S., men's cycling trips surpass women's by at least 2:1*", "*in the Netherlands, where 27 percent of all trips are made by bike, 55 percent of all riders are women"; while "In Germany 12 percent of all trips are on bikes, 49 percent of which are made by women.*" (Baker, 2009) Under the development of cycling behaviors in Australian cities and towns, the facilities are increasingly being used by cyclists but most of the cyclists are male. Therefore, the researchers proposed findings and guidelines as interventions to motivate females' participation through creating supportive physical, social and cultural environments for cycling (Garrard et al., 2006). To advocate overall cycling behaviors for developing facilitations, investigations of frustrations and unwillingness are must be taken account of female populations in Taiwan.

To figure out the primary phenomenon in female cycling, we turn to persuasive researches before proposing corresponding strategies. While a number of persuasive design system or services for changing users' attitudes or behavior are growing, several behavioral theories from social psychology are often drawn and extensively applied to the study such as *Transtheoretical Model of Behavior Change*, *Goal-Setting Theory*, *Presentation of Self in Everyday Life* or *Cognitive Dissonance Theory*. Those theories provide the rule of thumb that what will be reflected and interacted in individual for developing persuasive technologies design strategies.

Since captology presents a new perspective on the role of computers, the design space is large and relatively unexplored. The persuasive system domains or issues which are interested could be varied (Fogg, 1998), which is also can be employed in the issue of female cycling. However, it is identified and conducted that applications of traditional behavioral theories to digital environmental are often not able to cope with and give support for the vast amount of dynamics involved (Brown, 2008). For the technologies could immigrate into individual's life and behavior change lead to intervene in individual's social world, designers must therefore consider the social implications for the individual's daily experience (Consolvo et al, 2009). In order to encourage designer's access to design strategy process of persuasive technologies, the offer of target individual's need, interests, and choices in behavior is essential and supportable.

Moreover, for cycling persuasive design, it could be more supportive to develop a systematic process and then give explicit design strategies for practical applying. In order to develop a more

expectable and specific strategies for target audiences, one of the direction is to proceed user study of exploring user's real behaviors in their living context. Compare with traditional behavioral theories, user study is a research based on user's perspective through understanding the life they interact and react to. The collection and construction of information of behaviors from users' experience conduct how users think and what's their feel in their use experience. One of the main issues in this research is if user study could support the persuasive design and develop a practical study process.

In our research, the persuasion issue of cycling activity is confined as cycling recreation in female's leisure times. For persuading more cycling activities, recreation such as riding in a leisure way along or traveling with friends is our target persuasion behavior. Therefore, using cycling only as a commuting tool but without other activities is not our expected behavior for persuasion. Based on understandings the reasons of both agreement and disagreement with cycling recreation activities, it's possible to screen the audiences which designers target firstly. Through exploration with those audiences, frustrations and unwillingness behind them could be further appeared. In addition, the acceptable reasons from people who already changed to the purposed behaviors may provide proper approaches according to their real cases. Works of user study connect to the persuasive framework, which is the skeleton in persuasive design body, precise strategies and inspire persuasive design for female cycling.

1.3. Objectives

For helping and operating persuasive design in female cycling issue, there are already numerous developed theories and studies suggested designers the proper persuasive design principles. In particular, user study process promotes the exploration of problems and context of persuasion and proposes effective strategies for system development. With the point of view, three objectives in this thesis are focused as follows:

A. Apply a user study process for the developing of female cycling persuasive system

Before the concept development of persuasive design, a systematic user study process could be helpful to collect evidences which are obtain from user and analyzed for practical design supports. Through this research, the methodologies for user studies are proposed and applied through a persuasive case to conduct persuasion strategies for system evaluation or development.

B. Conduct the user study results and provide the supportive design strategies for female cycling

After the process user study, the results should be interpreted and analyzed to propose for conducting the persuasion strategies for design. The integration of the study results and the persuasive theories are proposed to deliver the design strategies. Therefore, the processes to conduct persuasion strategies are essential for delivery.

C. Define the roles of using persuasive tools in persuasive design

Moreover, it's essential to identify the process of applying user study and persuasive related theories in persuasive design. In Fig.1-5, the four roles are defined as *target persuasive issue*, *users to study*, *persuasive tools*, and *system designer* and proposed to identify the relationship among each role in research process. It's essential to figure out how user study connect each roles in persuasive design.

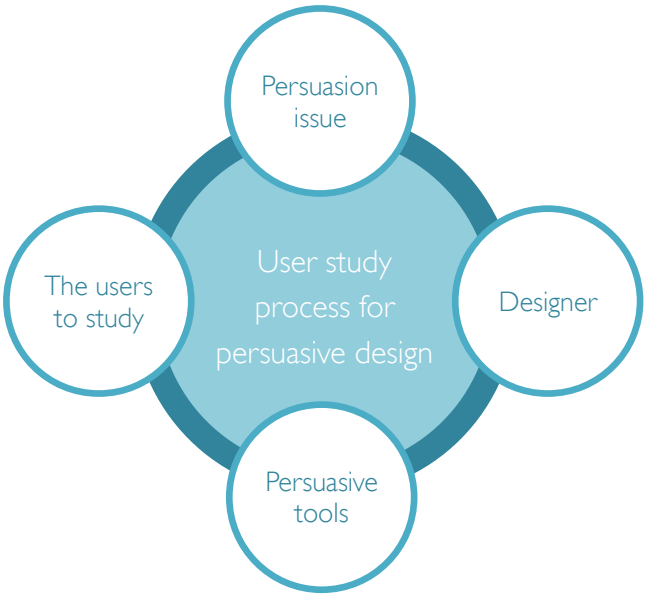


Fig. 1-5 Each role of persuasive design user study process for developing design strategy

In sum, the research aim is applying the user study process to derive design strategies guide to help the process of female cycling persuasive design.

1.4. Research issues

In this research, the issues of user study process for persuasive design have several aspects which corresponded to three objectives.

A. How to undertake a user study process

Firstly, user study is proposed to obtain what information and opportunity could be adopted persuasion techniques on the appropriate audiences. The constructing of study process should clarify each step in the planning of user study for the following interpretations.

B. What is persuasion strategy for persuasive system design

Along with user study process, the study results are corresponded to the persuasive theories and are conducted with persuasion strategies. The strategies would be evaluated through the study experiments and delivered in a specific format to help designer interpret for concept development.

C. How to apply persuasive tools in system design and what it helps

In this research, user study is proposed to help explore persuasion contexts. For outputting persuasive design strategies, the four roles of persuasion issues, users, persuasive tools and designers are connected and cooperated in research process. The utilization of persuasive theories combined in user study process with our persuasive issue is also interested for delivering design strategy.

1.5. Outline of thesis

There are six chapters in this thesis. In chapter one, which is introduction, presents the background, motivation, objective and issues of this research. In chapter two, the literature reviews follow with the persuasion theories and development for clarifying the scope and contribution in this research. In chapter three, the methodologies of user study process and analysis are bought up for research development. In chapter four, the research findings are delivered and proposed and contributed for discussing with the research results in the following chapter five. Finally, results of conclusion, limitation, contribution and future works upon this research are proposed as the end of this thesis.

Chapter 2
Literature Reviews

For the development of persuasive technologies applied in practical issue with female cycling persuasion, there were numerous literatures proposing strategies which came up from different aspects. From the psychology field, scholars applied the investigations of behaviors or cognitive theories in human beings to give design principles and suggestions. The reviews and observations over developed technologies also provide lots of results for evaluating the implement of persuasion. Recently, with the researches of persuasive design through user study, design, prototyping and evaluation, there are lots of implications for persuasive design in a wide range of domains, from environmental conservation to activity encouragement. However, for facilitating the developing of persuasive technologies systematically, the design or evaluation processes are proposed.

For the research aim to propose persuasion strategy for developing persuasive design with encouraging female cycling, the investigation processes based on this research purposes contains four parts: related works, persuasive theory and strategy, persuasive system design process and evaluation tools, and the research methodologies for user study and analysis.

2.1 Related works

Since cycling is an activity lifestyle which is related to health and environment, different issues are studied in varied field. Studies of female cycling are therefore proposed in transport, physical activities and recreation. For cycling use may differ from age, income levels, and geographic areas, there are several studies focus on the differences by gender (Krizek et al.,2004). To inspect the difference firstly, safety concerns include road and parking are the main obstacle to cycling in both U.S. and Australia (Garrard, 2003; Krizek et al.,2004). The risk perceptions of injuries in cycling are also level down females' willingness. It indicated that personal experience of cycling is effective way of bridging the gap between perception and actual situations (Garrard, 2003).

However, for the lack of studies in female cycling, a comprehensive Australia study with both

qualitative and quantitative surveys were proposed for identifying a series of findings of female cycling in 2006. Not only the motivations, supports, and constraints within female cycling participation were identified, the recommendations for strategies or programs were also developed for increasing participation (Garrard, Crawford, and Hakman, 2006). Guidelines based on this research were presented for encouraging female to cycle. The Australia research results delivered valuable references of encouraging female cycling participation through solid studies. In order to producing strategies for developing persuasive system design in this research, there are some related persuasive technologies researches and works produced for encouraging physical activity.

The persuasive technology design work was proposed with a mobile phone-based fitness journal device called *Houston* for encouraging physical activity by providing personal awareness of physical level and the as media with physical activity related social interaction among friends. Four design requirements for technologies that encourage physical activities are conducted with (1) give users proper credit for activities (2) provide personal awareness (3) support social influence (4) consider the practical constraints of users' lifestyle (Consolvo et al., 2006). On the other hand, employing goals in persuasive technologies are proposed to be effective way to encourage behavior change through studying the UbiFit system on mobile phone for encouraging physical activity. Their three-month field study presented findings that *goal sources* (who should set the goal) and *goal timeframe* (over what time period should an individual have to achieve the goal) can be specifically implemented (Consolvo et al., 2009).

Under the goal to develop a persuasive system for encouraging female cycling in Taiwan, literatures related to persuasive theories, tools, or processes are collected for helping to propose the persuasion strategies through user study processes.

2.2 Persuasion strategies from traditional behavior change and cognitive theories

To explore the developments of persuasion, the literatures from traditional cognitive and behavior theories are reviewed for understanding fundamentally. For suggesting study of person's attitudes toward behavior and the subjective norms of how a person will act, there are abundant and well-developed theories and studies in the field of both psychology and social psychology using in persuasive design. Through the overview of theory-driven design strategies, we will review some theories which are frequently used in persuasive design.

2.2.1 From the perspective of traditional behavior change theories

Goal-setting theory had been purposed since 1960s to describe how people respond to different types of specific goals, be stimulated human motivation and further promote higher task performances. Fundamentally, self-efficacy, normative information of expected performance level, and the satisfaction from achieving the goal are three ways to specify how to stimulate high performance. The goal, which is challenging but realistically achieved, should be easy to gauge the progress and know when people meet the goal. However, *Group Goals* which is associated with higher performance than individual goals tends to disappear when the size of group increasing. For recommend to the online communities designs, these communities should set specific and challenging contribution goals for all members (Beenen etal., 2004). It was considered an effective way for designing and evaluating a mobile UbiFit system to encourage physical activities in specific implements with goal-setting strategy. In this study, the five goal sources, (1) self-set, (2) assigned, (3) participatory, (4) guided, and (5) group-set, are employed for persuasive technology design used in physical activity which is originally identified and represented by Shiltz, Horowitz, and Townsend (Consolvo etal., 2009).

The *Transtheoretical Model* (Prochaska and DiClemente, 1982) is often referred to the studies of health promotion field. It constructed to represent the individual process of change, including the stages to intentionally modify addictive or other problematic behaviors. Based on the transtheoretical model, according to the work of Consolvo, McDonald, and Landay (2009), they suggested that a persuasive technology should focus on different stages and give the validate strategies on individuals, which is presented in Table 2-1.

Table 2-1 Persuasion strategy from five stages of transtheoretical model (Consolvo et al, 2009)

As a role of persuasive technology	Description in each stage	Strategies
1 Precontemplators	No intention to change in the foreseeable future	Education
2 Contemplator	Contemplation—seriously considering changing, but has not committed to taking action	Techniques for overcoming barriers or rewards for performing the desired behavior
3 Preparation stager	Intends to take action in the next month and has unsuccessfully taken action in the past year	Rewarding behaviors, even when the behavior is not consistent and increasing awareness of patterns of the behavior to encourage consistency
4 Action stager	Has performed the desired behavior consistently for less than six months;	Keeping track of progress to maintain consistency and possibly incorporate elements of social influence
5 Maintainer	Has consistently performed the desired behavior for six or more months	Coping strategies for problems encountered previously and helping the individual realize how she is becoming "the kind of person one wanted to be"

Adams and White (2005) integrated number of reasons why stage-based interventions to promote physical activity don't work, and then concluded that the interventions based on Transtheoretical Model may have failed to appreciate the true complexity of task:

- Exercise behavior is a complex of different behaviors, not a single behavior such as cigarette smoking.
- Determining current stage of change is crucial to intervention delivery, yet few validated algorithms are used.
- Exercise behavior is influenced by numerous external factors not considered by the TTM.
- The TTM suggests that stage progression is a significant outcome, but this is not always associated with behavior change.
- Stage-based interventions are highly complex and may require more than one level of development and evaluation.

According to other researches, the TTM theory does not account for individual's different levels of exercise and address the possibility for skipping between the stages (Maitland etal., 2006).

Cognitive Dissonance Theory is developed to explain what happens when an individual realizes the attitudes and behaviors are inconsistent. The motivation to reduce the experience of psychological discomfort, which is also the dissonance they experienced, depends on the importance of the beliefs or behaviors for individual (Festinger, 1957). Reviewer proposed the persuasive technology should help the individual to remain focused on their commitment to change by providing the awareness persistently available and easy to access (Consolvo, McDonald, and Landay, 2009).

Turn to social larger social context. *Social Cognitive Theory* based on the ideas that people learn by watching others do and learn actions through observations with positive reinforcement (Miller and Dollard, 1941). Giving advice from professionals, sharing activity information, and providing personal relevant tailored information are the evidences of simulating and increasing activity affected by wider social interaction (Maitland etal., 2006). According to Karau and Willams' *collective effort model* (1993), people work harder individually than in group. Give the believing that their contribution is important to the group's performance and identifiable when they like the group they are working with (Beenen etal., 2004).

Consolvo, McDonald, and Landay (2009) adopted and illustrated the valuable ideas for persuasive technologies from *Presentation of Self in Everyday Life* (Goffman, 1959) to address social interaction that individual manage daily. It is used the metaphor of the theater stage to describe how people interact with others. To encourage lifestyle behavior change, there are some implications when using technology:

Table 2-2 Persuasion implication from *presentation of self in everyday life* (Goffman, 1959)

Metaphor	Description	Implications for technology support
Impression management	Information which collected and used is in control	It may be important to provide the ability for the individual to disguise something about their activities, enable the individual to misrepresent something of their behavior, or support secret consumption
Backstage	A place where performer can relax and drop their front, forgo speaking his lines, and step out of character	Give individual's control space so it enables individual to perform differently for different audiences.

Understanding and applying the behavior change theories and studies help to address individual or social aspects in varied design cases. However, the uses of traditional psychology theories are proven not controllable and enough to cope with. Beenen etal. (2004) tried to build a link between social science theories and CSCW design in tests and found social science theories may not cover the real design tasks when multiple features vary simultaneously. The norm in social psychological research is abstracting the contextual details away. Designers are therefore forcing to improvise when attempting to apply social psychological knowledge to solve design problems.

2.2.2 Persuasive design from the perspective of cognitive processes

Before the decision of changing to the purposed behaviors, information processing theory and

Cognitive consistency theories are fundamental used to explain the individual's process when perceiving persuasion information in human mind. The Elaboration Likelihood Model and influence techniques suggested by Cialdini further purposed for promising persuasive communication approaches (Harjumma and Oina-Kukkonen, 2007).

Elaboration Likelihood Model was proposed by Petty and Cacioppo (1986) and fundamentally illustrated a individual's think process when receive a message and try to understand the communication. They suggested there are a central route and a peripheral route to persuasion. A person may possibly be persuaded through the central route who involves in the elaboration of persuasive message and carefully think about the content, while a person may be persuaded through the peripheral route who only perceives surface characteristics of persuasive message and not think carefully but only skims over it. The routes are flexible since people can also swing between the two. Therefore, persuasion message should be considered when designers decide which information they want to process.

On the other hand, Cialdini (1998), who is the well known psychologist and also the author of *Influence: The psychology of persuasion*. In his book, he verified people tend to response and make decision through mental process. It was proposed as weapons to give stronger influences to persuasive message so can be related to persuasive technology for changing a target behavior. The six principles of influencing persuasion include:

1. Reciprocity: give what people want and they likely return a favor.
2. Commitment and Consistency: people are likely to be honor for their commitment even without their original motivation.
3. Social Proof: the similar others' behaviors and attitudes could be easily followed for expecting social norm if it's OK to do in their circumstances.
4. Authority: people are likely to obey expert's opinions for their reliability of expertise.
5. Liking: it's easily to persuade people by others who they like or attract to.
6. Scarcity: things seem more important when they are limited or unavailable.

Recently, Fogg (2009) presented a new model, Fogg Behavior Model (or FBM), to illustrate the drivers of human behaviors in a visualization (Fig. 2-1).

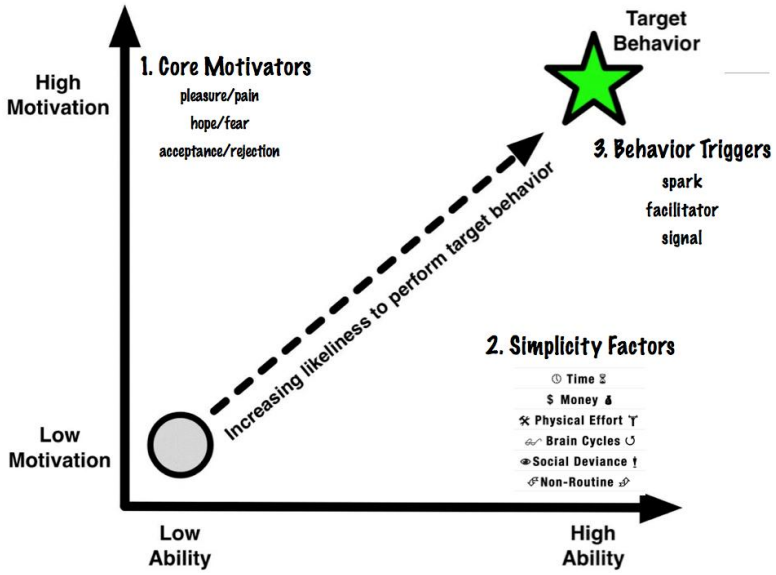


Fig. 2-1 The FBM and subcomponents of each factor (Fogg, 2009)

The FBM is composed by two axes to form the plane. Using the horizontal axis representing ability, vertical axis representing motivation, the star representing the target behavior, the model emphasize the relation among motivation, ability, and target behavior. Trigger is also shown on the plane when target behavior occurred. In FBM, motivation, ability, and trigger each factor has its subcomponents. That means if users are likely to perceive behavior triggers and then perform target behaviors when they have a high motivation and a high ability of target behaviors. The FBM framework identifies problems and helps designers or researchers think systematically when developing a persuasive system.

In conclusion, numerous literatures have been studied from human's cognitive and behaviors in traditional psychology field to help the development of persuasive designs. It represented the phenomenon in persuasive design are widely concerns. However, different from the perspectives from studying human beings' cognitive and behaviors theories, there are also persuasion studies from developing of technologies.

2.3 How technologies are used to persuade people

Since the employments of persuasions are widely utilizing in varied issues from health, environment to marketing, based on using computer to persuade people, this field named "captology", which is proposed in 1.1previously, has been developed years after it was opened up. To understand captology domain and explore the insights for further research and design, there are different ways to inspect and classify. Since machine does not have intentions, Fogg, who is the chief researcher from the Stanford

Persuasive Technology Lab, opened and coined captology field of research, suggests "*the context of creation, distribution, and adoption classifies a computer as persuasive.*" (1998) He argued that persuasion implies intent to change attitude or behaviors and he proposes three types of intent which could be used by computer technologies (Table 2-3).

Table 2-3 Three types of persuasive intent with examples (Fogg, 1998)

Type of intent	Where intent comes from	Example
Endogenous (from within)	Those who create or produce the interactive technology	Health-Hero video games are designed to persuade children to develop good health habits
Exogenous (caused by external factors)	Those who give access to or distribute the interactive technology to others	A mother may give her son a Palm Pilot PDA in hopes that he will become more organized
Autogenous (self-produced)	The person adopting or using the interactive technology	A person may buy and use a calories-counting computer device to help change his or her own eating behavior.

By viewing numerous works of persuasion scholars, Fogg (1998) synthesized and defined *"persuasion as an attempt to shape, reinforce, or change behaviors, feelings, or thoughts about an issue, object, or action."* To clarify the type of persuasion, which attempt to change people's attitudes or behaviors through persuader sending a persuasive message to a persuadee or audience, Harjumma and Oina-Kukkonen (2007) drew the relationship and explained differences shown in Fig. 2-2.

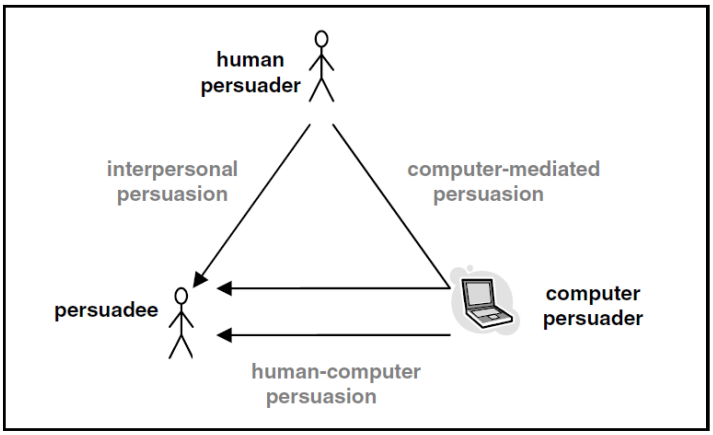


Fig. 2-2 Three types of persuasion (Harjumma and Oina-Kukkonen, 2007)

They indicated that people may be persuaded through *interpersonal persuasion* occurs when two or more people interact with each other, also by other *computer-mediated communications* such as weblog. However, persuasive technology is about human-computer interaction, which is defined as the study of how people are persuaded when interacting with computer technology (Fogg, 2003) and referred as *human-computer persuasion* here. It was helpful for clarifying the fundamental structure of persuasion.

Since persuasive system can be used either computer-human persuasion or computer-mediated persuasion, it's complex to develop the design of persuader. For the differences between human and computer communications, it's essential to realize how people reacted to computer communications. Through the experiment for studying the human-computer interaction when experienced computer users apply social rules, it was shown their relationship was social and related to the literatures of social psychology, communications and sociology. (Nass, Steuer, and Tauber, 1994) Also in the study of evaluating the effects of computer that flatter, it's the same flattery produced from computer as from humans. (Fogg & Nass, 1997) The studies reported the patterns of social psychology are similar to human-computer interaction.

2.3.1 Persuasion strategies through different functions

Fogg (1998) proposed persuasive computer in three functional roles: as tools, as medium and as social actor different ways and gave each role examples in Fig 2-3.

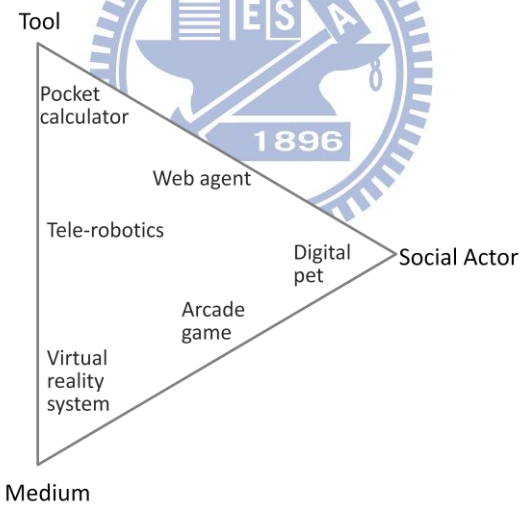


Fig. 2-3 Three functional roles of persuasive technology (Fogg, 1998)

In the publication of Persuasive Technology-Using computer to change what we think and do (2003), Fogg worked in the investigating of how were the computers be use and what were they performed when using in persuasive technology. He elaborates how computer be a persuasive *tools*, a persuasive media, a persuasive social actors, and develops the credibility of computer for increasing persuasion through mobility and connectivity approaches afterward in the book.

Firstly, Fogg argues "a persuasive technology tool is an interactive product designed to change

attitudes or behaviors or both by making desired outcomes easier to achieve." Using computers as persuasive tools facilitates the increases of capability. He mentions a tool can be persuasive by "making target behavior easier to do", "leading people through a process", and "performing calculations or measurements that motivate."(p.32) Fogg identified seven types of persuasive technology tools and illustrates each one explicitly and summarized in table 2-4 below:

Table 2-4 Classification of persuasive technology as tools in seven types (Fogg, 2003 p.32-53)

Persuasive technology as tools	Principle
Reduction (Simplifying)	Using computing technology to reduce complex behaviors to simple tasks increases the benefit/cost ratio of the behavior and influences users to perform the behavior
Tunneling (Guide)	Using computer technology to guide users through a process or experience provides opportunities to persuade along the way
Tailoring (Customization)	Information provided by computing technology will be more persuasive if it is tailored to the individual's needs, interests, personality, usage context, or other factors relevant to the individual.
Suggestion (Intervening at the right time)	A computing technology will have greater persuasive power if it offers suggestions at opportune moments
Self-monitoring (Taking the tedium out of tracking)	Applying computing technology to eliminate the tedium of tracking performance or status helps people to achieve predetermined goals or outcomes
Surveillance (persuasion through observation)	Applying computing technology to observe others' behavior increases the likelihood of achieving a desired outcome
Conditioning (Reinforcing target behaviors)	Computer technology can use positive reinforcement to shape complex behavior or transform existing behaviors into habits

There were various researches proposed practical employments through employing persuasive technologies as tools. Through SMS text messages, sending educating, notifying, and reminding Info are proposed to suggest users in particular timings; while gathering Info in collecting data and journaling by individuals are also proposed in self-monitoring of users for improve health behaviors. (Fogg and Allen, 2009) Also, the application on mobile phone of Houston was utilize as the personal journal to give deceptive measurements and sufficient information of activity results; while it also provide personal awareness of activity level with history of past behavior, current status, and activity level performance to encourage more activity with self-monitoring and surveillance tool. It is also proposed the consideration with practical constrains of user's lifestyle (Consolvo et al., 2006). UbiFit is another interactive application and fitness device system designed of self-monitoring for encouraging individuals' physical activity (Consolvo et al., 2009).

On the other hand, when using a *medium* as persuasive technology, it provides experience to "allow people to explore cause-and-effect relationships", "provide people with vicarious experiences

that motivate", "help people rehearse a behavior." (p.62)

Table 2-5 Classification of persuasive technology as mediums in three types (Fogg, 2003 p.62-79)

Persuasive technology as mediums	Principle	Sources
Cause-and-effect scenarios	Persuade people to change their attitude or behaviors by enabling them to observe immediately the link between cause and effect	1. Enables users to explore and experiment in a safe, nonthreatening environment. 2. Shows the link between cause and effect clearly and immediately 3. Persuades in subtle ways, without seeming to preach.
Environmental simulations	Providing a motivating simulated environment in which to rehearse a behavior can enable people to change their attitudes or behavior in the real world	1. Can create situations that reward and motivate people for a target behavior 2. Allows rehearsal- practicing a target behavior 3. Can control exposure to new or frightening situations 4. Facilitates role-playing-adopting another person's perspective
Object simulations (Providing experiences in everyday contexts)	Portable simulation technologies designed for use during everyday routines can highlight the impact of certain behaviors and motivate behavior or attitude change.	1. Fits into the context of a person's everyday life 2. Less dependent on imagination or suspension of disbelief 3. Makes clear the impact on everyday life

Since a persuasive technology acts as a social actor, it creates relationships with users. It may "reward people with positive feedback", "model a target behavior or attitude", and "provide social support to users." (p.90) Fogg performs the primary types of *social cues* that cause social experience when users interact directly with computer.

Table 2-6 Classification of persuasive technology as social actor in five types (Fogg, 2003 p.90-114)

Persuasive technology as social actor	Examples	Highlighted principles
Physical social cues	Face, eyes, body, ,movement	A computing technology that is visually attractive to target users is likely to be more persuasive as well. **(principle of attractiveness)**
Psychological social cues	Preferences, humor, personality, feelings, empathy, "I'm sorry"	People are more readily persuaded by computing technology products that are similar to themselves in some way. **(principle of similarity)**
Language	Interactive language use, spoken language, language recognition	By offering praise, via words, images, symbols, or sounds, computing technology can lead users to be more open to persuasion. **(principle of praise)**
Social dynamics	Turn taking, cooperation, praise for good work, answering questions, reciprocity	People will feel the need to reciprocate when computing technology has done a favor for them. **(principle of reciprocity)**
Social roles	Doctor, teammate, opponent, teacher, pet, guide	Computing technology that assumes roles of authority will have enhanced powers of persuasion. **(principle of authority)**

Practically employing SMS text messages to providing social cues through providing user questions and expert responses and people-to-people connections are also proposed to improve health behaviors. (Fogg and Allen, 2009) Otherwise, EatWell is also the persuasive system with social support that allows people create voice memories of eating healthfully to share experiences and listen to the

memories created from others in a local context. (Grimes, Bednar, Bolter, and Grinter, 2008)

2.3.2 Increasing persuasion through system credibility and social influences

In addition to the three different types of roles, Fogg mentioned the importance of credibility in persuasive technology. He suggested that "credibility is a perceived quality that has two dimensions: trustworthiness and expertise." (p.122) Trustworthiness includes truthful, fair and unbiased, while expertise indicates knowledge, experience, and competence. Although not all the technology matter with credibility, there are seven situations are essential for persuasive technology.

1. When computers instruct or advise users
2. When computers report measurements
3. When computers provide information and analysis
4. When computers report on work performed
5. When computers report about their own state
6. When computers run simulations
7. When computers render virtual environments

To make sure the success of persuasion, the seven contexts should be operated and perceived credible in persuasive technologies.

Finally, for people are in a great opportunity to work together and interact with each other through Internet or many connected products, the influences of other people play a more important role nowadays. The leveraging of social influence is explored to apply in connected persuasive technology product for the ubiquitous network development. Fogg proposed the following four prominent theories to explain the approaches to apply to connected persuasive technologies. (p.197)

(1) The principle of social facilitation is originally describes that the present, participate, or observe of other people makes people have a better performance. With the using of connected products which allow people to present virtually, people may be observed or discern others who are performing the behavior along with. Under this condition, people are more likely to perform a well-learned target behavior. For applying this principle, designers' can use simple avatars to represent other people.

(2) Social comparison theory described people determine how they compare with others and what they should think. It could change people's attitude and behaviors since they seek to know similar other's

performance and then they could be motivated to perform target behavior. It's different to put peer pressure but provide similar other's information help people shape decisions and behaviors.

(3) Different from social comparison, principle of normative influence tend to change attitudes and behaviors to match the expectations, attitudes and behaviors from groups. The groups can be classmates, a team, a family, a work group. Therefore, the leverage of normative influence or peer pressure promotes people to adopt or avoid target behaviors can be also applied in persuasive technology.

(4) Social learning theory is one of the most popular and effective ways for changing behaviors. (p.201) People observe other's action and note the consequences of the action, such as reward, and they are likely to be motivated to change behaviors. Forums, clubs, buddies area and other applications of community provide opportunities to see others' progress, success and interact could be help for encouragement.

For example, the research of mobile audio support as "Jogging over a Distance" is proposed to encourage joggers and support the social communication between them (Mueller, O'brien, and Thorogood, 2007). The mobile phone, Houston, is also applied social pressure, social support, and communication to affect participants (Consolvo et al., 2006).

In addition to social influence, intrinsic motivators in group are also the energizing force to arise activities, includes competition, cooperation, and recognition. The following are principles inferred by Fogg (p.205):

Table 2-7 Three principles of in-group motivators for persuasion (Fogg, 1998, p.205)

In-group motivators	Principle
Competition	By leveraging human being's natural drive to compete, computing technology can motivate uses to adopt a target attitude or behavior.
Cooperation	Be leveraging human being's natural drive to cooperation, computing technology can motivate users to adopt a target attitude or behavior
Recognition	By offering public recognition (individual or group), computing technology can increase the likelihood that a person or group will adopt a target attitude or behavior.

2.3.3 Comprehensive design features of persuasive technology

Based on the Fogg's framework which provided useful means of techniques, for specifying designing

and evaluating, Oinas-Kukkonen and Harjumaa proposed a systematic design features for evaluation persuasive system content and software functionality (2009). The specification covered the requirements with descriptions of how a system should behave, qualities it should have, and constraints on design and development process, which are related to the persuasiveness. They categorized the system features as providing primary task, dialogue, system credibility, and social support. It established conceptual but gave practical implications. Compare to the works with Fogg, they disassembled the functional triad and its design principles to categorize system features comprehensively in the table below:

Table 2-8 Systematic persuasive design features (Oinas-Kukkonen and Harjumaa, 2009)

Primary task support	Dialogue support	System credibility support	Social support
Reduction	Praise	Trustworthiness	Social learning
Tunneling	Rewards	Expertise	Social comparison
Tailoring	Reminders	Surface credibility	Normative influence
Personalization	Suggestions	Real-world feel	Social facilitation
Self-monitoring	Similarity	Authority	Cooperation
Simulation	Liking	Third-party endorsement	Competition
Rehearsal	Social role	Verifiability	Recognition

For investigating the research knowledge about persuasive systems produced during 2006-2008, it was used to further review and analyze the literatures of Persuasive Technology Conferences. They found the most used design principles. The most used ways for persuasion to support accomplishing one's primary task are tailoring, tunneling and reduction. In addition, suggestion is used to support the user-system dialogue, while social comparison and normative influence are the means to provide social support. It was concluded with a main finding of the phenomenon of blanking in dissemination work itself, and they suggested a heuristic to reflect variables for making persuasive system clearer. (Torning and Oinas-Kukkonen, 2009) To process a heuristic, there are some literatures inferred and going to be shown in the following section.

2.3.4 The heuristic persuasive design from users' point of view

There were eight dimensions of taxonomy framework was constructed for looking the problems to support investigate human interruption. Including the source, individual characteristic, method of

coordination, meaning of interruption, method of expression, channel of conveyance, human activity changed by interruption, and effect of interruption. (McFarlane, 1998) Incorporating into cognitive theory, Norman's 7-stage action model (Norman, 1988) was established to explain the individual's action when interruptions exist and the impacts. Based on the model, the cognitive theory of persuasive interruptions was developed. It also illustrated individuals' action cycle framework and applied taxonomy to assess individuals' context, included user properties, task properties, presentation, and interruption effectiveness. (Walji etal., 2004)

The similar framework was used in persuasive context. The investigation helped to provide a heuristic of persuasive technology design through understanding users' thinking, discern opportune moments for delivering messages, and persuade effectively. Also, it proposed to recognize the obstructions of target behaviors. Oinas-Kukkonen and Harjumaa demonstrated the system of persuasive context to analyze through three stages: the intent, the event, and the message routes, which is illustrated in Fig. 2-4(Oinas-Kukkonen and Harjumaa 2009).

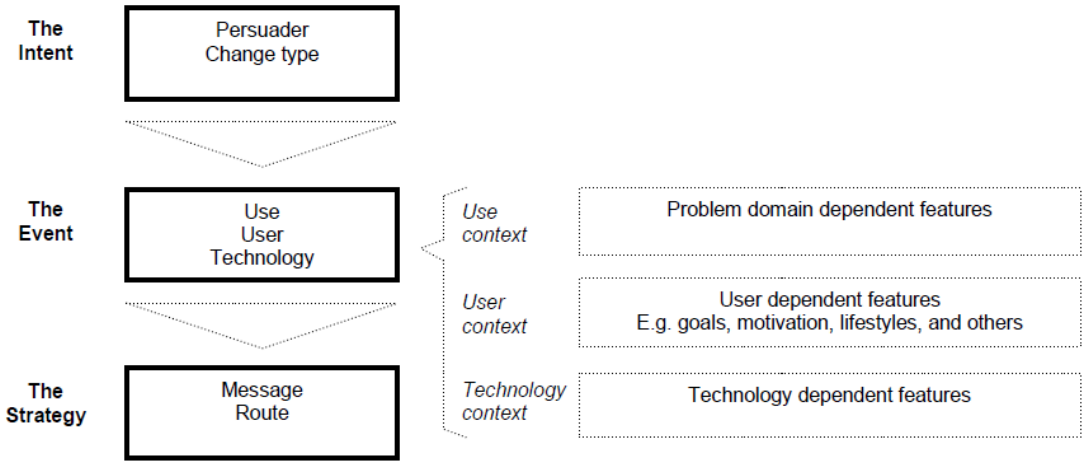


Fig. 2-4 Analysis of the persuasion context (Oinas-Kukkonen and Harjumaa, 2009)

In addition to exploring the persuasive or interruption context, the aspect of *seduction* was also proposed in captology. Seduction is the aware of emotion process that has a beginning, middle, and an end when people use or interact with products or technologies. The first three basic steps of seductions are:

(1)Enticement, the operation to attract users' attention and make the emotional promise;

(2)Relationship, the progress to give users some fulfillments and more promises, which is continuing indefinitely; and

(3)Fulfillment, to fulfill users' final promises and end the experience in a memorable way.

The process can be modified to extend details in each step and explain works in both physical and software products. Stack's juicer and Plumbdesign's Thesaurus were examined in the paper. (Khaslavsky and Shedroff, 1999)

Later in 2007, Fogg examined how Web services influence users sequentially through outlining the behavior chain, which is also in the series pattern of developing the three steps of seductions for target behaviors (Fig. 2-5).

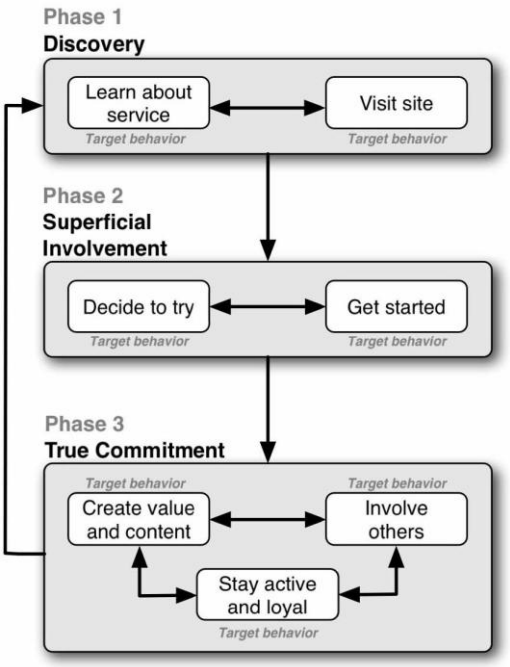


Fig. 2-5 Three steps of seductions for target behaviors (Fogg, 2007)

Begins with the first phrase of behavior chain, *Discovery phrase* is the stage to attract users to use and further guide them about what services the system provides. In practical use, most Web site operators seek ways to motivate people to learn about and visit their site, which is the general target behavior in this phrase. After the first phrase, users have the idea of services so they may decide whether to involve in the services if it can fulfill their expectations in *Superficial Involvement phrase*. Web services influence users to decide to try and to get started with the service for reaching their compliance. In this phrase, it's the goal to gain users' compliance to prepare the path for the long-term behavior change in *True Commitment* phrase. Go beyond the one-time compliance, in this phrase, creating habits is the aim of Web services. For example, services persuade users to frequently comment in responding to their contents. Another contribution in phrase 3 is introducing and moving other users through the

chain, which includes a path from phase 3 to phrase 1. Fogg suggested the concept of behavior chain is helpful for apply in other domains for mapping and compared to understand the structure of persuasion.

2.3.5 Developing processes of persuasive technologies design

In order to develop persuasive technology systems, scholars studied the theories in psychology field to find users' perspective toward persuasion or technologies; meanwhile, they reviewed system features and evaluated the utilization through years of development. There were also some useful frameworks for developing persuasive technologies. However, for providing a better approach to direct apply in the developing or evaluating of persuasive systems, Oinas-Kukkonen and Hajumaa (2009) demonstrated a framework to development of persuasive system. It was consisted by three phrases: obtain sufficient understanding of system for analyzing or designing, recognize the users' intention, ability of persuasive event, and appropriate strategies through context, and finally define the system qualities for designers to develop a system (Fig. 2-6).

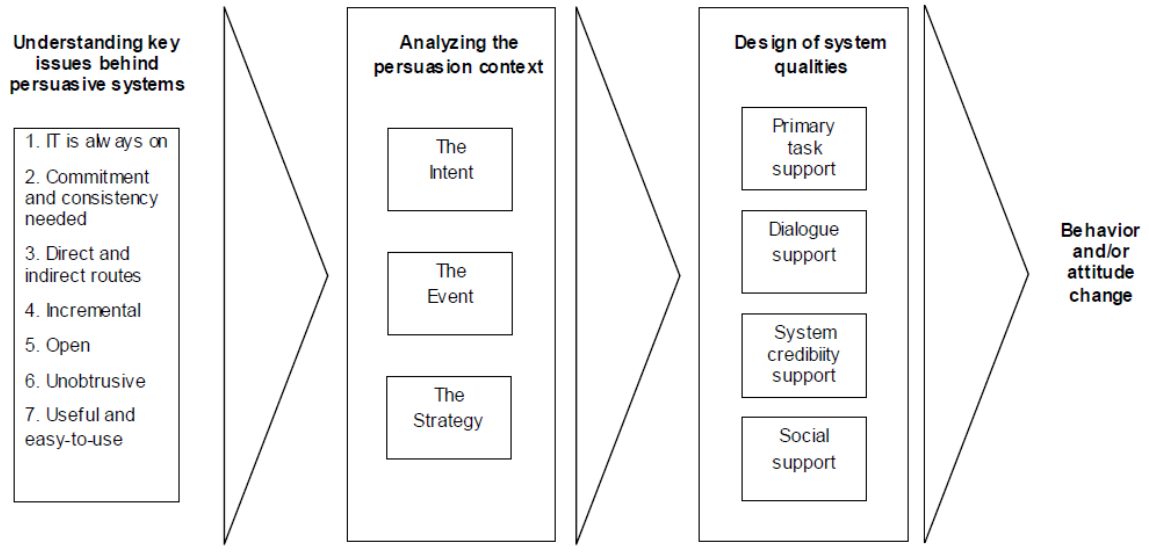


Fig. 2-6 Frameworks for developing persuasive system (Oinas-Kukkonen and Hajumaa, 2009)

On the other hand, in order to give a process to be practical utilize for developing successful persuasive technologies, Fogg published the paper also in 2009 to share and explain the eight-step process drawing on his 15 years of studying experiences of creating persuasive technologies to influence people. The process is shown in Fig. 2-7.

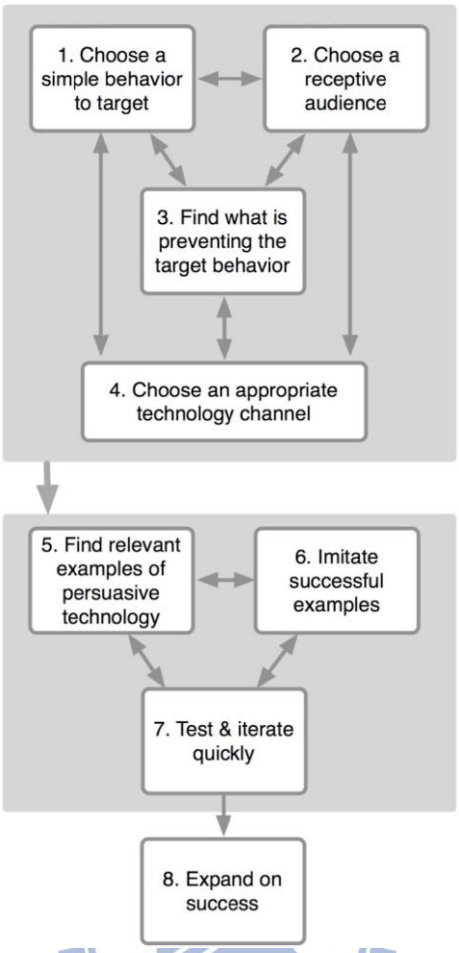


Fig. 2-7 Eight-steps in early-stage persuasive design (Fogg, 2009)

To prevent the failures and make sure it's possible for successful persuasion, Fogg outlined the clear and specific path for design practice. It is conservative but estimated carefully to form the process step by step. In order to increase the acceptances from users, the process suggested selecting simple behavior, receptive audiences, and appropriate channel for them. Each step should be proceeded back and forth to examine if the process cannot develop continuously. It's essential to find the reasons preventing the target behaviors in the upside part of framework. After that, find the successful examples, try to imitate them and further proceed a quick test. This process was established systematically and conscientiously for applying in practical persuasive technology design.

In conclusion, the developed persuasive technologies and practical application studies suggested most of implications in varied aspect of persuasion in physical activities, environmental preservation, health concerns or other issues. Researchers conducted plenty of different process or theories based on particular issues. For our aim to propose persuasion strategies for developing persuasive system in order to applying on persuading female participate in cycling, we undertake a user study to explore user

contexts through systematic process practically.

2.4. Research methodology

In this thesis, there will be several methodologies related to the study works. Firstly, "Diary studies" and "In-depth interview" are the methods for exploring two groups of users' behaviors and perspectives under their daily contexts toward cycling activities. After that, the approach of "Means-end analysis" and "Focus group" are proposed to help data analysis from user study results and conducting persuasion strategies for persuasive system design.

2.4.1. Diary studies

Before design processes, diary studies, which is also known as cultural probe, is an approach for proposing the data gathering participants' needs in developing a novel projects. (Gaver, Dunne, and Pacenti, 1999, Crabtree et al., 2003) Different from direct-observation approaches used in traditional field studies or usability testing, it was used to allow participants' self-document to lead a conversation with the groups toward unexpected ideas without dominating. In other words, the information is inspired by probe diaries to inform design. (Gaver , 2006) It neither has a given way since it's a design-led approach to encourage participants' subjective engagement, empathetic interpretation and a pervasive sense of uncertainty as positive value for design. (Gaver et al., 2005)

Diary studies was used media diaries and photography during an ordinary week to gain insights into the development of HCI field for studying the role of internet video in everyday domestic media consumption and online social life, (Oumard et al., 2008) Using a open space with oblique questions and evocative image on postcards, map for pointing the familiar positions, photo and media to record their live story, which allowed elders' respond their attitudes towards their lives, cultural environments and technology. (Gaver et al., 1999) Both them were used for inspiring design. On the other hand, there were other approaches for probing. Informational probes were used to report participants' information to provide insights into users' needs and perceptions for the beginning of the study in elders (Crabtree et al., 2003). It opened dialogues with users. Mattelmäki (2005) summarized four reasons to apply diary study: inspiration, information, participation, and dialogue.

There were three types of diaries are categorize. Firstly, interval-contingent methods are usually

used for studying some prevalence of certain events in daily life or report experiences across general time period. Signal-contingent methods use device to prompt participants to reports, and event contingent to report when each time the event occur. (Wheeler and Reis, 1991) It was stated that inspiration probes used raw data in way to create persona, frame problem spaces and capture design ideas, while information probes were used directly to elicit information about user needs (Haines et al., 2002).

In order to exploring how target behaviors are proceeding in users' real life, using diary studies may be an appropriate approach to understand the intention and needs. Also, dialogues are furthered opened to investigate problems and issues preventing the behaviors. It helps to provide sources and evidences to investigate persuasion strategy

2.4.2. In-depth interview

As one of qualitative interviews in addition to structured and semi-structured interviews, in-depth interviews are also proposed a technique for verifying problems with questions based on interviewees' answers (Britten, 1995). With the form that participant is considered as an expert and the interviewer as a student, the interviewers raised questions neutrally and listened to participants' responses for asking follow-up questions face-to-face. It benefited for learn the perspectives of the research topic from users', including the experience, feelings, needs, and problems. (Guion, 2001; Mack et al., 2005)

The process of in-depth interviews is logistic with proposing seven key characteristics include open-ended questions, semi-structured format, seek understanding and interpretation, conversational, the recording of responses, observations, and reflections. Although interviewers could prepare pre-planned questions to ask in interview, the questions should flow naturally depends on the participants' responses (Guion, 2001).

In our study, in-depth interviews are proceeding based on diary studies to investigate following questions according to interviewees' one week records.

2.4.3. Means-end analysis

In order to offering a way to orientate position of products in marketing, a means-end chain (MEC)

is a model for explaining how products or services facilitate the achievement of desired end states. It consists of elements that represent the consumer's cognitive processes which link their values to behaviors. Consequence is defined as the result of consumers' behaviors. The desirable consequences called benefits, which is differed from products' attributes whereas it depends on what people are received. Consequence could be physiological with satisfying hunger, psychological with self-esteem, or sociological with enhance status. In sum, the model is a hierarchical link between values *ends* and the *means* represented by product attributes. (Gutman, 1982; Reynolds and Gotman, 1988)

The MEC model was widely applied in discovering the experiences of consumers, users, or participants through engaging in the services providing (Lin, 1990), purchasing behaviors (de Boer and McCarthy, 2002; Chiou-wei and Li, 2002), or particular experiences. (Marsh, 2008) Laddering interviews were proposed to gather the information of users' perceptions. Through the laddering referred to one-on-one in-depth interviews, it is determined the linkages between the key conceptual elements among attributes (A), consequences (C), and values (V). In other words, the elements' relationship between participants' values and consequences and the corresponded attributes could be found and constructed in the laddering involves tailored interviews using a series of directive probes (Reynolds and Gutman, 1988). The structure of model was furthered illustrated in a hierarchical type shown in Fig. 2-8.

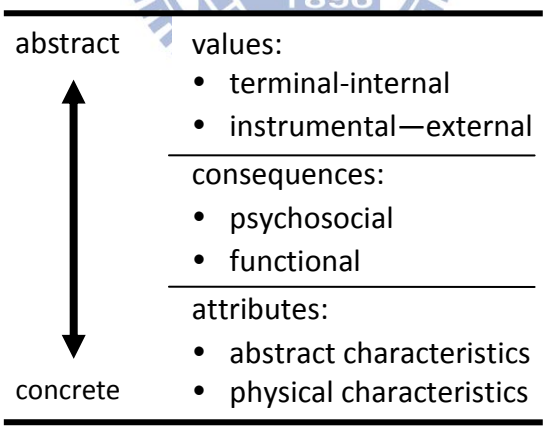


Fig. 2-8 Customers' MEC model in hierarchical (Lin, 1990)

For investigating female cycling features to explore persuasions to pull female participate in cycling activity in this thesis, applying approach of MEC is a way to understand users' thought process of making decisions or engagement experiences in behaviors. We can use this approach to explore participants' cognitive connection through the knowledge of behavior context, which is the attribute, and their attitudes which is the consequence corresponding to values.

2.4.4. Focus group

Created by Robert Merton, focus group is a general study approach in social science field in late 20th century. Different from traditional closed interview studies, focus group proceeds without prepared questionnaires but converses in an open and free atmosphere. Through the communications between participants in the form of group, researchers encourage them to talk, ask questions, exchange and comment on each other's sharing instead of asking each participant questions in turn. It's could be particular used for exploring the participants' perspective and experiences. The group process helps researchers to explore and clarify their views and particular appropriate with open ended questions to identify the issues of importance. (Kitzinger, 1995&1996)

Using focus group provided the advantages to collect data on a large range of behaviors, give a greater variety of interactions with the study participants, and have more open discussion of research topic in a limited period of study session. Focus group was found appropriate for providing an approach to collect data of the research topics from group discussion (Morgan, 1997).

For conducting the data from diary studies and in-depth interview with users, focus groups which are formed with experienced producers and designers who are professional and experienced in design processes are invited to verify and classify persuasive features based on user study results.

2.5. Summary

In previous research, persuasion strategies for design are conducted through cognitive and behavior theory from social and psychology field. Along with the development of technology, studying of the effects and results on the operating of human-interface reflects and defines strategies for future design. Recently, most of literatures develop persuasive design through user study process with interviews, prototyping, and user testing. For discovering systematic process or structure to design and evaluate persuasive design works, therefore, there are persuasive design theories and processes proposed in recent years. For developing persuasive design to persuade female to participate in cycling in Taiwan, based on the structure which is similar to Fogg's eight-step persuasive design model (2009), we build a user study process for studying two groups of participants to evaluate the preventions of persuasive issue and imitate a success group. Applying with systematic persuasive features for design or

evaluate system (Oinas-Kukkonen and Harjumaa 2009), the persuasion strategies are extracted and conducted with different perspectives to suggest the developing or evaluating of persuasive systems.

Chapter 3
Methodology

While designers have applied design strategies from varied theoretical guidelines from reviewing the past researches or experience, for proceeding persuasive design to change what user think and do, we proposed a systematically user study framework to help develop persuasive design.

To persuade users change their attitude or behavior, we must investigate user context firstly to find out the fundamental information of user's needs, interests, motivations, attitudes, social anchors, even the whole personality. However, the user-centered research process is usually time-wasted through exploring complicated user's thinking and behavior in their lives. Therefore, it's essential to organize a systematic user study process to give the effective user information. In this research, the systematic study process is organized and experimented through a practical persuasive design problem. The persuasion issue in this research is chose to propose the persuasion strategies for convincing female to participate in cycling activities. After the practical experiment through user study process, the analyses through means-end analysis and focus group to identify persuasive features are developing to conduct persuasion strategies.

3.1. Framework

The research structure focuses on processing a user study and develops the persuasive issues for conduct persuasion strategies. Begin with the delivering with the user study process, an appropriate behavior to target for persuading should be firstly defined and proposed. Here we choose to apply the process to explore the strategies for persuading female participating in cycling activities. Since the user study process is constructed on the proposed of persuasive design problem demand, the study should conduct user context information.

The user study process starts with recruiting the target study users. With the focused design problems, persuasive solutions for female cycling, the probe diaries are produced for realizing user's context and their fundamental or emotional reasons of cycling related behaviors. Moreover, with the diary studies and the following in-depth interviews proposed the evidences to interpret. With further

classifications and analysis, after the interpretation of user results, the approaches of classifications and analysis are applying to propose the persuasion strategies. Further explanations and discussions are processed for suggesting the employment of persuasive system evaluation and development.

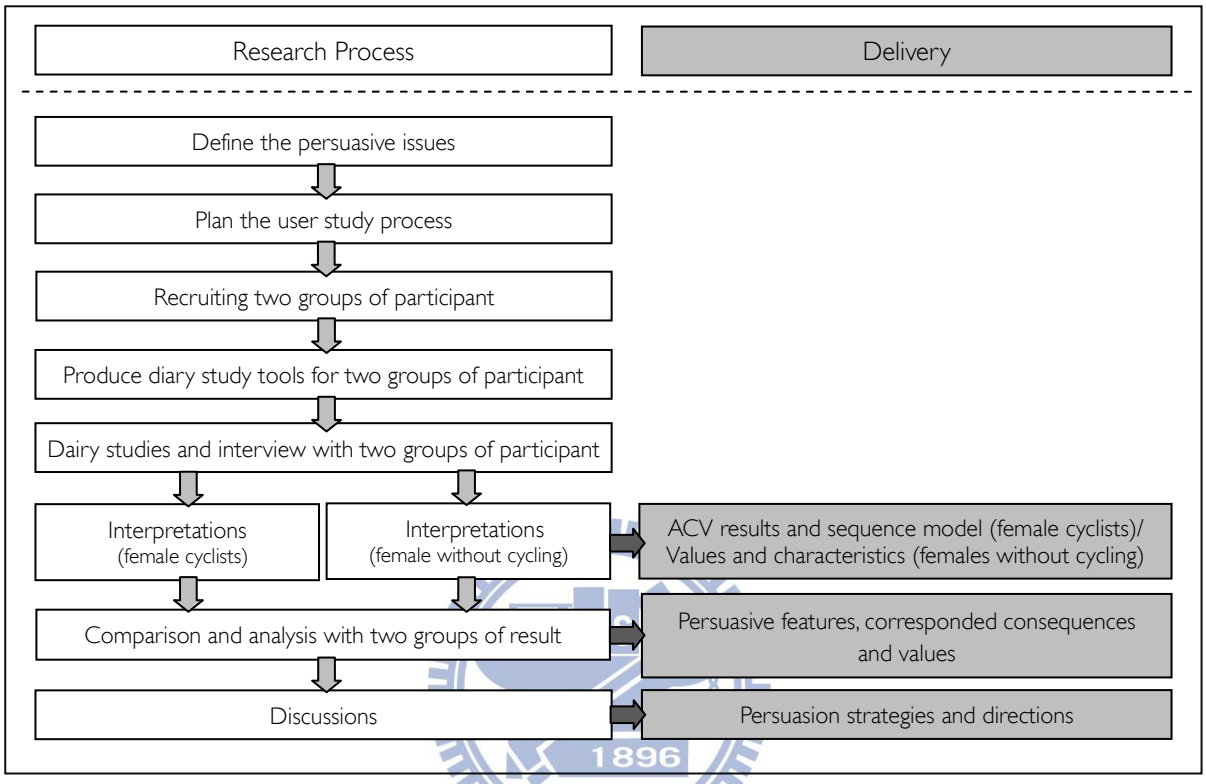


Fig. 3-1 Research structure

3.2. Study processes: how we collect data

The purpose of this thesis is to develop a normative study process for producing persuasion strategies of female cycling systematically. According to Fogg's investigation: *Creating Persuasive Technology: eight-step design process* (2009), he suggested the process to imitate successful examples of persuasive design for developing a persuasive technology effectively. He suggested a framework in eight-steps to follow in the early stage when producing persuasive technologies which was demonstrated success in practice. We therefore bring up the concept of imitating the successful practical examples to proceed a development process of the user study works and then conduct the effective design strategies for using persuasive design.

First of all, for deriving design strategies effectively from user study to help the proceeding of

persuasive design, we should construct a systematic study process. The user study framework is organized from the arranging and discussing works for study, proceeding the study process with focused issue, finally conducting data and outputting the design strategies or guidelines for persuasive design (Fig. 3-2).

Fig. 3-2 The user study framework for persuasive design

Before starting develop the user study process for persuasive design, it is essential to identify the objects for studying. According to the framework in *analysis of the persuasion context* derived by Oinas-Kukkonen and Harjumaa in Fig2-6(2009), there are three components including in the persuasion context exploration, the intent, the event, and the strategy. As we aim to examine the user study with imitating the successful practical examples to proceed developments of persuasive system process, the objects therefore can be separated in two parts. From studying the role model participants, we aim to obtain the experiences within their behaviors and lifestyle; while we aim to collect the lifestyle within their daily activities from potential influenced audiences. The objects we want to study can be defined in different dimensions of persuasion context and listed below in Table 3-1.

Table 3-1 User study contents for deriving the persuasion context

Dimension\Group of user study		Role model in behavior	Potential influenced audience
Intent		Intention to target behavior	Expectation toward target behaviors
Event	Use context	Process to participate in target behavior	Problems or bad experiences preventing target behavior
		Experience engaged in the behavior	
	User context	Daily activities	
Message		Influential approaches	Possible gateway to join

In order to achieve the purposes to get insights on users' perspectives and behaviors, the following

data collecting tools are used in three phases in sequence: screening inquiries, diary study, and in-depth interview (Fig. 3-3).

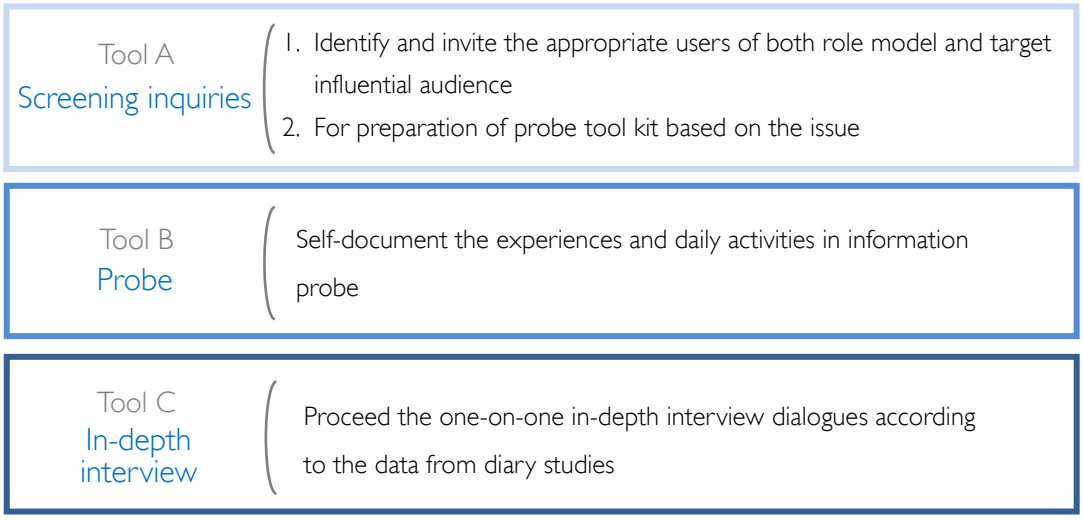


Fig. 3-3 Tools for user study process

3.2.1 The user to study

The users we want to study can be divided into two groups. The first group is the "*potential influenced audiences*", who are not in the behavior but the target users we are going to influence. For developing a persuasive technology, designers have to choose the audiences for accepting the design and further change their attitude or behavior. However, it might not be clear enough about which type of audience could be appropriate targeted and further influenced. Therefore, it is also necessary to figure out the problems which preventing the behaviors, select the possible users to influence, and further focus on their needs, interests, and personality for persuading.

The second group is the "*role model*", the successful persuaded user which is already engage in the target behavior, which can be investigated and learned from. To create persuasive technologies, it's efficient and effective to identify and adapt the examples of successful technologies to proceed our design project at hand. (Fogg, 2009) Since the role model who was persuaded successfully, the comprehension of the existed persuaded use and user context could provide rich information of what happens in the real persuasive communication and their good experiences. User study helps to provide the understanding of the role model's motivation, ability trigger, and experiences within behaviors, and also give the successful insights of process with behavior change to derive the attributes of persuader.

3.2.2 Recruiting the participants

Since there are two groups of users for studying, the process begins with screening inquiries to recruit the two groups, the *role model* and the *potential influenced audience,* to find out the users we want to focus. The two group participants were asked to write down their rudimentary information with screening questions. For recruiting two different groups of participants, there are two sets of questions. For potential influenced participants, female who do not participate in cycling in this research, the screening inquiries basically contain (1) general personal information (2) interests and leisure activities (3) their tendency toward learning new (4) experiences related to cycling activities. The second inquiries contain not only the same questions of the first three parts for potential influenced participants, the questions of cycling experiences based on the female cyclists activities are added for role model participants. See appendix A for full screen shots of this screening inquiries.

For cycling recreation activities are our target persuasion behavior, questions are listed for screening informants. The screening inquiries provide researcher to set criteria for deciding and recruit the appropriate user groups to focus. It is also the approach to preview participants' information with obtaining a sketch of their life style for considering the development of following diary studies from users' basic personal information, interests and activities in leisure time. Therefore, before the investigating user study, we recruited Taiwanese females within the age from 23 to 40 as the first participant group who do not own bicycle nor participate in cycling through questionnaire. In the study section, we finally recruited three single females within different lifestyle to join the diary studies and following interviews. At the same time, we recruit female cyclists who participate cycling activities at least once per month and maintain for more than one year. Finally we invite four single female cyclists to join our studies. The profiles of two groups of participants we recruited are shown at table 3-2.

Table 3-2 Profile of two groups of participant (table top: female without cycling; table down: female cyclist participants)

Potential influenced participants (female without cycling)			
Participants	Age	Hobby	Exercises
A	29	Watch TV, surf Internet, shopping and enjoy delicacy	Swim (2 times/week)
B	25	Watch TV, surf Internet, gather with friends, date with boyfriend	Gym (1 times/week)
C	31	Cook, watch TV, shopping, date with boyfriend, visit friends	None

Role model participants (female cyclist)					
Participants	Age	Hobby	Exercise	Cycling experience	Frequency of cycling
D	37	Cycling, watch TV, surf internet, reading, and gather with friends	Cycling	2 years	1-2 times/week
E	29	Movie, drama, cycling	Cycling, yoga	1.5 years	1-2 times/ month
F	33	Watch TV, gather with friends, cycling	Cycling, swim	3 years	2 times/week
G	27	Surf Internet, jogging, cycling	Jogging, dance, cycling, climbing	2 years	Almost everyday

3.2.3 Producing probe tool kit for diary studies

The use of diary studies provides the strategies to collect data of users' behaviors within the context and help to create the dialogues between the user and researcher in the following in-depth interview phase. For the purposes to gather users' activities and context information, we use the informational probes study to adapt for information collecting instead of inspiration probing. The probe tool kits are produced and included several parts. Tools for diary studies are different from the group of role model and target influenced audience. The informational probe provides an approach to preview users' context quickly before the in-depth interview. See table 3-3 for full screen shots of the detailed contents in tool kit.

Table 3-3 Contents of probe tool kit of two groups of participants

Potential influenced participants (female without cycling)	Role model participants (female cyclist)
1. Instruction 2. Diary for daily activities(daily plan, contact, and schedule) 3. Map for drawing activity regions 4. USB for storing pictures of daily dress and activities in this week	1. Instruction 2. Diary for daily activities (daily plan, contact, and schedule) 3. Workbook for noting process and impressions experiences of cycling 4. Map for drawing activity regions 5. USB for storing pictures of daily dress/ preparation and impressive record of cycling

Fig. 3-4 Probe tool kit (instruction/workbook for noting the process and the impressions experiences of cycling(role model), and diary for their daily lives/ maps for pointing out the activity regions/ USB for saving photos with cycling (role model) and daily dress)

Both groups of participants are asked to record their live through using the tool kits for one week after receiving the tool kit. After accomplishing the self-document, they are asked to use the stamp in the kit and mail it back. The probes are shown in Appendix B.

3.2.4 In-depth interview phase after diary studies

The objective of studying this user group is to investigate their needs, interests, and personality and discover the attitudes or lifestyle toward target behaviors. Besides, the investigations are help for designers to identify the appropriate target users for influence them changing attitudes or behaviors through persuasive design systems. After the diary studies, the documents give a preview of users' context and also provide outlines of their behaviors. To further clarify the persuasion context, the in-depth interview is essential for conducting design strategies in persuasive system. The goal in this session of in-depth interview is to collect the participants' experiences from real life information to complete the data collecting process.

With the recording of diaries, the dialogues can be opened up for the communication between researchers and participants in the beginning of interview. Comparing with the persuasion context we expect to explore through user study in table 3-1, the processes of interview are proposed in two scripts for different groups of participants. For the group of potential influenced participants, the following questions of plan, contact, and mood based on the daily activities in a week are proposed in the script. The questions about related experiences, expectations, problems and possible gateway for cycling are also proposed in script. On the other hand, for the role model group of participants consisted by female cyclists, questions about the process of participating in cycling, impressive experiences of cycling, and cycling activities during the diary week are included in the script. There is an additional step to co-develop with the role model participants lastly. Researchers could invite the role models to draw up a persuasion plan for asking one of their friends to change into the target behavior which they already engage in. This step is supportive to sum up the interview session with those participants to give their insights of target behaviors. The questions of script for interviews are shown in table 3-4.

Table 3-4 Sets of questions of script in the interview

	Issues for female cyclist	Issues for female without cycling
Daily life experiences	Interaction or related activities of cycling recorded in diary	Daily activities based on dairy record
Cycling related experiences	1. Intention of cycling 2. Process of participating in cycling 3. Experience engaged in cycling activities	1. Expectations toward cycling 2. Possible gateway to participate in cycling 3. Problems or bad experiences preventing target behavior/related experiences

The sharing of their perspectives toward cycling behavior from both groups participants are delivered for analysis and further comparing to develop persuasion strategies. Through applying the technique of laddering during the interviews, researches gain the experiences and perspective under the participants' lifestyle.

The in-depth interview is the last session of data collecting process. After the process which is start from recruiting participants, diary studies, to processing the in-depth interview with both groups, the stage of collecting evidences is accomplished. Based on these data, the next stage could be started to analyze these users' data and then conduct the strategies from the results in the following stage.

3.3 Results consolidated from user study

After accomplishing the complete user study process, there are going to start the process to classify and analyze the results from both groups. From studying the role model participants, we aim to work out the ACV matrices of means-end analysis and sequence model of behaviors to explore their experiences; while another aim of results is to build up the personas and means-end results in the daily activity record from potential influenced audiences. Compare the potential influenced audiences' results with the role model participants', we could verify if the participants' values with different behaviors could be varied.

Moreover, in order to conduct the utilization of user study results for developing persuasive system, the characters in ACV matrices of target behavior are used to correspond to the systematical design features of persuasive system. The ACV characters and corresponding features are used for constructing

the strategies for developing persuasive systems.

3.3.1 Conduct study results through means-end analysis

To analyze the data collected from participants, it is essential for researchers to consolidate large amounts of data efficiently and then use an effective approach to extract the meaningful information through it. That is also the purpose to discover and figure out the important and reflective characteristics valued from participants' experiences in analysis session.

In the beginning, the raw data from user studies is reviewed in detail and decomposed to description sentences firstly. To continue, the discrete data such as events, thoughts, and feel within participants' behaviors or activities in each group would be extracted. By using means-end analysis, work results in the user study phase could be identified and further categorized. The activities and interview results are sorting and classify through means-end analysis which depict characters into different forms from two groups of participants.

The first structure is built of daily life activities from potential influenced audiences. The relationship between their means and ends represent within their daily activities are delivered with affinity diagram. Since there are collected with huge amounts of user data from the diary studies and interviews, affinity diagram is a systematic tool to organize them with their attributes. Through recording each description on note, the similar or related notes are sorted and assigned in groups. According to the through grouping and classifying the tools, media, or processes they choose to use and the purposes they have in daily lives in the diary week, the means-end results depict each character and reflect participants' lifestyle.

On the other hand, the categorization was identified as attribute, consequence, and value of cycling activities in three levels. According to the each female cyclist's sharing of experiences, the feelings and receptions represent "consequences" based on their previous activities; while the corresponding "attributes" of activity are bringing up at the same time. Moreover, as applying the process of interview in laddering, the "values" behind the consequences could be figured out in questions after the sharing of experiences. Meanwhile, the relationships between attributes to consequence and consequence to values of each component out of three levels are established through extracting cycling characters from

the dialogues within the interviews. The relationships between values (V) versus consequence(C), and consequence(C) versus attribute(A) are constructed in V-C relationship matrix and C-A relationship matrix. Figure 3-5 diagrams the structure of relationships and the matrices of role model participants' target behavior.

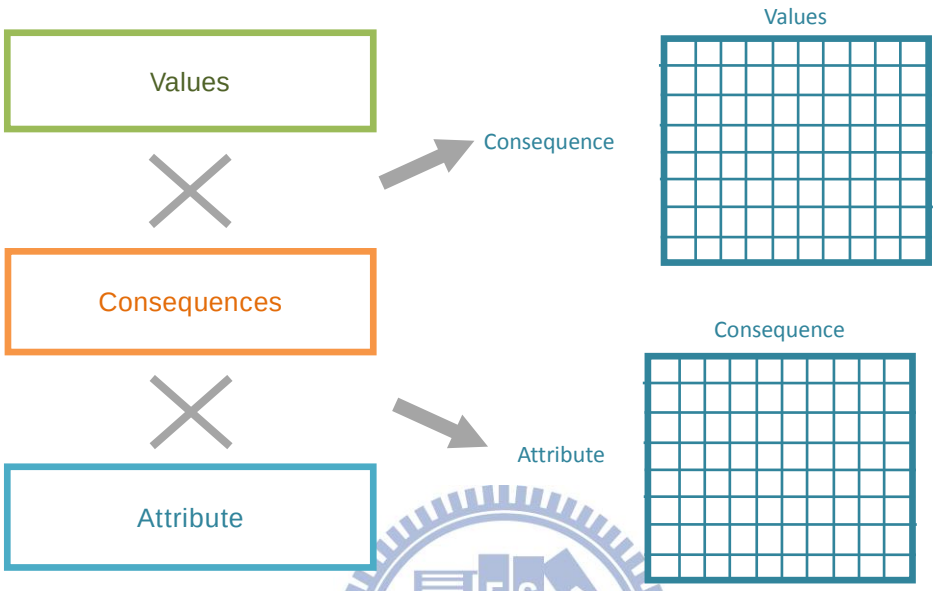


Fig. 3-5 Diagram represents relationship between values-consequence and consequence-attributes.

3.3.2 Identify the characters as persuasive features of cycling through focus group

After rich experiences of target behaviors from role model participants are collected by researchers, the characters are extracted and organized in the ACV matrices. However, for applying the user study results in the development of persuasive systems, the conjunction of components in behaviors and persuasive tools have not constructed yet.

As attributes, consequence, and values in the behaviors of role model participants are identified and related in the ACV matrices, that means the persuasive components are extracted. For persuading audiences change to the target behaviors, we propose to use the extracted "attributes" of to develop the persuasive strategies. From the perspective of users, the extracted attributes represent the participants' feelings and impressions through target behaviors; while the attributes represent the behavior characteristics based on the point of tools. To compare the two meanings of attribute, we use

the design features as reference to character each persuasive features of behavior attribute. Figure 3-6 diagrams the corresponding relationship between attribute and persuasive features in the ACV structure.

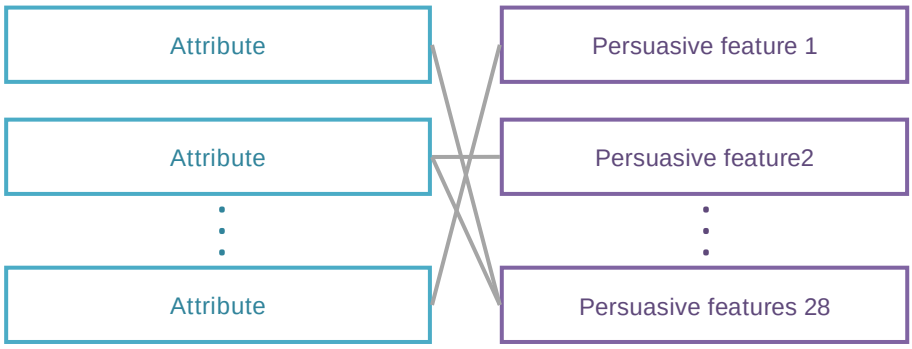


Fig. 3-6 The structural diagram of relationship connected between cycling attributes and persuasive features

The design features constructed systematically by Oinas-Kukkonen and Harjumaa (2009) for evaluating the persuasive system content and software functionality. It provides a systematic reference to check the persuasive features of each attribute in target behavior, and also bridges the user study results as persuasive components. The principles of features are listed in table 3-5. Through the process of focus group, three to four experts of experienced system designers and producers are invited to assign the fifty-one cycling attributes with different weight in three levels of score 9, 3, 1 with corresponding to twenty-eight persuasive design features.

Table 3-5 Design features of persuasive system (Oinas-Kukkonen and Harjumaa, 2009)

Primary task support		
Feature		**Principle**
1	Reduction(Simplifying)	A system that reduces complex behavior into simple tasks help users perform the target behavior and it may increase the benefit/cost ratio of a behavior
2	Tunneling(Guided)	Using the system to guide users through a processor experience provides opportunities to persuade along the way
3	Tailoring(Customization)	Information provided by the system will be more persuasive if it is a tailored to the potential needs, interests, personality, usage context, or other factors relevant to a user group
4	Personalization	A system that offers personalized content or services has a greater capability for persuasion
5	Self-monitoring	A system that helps track one's own performance or status supports in achieving goals
6	Simulation	System that provide simulations can persuade by enabling them to observe immediately the link between the cause and its effect.
7	Rehearsal	A system providing means with which to rehearse a behavior can enable people to change their attitudes or behavior in the real world

Dialogue support		
8	Praise	By offering praise a system can make users more open to persuasion
9	Rewards	Systems that reward target may have great persuasive powers
10	Reminders	If a system reminds users of their target behavior, the users will more likely achieve their goals
11	Suggestions	System offering suggestions at opportune moments will have greater persuasive powers
12	Similarity	People are more readily persuaded through systems that remind themselves in some meaningful way
13	Liking	A system that is visually attractive for its users is likely to be more persuasive
14	Social role	If a system adopts a social role, users will more likely use it for persuasive purposes
System credibility support		
15	Trustworthiness	A system that is viewed as trustworthy (truthful, fair, and unbiased) will have increased powers of persuasion
16	Expertise	A system that is viewed as incorporating expertise (knowledge, experience, and competence) will have increased powers of persuasion
17	Surface credibility	People make initial assessments of the system credibility based on a firsthand inspection
18	Real-world feel	A system that highlights people or organization behind its content or services will have more credibility
19	Authority	A system that leverages roles of authority will have enhanced powers of persuasion
20	Third-party endorsement	Third-party endorsements, especially from well-known and respected sources, boost perceptions on system credibility
21	Verifiability	Credibility perceptions will be enhanced if a system makes it easy to verify the accuracy of site content via outside sources
Social support		
22	Social learning	A person will be more motivated to perform a target behavior if he or she can use a system to observe others performing the behavior
23	Social comparison	System users will have a greater motivation to perform the target behavior if they can compare their performance with the performance of others
24	Normative influence	A system can leverage normative influence or peer pressure to increase the likelihood that a person will adopt a target behavior
25	Social facilitation	System users are more likely to perform target behaviors if they discern via the system that others are performing the behavior along with them
26	Cooperation	A system can motivate users to adopt a target attitude or behavior by leveraging human being's natural drive to co-operate
27	Competition	A system can motivate users to adopt a target attitude or behavior by leveraging human beings' natural drive to compete
28	Recognition	By offering public recognition (for an individual or a group), a system can increase the likelihood that a person or group will adopt a target attitude or behavior

Chapter 4
Results and findings

Since we develop the user study process and proceed in previous illustrations in chapter 3, we focus on a persuasion issues for examining a practical case and propose the results and findings. The gender difference of cycling participation in Taiwan is the targeted persuasion issue to develop persuasion strategies for motivating female participate in cycling through persuasive technologies design. Therefore, clarifications of problems from female without cycling and experiences of female cyclists are delivered in this chapter. Two groups of user study results are conducted and explaining for further discussions. Also, for encouraging female cycling activities, we aim to conduct the persuasion strategies from these results for developing or evaluating the persuasive systems.

From the potential influenced participants, we conduct their daily life records through means-end analysis to produce affinity diagram to clarify the values inherent in their lives. There are also two personas built for presenting and realizing the attributes of needs and problems in real context. On the other side, results of female cyclists are conducted through means-end approach to analysis attributes, consequences, and values in their cycling experiences and construct with their relationship in matrices. The persuasive features results which are weighed with corresponding cycling attributes through focus group are also presented. They are employed for proposing the influential persuasive features with causing persuasive consequences for female cycling.

4.1. Results of the females who do not participate in cycling activities

Since the females who do not participate in cycling are considered as the potential influenced audiences, the needs, problems and intentions related to cycling are essential for developing persuasive technologies. Through diary studies and interview, data from user study are sorted and grouped for interpreting. The analyses are proposed through means-end analysis to depict the values and characteristics under the lifestyle with daily activities.

4.1.1. Daily life picture through means-end analysis

The user study results of female participants who do not participate in cycling are extracted from their participants' lifestyle and behaviors in daily activities of work and leisure time. According to their diary records and interview results, we sort the results of all participants and construct a framework through means-end analysis (Fig.4-1). The right column below represents the means lists include activities region, communication platform, and media of entertainment utilized by out participants throughout their daily activities. On the other side, the left column represents the end lists as the purposes reflected with their lifestyle.Through extracting means and end lists of their daily activities from the whole study sections, we piece these attributes together in pictures of their lives and present systematically.

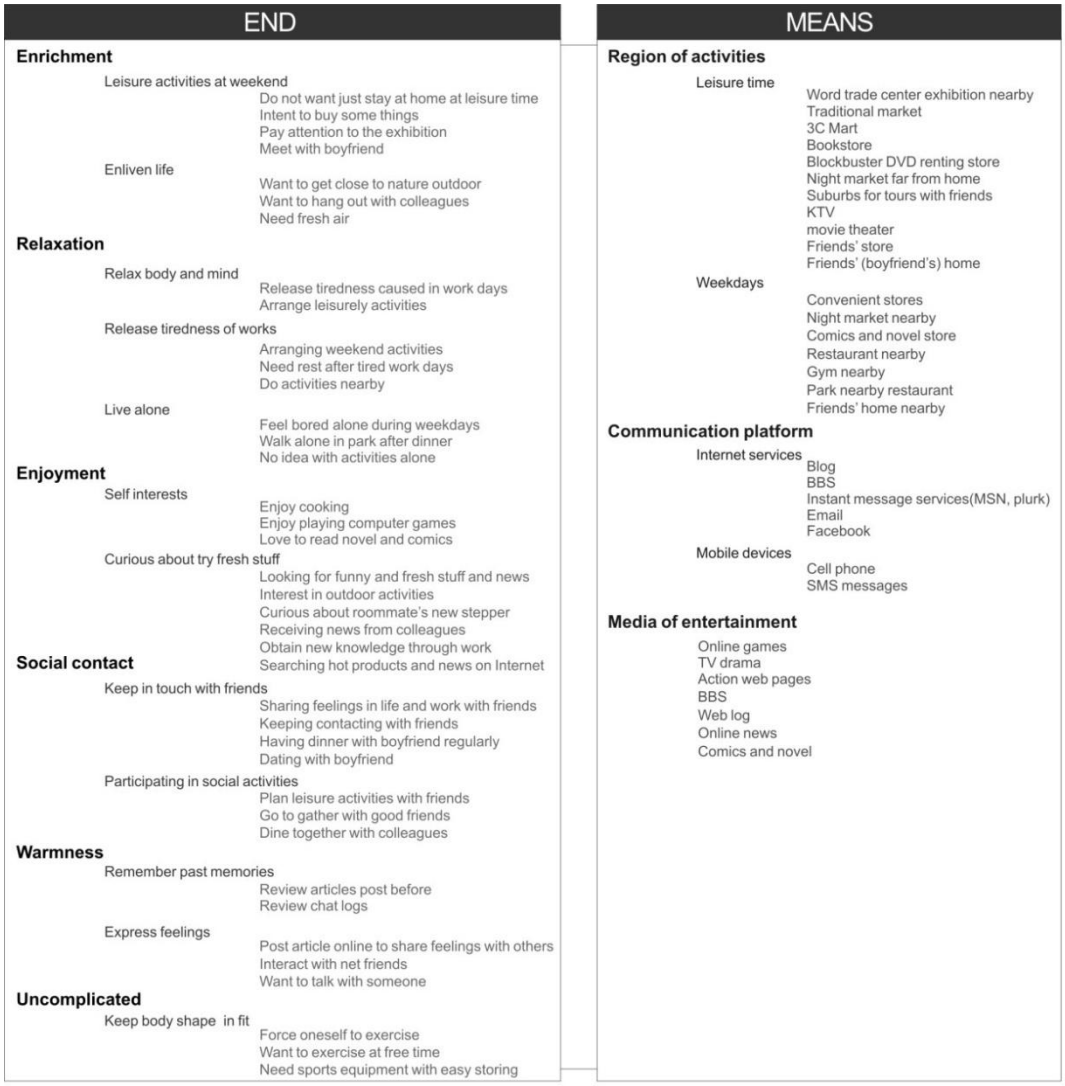


Fig. 4-1 Means-end analysis of participants' daily activities

Based on this means-end analysis framework result, the process of sorting and grouping proposes the affinity diagram of participants' values from lists of end. The affinity diagram consolidates participants' purpose in lives and finally group in six sorts of values which are shown as the left entries in Fig. 4-1.

4.1.2. Six values from participants' life style on affinity diagram

Though the analysis approach of affinity diagram, it is appropriate to process large amounts user data. It is utilizing for building the relationship and further sorting to conclude the clarified values in user studies. Since the possible influenced participants provide their attributes varied from works, contacts, and hobbies in diaries and interviews, values within their lifestyle are reflected in six categories on the affinity diagram result of end in Fig 4-2. Also on the figure, the breakdowns of participating in cycling related activities are marked with blue on the corresponding purposes through the questions about activity frustrations in interviews (Table 3-4).

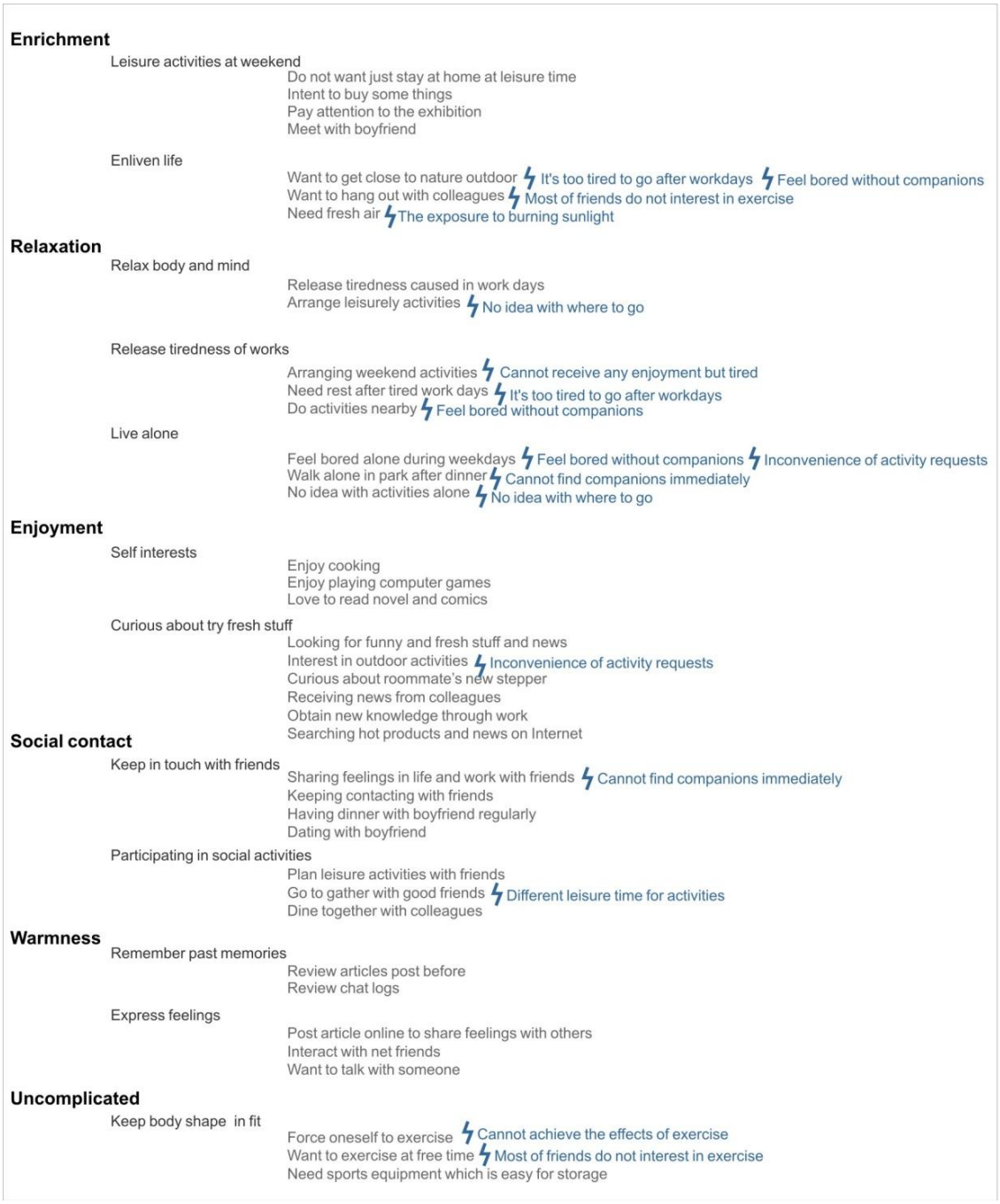


Fig. 4-2 Affinity diagram of participants' values reflected from their lifestyle
(Blue marks represent the frustrations toward activities)

The six values, *uncomplicated*, *relaxation*, *enrichment*, *enjoyment*, *social contact,* and *warmness* are shown and explained as below:

Uncomplicated and relaxation

The activities are chosen by our participants depends on their work hours mostly. *Uncomplicated* and *relaxation* are the two values which usually caused from their tiredness in works. For relieving the

tiredness or pressure at work, they would like to choose the indoor activities or walk nearby rather than outdoor activities. Activities with slow pace and carefree are appreciated in their leisure time. However, the study results also reflect the desire for outdoor activities at weekend after the sealed and exhausted indoor work days. Although the participants are exhausted and tired after weekdays with works, they still would like to go outside for breathing fresh air and close to nature after the rest.

(Participant C)

"After the work days for a week, I don't want to go anywhere but stay home. No matter do what, I can sleep, watch TV, or just lie on the chair at the precious weekend. "

"I need to breathe some fresh air at weekend outdoor out of my workdays at weekend. But I prefer to go suburbs without long distances of movement in my limited leisure time."

Enrichment and enjoyment

On the other hand, the values *enrichment* is extracted by participants' desires of hobbies. They usually behave in the activities which are interested frequently during their weekday. What they interested provide rich incentives to look for something new periodically and motivate them to learn more and deeply while the behaviors provide them *enjoyment* out of work. Influenced by media and social interactions in their daily lives, the information they received prompt them to pursue more related knowledge and stuff.

(Participant A)

"Since I am curious of all of new stuff, I like to look around and see the stuff of new arrivals in 3C stores or market at weekend even I seldom buy them."

"After my roommate bought a new stepper and put it in our living room, I was interested in it so I search some information through Internet"

(Participant B)

"Don't you know the hot exercise device, X-bike? It's really hot recently on PPT. There are lots of Net friends buy together on BBS. I am interested in it and want to buy one since It is especially attractive for me to exercise and using laptop or watching TV at the same time."

Social contact and Warmness

By consolidating participants' daily activities through means-end analysis, *social contact* is the value which existed variedly in dimensions. Firstly, the targets they interact with dominate their desires of activities. In other words, the priority of behaviors is influenced by their boyfriends, good friends, or classmates who they care about for staying in touch. The interactions also produce the routine behaviors. Besides, the

participants need to share their current situations and expect others' feedback, which reflects the existence of *warmness*. Those participants are used to engage in consistent contact patterns for social interaction and sharing.

(Participant A)

"I am used to chat to my best friends for almost 2 to 3 hours every time to share our lives."

(Participant B)

"I would like to use MSN to chat with my friends online or looking for someone to go out together on the bored weekend."

4.1.3. Summary

Through the studies of females without cycling activities, the results reflect the lifestyle, expectations and frustrations in cycling activities. According to these results, the means-end analysis and affinity diagrams represented with values are purposed for comparisons and discussions with other findings in another user study group which will be proposed in the following chapters.

4.2. Results of female cycling participants

Through the user study process with role model female cycling participants, the feelings and experiences of cycling behaviors are provided. Through questionnaires, we recruit the participants with cycling activities at least once per month and maintain for more than one year. User study results are collected with probe records and following interviews. In analysis stage, the results are working up with three main processes, cycling sequence mode, attributes, consequences and values of cycling activities, and the persuasive features with great influences throughout user study results. Since our purpose is figure out the persuasion strategies from those existing success experiences on female cyclists, the aim of analysis is focused on clarifying resources and evidences to support the persuasive technologies design.

4.2.1. Sequence model of cycling activities

For clarifying the cycling activities, the construction of sequence model are proposed to clarify the intention, action, and trigger in each phase. Through the timeline records of cycling participation process

and the following interviews for details and omissions, the sequence model is built as below in Fig 4-5.

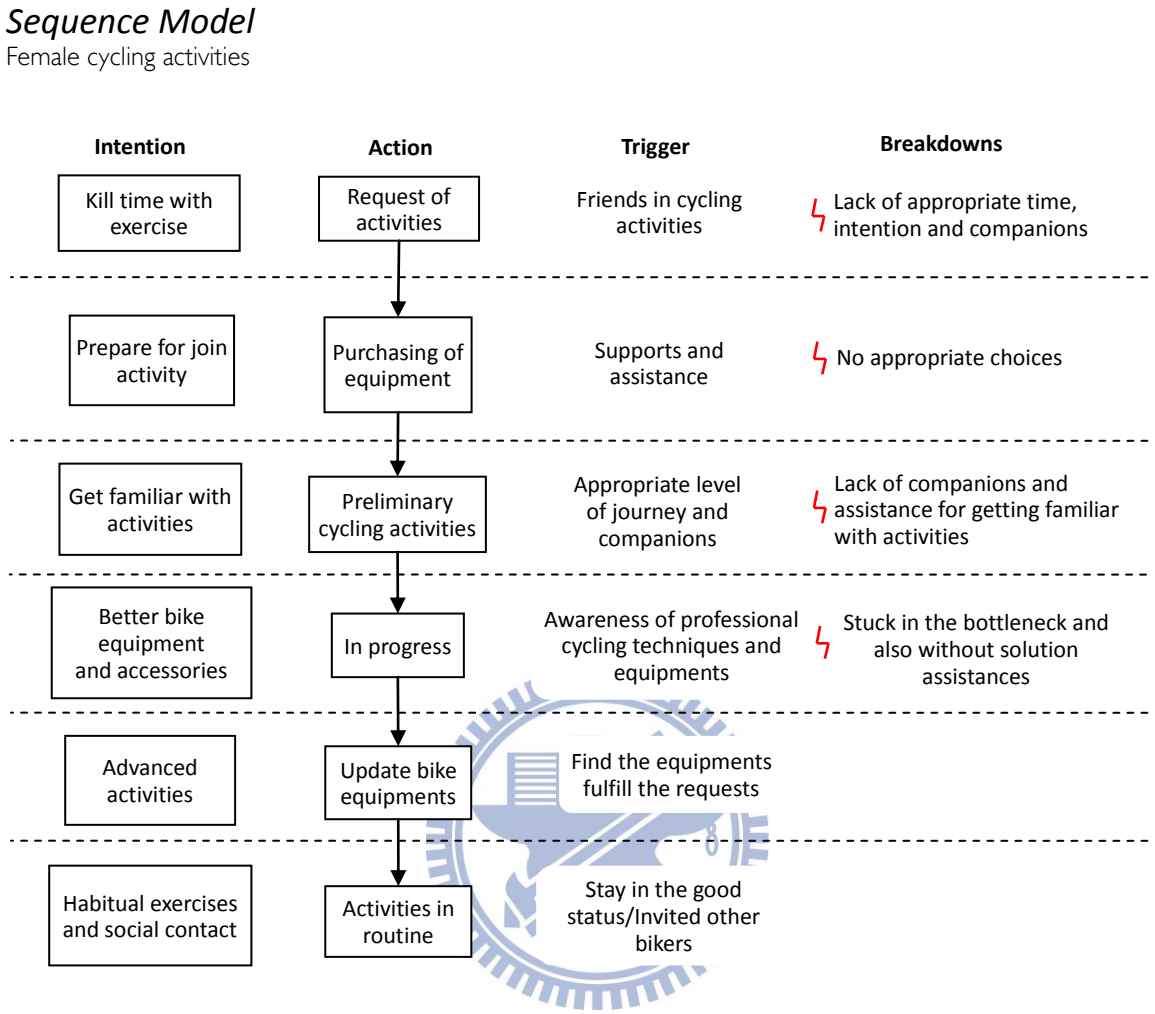


Fig. 4-3 Sequence model of female cycling participation

According to the participants' recording in diaries, the six phases of process with their event and actions of preparations in the sequence along cycling history are shown. Together with the following interviews, the questions based on each cycling event are extended for participants to express their experiences in memories. Triggers and intentions with actions in sequences are also asked to explain for providing their process to engage in cycling activities. In Fig 4-5, the participating intentions and triggers of action are simultaneous represented along the process of action in phases throughout a sequence. Besides, through the interviews, the breakdown marks with red flash icons on the right side of sequence model represent the problems during their participating cycling processes.

4.2.2. ACV results of cycling activities

Those participants, who have experienced for over than one year, have the different participation process and rich experiences in the cycling activities. The trigger, enjoyment, and other positive experiences within the participation are varied in participants' intention, personality, or activities. However, to look for the persuasive characters among the huge amount of user data, a systematic approach is essential to extract the attributes of target behaviors. Since cycling experiences are expressed together with attributes from female cyclist participants, the values behind consequences are asked in following questions within laddering interview process. For example, relaxation is the values reflected in consequence with "enliven life" and "ease body and mind", "close to nature", etc. Related attributes which cause those consequences are connected with consequences. Natural scenes and journey is one of the attributes in this example. Therefore, through applying means-end analysis, the values (V), consequences (C), and attributes (A) of cycling activities are extracted from user study results of the females who already participate in cycling. It provides the approach to propose core values, participation consequences and appreciated cycling attributes from those participants to conduct the strategies for following persuasive design developments.

First of all, the characteristics in dimensions of cycling experience results (consequence) and the causes (attribute) are constructed based on user study results from female cyclists' participation. Through the means-end analysis, fifty-two attributes and twenty-six consequences are extracted according to our cycling participants. For illustrating the relationships between attribute and consequence, the characteristics are arranged in the A-C matrix to manifest them into two dimensions with column and row. The twenty-six consequences are shown in column at the left and fifty-one attributes are shown in row at the top of matrix table. The unitary number of 1 are marked and represented as the existing of relation between each attribute and consequence (Table. 4-1).

Table 4-1 Consequence-attribute relationship matrix table

(The complete table is shown in Appendix C)

Consequence(26)\Attribute(51)	Movie about cycling/Others' cycling experience	Natural scenes and journey	Participate cycling under encouragement of friends	Another choice of exercise	Invited to join the Interesting journeys
Warm and Friendly			1		
Companionate			1		
Interactive					
Building Friendship			1		
Enjoyment in Journey		1			
Making Steady Progress					1
Ease Body and Mind					
New Experience		1		1	
Enliven The Life		1		1	
Explore The Unknown		1			
Simple Activity					
Ability Proving	1				
Explore and Challenge	1			1	1
Be Invited			1		
Reward					
Incentive					
Without Prepare				1	
Directive or Guiding			1		
Support and Assistance					
Professional Advice					
Close to Nature		1			
Increase Personal Qualities					
Bonus					
Achievable	1				
Encouraging			1		
Opportunity for Start	1		1	1	

Meanwhile, the participants' values which behind the consequences and proposed through interviews from our participants. According to the attributes which connect to the consequences, there are twelve values are extracted from the consequences in female cycling activities and also constructed in a matrix through means-end analysis. The twenty-six consequences are shown in column at the left and twelve values are shown in raw at the top of matrix table. The unitary number of 1 are marked and represented as the existing of relation between each consequence and values (Table. 4-2).

Table 4-2 Values-consequence relationship matrix table

(The complete table is shown in Appendix C)

Consequence(26)\Values(12)	Warmness	Social contact	Enjoyment	Enrichment	Growing up	Reliable
Warm and Friendly			1	1		
Companionate		1	1	1	1	
Interactive	1		1	1		
Building Friendship		1	1	1	1	
Enjoyment in Journey			1			
Making Steady Progress			1			
Ease Body and Mind			1			
New Experience				1	1	
Enliven The Life				1	1	
Explore The Unknown				1	1	
Simple Activity				1		
Ability Proving				1		
Explore and Challenge						
Be Invited						1
Reward					1	1
Incentive	1					1
Without Prepare		1				1
Directive or Guiding	1					
Support and Assistance						1
Professional Advice		1		1	1	1
Close to Nature	1	1				
Increase Personal Qualities				1	1	
Bonus		1				
Achievable						
Encouraging				1	1	1
Opportunity for Start	1		1		1	

In sum, the cycling experiences are characterized as attribute, consequence, and values three related dimensions and arranged in the two matrices to illustrate each relationship.

4.2.3. The relationship between cycling characters and persuasion

Since the appreciated attributes and corresponding consequences of cycling are extracted through means-end analysis in table 4-1, the results represent the characters of cycling which attract our user study participants to join in cycling activities. For undertaking the task to extract the persuasive features from attributes in cycling, the experts are asked to weigh the most utilized of persuasive features with three levels of score in the geometric ratio order 9, 3, 1 in each attributes throughout a focus group. Fig. 4-4 diagrams the connection of weight between each attribute and persuasive feature. It will be represented as a relationship matrix for interpreting and further calculation.

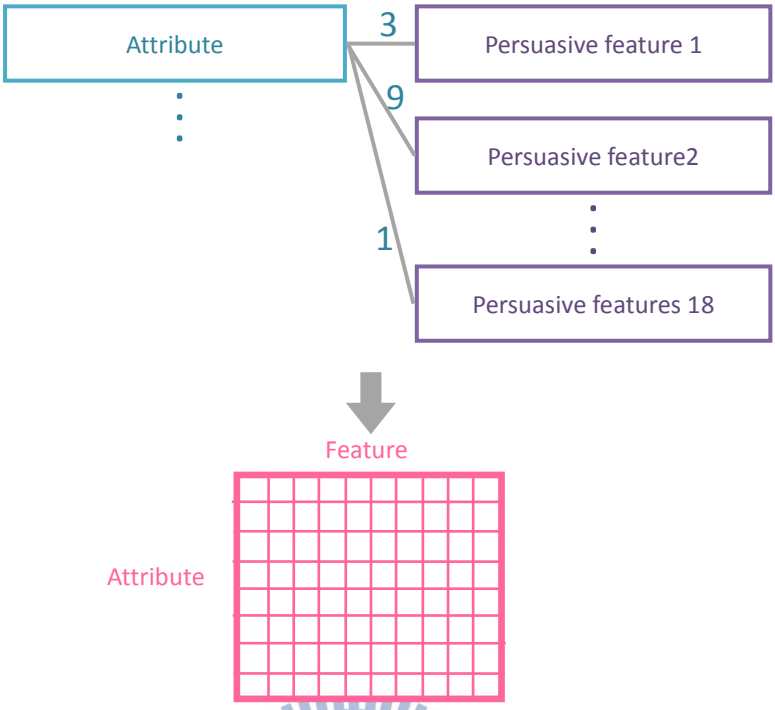


Fig. 4-4 The connections with different weight between each attribute and persuasive feature

In table 4-3, twenty-eight persuasive features are shown in the column of left table while the attributes are shown as the row at top of table. According to scores results, we sum up them, weigh and calculate their proportions of persuasive feature and category shown at the right column of table. Therefore, the persuasive features are identified in each cycling attribute with different proportion of weight. The persuasive feature with larger proportion of weight plays an influential role and therefore seems as the influential role for persuading female participating in cycling. Therefore, the cycling attributes which give influences with persuasion and the corresponding persuasive features are identifiable.

Table 4-3 Persuasive features-attributes relationship matrix table and weight of persuasive feature
(The complete table is shown in Appendix C)

Persuasive features(28)\Attributes(51)	Movie about cycling/Others' cycling experience	Natural scenes and journey	Participate cycling under encouragement of friends	Another choice of exercise	≈	Invited to join the Interesting journeys	Total weight of each feature(%)	Total weight of each category(%)
Reduction							5.8%	Primary task support 48.7%
Tunneling	1						9.0%	
Tailoring				9			17.9%	
Personalization							0.9%	
Self-monitoring						9	4.1%	
Simulation	3	1		3			3.5%	
Rehearsal						3	7.5%	
Praise							4.3%	Dialogue Support 28.9%
Rewards		3					2.7%	
Reminders			1				0.2%	
Suggestions			3	1			4.7%	
Similarity							2.3%	
Liking		9					2.9%	
Social role							11.8%	
Trustworthiness							0.0%	System credibility 0.5%
Expertise							0.0%	
Surface credibility							0.5%	
Real-world feel							0.0%	
Authority							0.0%	
Third-party endorsement							0.0%	
Verifiability							0.0%	
Social learning	9						6.1%	Social Support 22.0%
Social comparison							1.4%	
Normative influence			9				5.3%	
Social facilitation							1.5%	
Cooperation							5.2%	
Competition							0.0%	
Recognition							2.4%	

On the other hand, based on the persuasive features versus attribute matrix result, persuasion of consequences are also proposed for identifying the appreciated participation experiences of cycling influenced by persuasive features for developing persuasive design. The approach of multiplying the persuasive feature-attribute matrix (table 4-3) by the attribute-consequence matrix (table 4-1) conducts the persuasive feature-consequence matrix for interpreting the appreciated consequence with persuasion in table 4-4.

Table 4-4 Persuasive features-consequence relationship matrix with scores
(The complete table is shown in Appendix C)

Persuasive features(28) /Consequence(26)	Reduction	Tunneling	Tailoring	Personalization	Self-monitoring	Simulation	Rehearsal	Praise	Recognition
Warm and Friendly	0	9	0	0	0	0	0	18	3
Companionate	0	10	0	0	0	0	0	9	3
Interactive	10	25	12	0	0	1	1	27	7
Building Friendship	9	1	12	0	0	0	0	0	4
Enjoyment in Journey	0	19	20	3	0	13	18	9	4
Making Steady Progress	0	13	39	0	24	1	16	18	2
Ease Body and Mind	0	0	14	0	0	3	24	0	0
New Experience	0	10	30	0	0	4	3	0	0
Enliven The Life	9	10	66	3	3	16	30	0	0
Explore The Unknown	9	1	27	0	6	1	3	0	0
Simple Activity	27	9	12	0	3	0	3	0	0
Ability Proving	0	2	39	3	15	6	12	0	0
Explore and Challenge	0	13	54	0	18	6	6	0	0
Be Invited	18	0	12	0	0	0	3	0	1
Reward	0	9	6	3	0	3	21	9	1
Incentive	0	0	0	0	0	0	0	28	12
Without Prepare	27	9	21	0	3	3	3	0	0
Directive or Guiding	19	38	19	3	3	0	4	0	0
Support and Assistance	29	20	12	0	0	0	4	0	2
Professional Advice	11	28	12	0	0	1	1	0	1
Close to Nature	9	10	41	3	0	4	15	0	0
Increase Personal Qualities	0	0	3	0	0	0	0	10	10
Bonus	0	1	23	0	0	3	24	10	13
Achievable	29	24	22	3	3	6	6	0	0
Encouraging	0	0	0	0	0	0	0	27	3
Opportunity for Start	10	5	9	0	0	6	3	0	1
Proportion of weight in each feature (%)	6.4%	7.3%	15.6%	0.6%	2.3%	2.3%	7.1%	7.7%	3.3%
Proportion of weight in each category (%)							41.7%		24.9%

The twenty-six consequences are shown in the left column and the twenty-eight persuasive features are shown at the top of row in table 4-4. Through summing up the scores of each persuasive feature in column, the proportion results are calculated for representing weight of each feature among total twenty-eight features. Since the matrix with unitary number of 1 represented as the relation between each attribute and consequence do not include weight, the multiplying by the matrix of weighed results of attribute with persuasive features conduct the percentage of weight. Therefore, it is considered the results of feature with larger percentage of weight represent as influential persuasive features.

In sum, these results express the consequence through utilizing persuasion features in cycling activities. Since the appreciated consequences are proposed, to develop a persuasive design, it is help for identifying the effects as design goals to focus on with the identified persuasive features for imitating. The persuasive feature with larger proportion of weight plays an influential role and therefore seems as the influential role for persuading female participating in cycling.

4.2.4. Different attributes in three cycling participation phases

With the sequences model of female cycling activities in Fig. 4-5, we found the participating process is delivered in several phases. To arrange the cycling actions in varied phases, there are exist theories of behavior chain to use for comparing and understanding the persuasion (Khaslavsky and Shedroff, 1999; Fogg, 2007). According to our study results, the attributes of ACV results are divided into three phrases: *preliminary participate*, *gradual involvement*, and *habitual activities*. In addition to interpret the persuasive feature results comprehensively, here is another perspective to suggest implications in different phases. With totally fifty-one cycling attributes, there are ten assigned in preliminary phase, thirty in gradual involvement phase, and twelve in habitual activities for there are some attributes assigned repeatedly.

Persuasion for preliminary participate phase

In preliminary participate phase, there are ten appreciated attributes in connection with the attractions, encouragements, arrangement of activities, and the guide to inspire participants to join cycling presented by studying participants in their previous cycling experiences. The ten attributes are listed with corresponding three different grades toward persuasive feature and shown in table 4-5.

Table 4-5 Attribute-persuasive feature relationship matrix with scores in preliminary participate phase (The complete table is shown in Appendix C)

Attribute(10)/Persuasive feature(28)	Reduction	Tunneling	Tailoring	Personalization	Self-monitoring	Simulation	Recognition
Movie about cycling/Others' cycling experience		1				3	
Natural scenes and journey						1	
Participate cycling under encouragement of friends							
Another choice of exercise			9			3	
Participate without most of preparation	9						
The real situation of journey is not explicit before the activity							
Assistance and advices of purchasing cycling equipments	1	3					
Checking and adjusting equipment with assistance	9	3					
Reminder of operation and technique with cycling		1					
Invited to join the Interesting journeys							

Gradual involvement

After the preliminary stage to get familiar with activities, the female participants' hesitations and anxieties about cycling are released through the assistance resources. Follow on the understanding and familiarity of cycling, they are provided with new experiences to encourage participation from involving in activities. In this phase, participants receive lots of firsthand discoveries and feels beyond the preliminary recognitions through participating in practices. Consisted with most appreciated enjoyment of the cycling attributes, there are thirty lists in this phase in table 4-6.

Table 4-6 Persuasive features-attribute relationship matrix with scores in gradual involvement phase

(The complete table is shown in Appendix C)

Attribute(30)/Persuasive feature(28)	Reduction	Tunneling	Tailoring	Personalization	Self-monitoring	Simulation	Recognition
New experience different with daily lives		1	9				
Enjoyment throughout natural journey			1			3	
Encouragement during the difficult journey							1
Full of vitality after exercises			1				
Experiences of riding together							
Routes, landmark and map of journey		9					
Timing for interacting with other riders							1
Activity option in leisure time	9		3				
Receive encouragement from passerby or other cyclists							1
Positive assessment of riding skill from experienced riders							1
Strong endurance and strength for riding from other cyclists						3	
Desired goals throughout journeys		9	1	3			
Outdoor activity helps for releasing stress caused in workdays in nature			9				
Receiving encouragement even with little progress							1
Stop for take break according to personal physical status			9		3		
Friends which overcome difficulties in preliminary journeys together		1					
Practical riding experiences at the beginning for adapting to following cycling			3				
Tutorial and suggestion for riding throughout activity		3					
Guiding and waiting in journey		9					
Appropriate options of equipment in function or look			9	3			
Suggestions for cyclist's own experiences, ability and needs			9				
Assistance for solving problems or frustrations in cycling			3				
Practical demonstrations of riding skill and techniques		9				1	
Maintenance and supports for riding	1						
Invited to join the Interesting journeys							
Ubiquitous and convenient stop site for rest and supply	9						
Memories and interactions together with cyclists in activity							1
Riding with cyclists in the same level of ability							
Sharing from cyclists enthused in cycling		9					
Another choice of exercise			3				

Habitual activities

In the habitual activities phase, participations of cycling are presented as a habit which is already included in their daily life. Since they are satisfied and pleased in the activities and have the specific group of bikers to join with, they participate in cycling regularly as one of their hobbies. Our participants look cycling as an exercise, an outing, a date with friends, or social exchanges. Significantly, the exploration of challenges, enjoyment with friend and perceptions throughout nature in processes of activity are the primary characters and regarded as the most appreciated in this phase. There are twelve attributes assigned in this phase in table 4-7.

Table 4-7 Persuasive features-attribute relationship matrix with scores in habitual activity phase
(The complete table is shown in Appendix C)

Attribute(12)/Persuasive feature(28)	Reduction	Tunneling	Tailoring	Personalization	Self-monitoring	Simulation	Recognition
Show with an extra specialty							9
New route or goal without previous experience			9				
Full of vitality after exercises			3				
Image records of memorable journeys						9	
Advanced cycling activity			9		3		
Purchasing new bike or upgrade			9				
Training based on accumulated ability and experiences					9		
Level and speed progressed from simple to advance		1	9		3		
Flexible timing for participation			9				
Recruit someone else to join the activity together							1
Control and adjustment of heart beat and speed status					9		
Enjoyment throughout natural journey			1			3	

4.2.5. Values in female cycling participants

To interpret the *values* of female cyclist in our user study, firstly, the twelve values are listed with rank according to the percentage which is calculated through summing up their each weight and scale with others in table 4-8.

Table 4-8 The cyclists' values corresponded to consequence in the rank of weight

(The complete table is shown in Appendix C)

Consequence(26)/Values(12)	Enrichment	Growing up	Carefree	Relaxation	Enjoyment	Self confidence
Warm and Friendly	1				1	
Companionate	1	1		1	1	
Interactive	1				1	
Building Friendship	1	1		1	1	
Enjoyment in Journey				1	1	
Making Steady Progress					1	
Ease Body and Mind				1	1	
New Experience	1	1				
Enliven The Life	1	1	1			
Explore The Unknown	1	1				1
Simple Activity	1					1
Ability Proving	1					1
Explore and Challenge			1	1		
Be Invited			1	1		
Reward		1	1			
Incentive			1	1		
Without Prepare						
Directive or Guiding			1			
Support and Assistance			1	1		
Professional Advice	1	1				
Close to Nature						
Increase Personal Qualities	1	1				1
Bonus			1			
Achievable			1			
Encouraging	1	1				
Opportunity for Start		1			1	1
Sum of each values	12	10	9	8	8	5
Weight of each values(%)	13.6%	11.4%	10.2%	9.1%	9.1%	5.7%

With the weight more than average, *enrichment*, *grow up, carefree, enjoyment, and relaxation* are five core values referred in female cycling activities by our participants. To interpret the values in detail, the top four core values are discussed with evidences from user studies are shown as following.

Enrichment

The cycling activities provide some extra experiences beyond their daily activities. The bikers' interactions in cycling induce participants the opportunities to know others and get familiar with their friends. Even the praises and encouragements received from passerby in activities. Besides, the achievement of cycling is an extra bonus of their characteristics. For the participants, the cycling is another world different from their daily life in different activities, people, and environment. In short, cycling activities give them another aspect toward their regular lives.

(Participant D)

"There are little interactions of cycling activities and my workdays. However, the cycling activities provide the opportunities to discover a new experience."

(Participant E)

"I never think about that I would participate in cycling because I felt that it's a activity that work hard but get little gain…however, I participated in the long ride invited by my best friend at one weekend…on the road, I saw the old men work in the farm and early young people got up for work in early morning. I thought if I was in Taipei, I must still sleep at the time.

Growing up

From the easiest ride to the more difficult one, the female participants stage by stage. Through the participation, the progresses of ability and accomplishment motivate they participate regularly. The endless explorations of activities provide the participants lots of interests and new experiences. Through the activities, others' accompanying and encouragement always give me lots of energy to move on.

(Participant D)

"After the 2-3 cycling participations, other bikers invited me to try a harder route…. Even it was the hard one I had never try before, I got the confidences that I can do that after the experience! It also impacted me on paying more attention to participate in cycling activities…For advances of cycling, I changed my bike to the racing one."

Relaxation

The feature of activity to expose participants to nature produces the enjoyments different from the indoor workdays. For the participants, cycling activities provides a great way of approach with nature on weekends. Besides the beautiful scenes and the feel of facing the wind in the ride, the vitality after exercises and sweating releases the tiredness and pressure through the activities.

(Participant F)

"After every ride of cycling, I feel good. I don't know the reason actually, but I've heard there are positive chemical factors releasing after exercising. I feel it in the same way. "

Carefree

It's the value especially related to the issues most female care about. For female seem lack of physical strength toward long and difficult rides and inability toward techniques of hardware, the doubt of enduring the strenuous exercise, exposed to sunlight, and unfamiliar with bike hardware are generally

considered. However, the cycling guidance and support persuade them to participate in. Three participants rode with experienced biker to overcome the unfamiliar cycling at the beginning of activities. Moreover, the receiving of warmness and ease in cycling are provided from the invitation of their friends or companions in their journeys. Therefore, they do not have to worry about the hardware or difficulties on the threshold.

(Participant E)

"All I need to do was following my friends. Since they rode the route many times, I don't have to prepare or understand the route before the journey…Since I was too tired to ride, I stopped for the rest. After the revived of physical strength, I started the continued route again…My friend rode at the front to just keep their journey but they waited for us during the rests."

In sum, the results of attribute, consequence, and values of characters are extracted from the female cyclists' appreciated cycling experiences through means-end analysis. We conduct the *values* of them with cycling upon the evidences upon the user study. The results provide designers the understanding of useful directions to apply in developing persuasive systems. However, the practical approaches can be reflected through building the relationship with persuasion features which is discussed in the following chapter.

Chapter 5
Research discussions

In the previous chapters, through the studies from two groups of user with both potential influenced targets and role model participants, findings within their behaviors are delivered. After that, contributions to persuasion strategies for female cycling are brought up for discussion in this chapter. Since the research aim is to apply the user study process to derive strategies to guide the development of female cycling persuasive system, varied persuasion strategies are proposed in different aspects through comparisons and discussions in this chapter.

The persuasion strategies are defined as the proposed persuasive features with corresponding cycling consequences and values through the interview results from female cycling participants. Through our research, the ACV results are constructed based on cycling participation. Since the consequences are extracted from the existed appreciated experiences with attributes, to propose persuasion for developing design strategies, the persuasive features are extracted from each cycling attribute. After that, the relationships of persuasive feature, consequence, and values are constructed as chains for persuasion strategies.

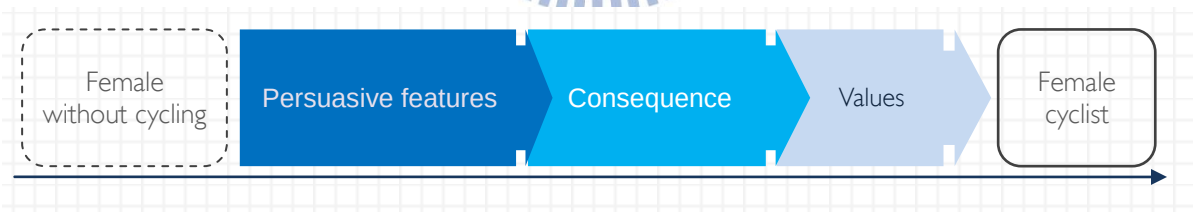


Fig. 5-1 Diagram of persuasion strategy

In chapter 5-1, the persuasive strategies are purposed and discussed based on the female cycling participants' experiences with ACV results and the corresponding persuasive features. The comprehensive and phased interpretations are discovered to represent different perspective of persuasion strategies. In 5-2, the values between female cyclists and female without cycling activities are compared to suggest an influence process through applying identical values to make female to participate in cycling easier. Finally, in 5-3, we propose the problematic sequence model to indicate breakdowns of female participants in cycling. The persuasive strategies are proposed for utilized to overcome those specific frustrations. The three different perspectives of discussion are delivered with

persuasion strategy for applications and employment practically (Fig 5-2).

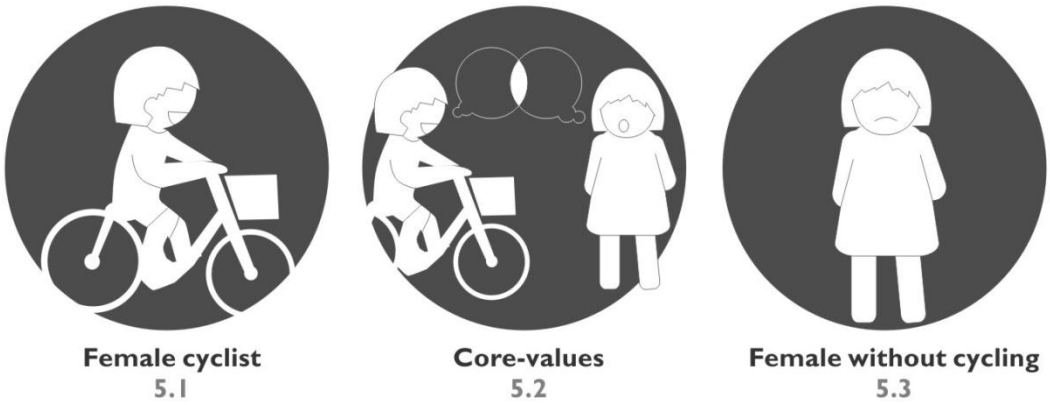


Fig. 5-2 Three different perspectives of persuasion strategy for female cycling discussed in chapter five

5.1. Persuasion strategies from female cycling participation

Through the user studies of female cycling participants' results, the persuasive features are proposed with the consequences during their activities. In other words, we proposed those persuasion strategies from the perspective of female cycling participants. Their positive cycling experiences set examples and also provide great resources for increasing persuasion through fulfill the needs and help them access those desirable consequences within the female cycling participation. Therefore, the persuasive features extracted from female cycling participations are proposed as persuasion strategies.

The persuasion strategies are proposed through comparison the two groups of user study results from different participants. For imitating the success cycling experiences, firstly, persuasion strategies are proposed with overall and results in three participating phases. Based on the perspective of interpretation, the strategies results can be employed in different design scope. Besides, the persuasion issues for considering are reflected through comparing different values between group of role model and potential influenced participants. Finally, according to the perspective of female who do not participate in cycling, the persuasion issues of cycling activity for focusing are considered together since the goal of this research is helping the development of persuasive technologies

5.1.1. The influential persuasive features for female cycling comprehensively

Results in the cycling female participants' experiences, firstly, we proposed a general persuasion strategies for employing the evaluations or plans of persuasive systems. Inspecting the overall cycling persuasive features weight results in four categories, "*primary task support*" includes most powerful features with 43.7%. The influential persuasive features in this category are (3) **tailoring** (16.2%), (2) **tunneling** (8.5%), (7) **rehearsal** (6.4%), and (1) **reduction** (6.9%). Besides, category of "*dialogue support" (31.4%)* contains (14) **social role** (12.2%) and (8) **praise** (5.3%), which are also the influential persuasive features. (24) **Normative influence** (8.8%) and **cooperation** (6.3%) are the effective tools in category of "*social support*." In table 5-1, the distributions of twenty-eight persuasive features are weighted and calculated which demonstrate the eight influential persuasive features of female cycling for their weight higher than the average.

Table 5-1 The proportion of weight in persuasive feature (%)

Primary task support (43.7%)			Dialogue support (31.4%)			System credibility support (0.4%)			Social support (24.5%)		
1	Reduction	6.9	8	Praise	5.3	15	Trustworthiness	0	22	Social learning	4.4
2	Tunneling	8.5	9	Rewards	2.7	16	Expertise	0	23	Social comparison	1,2
3	Tailoring	16.2	10	Reminders	0.2	17	Surface credibility	0.4	24	Normative influence	8.8
4	Personalization	0.7	11	Suggestions	4.6	18	Real-world feel	0	25	Social facilitation	1.6
5	Self-monitoring	2.5	12	Similarity	2.7	19	Authority	0	26	Cooperation	6.3
6	Simulation	2.5	13	Liking	3.8	20	Third-party endorsement	0	27	Competition	0
7	Rehearsal	6.4	14	Social role	12.2	21	Verifiability	0	28	Recognition	2.1

Comparing with the persuasive feature-consequence relation result, the persuasion strategies are interpreted through persuasive features with consequence in appreciated cycling activities. The eight influential persuasive features cause by appreciated cycling consequences with higher persuasion scores are proposed and weighed among three categories. Since each of influential features is proposed with its component table of female cycling consequence, it can be conducted for persuasion strategies. In other words, the persuasion strategies are evidenced by components of consequence in each persuasive feature in table 5-2. Consequence components of eight influential persuasive features indicate the employment of strategy.

Table 5-2 The scores of persuasive feature corresponded with consequence

Consequence\persuasive feature	A Reduction	B Tunneling	C Tailoring	D Rehearsal	E Praise	F Social role	G Normative influence	H Cooperation
Warm and Friendly	0	9	0	0	18	15	18	0
Companionate	0	10	0	0	9	16	30	34
Interactive	10	25	12	1	27	57	3	28
Building Friendship	9	1	12	0	0	24	15	30
Enjoyment in Journey	0	19	20	18	9	3	3	18
Making Steady Progress	0	13	39	16	18	18	0	0
Ease Body and Mind	0	0	14	24	0	0	0	0
New Experience	0	10	30	3	0	0	9	0
Enliven The Life	9	10	66	30	0	0	12	0
Explore The Unknown	9	1	27	3	0	9	2	3
Simple Activity	27	9	12	3	0	1	11	3
Ability Proving	0	2	39	12	0	1	0	1
Explore and Challenge	0	13	54	6	0	9	18	3
Be Invited	18	0	12	3	0	9	31	0
Reward	0	9	6	21	9	3	0	9
Incentive	0	0	0	0	28	6	0	0
Without Prepare	27	9	21	3	0	1	20	3
Directive or Guiding	19	38	19	4	0	29	29	3
Support and Assistance	29	20	12	4	0	61	1	16
Professional Advice	11	28	12	1	0	45	0	0
Close to Nature	9	10	41	15	0	0	21	0
Increase Personal Qualities	0	0	3	0	10	3	0	0
Bonus	0	1	23	24	10	12	3	18
Achievable	29	24	22	6	0	29	11	6
Encouraging	0	0	0	0	27	9	9	9
Opportunity for Start	10	5	9	3	0	21	29	12
Sum of scores	216	266	505	200	165	381	275	196
Proportion of weight	6.9%	8.5%	16.2%	6.4%	5.3%	12.2%	8.8%	6.3%

A. Reduction: simplify the cycling preparation tasks in preliminary journeys

The reductions of complicated preparation works in preliminary participation are essential for those female participants. Through the interactive supports and assistances by friendly cyclists, they got help to access the equipments and get familiar with cycling journeys without lots of considerations or planning works. Along with a friendly assistant, female participants get their equipments without lots of preparation difficulties. Also, riding a simpler journey accompanied with experienced cyclists reduces considering or planning for journeys and helps their accesses. The reductions of cycling preparations tasks make activities achievable and motivate females get willing to join the activities.

(Participant D)

"One of my old friends, who is a senior cyclist, once heard I had interest in cycling on weekends and tend to buy a folding bike during our chatting. Then she took me to her familiar cycling shop to buy one and invited me to participate with her friends at that weekend…I think the start of my cycling was along her lead and process smoothly and rapidly."

(Participant E)

"In one weekend, my best friend and her boyfriend rode their bikes, stop downstairs of my home and call us for joining their cycling. Then we rode our bike and joined their journey to Shilin…All I need to do was following behind them and kept riding."

B. Tunneling: activity advices and goals lead progressive cycling journeys

The activity directive guiding of achievable journeys with goals in warm and friendly provides female participants to achieve cycling enjoyment and experience through unfamiliar nature journeys at the beginning. Along with experienced advices throughout journeys, achievable cycling activities can be process progressively without helpless frustrations of physical exhausted or unexpected difficulties for elementary participants. The interactive acts are also proposed for employing these guide or advices especially for female participants. Besides, incentive goals in cycling journeys should be also brought up for them to obtain. For example, it's proposed to encourage riding for achieving absorbing spots of hot springs, night views and natural landscape, or stop with coffee/tea, ice cream and other delicacies. The enjoyments throughout journeys are help to encourage preliminary cyclist progress to their destination step by step. In sum, directive guide assistant, profession riding advices and incentive goals throughout journeys are proposed to be interactive for both assistant and participants for persuading female cycling through *tunneling*.

(Participant E)

"All I need to do was following my friends. Since they rode the route many times, I don't have to prepare or understand the route before the journey…Since I was too tired to ride, I stopped for the rest. After the revived of physical strength, I started the continued route again…My friend rode at the front to just keep their journey but they waited for us during the rests."

"I was exhausted at my first journey…but they told me that we will stop at a coffee shop and take a rest over there. Therefore, I rode for the cake and finally I got the shop and enjoy my cake. After the rest, I was refilled with energy so I was able to continue the following journeys."

C. Tailoring: customization for providing the discoveries of natural experiences and fitting abilities

Tailoring is the most influential feature which also identified as "customization" and defined as "*Information provided by computing technology will be more persuasive if it is tailored to the individual's needs, interests, personality, usage context, or other factors relevant to the individual*" by Fogg (2003). According to the female cycling participants, cycling activities provide them an approach to enliven their lives. Different from their regular indoor workdays, the explorations of varied nature scenes in cycling journey provide

fresh experiences. Through cycling activities, participants acquire vitality and tangible natural experiences outdoor. The reinforcements of tangible natural expressions are fascinated persuasion strategies for female. According to our user study, the abundant natural beauties in Taiwan is suggested as great persuasion with providing of attractive stories with video or vivid pictures gives great motivations for participation. The movie "*Island Etude*" motivates participant F start her cycling activities with capturing scenes of east Taiwan and describing the aspiring story of cycling around Taiwan (Figure 5-3).

(Participant F)

"I started cycling for touching by the movie, Island etude. I appreciated of the fantastic natural scenes of Taiwan, and the story through cycling made I feel cool. After that, I decided to have cycling journeys if I have a chance. But the lines of "There are many things you would never do if you do not make it now" in movie left deep in my heart and motivated me set out to the preparation of cycling around our island. All I thought was that I have to ride around out island once in my life."

Fig. 5-3 Movie "*Island Etude*" motivates participant to start her cycling activities

In addition to natural experiences, the cycling activities with different purposes and levels fulfill various abilities and expectations. Start from easier journeys, female cyclists' ability and activities behave progressively through experiences. The explorations through endless and varied natural cycling journeys are fun and fresh with challenges to enliven their lives. Customized journeys with different abilities and expectations make female participants behave progressively with confidences in cycling.

(Participant D)

"After the 2-3 cycling participations, other bikers invited me to try a harder route…. Even it was the hard one I had never try before, I got the confidences that I can do that after the experience! It also impacted me on paying more attention to participate in cycling activities…For advances of cycling, I changed my bike to the racing one."

(Participant E)

"If I participated in the long distance cycling activities in the journey of Hualien at the beginning, I would never interest and engage in the activities."

D. Rehearsal: great experiences throughout cycling journeys

Through cycling journeys, the relaxation and enjoyment from natural vitality and tangible experiences reward female participants a lot. In addition, feelings of ease in participants' body and mind caused through exercise with cycling especially reward them. Therefore, rehearsal opportunities have to be proposed to persuade participants with receiving the enjoyment and vitality through activities.

(Participant F)

"After every ride of cycling, I feel good. I don't know the reason actually, but I've heard there are positive chemical factors releasing after exercising. I feel it in the same way. "

E. Praise: activities motivated by encouragement

Throughout cycling activities, others' admirations and encouragements provide participants lots of rewards as a dialogue support. Praise is a symbol of energy for cyclists. For the female participants, praise from other cyclists or unfamiliar passerby on road produce great encouragement especially during their tired and difficult journeys. It can be precious memories, motivate them to participate in following cycling and also makes them progress in activities.

(Participant D)

"The encouragements are very important for me. Other biker encouraged me that "you still have the ability. It's just about the less of practices" even when I was bad and couldn't follow others' pace."

(Participant F)

"There is one old man who is also a biker impressed me a lot. He praised me that "This journey is even difficult for male. You must be a superwoman to participate in cycling under the burning sunlight in such a hot weather" and motivate me a lot when I was in the tough journey."

F. Social role: dialogue with assistance, advice, and someone company

Social role of dialogue support is defined as *"if a system adopts a social role, users will more likely use it for persuasive purposes."* (Oinas-Kukkonen and Harjumaa, 2009); while reference from Fogg, social actor can be a doctor, teammate, opponent, teacher, pet, or guide. (Fogg, 2003) In our case, the social role can be defined as assistant, advisor and companions in female cycling. First of all, dialogue support with assistance for cycling, the role of reliable master worker and experienced cyclists are essential when

females are in the process of equipments purchase for participating cycling and learning riding techniques or skill throughout activities.

(Participant D)

"The experienced biker, who was also the employer search the appropriate bike and sold me, checked bike condition for me every time before our journey…Once I found both of my inner tube and the tire had puncture, I called the employer for helping me. After 20 minutes, he drove my bike and me downhill to his store for repairing."

"The encouragements are very important for me. Other biker encouraged me that "you still have the ability. It's just about the less of practices" even when I was bad and couldn't follow others' pace."

Secondly, advices with riding postures and equipment adjustment improve participants' abilities and involvements. The interactions with assistants and supporters help to explain or solve their difficulties for continuing following cycling.

(Participant E)

"In every cycling activity, I felt the uncomfortable of my waist over a distance of road but I don't know the reason. My boyfriend who rode behind of me checked my riding posture and helped me to adjust though the following journey."

Finally, gathering through publicizing on MSN or contacting with friends are proposed to assemble the cycling companions for starting participants' preliminary journeys in our studies. With someone companion, the encouragement or conversations with friendship and warmness in cycling are perceived by female cyclist. Warm supports are especially help for mitigating tiredness and sharing with pleasure and pains throughout journeys. Therefore, dialogues as companions with sharing or communicating among cyclists are essential throughout cycling journeys.

(Participant F)

"I still remember there was a postman gave me a flower after we encountered many times on the road. He was curious about my journey and then encouraged me that" GO! GO! Lady! You can do that!" with a flower and warmed me up at the beginning of journey to ride around Taiwan island.

In sum, since dialogue support as reliable assistant, professional advisor and warm companions are three essential persuasion strategies as social roles for female cycling. Approaches or content providers for giving dialogue support should be considered when developing persuasive design of female cycling.

G. Normative influence: social influences from cycling companions

Normative influence is defined as" a system can leverage normative influence or peer pressure to increase the likelihood that a person will adopt a target behavior" (Oinas-Kukkonen and Harjumaa, 2009) which means the in-group influences provide more pressure for persuasion as social support. In cycling activities, the invitations from other cyclists or friends are hard to decline for females participants. It's easier to be motivated to participate in more difficult or advanced journeys under the others' encouragement and participating of activities. The peer pressures prompt cyclist to take actions through the pull with others with encouragements or group activities. Therefore, it applied as social support persuasion strategy to set up a group of avatar or access approaches to recognize others' activities or encouragement in developing persuasive system.

(Participant E)

"I own bikes for more than one year but I didn't ride once. In one weekend, my best friend and her boyfriend rode their bikes, stop downstairs of my home and call us for joining them… I thought it was also an opportunities to get along with her instead of going shopping or restaurants."

H. Cooperation: motivated from co-work experiences in cycling

Similar to companion, cooperation propose participants access achievement from co-activities. The interactions of support and co-work experiences reflected cooperation in cycling activities. Throughout cycling journeys, participants stand together and encourage each others to continue in the times under difficult journeys. The experiences of sharing with pleasure and pains are especially impressed for cyclists. The togetherness not only gives participants impressions but motivate them for join activities with their companies.

(Participant D)

"…at the middle section of journey in competition, I was exhausted and feel it is out of my ability. However, one of my familiar faces appeared who was one of my team members. We rode together, help and encouraged each other to keep our riding for the rest of journey to till the end. It was impressed me with the experiences of sharing pain and pleasure. The friendship built through the journeys was especially precious for me."

In conclusion, in addition to the eight influential persuasive features, there other persuasive features with less weight are also related with female cycling consequence. The persuasive features which share with heavier weight over than the average should be considered to applying for strategies. To apply in practice, the top influential persuasive features with heavy weight of consideration in cycling experiences

are suggested to integrated utilize for system evaluation or development. In sum, these persuasive features for cycling activities are proposed based on the overall research results. The results are applicable for evaluating or planning overall strategies of persuading females to join cycling activities.

5.1.2. Strategies change among cycling participation phases

Upon the sequence model of cycling participation, it demonstrates that cycling activities are processed successively in several action phases from preliminary activities in leisure time, updated journeys to advanced cycling habitually according to cycling attributes. Table 5-3 demonstrates the different weight of twenty-eight persuasive features in three phases.

Table 5-3 The proportion of twenty-eight persuasive features in three cycling phases (%)

Persuasive features	Preliminary participate	Gradual involvement	Habitual activities
Reduction	15.0%	5.6%	0.0%
Tunneling	4.6%	12.3%	0.7%
Tailoring	6.0%	13.1%	37.7%
Personalization	0.0%	1.1%	0.0%
Self-monitoring	0.0%	0.8%	10.6%
Simulation	4.2%	1.5%	6.0%
Rehearsal	3.2%	6.6%	18.1%
Praise	0.0%	8.8%	0.5%
Rewards	2.0%	3.3%	1.5%
Reminders	0.9%	0.0%	0.0%
Suggestions	8.8%	3.3%	2.5%
Similarity	7.2%	1.6%	0.0%
Liking	9.9%	2.3%	0.0%
Social role	11.3%	16.0%	0.0%
Trustworthiness	0.0%	0.0%	0.0%
Expertise	0.0%	0.0%	0.0%
Surface credibility	0.0%	0.7%	0.0%
Real-world feel	0.0%	0.0%	0.0%
Authority	0.0%	0.0%	0.0%
Third-party endorsement	0.0%	0.0%	0.0%
Verifiability	0.0%	0.0%	0.0%
Social learning	4.8%	5.0%	1.5%
Social comparison	0.0%	2.0%	0.0%
Normative influence	22.1%	4.4%	4.5%
Social facilitation	0.0%	1.6%	3.5%
Cooperation	0.0%	8.2%	7.5%
Competition	0.0%	0.0%	0.0%
Recognition	0.0%	1.9%	5.4%
Total	100.0%	100.0%	100.0%

Through inspecting the results differences among three phases, the weight of each persuasive feature is truly changed from phase to phase in female cycling. Each persuasive feature properties are reflected upon its consequences. From the weight result of twenty-eight persuasive features in each cycling phase, there are five trends of change are observed and proposed in following interpretations as table 5-4.

Table 5-4 Five trends of persuasive feature weight changing among three cycling phases

Type	Trend among three phases	Description
A		Persuasive features successive employed increasingly along phases
B		Persuasive features successive employed decreasingly along phases
C		Persuasive features successive employed equally along phases
D		Persuasive features employed concavely along phases
E		Persuasive features employed convexly along phases

Through each interpretation of table, it demonstrates that the influences of each persuasive feature in three phases are differently from the consequences with their percentage. The percentage of weight shows influences of persuasive feature upon consequences are varied from each phase. Since the persuasion scores of consequences are different in each phase, for measuring the influences of each persuasive feature, persuasive features versus consequences table are divided in three phases based on in order to interpret their influences in each phase.

A. Persuasive features successive employed increasingly along phases

Under this trend, weight of persuasive features is general increasing from the first to the third phase. From preliminary participate phase, most the weight of these features are little, but they increase to greater ones till habitual activities phase to phase. For example, the weight proportion of persuasive feature are successive increasing from the first to the third phase typically shown in *tailoring* from 6%, 13.1% to 37.7% in table 5-5.

Table 5-5 Consequence components of *tailoring* with scores change along three phases

Consequence of Tailoring in each phase	Preliminary participate	Gradual involvement	Habitual activities
Average weight	6%	13.1%	37.7%
Warm and Friendly	0	0	0
Companionate	0	0	0
Interactive acts	0	12	0
Building Friendship	0	3	9
Enjoyment in Journey	0	20	1
Making Steady Progress	0	3	36
Ease Body and Mind	0	11	4
New Experience	9	12	9
Enliven The Life	9	27	31
Explore The Unknown	0	9	18
Simple Activity	0	12	0
Ability Proving	0	12	27
Explore and Challenge	**9**	**18**	**27**
Be Invited	0	3	9
Get incentives	0	3	4
Receive others' praises	0	0	0
Without Preparation	9	12	0
Directive guiding	0	1	18
Support and Assistance	0	12	0
Professional Advice	0	12	0
Close to Nature	0	23	19
Increase Personal Qualities	0	3	0
Bonus	0	11	13
Achievable	0	22	0
Get encouragement from others	0	0	0
Opportunity for Start	9	0	0

Therefore, the increasing weight trend shows the influences of *tailoring* for cycling primary task support as persuasive feature are enhanced following with developing of cycling phases and should be employed increasingly depending on the corresponding consequences. However, the increasing influences among phases not represents the features should be employed increasingly in all situations but with the corresponding consequences. For example, tailoring is not proposed to be employed to provide for explore and challenge in the first phase until gradual involvement and habitual activity phase.

In addition to *tailoring*, the influences of persuasive features including *rehearsal*, *cooperation*, and *recognition* are also increasing progressively from the first to the third phase of female cycling. The detailed influences of these persuasive features upon corresponding consequences are shown in

Appendix D.

Table 5-6 Persuasive features with increasing influences along three phases (%)

	Persuasive features In three phases	Preliminary participate	Gradual involvement	Habitual activities
3	**Tailoring**	6%	13.1%	37.7%
7	**Rehearsal**	3.2%	6.6%	18.1%
26	**Cooperation**	0.0%	8.2%	7.5%
28	**Recognition**	0.0%	1.9%	5.4%

B. Persuasive features successive employed decreasingly along phases

In contrast to the increasing trend, the results also reflect that weight of persuasive features is decreasing from the first to the third phase. From preliminary participate phase, most of the weight of these features are heavy, but they decrease to smaller ones till habitual activities phase to phase. For example, the average weight of persuasive feature are successive decreasing from the first to the third phase typically shown in *reduction* from 15.0%, 5.6% to 0% in table 5-7.

Table 5-7 Consequence components of *reduction* with scores change along three phases

Consequence of Reduction in each phase	Preliminary participate	Gradual involvement	Habitual activities
Average weight	15.0%	5.6%	0.0%
Warm and Friendly	0	0	0
Companionate	0	0	0
Interactive acts	9	1	0
Building Friendship	0	9	0
Enjoyment in Journey	0	0	0
Making Steady Progress	0	0	0
Ease Body and Mind	0	0	0
New Experience	0	0	0
Enliven The Life	0	9	0
Explore The Unknown	9	0	0
Simple Activity	9	18	0
Ability Proving	0	0	0
Explore and Challenge	0	0	0
Be Invited	9	9	0
Get incentives	0	0	0
Receive others' praises	0	0	0
Without Preparation	9	18	0
Directive guiding	19	0	0
Support and Assistance	19	10	0
Professional Advice	10	1	0
Close to Nature	0	9	0
Increase Personal Qualities	0	0	0
Bonus	0	0	0
Achievable	10	19	0
Get encouragement from others	0	0	0
Opportunity for Start	10	0	0

Therefore, the decreasing trend shows the influences of *reduction* for cycling primary task support as persuasive feature are reduced following with developing of cycling phases and should be employed decreasingly depend on the corresponding consequences. However, the decreasing influences among phases not represents the features should be employed decreasingly in all situations but with the corresponding consequences. For example, *reduction* is proposed to be employed strongly through providing interactive experiences for female cyclist in their preliminary participation. But the employment could be decreased in gradual involvement phase. In the lately phase of habitual activities, the persuasive feature of *reduction* is not suggested to employ anymore according the table.

In addition to *reduction*, the influences of persuasive features including *suggestions*, *similarity*, *liking*,

and *social learning* are also decreasing progressively from the first to the third phase of female cycling. The detailed influences of these persuasive features upon corresponding consequences are shown in Appendix D.

Table 5-8 Persuasive features with decreasing influences along three phases (%)

	Persuasive features In three phases	Preliminary participate	Gradual involvement	Habitual activities
I	**Reduction**	15.0%	5.6%	0.0%
I1	**Suggestions**	8.8%	3.3%	2.5%
I2	**Similarity**	7.2%	1.6%	0.0%
I3	**Liking**	9.9%	2.3%	0.0%
22	**Social learning**	4.8%	5.0%	1.5%
24	**Normative influence**	22.1%	4.4%	4.5%

C. Persuasive features successive employed equally along phases

Under this trend, the weight of persuasive features is general keeping equally from the first to the third phase. From preliminary participate phase, the influence of the feature is not changed a lot until habitual activities according to the average weight results. For example, the weight of persuasive feature are almost equal from the first to the third phase typically shown in *rewards* from 2.0%, 3.3% to 1.5% in table 5-9.

Table 5-9 Consequence components of *rewards* with scores change along three phases

Consequence of Rewards in each phase	Preliminary participate	Gradual involvement	Habitual activities
Average weight	2.0%	3.3%	1.5%
Warm and Friendly	0	3	0
Companionate	0	3	0
Interactive acts	0	3	0
Building Friendship	0	0	0
Enjoyment in Journey	3	3	0
Making Steady Progress	0	0	0
Ease Body and Mind	0	9	0
New Experience	3	0	0
Enliven The Life	3	9	0
Explore The Unknown	3	0	0
Simple Activity	0	0	0
Ability Proving	0	0	0
Explore and Challenge	0	0	0
Be Invited	0	0	0
Get incentives	0	12	0
Receive others' praises	0	3	3
Without Preparation	0	0	0
Directive guiding	0	0	0
Support and Assistance	0	0	0
Professional Advice	0	0	0
Close to Nature	3	0	0
Increase Personal Qualities	0	0	3
Bonus	0	12	3
Achievable	0	0	0
Get encouragement from others	0	3	0
Opportunity for Start	0	0	0

However, the equal average weight among phases not represents the features should be employed equally in all situations but with the corresponding consequences. Since proportion of weight show influences of persuasive feature upon consequences among each phase, the average weight shows the influences of *rewards* for cycling dialogue support as persuasive feature are keeping equal but aim to different consequences for developing in three cycling phases. For example, *rewards* is the persuasive feature which is proposed to be employed to provide much enjoyment in journey at the first phase, the feel of easing body and mind at gradual involvement phase, and others' praises in habitual activity phase. In short, the weights of *rewards* are equal among three phases but different employments should be considered upon the corresponding consequences.

D. Persuasive features employed concavely along phases

Under this trend, the weight of persuasive features is especially little at the middle than the first and third phase. With heavier weight in preliminary participate phase, the influences of the feature are little at habitual activities but turn to heavy at the third phase. For example, the weight of persuasive feature are changed in the three phases in this way typically shown in *simulation* from 4.2%, 1.5% to 6.0% in table 5-10.

Table 5-10 Consequence components of *simulation* with scores change along three phases

Consequence of Simulation in each phase	Preliminary participate	Gradual involvement	Habitual activities
Average weight	4.2%	1.5%	6.0%
Warm and Friendly	0	0	0
Companionate	0	0	0
Interactive acts	0	1	0
Building Friendship	0	0	0
Enjoyment in Journey	1	3	12
Making Steady Progress	0	1	0
Ease Body and Mind	0	3	3
New Experience	4	0	0
Enliven The Life	4	3	12
Explore The Unknown	1	0	0
Simple Activity	0	0	0
Ability Proving	3	3	0
Explore and Challenge	6	0	0
Be Invited	0	0	0
Get incentives	0	3	3
Receive others' praises	0	0	0
Without Preparation	3	0	0
Directive guiding	0	0	0
Support and Assistance	0	0	0
Professional Advice	0	1	0
Close to Nature	1	3	3
Increase Personal Qualities	0	0	0
Bonus	0	3	3
Achievable	3	3	0
Get encouragement from others	0	0	0
Opportunity for Start	6	0	0

Since percentage of weight show influences of persuasive feature upon consequences are changed among each phase, it shows the influences of *simulation* for cycling primary task support as persuasive feature are different with developing of cycling phases. For example, *simulation* is the persuasive feature

which is proposed to be employed for providing approaches to enliven life at the first phase but not essential for gradual involvement phase. In other words, employing *simulation* in habitual activities is especially emphasized with applying on giving enjoyment throughout journeys. *Simulations* persuade cyclists the image or video records and processes for encouragement from others' or themselves' experiences.

E. Persuasive features employed convexly along phases

Opposite to concave trend, the weight of persuasive features is especially heavy at the middle than the first and third phase in the convex curve. With little weight in preliminary participate phase, the influences of the feature are heavier at habitual activities but turn to little at the third phase. For example, the weight of persuasive feature are changed in the three phases in this way typically shown in *tunneling* from 4.6%, 12.3% to 0.7% in table 5-11.

Table 5-11 Consequence components of *tunneling* with scores change along three phases

Consequence of Tunneling in each phase	Preliminary participate	Gradual involvement	Habitual activities
Average weight	4.6%	12.3%	0.7%
Warm and Friendly	0	9	0
Companionate	0	10	0
Interactive acts	4	21	0
Building Friendship	0	1	0
Enjoyment in Journey	0	19	0
Making Steady Progress	0	12	1
Ease Body and Mind	0	0	0
New Experience	0	10	0
Enliven The Life	0	10	0
Explore The Unknown	0	1	0
Simple Activity	0	9	0
Ability Proving	1	0	1
Explore and Challenge	1	11	1
Be Invited	0	0	0
Get incentives	0	9	0
Receive others' praises	0	0	0
Without Preparation	0	9	0
Directive guiding	7	30	1
Support and Assistance	7	13	0
Professional Advice	7	21	0
Close to Nature	0	10	0
Increase Personal Qualities	0	0	0
Bonus	0	1	0
Achievable	4	20	0
Get encouragement from others	0	0	0
Opportunity for Start	4	1	0

Since amounts of percentage show influences of persuasive feature upon consequences are varied from each phase, it shows the influences of *tunneling* for cycling primary task support as persuasive feature are different with developing of cycling phases. For example, *tunneling* is the persuasive feature which is proposed to be employed for providing directive guiding at the middle phase of gradual involvement but not essential in the first or last phase. In other words, it is especially emphasized to employ persuasive feature with providing directive guiding through *tunneling* in gradual involvement phase.

In addition to *tunneling*, the influences of persuasive features including *praise* and *social role* are also in the convex trend from the first to the third phase of female cycling. The detailed influences of these

persuasive features upon corresponding consequences are shown in Appendix D.

Table 5-12 Persuasive features in convex trend along three phases (%)

	Persuasive features In three phases	Preliminary participate	Gradual involvement	Habitual activities
2	**Tunneling**	4.6%	12.3%	0.7%
8	**Praise**	0.0%	8.8%	0.5%
14	**Social role**	4.8%	5.0%	1.5%

5.1.3. Particular persuasion strategies in three phases

Inspecting the persuasive features in female cycling activities, we found the influences are different from participation phases. For example, the persuasive feature of tailoring influences participants in different situations. The persuasion principle can be applied in the beginning to provide attractive scenes or story for join cycling activity. However, after several cycling experiences, new demand for diversity of activity and incentive of challenge and exploration should be considered for the progress of cycling activities. In other words, the persuasive features are proposed varied along behavior consequences in different cycling phases *preliminary participate*, *gradual involvement*, and *habitual activities*.

Preliminary participate phase

The specific corresponded consequences and attributes are emphasized differently from the comprehensive results. To inspect the persuasion features in the first phase, the feature of *dialogue support* with 40.1 % weight is the dominant category in the preliminary phase. It is different from the dominance of *primary task support* in the comprehensive result. It reflects that although the persuasion features of *primary task support* are important within cycling activity of overview, most of the utilized persuasive features of *dialogue support* are suggested in preliminary phase.

Table 5-13 Persuasive features-consequence relationship with scores in preliminary participate phase

(The complete table is shown in Appendix D)

Persuasive feature(28)\Consequence(26)	Warm and friendly	Companionable	Interactive	Building friendship	Enjoyment in journey	Total weight of each feature(%)	Total weight of each category(%)
Reduction			9			15.0%	Primary task support 33.0%
Tunneling			4			4.6%	
Tailoring						6.0%	
Personalization						0.0%	
Self-monitoring						0.0%	
Simulation					1	4.2%	
Rehearsal						3.2%	
Praise						0.0%	Dialogue support 40.1%
Rewards					3	2.0%	
Reminders	1	1		1		0.9%	
Suggestions	4	4	3	3		8.8%	
Similarity						7.2%	
Liking	3	3			9	9.9%	
Social role			10			11.3%	
Trustworthiness						0.0%	System credibility 0.0%
Expertise						0.0%	
Surface credibility						0.0%	
Real-world feel						0.0%	
Authority						0.0%	
Third-party endorsement						0.0%	
Verifiability						0.0%	
Social learning						4.8%	Social support 26.9%
Social comparison						0.0%	
Normative influence	18	18		9		22.1%	
Social facilitation						0.0%	
Cooperation						0.0%	
Competition						0.0%	
Recognition						0.0%	

To go deep into each persuasive feature in table 5-13, "*normative influence*" is the most utilized feature in this phase. However, it is in the category of *social support* rather than *dialogue support*. It reflects that for choosing persuasion feature for emphasizing, it should not only adopt dialogue support; persuasion of *normative influence* is the key feature which is also representative of its category for preliminary participation. According to the consequences of female participants, the friendly invitation and leverage of relationship among companions encourage them for preliminary participating in cycling.

On the other hand, persuaded with dialogue support, which is the most utilized category, female participants are attracted by applying six out of seven persuasion features. Dialogue are defined to support help participants move toward their goals or target behavior (2009).The distribution of proportion in this category represents the type of dialogue supports should be used with different persuasion features. *Liking*, *suggestion*, and *social role* are the three main features in this category and each reflects various aspect of persuasion. As using the feature of *Liking* attracts females to participate in cycling through expressing enjoyment of nature activities, *suggestion* offers appropriate encouragement, directive guide, and suggests opportunities of being together in opportune moments. Together with

adopting *social role* as consultant and assistance of cycling, the utilizations of dialogue support proceed the preliminary cycling participation.

In primary task support, the feature of using *reduction* is effective through producing support, assistance, and advices through the interaction to reduce complexity caused by unfamiliar and difficult accommodation at the beginning of cycling.

Gradual involvement phase

For gradual involvement in cycling, the dominant persuasive category is changed to *primary task support* (41%); while *dialogue support* (35.3%) is turning with less influence. However, look into the table, the contribution of attribute is similar to the comprehensive results. In similar, social role of *dialogue support* and tailoring of *primary task support* are existed for applying across the progressive qualities within cycling. In short, the dialogue support as both the reliable guides and friendly and warm companions are essential for females especially in gradual involvement stage.

Table 5-14 Persuasive features-consequence relationship with scores in gradual involvement phase (The complete table is shown in Appendix D)

Persuasive feature(28)\Consequence(26)	Warm and friendly	Companionable	Interactive	Building friendship	Enjoyment in journey	Total weight of each feature(%)	Total weight of each category(%)
Reduction			1	9		5.6%	Primary task support 41.0%
Tunneling	9	10	21	1	19	12.3%	
Tailoring			12	3	20	13.1%	
Personalization					3	1.1%	
Self-monitoring						0.8%	
Simulation			1		3	1.5%	
Rehearsal			1		15	6.6%	
Praise	18	9	27		9	8.8%	Dialogue support 35.3%
Rewards	3	3	3		3	3.3%	
Reminders						0.0%	
Suggestions		2	13	1	1	3.3%	
Similarity	3		6	3		1.6%	
Liking		3			3	2.3%	
Social role	15	16	47	24	3	16.0%	
Trustworthiness						0.0%	System credibility 0.7%
Expertise						0.0%	
Surface credibility						0.7%	
Real-world feel						0.0%	
Authority						0.0%	
Third-party endorsement						0.0%	
Verifiability						0.0%	
Social learning	1		10	9	9	5.0%	Social support 23.1%
Social comparison		9	9			2.0%	
Normative influence		9				4.4%	
Social facilitation		3	7	3	3	1.6%	
Cooperation		25	19	21	9	8.2%	
Competition						0.0%	
Recognition	3	2	6	3	3	1.9%	

Moreover, *tunneling* is used to guide the journey with direction in the practical journey. To female participants, the progress of in person accumulative practices and experiences is along with specific tracks. According to participants, the adjustments of riding techniques or equipments from experienced biker make them in progresses during journeys. The progresses are also appeared while the questions and difficulties are solved immediately in this phase. Therefore, the support and assistance for progressing through practical experiences ought to be provided along with appropriate condition within the involvement.

In this phase, *praise* as dialogue support is particular proposed. According to the female participants, the praises are great encouragement for keeping their cycling activities. The praises particular come from experienced bikers with affirmatives about their ability or potential in cycling; while the praises with admirations from passersby on the road give them great drive and confidences to continue.

After phase of gradual involvement, the persuasion characters as above particular exist in the continuous progress of cycling activities can be reflected especially in this gradual involvement stage.

Habitual activity phase

These persuasive features are mostly focused on *primary task support* (73%) and social support (22.4%) in habitual activities phase. Inspect with the table, *Tailoring* is the most dominant feature in task support through providing appropriate information fulfill their requirement of level and interests in habitual cycling activity. In the study with female cyclists, we found that they love the enjoyment of cycling in nature and interactions with friend. Throughout cycling activities, they feel the ease in body and mind with the exposures in nature. This is one of the significant factors to maintain their activities. Besides, the participants also expect new cycling experiences to discover continuously. The explorations of unknown journeys provide them more challenges and more discoveries to enliven their life. To provide messages or approaches for persuasion, more enjoyment and ease of cycling are more attractive to female participants.

Table 5-15 Persuasive features-attribute relationship matrix with scores in habitual activity phase

(The complete table is shown in Appendix D)

Persuasive feature(28)\Consequence(26)	Warm and friendly	Companionable	Interactive	Building friendship	Enjoyment in journey	Total weight of each feature(%)	Total weight of each category(%)
Reduction						0.0%	Primary task support 73%
Tunneling						0.7%	
Tailoring				9	1	37.7%	
Personalization						0.0%	
Self-monitoring						10.6%	
Simulation					12	6.0%	
Rehearsal					12	18.1%	
Praise						0.5%	Dialogue support 4.5%
Rewards						1.5%	
Reminders						0.0%	
Suggestions						2.5%	
Similarity						0.0%	
Liking						0.0%	
Social role						0.0%	
Trustworthiness						0.0%	System credibility 0.0%
Expertise						0.0%	
Surface credibility						0.0%	
Real-world feel						0.0%	
Authority						0.0%	
Third-party endorsement						0.0%	
Verifiability						0.0%	
Social learning						1.5%	Social support 22.4%
Social comparison						0.0%	
Normative influence		3	3	6	3	4.5%	
Social facilitation						3.5%	
Cooperation		9	9	9	9	7.5%	
Competition						0.0%	
Recognition		1	1	1	1	5.4%	

Also included in the category of *primary task support*, rehearsal provides processes to accumulate their enjoyment of cycling. Experience through each journey, the receiving with ease and enjoyment offer female participants a large reward. After all, the approaches to access cycling with reward continuously should be considered for habitual activities.

Another category of social support also gives influences with the features *cooperation* and *cognition*, which appear only in this phase. In the early involvement of activities, female participants require the companions and interactions friendly with other participants. With previous experiences, they receive with warmness and have the enjoyment of togetherness through every cycling activity. Therefore, the continuing of leverage from *cooperation* drives participants to join activities for involving the companionship and biker interactions.

At the time, the *recognition* in public gives extra motivations to participants. Although the ability and performance are less possible shown in participants' daily life, the opportunities to show their extra personal qualities in front of others who are not with cycling activity could also bring they

encouragements. For female participants are usually implicit in expressing cycling ability under their feminine appearance, the exposes of ability provides them another appreciations. After all, the stages for helping female participants to show their extra quality expand the likelihood of persuasion through receiving encouragement and increasing personal personality under social recognition.

5.1.4. Summary

Based on the user study process with female cyclist participants, we collect the appreciated consequences from their perspective together with the attribute and values. After that, several persuasive features are raised along with different proportion of weight in corresponding to consequence of cycling as persuasion strategies. In this research results, we proposed the most eight influential persuasive features for employing or evaluating in female cycling activities of persuasive technologies.

However, the persuasive strategies are presented differently through taking apart our results into three cycling phases, *preliminary participate*, *gradual involvement*, and *habitual activities*. In each phase, the persuasion strategies are presented differently according to the attributes and consequences. In preliminary participate phrase, *normative influence*, *liking*, *reduction* and *suggestion* are the suggested persuasive features for pulling participants participating cycling activity at the beginning. In gradual involvement phase, *social role*, *tailoring*, *tunneling* and *praise* are proposed to persuade participants involve in cycling activities after their preliminary activity. Finally in habitual activities phase, *tailoring*, *rehearsal*, *cooperation*, *recognition* are four persuasive features for motivating participants to participate in cycling habitually. For each persuasive feature, the strategies are proposed as along with its corresponded consequences to specify employments for design development.

5.2. Persuasion strategies result from participants' values

Through studying the female participants with and without cycling, we found the values are different in the two groups. Inspecting the six values of the participants without cycling and the twelve values of female cyclists, the six values are included in the twelve in table 5-16. In other words, there are six values are appeared especially in female participants with cycling activities. The values caused by the accumulated experiences in cycling activities can be regard as specific values according to cycling. Therefore, the six different values, *growing up*, *curiosity*, *accomplishment*, *self-confidence*, *carefree*, and

reliable are proposed as the specific values existed in female cyclists. The different values result from cycling activities are proposed here for discussing if there are specific persuasion issues in cycling activities.

Table 5-16 Values difference in two groups of participants

Values of female without cycling	Values of female cyclists
Warmness	Warmness
Social contact	Social contact
Enjoyment	Enjoyment
Enrichment	Enrichment
-	Growing up
Relaxation	Relaxation
-	Curiosity
Uncomplicated	Uncomplicated
-	Accomplishment
-	Self confidence
-	Carefree
-	Reliable

Through the differences in values we investigated through user study, we assume the persuasive features related to identical values between two groups of participant are easier for coping with those who do not participate in cycling. Based on this assumption, therefore, in addition to deliver the persuasion strategies contributing from the female cycling participants, we also compare the values between two female groups through the study results to identify the differences for proposing additional approaches with persuasion strategy.

5.2.1. Proposing persuasion strategy from Identical values

To make good use of the values existing in the target influenced audience for developing persuasion strategies, the identical values between female with and without cycling activities are suggested to figure out their corresponding persuasive features. The employment of identical values of two groups proposes opportunities or appropriate approaches to convince female through the values they already own. The six identical values include *warmness*, *social contact*, *enjoyment*, *enrichment*,

relaxation, *uncomplicated* which are inherent in their lives from the females without participating in cycling. We propose the consequences and corresponding persuasive features extended from the same values for developing approaches as the female cycling persuasion strategies.

Since we extract the female cyclists' experiences with A-C-V analysis and also propose the results of persuasive features corresponding to the participants' consequences in chapter four, the persuasion strategies are propose to interpret the persuasive features coped with corresponding values. The process is illustrated in Fig. 5-4 as below.

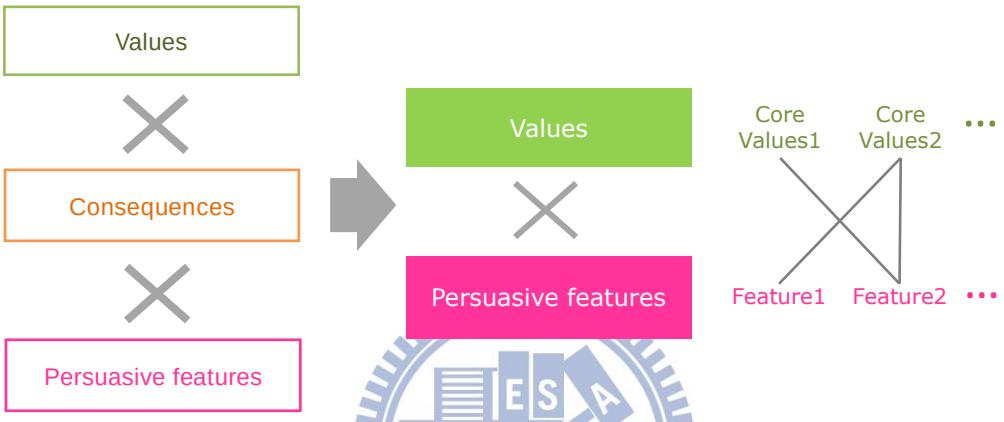


Fig. 5-4 Process to build the connection between values and persuasive features

According to the process, the result of values-consequence matrix is multiplied by the consequence-persuasive feature matrix. It produces the matrix of values-persuasive feature which represent the persuasive features related to specific values. Through the calculation results, persuasion strategies are proposed in two perspectives of view. First, we suggest the influential persuasive features through focusing on the existing values of potential participants. Besides, the overlapped values between female cyclists and existing ones are also proposed to extract their persuasive features for developing persuasive systems.

5.2.2. Persuasion strategies proposed from the group of identical values

For interpreting the identical values between two groups of participants, we firstly categorize the female cyclists' twelve values based on their corresponding consequences. The utilization of clustering analysis categorizes the values with high similarity components of consequences into a group. In other words, according to the consolidation, the similar values are categorized in a group. The results of female

cyclist' twelve values at the middle column are grouped into six categories of left with naming as the table 5-17 list below.

Table 5-17 Comparison of values with/without cycling in category

Category	Values of female cyclists	Values of female without cycling
Warmness	Warmness	Warmness
Social contact	Social contact	Social contact
Enlivenment	Enjoyment	Enjoyment
	Relaxation	Relaxation
Accomplishment	Growing up	-
	Enrichment	Enrichment
	Accomplishment	-
	Self confidence	-
Curiosity	Curiosity	-
Ease	Carefree	-
	Uncomplicated	Uncomplicated
	Reliable	-

To compare the values of female without participating in cycling at right column, their six values are distributed in *warmness*, *social contact*, *enlivenment*, *accomplishment*, and *ease* five categories of female cyclist values. In other word, it was reflected the five groups of values include the ones who exist in the female participants without cycling activities. Since the five categories contain the values which are similar to the values the participants already have, to influence females to participate in cycling activities, the persuasive features related to the values contained in the five categories should be accepted easily. Therefore, we propose the strategy that persuasive features employed within the categories which contain more identical values, more possibilities of success are provided for persuading female to participate in cycling. In our case, the first three categories, *warmness*, *social contact* and *enlivenment*, contain all of the identical values with female without cycling activities (Table 5-17). Therefore, we suggest applying the persuasive features corresponding to the three independent categories of values but not the ones which only contain some of identical values.

According to the multiplying of overall consequence-values matrix and consequence-persuasive features matrix, the result show weight of persuasive feature act in each values. To compare the influences among twenty-eight persuasive features in twelve different values, the averaged weight of persuasive features in each values are calculated and shown in table 5-18. The persuasive features

influence females to join the cycling activities are extracted from the four values, *warmness*, *social contact, enjoyment*, and *relaxation* contained in the three categories.

Table 5-18 Weight of persuasive features versus four values overlapped between female with and without cycling (%)

Category		Warmness	Social contact	Enlivenment		AVG
Values		Warmness	Social contact	Enjoyment	Relaxation	
1	Reduction	5.9%	7.8%	2.5%	5.5%	6.5
2	Tunneling	8.8%	7.7%	7.2%	5.2%	6.6
3	Tailoring	9.6	11.9	10.6	11.2	13.1
4	Personalization	0.8%	0.4%	0.3%	0.3%	0.5
5	Self-monitoring	0.3%	0.4%	2.1%	1.5%	2.0
6	Simulation	1.6%	1.4%	2.6%	2.4%	2.1
7	Rehearsal	3.4%	5.3%	**9.4%**	**8.8%**	5.8
8	Praise	**13.2%**	2.3%	7.7%	8.4%	8.9
9	Rewards	3.1%	2.5%	3.7%	4.5%	3.7
10	Reminders	0.3%	0.3%	0.5%	0.3%	0.3
11	Suggestions	4.7%	4.9%	3.8%	3.4%	4.3
12	Similarity	2.9%	2.5%	2.0%	1.2%	2.6
13	Liking	4.3%	3.6%	2.7%	3.2%	3.7
14	Social role	**13.9%**	**12.8%**	**13.7%**	**12.0%**	11.1
15	Trustworthiness	-	-	-	-	-
16	Expertise	-	-	-	-	-
17	Surface credibility	-	0.4%		0.2%	0.3
18	Real-world feel	-	-	-	-	-
19	Authority	-	-	-	-	-
20	Third-party endorsement	-	-	-	-	-
21	Verifiability	-	-	-	-	-
22	Social learning	2.6%	3.6%	3.6%	2.5%	4.5
23	Social comparison	0.8%	1.2%	1.4%	1.5%	1.1
24	Normative influence	**12.2%**	**13.7%**	**11.3%**	**12.2%**	10.6
25	Social facilitation	1.1%	2.4%	1.5%	1.4%	1.4
26	Cooperation	4.7%	**11.3%**	**10.9%**	**9.5%**	6.4
27	Competition	-	-	-	-	-
28	Recognition	5.9%	3.4%	2.6%	5.0%	4.6

Interpreting the results of table 5-18, the effectiveness of persuasive features for each existing values are delivered according to the amount of weight in percentage. As persuasion strategies for female cycling activities, it's suggested to employ effective persuasive features for aiming to the existing values of female. For example, to persuade cycling activities for the females focused with values of *social contact*, the persuasive features of *normative influence* as social support, dialogue with *social roles*, and *tunneling* task support are proposed to employ for developing or designing persuasive technologies. Comparing with the average results of persuasive features utilization percentage, we extract the features with weight over than average as the influential ones. After that, the results suggest the persuasion strategies

from relationship of persuasive feature-consequence-values to character persuasive feature specifically for focused values are diagramed as Fig. 5-5 below.

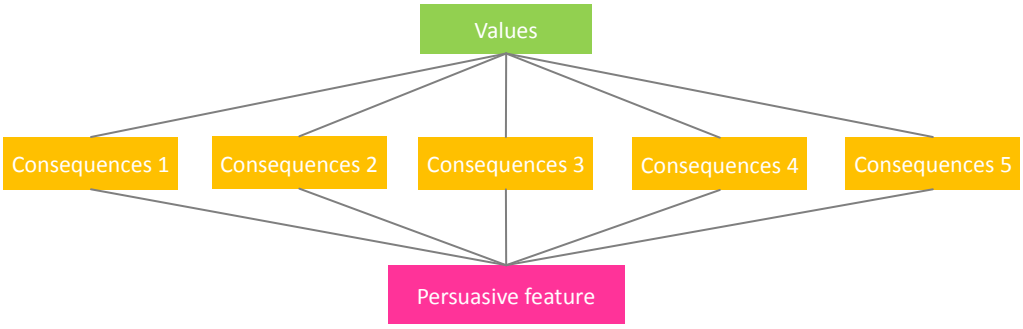


Fig. 5-5 Persuasive feature-consequence-values connection as persuasion strategy

To depict the persuasion strategies of each persuasive feature for particular values, the results are proposed as product through multiplying of consequence in each values by weight of consequence in each persuasive feature. For developing the persuasion strategy with values inherent in female, the three values (A) social roles (B) normative influence and (C) cooperation are proposed to employ with the aim to persuade females with their existing values. Since the three persuasive features are utilized in the four values with most percentage of weight, they are proposed as the persuasive features to evaluate the design strategies for persuading females to participate in cycling activities as following table 5-19.

Table 5-19 Integrated relationship of persuasive feature-consequence to depict the persuasion strategy for values of *warmness*, *social contact*, *enjoyment*, and *relaxation*

Consequence\Persuasive feature		A Social role	B Normative influence	C Cooperation
1	Warm and Friendly	5.5%	7.0%	0.0%
2	Companionate	10.5%	21.0%	30.9%
3	Interactive acts	14.6%	0.8%	9.9%
4	Building Friendship	17.8%	16.6%	30.9%
5	Enjoyment in Journey	1.2%	1.3%	10.1%
6	Making Steady Progress	3.7%	0.0%	0.0%
7	Ease Body and Mind	0.0%	0.0%	0.0%
8	New Experience	0.0%	0.0%	0.0%
9	Enliven The Life	0.0%	0.0%	0.0%
10	Explore The Unknown	0.0%	0.0%	0.0%
11	Simple Activity	0.0%	0.0%	0.0%
12	Ability Proving	0.0%	0.0%	0.0%
13	Explore and Challenge	1.7%	3.5%	0.8%
14	Be Invited	2.9%	12.6%	0.0%
15	Get incentives	0.0%	0.0%	0.0%
16	Receive others' praises	6.6%	0.0%	0.0%
17	Without Preparation	0.2%	5.3%	1.0%
18	Directive guiding	4.5%	4.8%	0.6%
19	Support and Assistance	9.5%	0.2%	3.5%
20	Professional Advice	9.8%	0.0%	0.0%
21	Close to Nature	0.0%	12.9%	0.0%
22	Increase Personal Qualities	0.0%	0.0%	0.0%
23	Bonus	2.4%	0.6%	5.0%
24	Achievable	0.0%	0.0%	0.0%
25	Get encouragement from others	0.0%	0.0%	0.0%
26	Opportunity for Start	9.2%	13.5%	7.3%

In sum, for female inherent values warmness, social contact, enjoyment and relaxation, there are three specific persuasive features *social role*, *normative influence*, and *cooperation* proposed to influence those potential persuaded audiences through utilizing in design strategies with its corresponded consequences. For these four values are included in the cluster of cyclist's values which own the identical values with the ones inherent in potential influenced participants, the results are focused on the persuasive features as a opportunity to change behavior more acceptable.

5.2.3. Persuasion strategies focus on appreciated values of cycling

Different from grouping the values with similar consequences to find out the persuasion strategy, we propose another process to compare and suggest strategy through corresponding with the appreciated values in cycling activity. Since there are the values of female cycling participation represent the values with most appreciated, they are valuable to suggest for focusing on as the specific persuasive

strategy. Therefore, in addition to extract the best features from existing values for employing, it's also suggested to focus on the intersected values between female cyclists' most appreciated values and the existing values of target influenced participants to propose the persuasion strategies. In this research, the results of *values* of female cycling activities, *enrichment, grow up, carefree, enjoyment, and relaxation* are the five most appreciated values referred in female cycling activities by the participants in table 5-20. Based on the result, diagram of the focused value is shown as fig. 5-6 below.

Table 5-20 Female cyclists' emphasized five values with most of weight in rank

(The complete table is shown in Appendix C)

CxV	Enrichment	Growing up	Carefree	Enjoyment	Relaxation
Sum	12	10	9	8	8
Average	13.6%	11.4%	10.2%	9.1%	9.1%

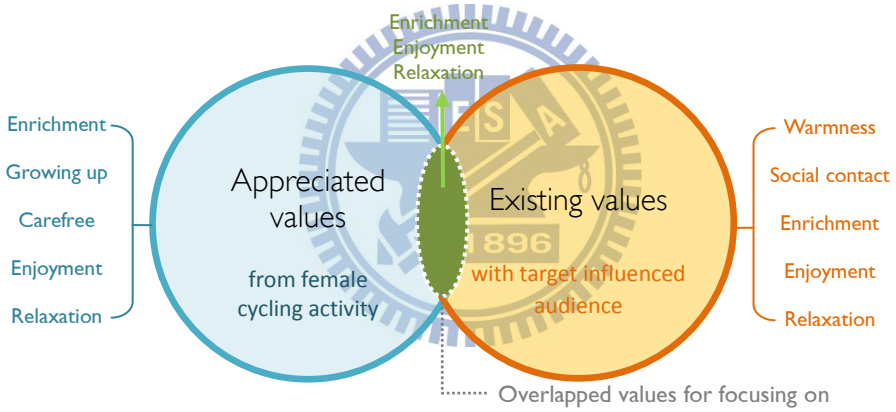


Fig. 5-6 Persuasion strategy focused on overlapped values between appreciated values and existing values

Since *"enjoyment", "relaxation" and " enrichment"* are the overlapped values of appreciated cycling activities values which are also the existing values of target influenced audiences, it was proposed to employ as the "focused values" to develop the persuasive design strategies. Therefore, checking the results of table 5-21, the persuasive feature corresponded consequences are shown with average weight below.

Table 5-21 Weight of persuasive features versus the three emphasized values of female cycling (%)

Persuasive feature\Values		Enjoyment	Relaxation	Enrichment	AVG
1	Reduction	2.5%	5.5%	5.5%	6.5
2	Tunneling	7.2%	5.2%	6.8%	6.6
3	Tailoring	10.6	**11.2**	**13.7%**	13.1
4	Personalization	0.3%	0.3%	0.3%	0.5
5	Self-monitoring	2.1%	1.5%	2.0%	2.0
6	Simulation	2.6%	2.4%	1.7%	2.1
7	Rehearsal	9.4%	8.8%	3.1%	5.8
8	Praise	7.7%	8.4%	9.1%	8.9
9	Rewards	3.7%	4.5%	2.7%	3.7
10	Reminders	0.5%	0.3%	0.4%	0.3
11	Suggestions	3.8%	3.4%	4.9%	4.3
12	Similarity	2.0%	1.2%	2.6%	2.6
13	Liking	2.7%	3.2%	4.1%	3.7
14	Social role	**13.7%**	**12.0%**	**12.2%**	11.1
15	Trustworthiness	-	-	-	-
16	Expertise	-	-	-	-
17	Surface credibility		0.2%	0.3%	0.3
18	Real-world feel	-	-	-	-
19	Authority	-	-	-	-
20	Third-party endorsement	-	-	-	-
21	Verifiability	-	-	-	-
22	Social learning	3.6%	2.5%	6.4%	4.5
23	Social comparison	1.4%	1.5%	1.6%	1.1
24	Normative influence	**11.3%**	**12.2%**	**9.5%**	10.6
25	Social facilitation	1.5%	1.4%	1.8%	1.4
26	Cooperation	**10.9%**	9.5%	7.2%	6.4
27	Competition	-	-	-	-
28	Recognition	2.6%	5.0%	4.0%	4.6

Integrated the top three persuasive features which contain most of weight in values of enjoyment, relaxation, and enrichment, the corresponded weight of consequences are accumulated. According to the calculation, the persuasion strategies are suggested to apply the four persuasive features *tailoring*, *social roles*, *normative influence*, and *cooperation* with corresponded consequences. The results are presented with averaged weight in each persuasive feature in table 5-22.

Table 5-22 Integrated relationship of persuasive feature-consequence to depict the persuasion strategy for values of *enrichment*, *enjoyment*, and *relaxation*

Consequence\Persuasive feature		A Tailoring	B Social role	C Normative influence	D Cooperation
1	Warm and Friendly	0.0%	**12.7%**	**15.3%**	0.0%
2	Companionate	0.0%	**14.4%**	**23.0%**	**30.1%**
3	Interactive acts	2.1%	8.1%	0.9%	**14.5%**
4	Building Friendship	2.1%	**18.1%**	**18.2%**	**30.0%**
5	Enjoyment in Journey	5.6%	1.3%	1.4%	**14.7%**
6	Making Steady Progress	0.0%	0.0%	0.0%	0.0%
7	Ease Body and Mind	11.0%	0.0%	0.0%	0.0%
8	New Experience	**13.0%**	0.0%	3.3%	0.0%
9	Enliven The Life	11.8%	0.0%	3.1%	0.0%
10	Explore The Unknown	11.7%	3.0%	0.7%	0.0%
11	Simple Activity	5.3%	0.3%	4.1%	0.0%
12	Ability Proving	**13.3%**	0.3%	0.0%	0.0%
13	Explore and Challenge	**13.7%**	1.7%	3.9%	0.0%
14	Be Invited	1.3%	3.0%	**13.8%**	0.0%
15	Get incentives	0.0%	0.0%	0.0%	0.0%
16	Receive others' praises	0.0%	3.5%	0.0%	0.0%
17	Without Preparation	0.0%	0.0%	0.0%	0.0%
18	Directive guiding	0.0%	0.0%	0.0%	0.0%
19	Support and Assistance	2.6%	10.1%	0.2%	0.0%
20	Professional Advice	3.6%	10.3%	0.0%	0.0%
21	Close to Nature	0.0%	0.0%	0.0%	0.0%
22	Increase Personal Qualities	3.0%	2.3%	0.0%	0.0%
23	Bonus	0.0%	0.0%	0.0%	0.0%
24	Achievable	0.0%	0.0%	0.0%	0.0%
25	Get encouragement from others	0.0%	4.2%	4.6%	0.0%
26	Opportunity for Start	0.0%	6.7%	7.4%	10.6%

The results of four persuasive features *tailoring*, *social role*, *normative influence*, and *cooperation* are proposed through focusing on specific female inherent values overlapped with appreciated cycling values. According to weight in each persuasive feature, the strategies are specifying to suggest these properties of consequences with consideration when developing for persuasion directions. This process suggests another opportunity for persuading female to participate cycling activities through attraction in cycling activity.

5.2.4. Summary

To suggest another strategy for persuading participants joining cycling activity, the perspective of taking uses of their inherent values are proposed to develop the consequences and corresponded persuasive features as the possible influence approach for persuasion. There are two accesses to employ their inherent values. First, through utilizing the cluster of values corresponded with similar

consequences which contain most of the identical values inherent in potential influenced audiences, *social role*, *normative influence*, and *cooperation* are proposed to fulfill the values of *warmness*, *enjoyment*, *social contact*, and *relaxation*. Another access to employ the overlapped values between appreciated cycling values and female's inherent values, *tailoring*, *social role*, *normative influence*, and *cooperation* are proposed with the values of *enjoyment*, *relaxation*, and *enrichment*. The two accesses propose different strategies through persuasive features and its corresponded components of consequence for interpretation. While the first access emphasizing a easier way for persuading with included in cluster of similar values, another one proposes a attractive way for pulling through the appreciated values.

5.3. Breakthrough the problems of persuading cycling activities

While our research aim is proposing the persuasion strategies of female cycling for persuasive system design, we have to clarify the problems of female participants and also narrow down our concern to the problematic issues. In this chapter, the conduct of breakdowns for cycling activities results based on the potential influenced audiences, which are purposed as the preventions of female cycling activities. And with the results of persuasive features for cycling activities from the female participants, we focus on the preventions and imitate the success persuasive features for extracting the solutions of persuasive system development.

5.3.1. The preventions of participating cycling activities

Upon the participants' interview results, researchers use the questions to expect the causes of prevent them to cycling participation in table 3.4. After that, both values of lifestyle and personas are delivered with the causes of prevention within both on the affinity diagram of inherent values and persona of attributes with customer needs in Fig. 4-1 and Fig. 4-2. However, for identifying the problems and expecting for deriving solutions, the adjustment on the sequence model of cycling activity is proposed. With putting the marks of breakdown on, the sequence model of cycling activity represent the causes which prevent the cycling participation and lead to breakdowns. The problematic sequence model with breakdowns is illustrated in the diagram below (Fig. 5-7).

Problematic Sequence Model

Breakdown prevent female cycling activities

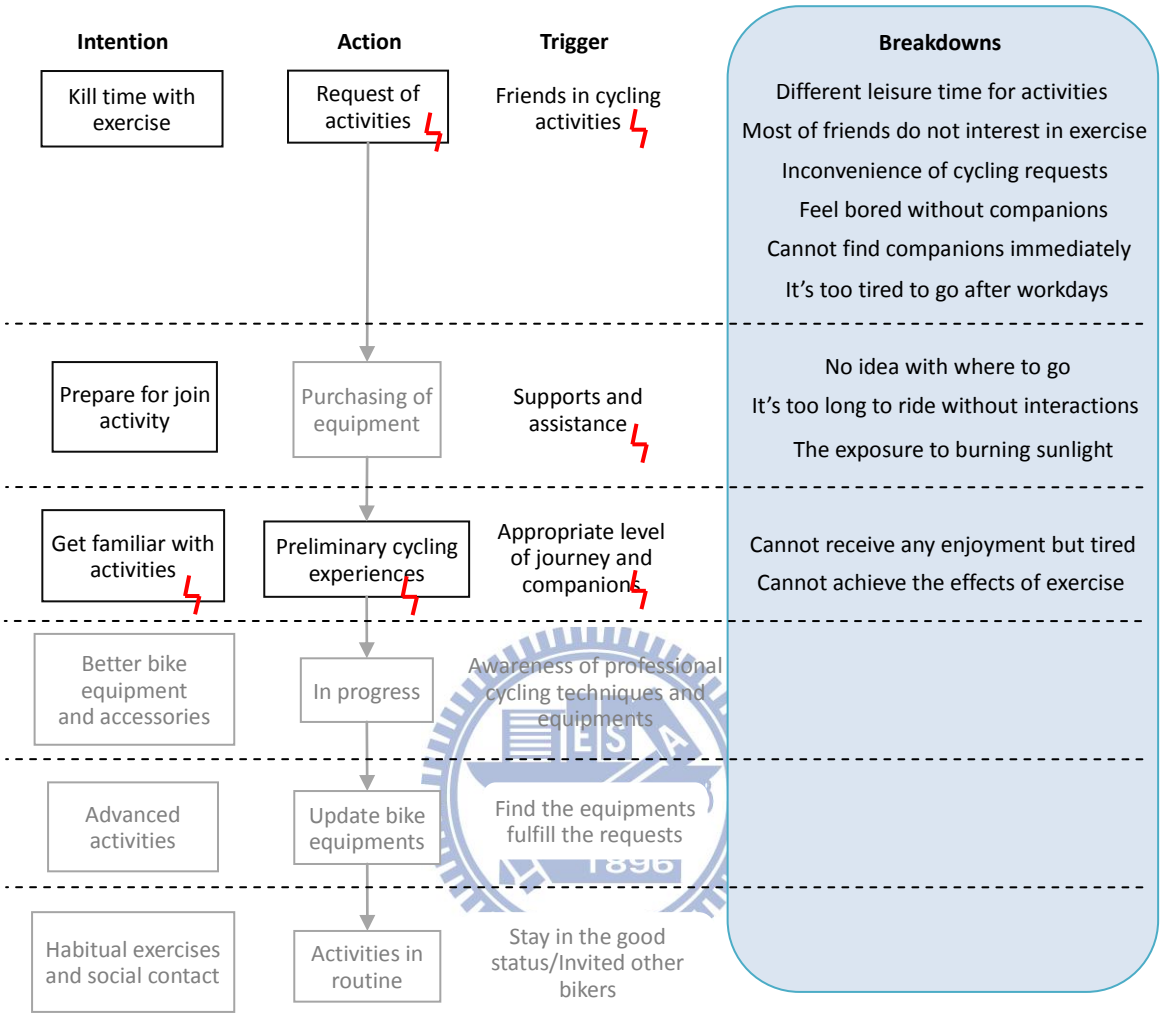


Fig. 5-7 Problematic sequence model of female without cycling activities

Inspect with the problematic sequence model, there breakdowns are highlighted upon the intentions, actions, and triggers and brought up in sentences on the right side of diagram. First, with the intention to kill time in on the weekends, the inconvenient and requests of preparation are referred as the excuses. The influences from others for participation are key points of trigger for overcoming problems.

On the other side, to prepare for join cycling activities, the breakdowns appear at the trigger of supports and assistances. Problems with directions of journey, interactive supports, and suggestions for cycling activities cause the breakdown when participants prepare for joining.

With the intention to get familiar with the activities through once participation, the breakdowns appear through the tired and ineffective experiences. Therefore, appropriate levels of journey and participation assistance are essential for preventing the breakdown.

5.3.2. Persuasive features to encourage participation of cycling activities

The problematic sequence model with the breakdowns which prevent potential female participants from cycling illustrates the cause and effect relationship of persuasion problems clearly. Through making use of the success cycling sequence model with persuasive features, the problems are proposed to solve in particular intention phases. The utilized of persuasive features for removing the preventions are delivered as following. Applying the results with persuasive feature corresponding to the cycling consequence, we extract the persuasion solutions for removing the breakdowns shown in the first three phases which contain the breakdowns.

Problematic Sequence Model

Breakdown prevent female cycling activities

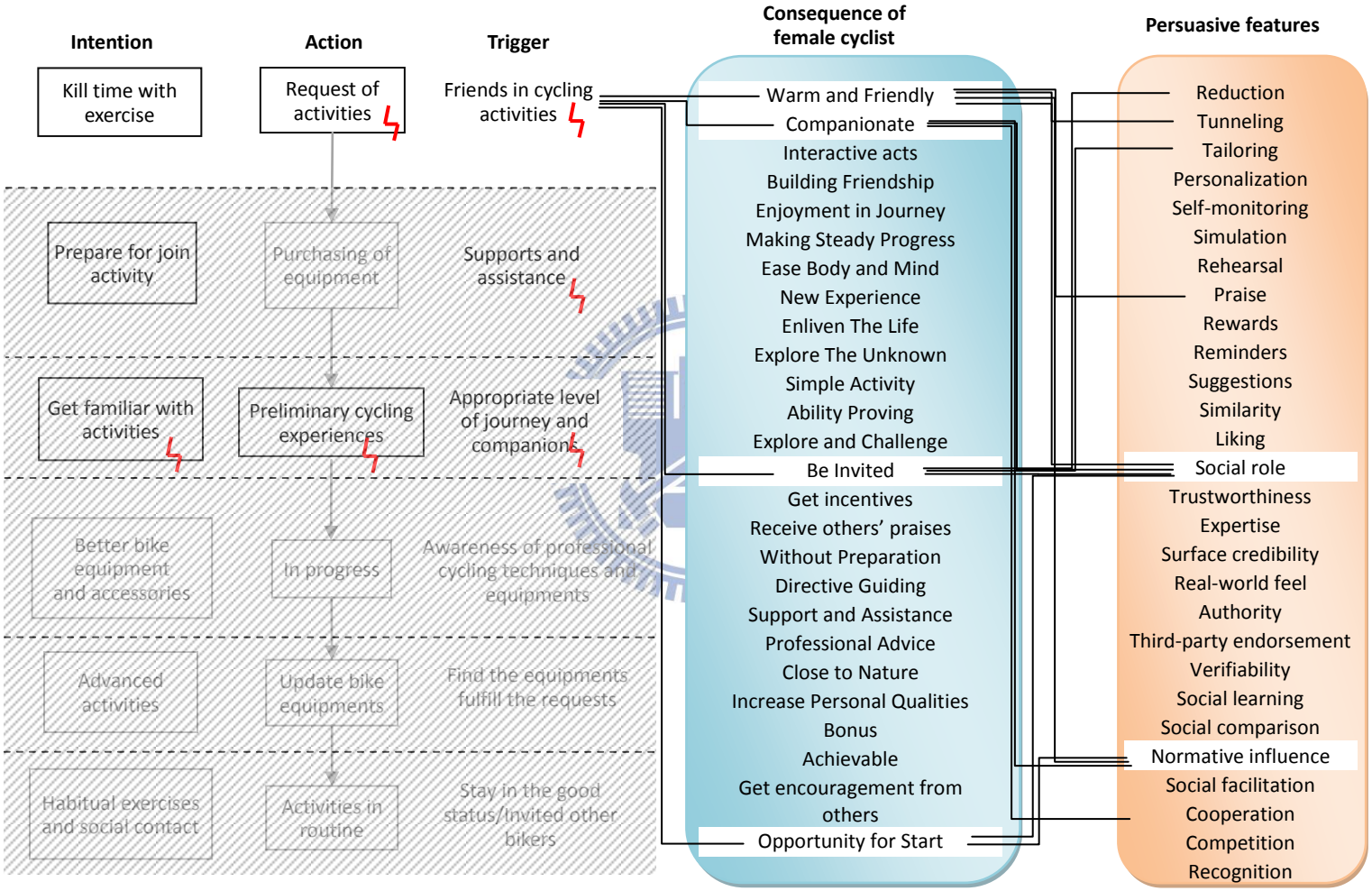


Fig. 5-8 The first phase of breakdowns and the corresponding consequence-persuasive features

First of all, for the breakdowns preventing the intention to kill time with exercise through cycling, there are two breakdown marks on action and trigger. In order to proceed the action of requesting for cycling, different leisure time for activity with friends, the absence of interests with exercises, and inconvenience for cycling requests are proposed from user study results. The lack of trigger from friends or companions also causes the breakdowns (Fig.5-7).

To imitate the possible features extracted from female cyclists to overcome these breakdowns, the appreciated consequences includes *warm and friendly*, *companionable*, *be invited*, and *opportunities to start* are proposed for employing. Corresponding with the persuasive features in Fig. 5-8, *social role* of providing assistance in dialogue support and *normative influence* in warm and friendly encouragements or invitations from social support are extracted for their heavier weight of influences. Through manipulating the corresponding persuasive features to gather the social motivation to support participants' intention, it is applicable for the preventing the breakdowns when females intent to participate cycling activity.

Problematic Sequence Model

Breakdown prevent female cycling activities

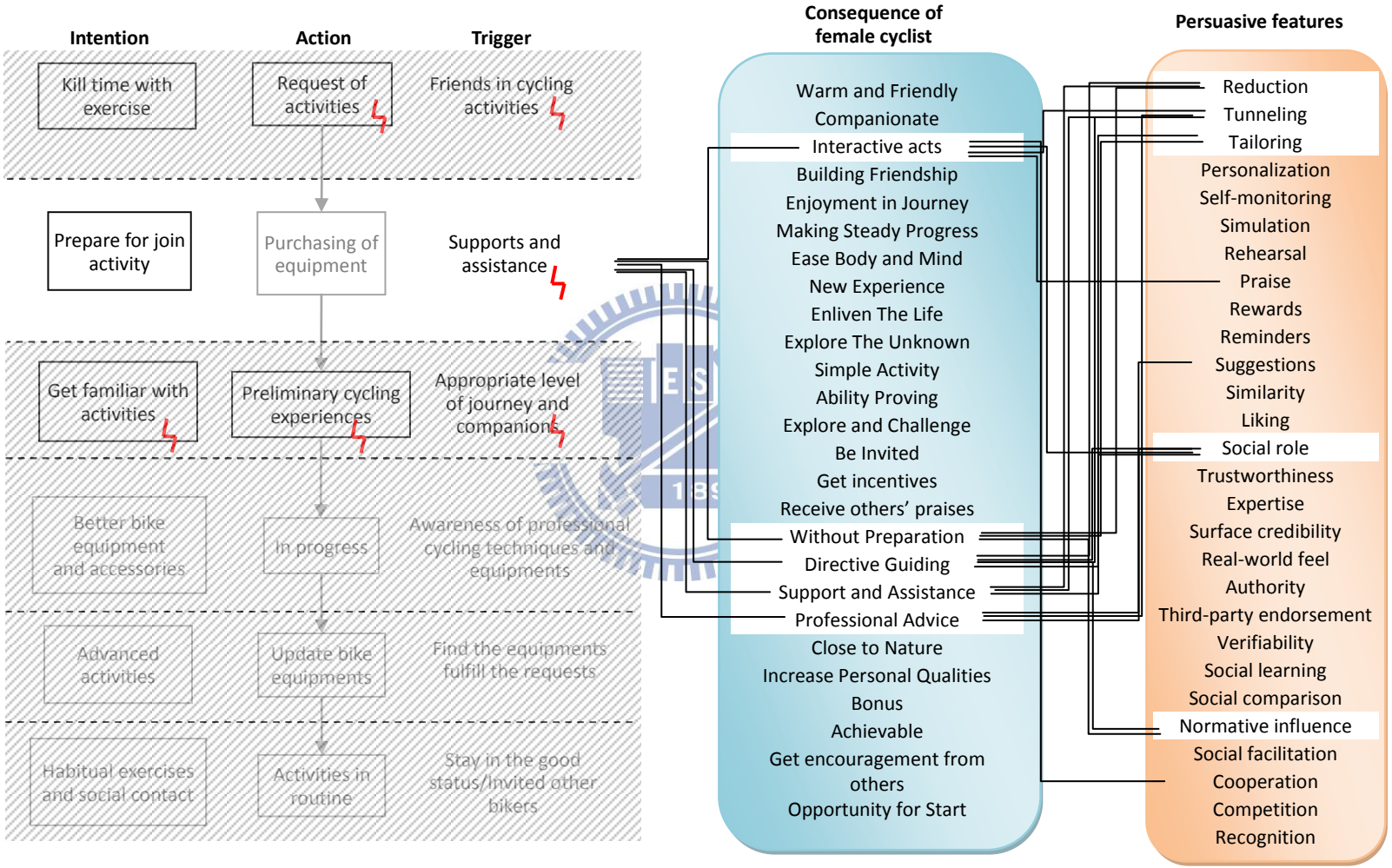


Fig. 5-9 The second phase of breakdowns and the corresponding consequence-persuasive feature

With the intention of preparing for cycling activity, there are some preparation tasks for novices. However, the breakdown is appeared when females are the lack of assistance and support as trigger at their preliminary works. The unfamiliar tasks of cycling equipments or techniques especially exist within female participants in general. According the interviews, the absence of idea with where to go, it's too long to ride without interaction, and activities exposure to burning sunlight are the breakdowns in this action phase in Fig. 5-7. To imitate the possible features extracted from female cyclists to overcome these breakdowns, the appreciated consequences includes *interactive acts*, *without preparation*, *directive guiding*, *support and assistance*, and *professional advices* to start are proposed for employing.

Through manipulating the corresponding influential persuasive features with heavier weight in Fig. 5-9, both of *reductions* in primary preparation support and *social roles* as the activity dialogue assistance are helping for preventions the breakdowns through supporting and assisting to get familiar with preliminary cycling. Also, the cycling task *tunneling*, *tailoring* journeys, and *normative influences* during preparations are supportive for persuasion. The sharing of assistance messages can be useful to provide preparation information, sharing and riding advices throughout journeys in preliminary cycling activities.

Problematic Sequence Model

Breakdown prevent female cycling activities

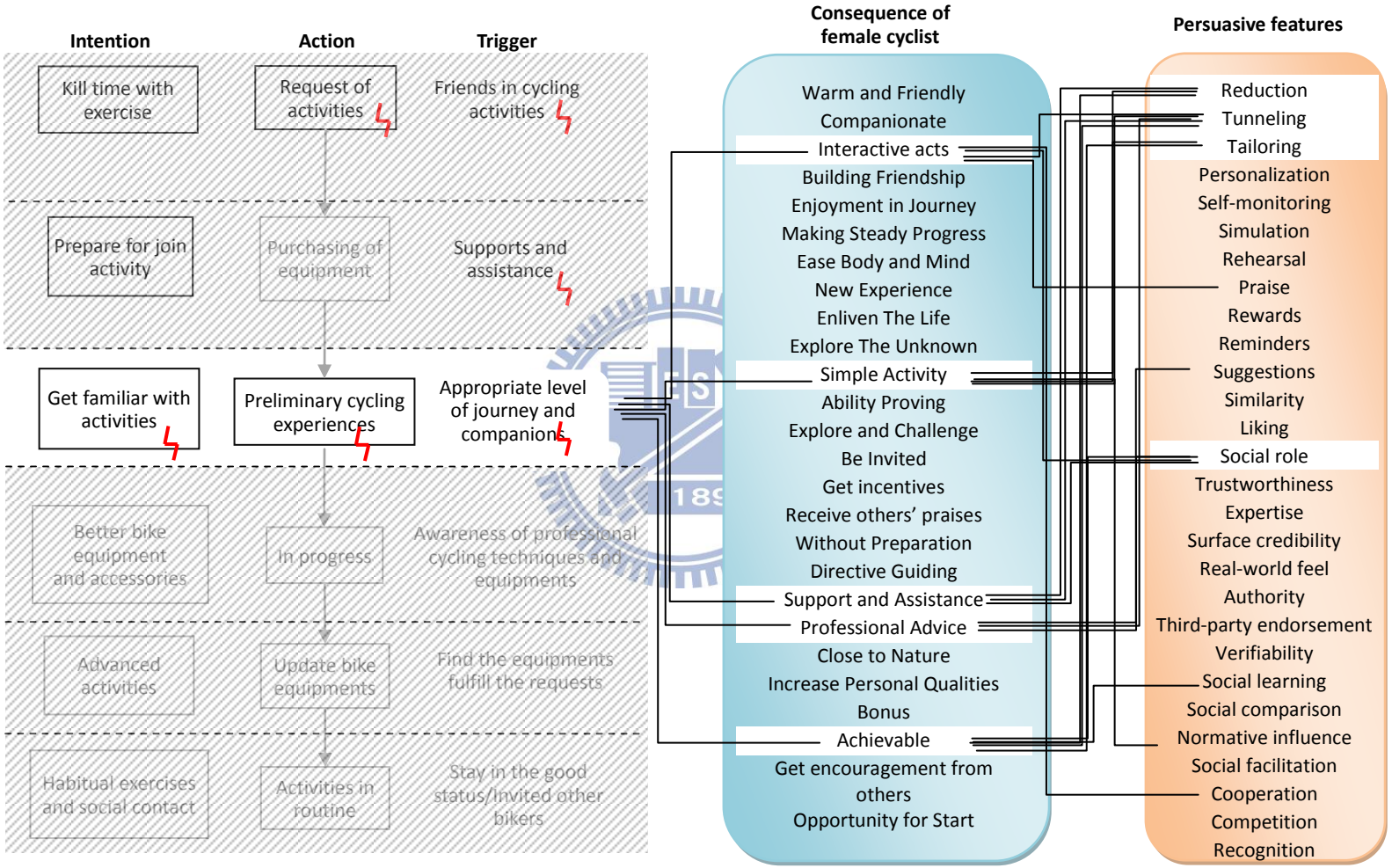


Fig. 5-10 The third phase of breakdowns and the corresponding consequence-persuasive features

For getting familiar with cycling activity, preliminary experiences cause the breakdowns when participants facing the frustrations with tiredness and difficulties during this action phase. In Fig. 5-7, participants cannot receive any enjoyment but tired but nor achieve the effects of exercise are proposed through our interviews. Extracting the appreciated consequences results, interactive acts, achievable, simple activities, support and assistances, professional advices are proposed for eliminating breakdowns in this phase (Fig. 5-10).

The persuasive features are suggested to manipulate are *reduction* for providing advices to avoid difficult journeys, *tunneling* through preliminary cycling journeys, *tailoring* the appropriate level of journeys to be achievable. In addition, *social roles* as advisors are proposed for overcoming the breakdowns in failed ineffective and tired cycling experiences. *Normative influences* are also help through the persuasion to participate with friends for getting fun.

5.3.3. Summary

In sum, facing the breakdowns with potential influenced participants, the influenced persuasive features extracted from appreciated cycling consequences are proposed to manipulate for helping females initial experiences. For the frustrations of the intention to kill time through cycling activity, *social role* and *normative influences* are proposed essentially to start without much effort under the influencing and assistances of warm cyclist friends. On the other side, for difficulties in preparing for activity, *reduction*, *tunneling*, *tailoring*, *social role* and *normative influence* are suggested with guiding and support the initial cycling participation. Moreover, to get familiar with activities, the disappointments are dismissed through *reduction*, *tunneling*, *tailoring* and *social role*. After all, since the persuasion strategies in these three phases are propose along with particular breakdown, corresponded consequence and persuasive feature, it is the more specific aspect of breakthrough when persuade female to join cycling activity. The integrated operations of persuasive features above from varied perspective of support within primary task, dialogue and social support are purposed for persuading the potential influenced audiences through eliminating their problems existed in their lives.

5.4. Comparison of persuasion strategies with theories

Since persuasion strategies are proposed in our research, comparing with traditional psychology theories, results are also explained and supported on the perspective of behavior change, cognitive and

other recent developed theories. Based on the perspectives of female cycling participation overall experiences, goal sources of *Goal-setting theory* for physical activity(Consolvo etal., 2009) are reflected in female cycling persuasion with persuasive feature as *tailoring* for self-set, *tunneling*, *reduction*, *social role* for guide, *normative influence* and *cooperation* for group-set. Therefore, three types of goals are proposed as specific goals to persuade female participating cycling activities with the specific persuasive features.

On the other hand, sequence model of cycling participation are also verified with *Transtheoretical Model* in stages of pre-contemplate, contemplate, presentation and action (Prochaska and Diciemente, 1982). Without intention to change, *social roles* as dialogue support and *normative influences* as social support are proposed within the pre-contemplate stage. For overcoming barriers or rewards, *reduction*, *tailoring* and *tunneling* are extracted persuasive tools in contemplate stage. The five previous persuasive features are proposed to utilize especially in stage. These features also reflected in *cognitive dissonance theory* for providing appropriate commitment supports (Festinger, 1957). In particular, normative influence and social roles with tailored information are identical with social cognitive theory (Miler and Dollard, 1941). Moreover, cooperation is particularly expressed from cycling experiences with moment of togetherness in action stage as persuasion strategy with actual cycling involvement.

Perspective from comparing two groups of participants' values is also inspected with cognitive theories. With ELM model (Petty & Cacioppo, 1986), messages of central route are proposed with persuasive feature of female's inherent values such as *warmness*, *social contact*, *enjoyment* and *relaxation*. Therefore, *social roles*, *normative influence* and *cooperation* are three persuasive features delivered for human cognition persuasion. Values of *enrichment* is proposed as peripheral route persuasion message for delivering tailored journeys with accessibility and attractions through *tailoring* tools support. Also, according to Fogg's developments and models of persuasive technology, FBM (Fogg, 2009) is one of the comprehensive views to interpret persuasion strategy. Considering start from motivations, the female participants' inherent values is corresponded with core motivators for delivering persuasive features to promote higher ability; while trigger is proposed to utilize overcoming problems of breakdowns in cycling participation sequence.

Although our research does not developed based on persuasion strategies, the persuasive features we delivered are also verified with traditional theories. Since the persuasive features are part of different roles as persuasive technology, they are proposed for utilizing in varied ways with particular persuasive design purposes and issues. The results of proposed persuasive features can be delivered for practical

persuasion design strategies, which are also corresponded to traditional psychology theories.

5.5. Summary of persuasion strategies for female cycling

For developing persuasive technologies, those strategies proposed from 5.1 to 5.3 are suggested as references to converge on. Since the design project process different with channels, strategies or limitations, the persuasion strategies can be utilized differently through varied proportion of persuasive feature corresponded to consequence. However, employ the persuasion strategy with pick one or two features randomly may not complete the persuading process. The combinations of several influential features with larger percentage of aspired consequence components are suggested to utilize in persuasive system development. After discussing varied aspects of strategy for persuading female participating in cycling activity in previous three chapter from appreciated cyclists' experiences, inherent values for easily influenced and breakthrough frustrations for participating, the analysis help for identifying strategy utilization in specific situations. After all, we consolidate these results and summarize as the key strategies in persuasive feature-consequence-values with implications under the persuasion issues as below.

5.5.1. Persuasion for female to start their cycling

To persuade female participating at preliminary phase, the four values are proposed as the keywords or core values to extend design strategy with *warmness*, *enjoyment*, *relaxation* and *social contact* since they are regarded as inherent in female participants for making female join in cycling easily. Those strategies are also proposed with breakthrough for overcoming breakdowns at beginning of activity. Besides lots of persuasive features included in the category of dialogue support are proposed for preliminary phase, here are three main suggestions are delivered for strategy.

A. Normative influence is the critical feature for pushing female participating cycling directly

Under the invitation or encouragement from friends, it is easier to start the intention toward cycling activity. It is the influential persuasive feature especially in preliminary cycling participation with consequences of invitation, companion and friendly interaction. Since it helps the breakthrough of frustrations of potential influenced target, reduction in utilizing normative influences is proposed in following participation stages. For example, as social support design feature, approaches it is suggested to provide the service with opportunities or content to produce connections of interests in cycling and

requests for activity are gateways for starting cycling within their social network. The using of SMS through cell phone or instant messages leverages the power of group dynamics for gathering friends (Fogg and Allen, 2009). With the same purpose, applications provide with instant message services of social network like Twitter, Facebook, or other web platform are suggested for releasing and sharing information of cycling for leisure times.

B. Social role is appropriate for introducing cycling activity as dialogue support

Since cycling is regarded as one of physical activity with paying lots of physical effort, dialogues as companions with sharing or communicating among cyclists are essential throughout cycling journeys for female participants. Using social role as dialogue support design feature, contents with assistance and companions are suggested from introducing phase to gradual involvement stage. It is therefore suggested to provide approaches to announce and spread instant message for sharing with or gathering cycling companions for developing persuasive technology. Approaches to share and communicate among cycling companions are also proposed throughout cycling journeys. For example, the interactive cell phone system such as EatWell was proposed to influence users through creating and sharing health-eating voice experiences as social support in the local context (Grimes, Bednar, Bolter, and Grinter, 2008). In similar way, the sharing of assistance messages can be useful to provide encouragement, preparation information, sharing and riding advices throughout journeys to eliminate frustrations caused by less experience in preliminary cycling activities. In another example, the mobile audio support as "Jogging over a Distance" is proposed to encourage joggers and support the social communication between them (Mueller, O'Brien, and Thorogood, 2007).

C. Reduction is essential for enable female join cycling activity as primary task support

To support get familiar with preparing for starting cycling activity, the shortcut of accessing equipment and technique with consequence of friendly assistance are proposed for persuasion. Since reduction is the primary task support design feature for enable female join cycling activity, it is only suggested to employ in preliminary participating phase through interactive ways. For those female cyclists, the simple processes of participating at the beginning are suggested to provide for encouraging people. Information with a campaign of equipment or journey under reliable and friendly support is suggested to provide for convincing female cycling is achievable.

5.5.2. Persuasion for making female involving in cycling

For persuading participants enjoy in cycling and being persuading through perceiving appreciated experiences, the values of *enjoyment*, *relaxation*, and *enrichment* are suggested for primary employing as primary spirit of developing persuasive design for they are also the values existed within potential influenced participants. Persuasions are raised to make them perceiving benefit fulfilled with the three values.

D. Social role and praise are dominant for persuading participants involve in cycling

Throughout cycling journeys, interactive dialogue of roles as companion, assistant and expert are proposed to persuade female step into cycling through progress. The dialogue support provided throughout journeys is especially suggested to employ with physical or virtual encouragement from different roles. It is especially proposed to enhance in habitual involvement participation phase. While warmness are appreciated through expressing participants encouragement from someone passerby, praises from expert or experienced cyclist give them confidences. *Praises* are referred as great encouragement for prompting participants to involve in activity with following journeys. Using praises as the dialogue support design feature is essential from experienced cyclists no matter the participants' performances. Advices along praises are regarded as a strategy of persuasion.

E. Tunneling and tailoring play primary roles for making participants access to enjoyment

For providing access to enjoy cycling activity, *tunneling* is an essential persuasive feature to be the gateway for receiving interest, relaxation and enjoyment under natural environment. Starting from preliminary journey, the design feature of *tunneling* as company and assistant with specific goals are helped the progressing of activity till advanced skill and interests with journey. For example, it is appreciated to suggest setting achievable and desired goals along journeys for access more enjoyment under the approach of tunneling. Integrate with *tunneling*, *tailoring* is suggested to fulfill demands of potential influenced audiences. Design feature with *tunneling* for making participant progress are suggested to involve in strategy with varied journeys depends on appropriate levels and personalization requests. From preliminary participants, it suggests to offer desirable and achievable journey with assistant information; while different properties of journey or activity are changed with preliminary experiences. Challenge and exploration are motives for encouraging female to seek more fun upon the values of enrichment. Information of varied journeys and explorations introduced by media is one of the examples as the implement. These results are conformed to the results of suggesting providing self-set goal or working with expert to set goal choices in persuasive design for encouraging physical activity on the UbiFit interactive application (Consolvo et al., 2009).

F. Cooperation come up with accompany and friendship

To enhance the involvement in cycling activity, *cooperation* is another appreciated persuasive feature with social support. Since co-activities give lots of enjoyments and friendly interactions with memory among cyclist, providing goals or activity for group cyclists are help to encourage involvement under in-group adherence and affections as the design feature from social support. It is the strategy for causing consequences of company and building of friendship. The situations of encountering subjects together are suggested for causing cooperation. Opportunities of co-work and other memorable experiences provide in journeys can raise the interests in expectations from participants even with different intention or ability. Cooperation is identical with one of the goal resources through group-set which is added by Shiltz, Horowitz, and Townsend to choose a goal for a group that encourages physical activity through goal attainment is contingent on the performance of group (2004).

Chapter 6
Conclusions

Through the practical planning and examining a user study process, persuasion strategies for female cycling persuasive design are proposed through the approaches of analysis processes. The study process not only contributes to female cycling persuasion issue, it can also be extended to other domain of varied issues for exploring persuasion strategy through further researches. At the end of thesis, this study concludes with findings, limitations, contributions and future works.

6.1. Conclusion of findings

For the research aim is to propose persuasion strategy to persuade female to participate in cycling, the results are delivered correspond to three objectives.

A. The development of a systematic user study process for exploring persuasion problems

For applying a user study process, our research is constructed systematically based on the structure of imitating successful persuasive design to deliver a persuasive system design which is proposed by Fogg (2009). The user study process starts with exploring the context in both potential influenced group and role model group through diary study and interviews. Through extracting appreciated consequences with attribute and values from role model participant group, the results are further proposed with persuasive features on persuasive system as the example to compare and follow with. User study results of another group composed of potential influenced participants, inherent values and problems are conducted as opportunities for persuading. Two parts of results are the resources for comparing and discussing to propose persuasion strategy in our issue.

B. Conduct the user study results with persuasion strategy for suggesting persuasive system design

Research results from the contexts of user-ended are delivered for conducting design strategies through the persuasive features-consequence-values relation chain to depict the employment in persuasive technology design. For applying these strategies on different design project with varied persuasive channels, problems, or particular group of users, three main perspectives for interpretation are proposed in chapter 5.1 to 5.3 and summarized with persuasion strategies in varied scopes for specific issues. In this research, the persuasive issue is focused on female cycling persuasion. The research results

are discussed and finally delivered with persuasion strategy for female cycling activity in three different aspects of view.

a. Strategy includes consequence and persuasive features conducted from appreciated cycling experiences with female cyclists participants as role model to imitate
b. Strategy of relationship among values, consequence to persuasive features conducted through discussing values of two groups of participants as opportunities for persuasion
c. Strategy with applying the appreciated consequences from role model cyclist to suggest solution for the problems of participating in cycling from potential influenced participants

C. Clarifying roles of user study to use persuasive features in system design.

The delivery conducted through a structural user study findings are proposed as strategies for female cycling persuasion. Through the understanding of specific persuasion strategy, the research process and result are provided for helping define persuasive design scope and problems clearly. Besides, the analyses upon these results include persuasion strategies for directing specific operation and implication with consequences in each persuasive feature. The user study process finally connects persuasive design issue with user, persuasion tools and designer for developing persuasive system design systematically.

6.2. Limitations of persuasion strategies in female cycling activity

In this research, we found there are several limitations of exploring persuasive features for female cycling activities. Firstly, the persuasive features cannot propose the persuasion suggestions for system credibility. Secondly, the specific female persuasion issues are not proposed with results.

Since we apply the systematic persuasive design features constructed by Oinas-Kukkonen and Harjumaa (2009), which is the new framework for designing and evaluating persuasive systems, it's contain comprehensive persuasive features in for categories: primary task support, dialogue support, system credibility, and social support. However, through the user studies of female participants who already participate in cycling activities, the results focus on their daily life, consequences and activities. Without a specific persuasive system or artifact in their cycling activities, the features of persuasive system credibility cannot be reflected through this research.

On the other hand, since our research results from the two groups of participants, the female cycling participant, and the female without cycling activities, we focus on their contexts to conduct the

strategies. The persuasion strategies and problems with cycling activities are conducted through the each analysis and comparisons. However, specific persuasion issue for female are hard to propose and discussed through comparing two groups with same gender.

6.3. Recommendation to future works and contributions

Focusing on the contribution of persuasion issue for female cycling, there are some recommendations for those researchers to develop studies of persuasive system design in several issues. Since the research discovers the persuasion strategies based on two groups of user-ended data with twenty-eight persuasive features, there are some other issues for helping to develop persuasive system design in female cycling. First of all, the recruiting of user study participant group is changed with the persuasion issues for design. For example, with concerning about difference with gender to propose strategies, the participants can be changed to male cyclist for comparing and investigation. Second, it is suggested to extract persuasive feature with different dimensions for developing varied type of strategies. Depending on the persuasive channel, user group or other scope, the persuasion strategies can be focused on specific issue through extracting particular persuasive properties. Finally, according to the scope of persuasive issue for design, varied perspectives to compare and analysis of user study results are suggested to widely extend for each particular persuasive design project.

However, for other domains out of this issue, the development of study process also contributes for proposing persuasion strategies with further studies. For the requirements of designer and producer to develop persuasive technologies, processes of user study are essential to discover appropriate problems or the specific design issues for focusing on firstly. Therefore, a systematic process determines approach to understand users and also the delivery which reflects specific persuasion issue. While designers have applied design strategies from varied theoretical guidelines from reviewing the past researches or experiences, for proceeding design to change what user think and do, we proposed a systematical user study process to help develop persuasive design strategies. Finally at the end of results, we propose a systematic user study process which conducts the delivery of persuasion context with user-ended data, persuasion strategy and approaches of analyses is contributed for developing a persuasive system design. This research results therefore contribute to (1) developing a systematic user study process for exploring persuasion problems (2) proposing user context for persuasion and suggesting persuasive design strategies for designers or producers (3) positioning the bridge of user study from persuasion issue, user, persuasion tools and designer. Through the process with practical

exploring of user study and analysis to conduct persuasion strategies, this research proposes a systematic implement for future study and design for persuasive system design.

References

Adams, J., & White, M. (2005). Why don't stage-based activity promotion interventions work? *Health Education Research, 20*(2), 237-243.

Baker, L. (2009). How to get more bicyclists on the road. *Scientific American, 301*, 28-29.

Consolvo, S., Everitt, K., Smith, I., & Landay, J. (2006). *Design requirements for technologies that encourage physical activity.* Paper presented at the Proceedings of the SIGCHI conference on Human Factors in computing systems.

Consolvo, S., Klasnja, P., McDonald, D., & Landay, J. (2009). *Goal-setting considerations for persuasive technologies that encourage physical activity.* Paper presented at the Proceedings of the 4th International Conference on Persuasive Technology, Claremont, California.

Consolvo, S., McDonald, D., & Landay, J. (2009). *Theory-driven design strategies for technologies that support behavior change in everyday life.* Paper presented at the Proceedings of the 27th international conference on Human factors in computing systems.

Crabtree, A., Hemmings, T., Rodden, T., Cheverst, K., Clarke, K., Dewsbury, G., et al. (2003). *Designing with care: Adapting cultural probes to inform design in sensitive settings.* Paper presented at the Proceedings of the 2004 Australasian Conference on Computer-Human Interaction (OZCHI2004).

De Boer, M., & McCarthy, M. (2003). *Means-end chain theory applied to Irish convenience food consumers.* Paper presented at the 83rd EAAE Seminar Food quality products in the advent of the 21st century, Chania (Greece).

Fogg, B. (1998). *Persuasive computers: perspectives and research directions.* Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems.

Fogg, B. (2009). *A behavior model for persuasive design.* Paper presented at the Proceedings of the 4th International Conference on Persuasive Technology.

Fogg, B. (2009). *Creating persuasive technologies: an eight-step design process.* Paper presented at the Proceedings of the 4th International Conference on Persuasive Technology.

Fogg, B., & Allen, E. (2009). *10 uses of texting to improve health.* Paper presented at the Proceedings of the 4th International Conference on Persuasive Technology.

Fogg, B., & Eckles, D. (2007). The Behavior Chain for Online Participation: How Successful Web Services Structure Persuasion. *Persuasive Technology*, 199-209.

Fogg, B., & Nass, C. (1997). Silicon sycophants: the effects of computers that flatter. *International Journal of Human-Computers Studies, 46*(5), 551-561.

Gaver, W., Boucher, A., Pennington, S., & Walker, B. (2004). Cultural probes and the value of uncertainty. *Interactions, 11*(5), 53-56.

Grimes, A., Bednar, M., Bolter, J., & Grinter, R. (2008). *EatWell: sharing nutrition-related memories in a low-income community.* Paper presented at the Proceedings of the ACM 2008 conference on Computer supported cooperative work.

Guion, L. (2001). Conducting an In-depth Interview. *FCS6012*. Retrieved from www.edis.ifas.ufl.edu

Gutman, J. (1982). A means-end chain model based on consumer categorization processes. *The Journal of Marketing, 46*(2), 60-72.

Haines, V., Mitchell, V., Cooper, C., & Maguire, M. (2007). Probing user values in the home environment within a technology driven Smart Home project. *Personal and Ubiquitous Computing, 11*(5), 349-359.

Harjumaa, M., & Oinas-Kukkonen, H. (2007). *Persuasion Theories and IT Design.* Paper presented at the Persuasive technology: Second International Conference on Persuasive Technology, PERSUASIVE 2007, Palo Alto, CA, USA.

Kitzinger, J. (1994). The methodology of focus groups: the importance of interaction between research participants. *Sociology of health and illness, 16*(1), 103-121.

Kitzinger, J. (1995). Introducing focus groups. *BMJ: British Medical Journal*, 299-302.

Lerbinger, O. (1972). *Designs for persuasive communication*: Prentice Hall.

Mack, N., Woodsong, C., MacQueen, K., Guest, G., & Namey, E. (2005). Qualitative research methods: A data collector's field guide. *Family Health International*, 00-95.

Mattelmaki, T. (2005). Applying probes¡Vfrom inspirational notes to collaborative insights. *CoDesign, 1*(2), 83-102.

Mcfarlane, D. (1998). *Interruption of people in human-computer interaction.* Citeseer.

Morgan, D. (1997). *Focus groups as qualitative research*: Sage Pubns.

Mueller, F., O'Brien, S., & Thorogood, A. (2007). *Jogging over a distance: supporting a jogging together experience although being apart.* Paper presented at the CHI'07 extended abstracts on Human factors in computing systems.

Norman, D. (2002). *The design of everyday things*: Basic Books New York.

Oinas-Kukkonen, H., & Harjumaa, M. (2008). *A Systematic Framework for Designing and Evaluating Persuasive Systems.* Paper presented at the Proceedings of the 3rd international conference on Persuasive Technology.

Oinas-Kukkonen, H., & Harjumaa, M. (2009). Persuasive Systems Design: Key Issues, Process Model, and System Features. *Communications of the Association for Information Systems, 24*(1), 28.

Oumard, M., Mirza, D., Kroy, J., & Chorianopoulos, K. (2008). *A cultural probes study on video sharing and social communication on the internet.* Paper presented at the Proceedings of the 3rd international conference on Digital Interactive Media in Entertainment and Arts.

Petty, R., & Cacioppo, J. (1986). *Communication and persuasion: Central and peripheral routes to attitude change*: Springer.

Preece, J., & Maloney-Krichmar, D. (2005). Online communities: Design, theory, and practice. *Journal of Computer-Mediated Communication, 10*(4).

Reynolds, T., & Gutman, J. (2001). *Laddering theory, method, analysis, and interpretation.*

Torning, K., & Oinas-Kukkonen, H. (2009). *Persuasive system design: state of the art and future directions.* Paper presented at the Proceedings of the 4th International Conference on Persuasive Technology.

Walji, M., Brixey, J., Johnson-Throop, K., & Zhang, J. (2004). *A theoretical framework to understand and engineer persuasive interruptions.* Paper presented at the Proceedings of the 26th Annual Meeting of the Cognitive Science Society, Chicago.

Wheeler, L., & Reis, H. (2006). Self-recording of everyday life events: Origins, types, and uses. *Journal of Personality, 59*(3), 339-354.

林勤豐. (2000). *顧客知覺分析之研究：以便利商店「服務性產品」設計為例.* Paper presented at the 第三屆商業現代化研討會.

邱魏頌正, & 李梅菲. (2002). 行動電話購買行為研究. *傳播與管理研究, 1*(2), 213-237.

賀先蕙. (2008). 奮起吧！腳踏車。. *商業週刊, 1075,* 100-121.

Websites

MOTC (Ministry of Transportation and Communications R.O.C.) 交通部99年自行車使用狀況調查摘要分析). From http://www.motc.gov.tw/mocwebGIP/wSite/lp?ctNode=164&CtUnit=96&BaseDSD=7&mp=1&pagesize=100

Nike+iPod website. from http://www.apple.com/tw/ipod/nike/

Official Web blog of Island Etude. from http://www.wretch.cc/blog/EtudeBike/6258953

Polar. from http://www.polar.fi/en

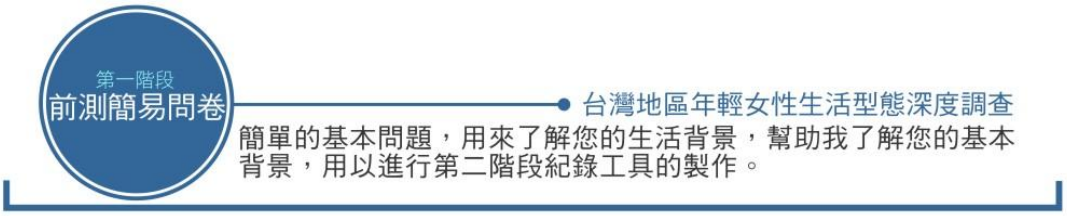
QuitNet. from http://www.quitnet.com/qnhomepage.aspx

Social indicators 2005, Directorate general of budget, accounting and statistics executive yuan, R.O.C. 社會指數統計年表2005 我國兩性主要運動項目. from http://www.dgbas.gov.tw/lp.asp?ctNode=3478&CtUnit=1033&BaseDSD=7U

Wiifit. from http://wiifit.com/

Appendix A

Screening inquiries



[A 基本資料]

A1.請問您的姓名（中文）：

A2.請問您的年齡（足歲）：

A3.請問您的婚姻狀況：（單身/已婚，幾個子女）

A4. 您有兄弟姊妹嗎（如一個哥哥一個妹妹）：

A5.請問您的工作類型（如服務業、製造業等）：

A6.目前與您同住的成員（如男友、先生、父母親、兄弟姊妹、同事等）：

A7.您的學歷：（選項有：高中職以上，大學以上，研究所以上，其他等）

A8.請問您的工作職稱：

A9.請稍微描述一下您工作的內容：

A10.您一週工作的日子有幾天（如一週五天，或隔週修二日等）：

A11.您平均一天的工作時間（小時）：

A12.您平常使用的交通工具：

A13.您的年收入大約是：

（選項有：0-30 萬，31-50 萬，51-99 萬，100-199 萬，200 萬以上）

[B 活動區域]

B1.您**居住**的位置是：（不用明確指出幾樓，如台北市松山區八德路四段 300 號）

B2.您**工作**的位置是：（不用明確指出幾樓，如台北市信義區松壽路 5 號）

B3.除了住家與工作的位置外，您**最常活動**的地區與活動：

（不用明確指出幾樓，如台北縣中和市中安路 40 號/拜訪朋友、聚餐、或逛街等）

[C 休閒與興趣]

C1.請舉出**三項**您最常做的休閒活動：（如看展覽、唱歌出外或在家看電影、看電視、上網、聚餐聚會、逛街、爬山、踏青等）

C2.您喜歡的休閒活動為戶外或室內活動：

C3.您討厭運動嗎？為什麼？（如果否請至 C4）

C4.您喜歡從事的運動，從事的頻率大約為：

（如游泳，大約每個月兩次）

C5.您害怕學習新事物嗎？簡單陳述一下。

[D 研究相關問題]

D1.您是否從事單車活動？（如果否結束問卷）

D2.您參與單車活動的頻率大約是（如：一週兩次/一個月兩次）

D3.您參與單車活動的目的通常是（如：運動/旅遊/觀光騎乘等）

Appendix B

a. Workbook for female cyclist participants


年輕單車女性生活型態研究
日誌手冊
WORKBOOK


說 明

妳好。
這個研究主要想了解台灣年輕女性的單車活動、以及妳們的生活，進而針對尚未加入單車活動的年輕女性，以設計或鼓勵手法讓她們更容易接受並也一起加入。本研究使用「探針調查法」，讓研究者像是妳的追蹤者，透過妳的活動紀錄以及日誌進一步了解妳的生活，最後再以這些資料進行分析，期望能獲取妳的生活態度與影響活動的因素。

本冊子分作兩個部份。
第一部份為**妳的單車資料紀錄**。請妳介紹妳的單車生活，包含如何開始、現在的狀態，以及妳的單車資訊來源等。

第二部份為**妳的生活紀錄**。這部份要每天紀錄為期一週，包含妳的生活、時間、工作與人際互動的關係，平日的衣著電子紀錄則存入USB中。

貼紙工具附在手冊最後面。每個部份都有範例，幫助您填寫時作為參考。
接下來，就請妳翻開下一頁開始手冊紀錄吧！


第一部份
關於**單車**生活


請先介紹一下妳的單車吧！


妳的單車生活是怎麼開始的呢？


請紀錄妳印象最深刻的單車活動過程吧！


製作妳的單車資訊相關圖


第二部份
關於**妳的**生活

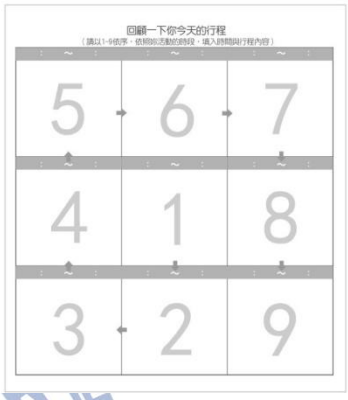

一週填寫方法說明


99年1月 日星期 ○工作日○假日天氣

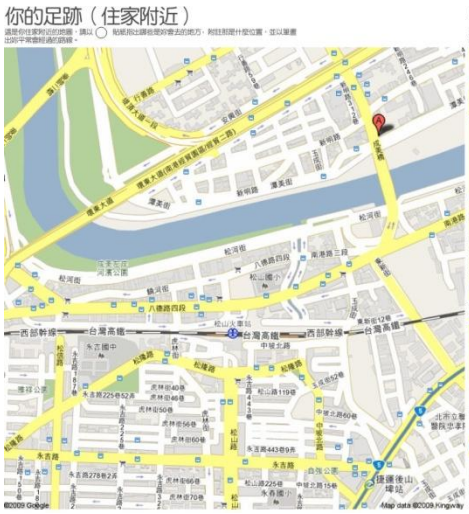

回顧一下你今天的行程

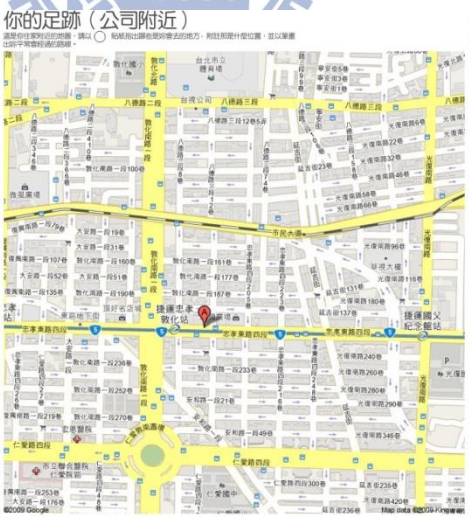

回顧一下你今天與人的互動

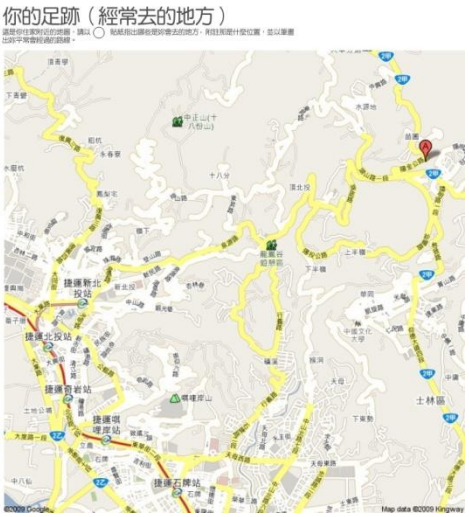
b. Workbook for female who do not participate in cycling



c. Maps for two groups of participants to point out the activity regions







Appendix C

Attribute 項目編號對應內容

1	Movie about cycling/Others' cycling experience
2	Natural scenes and journey
3	Participate cycling under encouragement of friends
4	Another choice of exercise
5	Participate without most of preparation
6	The real situation of journey is not explicit before the activity
7	Assistance and advices of purchasing cycling equipments
8	Checking and adjusting equipment with assistance
9	Reminder of operation and technique with cycling
10	Invited to join the Interesting journeys
11	New experience different with daily lives
12	Enjoyment throughout natural journey
13	Encouragement during the difficult journey
14	Full of vitality after exercises
15	Experiences of riding together
16	Routes, landmark and map of journey
17	Timing for interacting with other riders
18	Activity option in leisure time
19	Receive encouragement from passerby or other cyclists
20	Positive assessment of riding skill from experienced riders
21	Strong endurance and strength for riding from other cyclists
22	Desired goals throughout journeys
23	Outdoor activity helps for releasing stress caused in workdays in nature
24	Receiving encouragement even with little progress
25	Stop for take break according to personal physical status
26	Friends which overcome difficulties in preliminary journeys together
27	Practical riding experiences at the beginning for adapting to following cycling
28	Tutorial and suggestion for riding throughout activity
29	Guiding and waiting in journey
30	Appropriate options of equipment in function or look
31	Suggestions for cyclist's own experiences, ability and needs
32	Assistance for solving problems or frustrations in cycling
33	Practical demonstrations of riding skill and techniques
34	Maintenance and supports for riding
35	Invited to join the Interesting journeys
36	Ubiquitous and convenient stop site for rest and supply
37	Memories and interactions together with cyclists in activity
38	Riding with cyclists in the same level of ability
39	Sharing from cyclists enthused in cycling
40	Show with an extra specialty
41	New route or goal without previous experience
42	Full of vitality after exercises
43	Image records of memorable journeys
44	Advanced cycling activity
45	Purchasing new bike or upgrade
46	Training based on accumulated ability and experiences
47	Level and speed progressed from simple to advance
48	Flexible timing for participation
49	Recruit someone else to join the activity together
50	Control and adjustment of heart beat and speed status

Persuasive feature 項目編號對應

Number	Persuasive features
1	Reduction
2	Tunneling
3	Tailoring
4	Personalization
5	Self-monitoring
6	Simulation
7	Rehearsal
8	Praise
9	Rewards
10	Reminders
11	Suggestions
12	Similarity
13	Liking
14	Social role
15	Trustworthiness
16	Expertise
17	Surface credibility
18	Real-world feel
19	Authority
20	Third-party endorsement
21	Verifiability
22	Social learning
23	Social comparison
24	Normative influence
25	Social facilitation
26	Cooperation
27	Competition
28	Recognition

a. Matrix of relationship between consequences and attributes

(The complete table of table 4-1) Attribute 代號參照前表

Consequence\attributes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Warm and Friendly			1							1			1						1					1														1												
Companionate			1							1			1		1											1			1						1		1	1											1	
Interactive								1	1				1		1		1		1	1				1				1			1	1	1	1			1	1	1										1	
Building Friendship			1												1		1	1	1							1											1										1	1	
Enjoyment in Journey		1									1	1	1			1	1					1	1													1											1		
Making Steady Progress																				1				1			1	1					1								1			1	1	1	1			1
Ease Body and Mind												1		1								1																				1								
New Experience		1		1							1					1																		1								1								
Enliven The Life		1		1							1	1		1				1				1	1											1								1	1	1	1			1		
Explore The Unknown		1			1	1																		1	1																	1			1					
Simple Activity					1	1				1								1						1				1								1														
Ability Proving	1																			1						1			1									1						1	1	1	1			
Explore and Challenge	1			1						1	1					1								1	1										1							1			1				1
Be Invited			1		1					1								1	1																1										1			
Reward												1	1	1	1							1																				1								
Incentive													1							1				1																		1								
Without Prepare				1	1	1				1								1							1				1						1	1													
Directive or Guiding			1		1	1	1	1	1	1						1						1					1	1						1									1		1			
Support and Assistance					1		1	1	1										1						1		1	1		1	1		1		1	1	1												
Professional Advice							1	1	1								1										1			1	1	1	1					1											
Close to Nature		1								1	1	1						1				1	1											1							1					1			
Increase Personal Qualities																				1																				1								
Bonus											1	1	1	1	1		1		1																				1	1	1							1	
Achievable	1				1	1	1			1	1							1			1	1			1	1			1					1		1												
Encouraging			1										1		1					1				1																								
Opportunity for Start	1		1	1	1	1	1			1															1									1		1												

b. Matrix of relationship between consequences and values

(The complete table of table 4-2)

Consequence/values	Warmness	Social contact	Enjoyment	Enrichment	Growing up	Relaxation	Curiosity	Uncomplicated	Accomplishment	Self confidence	Carefree	Reliable
Warm and Friendly			1	1			1					
Companionate		1	1	1	1	1	1					
Interactive	1		1	1					1			
Building Friendship		1	1	1	1	1						
Enjoyment in Journey			1			1						
Making Steady Progress			1				1					
Ease Body and Mind			1			1						
New Experience				1	1				1			
Enliven The Life				1	1		1		1		1	
Explore The Unknown				1	1				1	1		
Simple Activity				1					1	1		
Ability Proving				1					1	1		
Explore and Challenge						1		1			1	
Be Invited						1		1			1	1
Reward					1			1			1	1
Incentive	1					1		1			1	1
Without Prepare		1					1	1				1
Directive or Guiding	1										1	
Support and Assistance						1					1	1
Professional Advice		1		1	1							1
Close to Nature	1	1										
Increase Personal Qualities				1	1			1	1	1		
Bonus		1									1	
Achievable											1	
Encouraging				1	1							1
Opportunity for Start	1		1		1					1		
Sum of each values	5	6	8	12	10	8	5	6	7	5	9	7
Weight of each values(%)	5.7%	6.8%	9.1%	13.6%	11.4%	9.1%	5.7%	6.8%	8.0%	5.7%	10.2%	8.0%

c. Matrix of relationship between persuasive feature and attributes

(The complete table of table 4-3) Attribute 代號參照前表

Persuasive features(28)\Attributes(51)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	Total weight of each feature(%)	Total weight of each category(%)
Reduction					9		1	9										9																1		9																5.8%	48.7%
Tunneling	1						3	3	1		1					9						9				1		3	9				9				9									1					9.0%	
Tailoring				9							9	1		1				3				1	9		9		3		9	9	3							9	3		9	9		9	9				17.9%	
Personalization																						3								3																				0.9%	
Self-monitoring																									3																				3		9	3			9	4.1%	
Simulation	3	1		3								3									3												1										9								3.5%	
Rehearsal					3						3	9		3									3			9	1															9	3			3				3	7.5%	
Praise													9							9				9																1											4.3%	28.9%
Rewards		3											3	9																										3											2.7%	
Reminders			1																																															0.2%	
Suggestions			3	1		3			3	1					1	1									1					1	3	9			1						1			1	1						4.7%	
Similarity						9													3															3																2.3%	
Liking		9								3						3																			3																2.9%	
Social role							9	1	9						3				9	3	1			3		9		9	1		1	1	3	9			3		3											11.8%	
Trustworthiness																																																			0.0%	0.5%
Expertise																																																			0.0%	
Surface credibility																																				3															0.5%	
Real-world feel																																																			0.0%	
Authority																																																			0.0%	
Third-party endorsement																																																			0.0%	
Verifiability																																																			0.0%	
Social learning	9																9				9																	1						3								6.1%	22.0%
Social comparison																																					9														1.4%	
Normative influence			9		1	1				9																									9												3	3		5.3%	
Social facilitation																	3														1						3				3									1.5%	
Cooperation															9											3			3								9	1											9		5.2%	
Competition																																																			0.0%	
Recognition													1				1		1	1				1													1			9								1		2.4%	

d. Matrix of relationship between consequence and persuasive feature

(The complete table of table 4-4) Persuasive features 代號參照前表

Consequence(26)\Persuasive feature(28)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Warm and Friendly	0	9	0	0	0	0	0	18	3	1	4	3	3	15	0	0	0	0	0	0	0	1	0	18	0	0	0	3
Companionate	0	10	0	0	0	0	0	9	3	1	6	0	6	16	0	0	0	0	0	0	0	0	9	30	3	34	0	3
Interactive	10	25	12	0	0	1	1	27	3	0	16	6	0	57	0	0	0	0	0	0	0	10	9	3	7	28	0	7
Building Friendship	9	1	12	0	0	0	0	0	0	1	4	3	0	24	0	0	0	0	0	0	0	9	0	15	3	30	0	4
Enjoyment in Journey	0	19	20	3	0	13	18	9	6	0	1	0	12	3	0	0	0	0	0	0	0	9	0	3	3	18	0	4
Making Steady Progress	0	13	39	0	24	1	16	18	0	0	3	0	0	18	0	0	0	0	0	0	0	3	0	0	3	0	0	2
Ease Body and Mind	0	0	14	0	0	3	24	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Experience	0	10	30	0	0	4	3	0	3	0	4	0	16	0	0	0	0	0	0	0	0	9	0	9	3	0	0	0
Enliven The Life	9	10	66	3	3	16	30	0	12	0	4	0	13	0	0	0	0	0	0	0	0	9	0	12	3	0	0	0
Explore The Unknown	9	1	27	0	6	1	3	0	3	0	6	9	9	9	0	0	0	0	0	0	0	0	0	2	3	3	0	0
Simple Activity	27	9	12	0	3	0	3	0	0	0	5	9	3	1	0	0	3	0	0	0	0	0	0	11	0	3	0	0
Ability Proving	0	2	39	3	15	6	12	0	0	0	3	0	0	1	0	0	0	0	0	0	0	21	9	0	3	1	0	0
Explore and Challenge	0	13	54	0	18	6	6	0	0	0	7	0	9	9	0	0	0	0	0	0	0	9	0	18	3	3	0	0
Be Invited	18	0	12	0	0	0	3	0	0	1	5	3	6	9	0	0	0	0	0	0	0	0	0	31	0	0	0	1
Reward	0	9	6	3	0	3	21	9	12	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	9	0	1
Incentive	0	0	0	0	0	0	0	28	6	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	12
Without Prepare	27	9	21	0	3	3	3	0	0	0	7	9	6	1	0	0	3	0	0	0	0	0	0	20	0	3	0	0
Directive or Guiding	19	38	19	3	3	0	4	0	0	1	13	9	9	29	0	0	0	0	0	0	0	3	0	29	0	3	0	0
Support and Assistance	29	20	12	0	0	0	4	0	0	0	15	6	0	61	0	0	3	0	0	0	0	0	9	1	4	16	0	2
Professional Advice	11	28	12	0	0	1	1	0	0	0	15	3	0	45	0	0	0	0	0	0	0	10	0	0	4	0	0	1
Close to Nature	9	10	41	3	0	4	15	0	3	0	3	0	15	0	0	0	0	0	0	0	0	0	0	21	3	0	0	0
Increase Personal Qualities	0	0	3	0	0	0	0	10	3	0	0	0	1	3	0	0	0	0	0	0	0	9	0	0	0	0	0	10
Bonus	0	1	23	0	0	3	24	10	15	0	2	3	0	12	0	0	0	0	0	0	0	9	0	3	6	18	0	13
Achievable	29	24	22	3	3	6	6	0	0	0	5	12	3	29	0	0	3	0	0	0	0	18	0	11	0	6	0	0
Encouraging	0	0	0	0	0	0	0	27	3	1	4	0	0	9	0	0	0	0	0	0	0	0	0	9	0	9	0	3
Opportunity for Start	10	5	9	0	0	6	3	0	0	1	9	9	6	21	0	0	0	0	0	0	0	9	0	29	0	12	0	1
Sum of scores	216	266	505	21	78	77	200	165	84	7	142	84	117	381	0	0	12	0	0	0	0	138	36	275	51	196	0	67
Proportion of weight in each feature (%)	6.9%	8.5%	16.2%	0.7%	2.5%	2.5%	6.4%	5.3%	2.7%	0.2%	4.6%	2.7%	3.8%	12.2%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	4.4%	1.2%	8.8%	1.6%	6.3%	0.0%	2.1%
Proportion of weight in each category (%)							43.7%							31.4%							0.4%							24.5%

e. Matrix of relationship between cycling attributes and persuasive feature in preliminary participate phase

(The complete table of table 4-5)

Attribute(10)/Persuasive feature	1 Movie about cycling/Others' cycling experience	2 Natural scenes and journey	3 Participate cycling under encouragement of friends	4 Another choice of exercise	5 Participate without most of preparation	6 The real situation of journey is not explicit before the activity	7 Assistance and advices of purchasing cycling equipments	8 Checking and adjusting equipment with assistance	9 Reminder of operation and technique with cycling	10 Invited to join the Interesting journeys	Proportion of weight in each feature (%)	Proportion of weight in each category (%)
Reduction					9		1	9			14.6%	
Tunneling	1						3	3	1		6.2%	
Tailoring				9							6.9%	
Personalization											0.0%	35.4%
Self-monitoring											0.0%	
Simulation	3	1		3							5.4%	
Rehearsal					3						2.3%	
Praise											0.0%	
Rewards		3									2.3%	
Reminders			1								0.8%	
Suggestions			3	1		3			3	1	8.5%	42.3%
Similarity						9					6.9%	
Liking		9								3	9.2%	
Social role							9	1	9		14.6%	
Trustworthiness											0.0%	
Expertise											0.0%	
Surface credibility											0.0%	
Real-world feel											0.0%	0.0%
Authority											0.0%	
Third-party endorsement											0.0%	
Verifiability											0.0%	
Social learning	9										6.9%	
Social comparison											0.0%	
Normative influence			9		1	1				9	15.4%	
Social facilitation											0.0%	22.3%
Cooperation											0.0%	
Competition											0.0%	
Recognition											0.0%	

f. Matrix of relationship between cycling attributes and persuasive feature in gradual involvement phase

(The complete table of table 4-6)

Attribute(31)/Persuasive feature	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
11 New experience different with daily lives		1	9				3																					
12 Enjoyment throughout natural journey			1			3	9																					
13 Encouragement during the difficult journey								9	3																			1
14 Full of vitality after exercises			1				3		9																			
15 Experiences of riding together											1			3												9		
16 Routes, landmark and map of journey		9									1		3															
17 Timing for interacting with other riders																						9			3			1
18 Activity option in leisure time	9		3																									
19 Receive encouragement from passerby or other cyclists												3		9														1
20 Positive assessment of riding skill from experienced riders								9						3														1
21 Strong endurance and strength for riding from other cyclists						3								1								9						
22 Desired goals throughout journeys		9	1	3																								
23 Outdoor activity helps for releasing stress caused in workdays in nature			9				3																					
24 Receiving encouragement even with little progress								9						3														1
25 Stop for take break according to personal physical status			9		3						1																	
26 Friends which overcome difficulties in preliminary journeys together		1												9												3		
27 Practical riding experiences at the beginning for adapting to following cycling			3				9																					
28 Tutorial and suggestion for riding throughout activity		3					1							9														
29 Guiding and waiting in journey		9												1												3		
30 Appropriate options of equipment in function or look			9	3							1																	
31 Suggestions for cyclist's own experiences, ability and needs			9								3			1											1			
32 Assistance for solving problems or frustrations in cycling			3								9			1														
33 Practical demonstrations of riding skill and techniques		9				1								3														
34 Maintenance and supports for riding	1											3		9														
35 Invited to join the Interesting journeys											1		3											9				
36 Ubiquitous and convenient stop site for rest and supply	9																3											
37 Memories and interactions together with cyclists in activity														3												9		1
38 Riding with cyclists in the same level of ability																							9		3	1		
39 Sharing from cyclists enthused in cycling		9												3								1						
4 Another choice of exercise			3										1									9						
Proportion of weight in each feature (%)	4.9%	12.9 %	15.5 %	1.6 %	0.8 %	1.8 %	7.2 %	7.0 %	3.1 %	0.0 %	4.4 %	1.6 %	1.8 %	15.0 %	0.0 %	0.0 %	0.8 %	0.0 %	0.0 %	0.0 %	0.0 %	7.2 %	2.3 %	2.3 %	1.8 %	6.5 %	0.0 %	1.6 %
Proportion of weight in each category (%)	51.7%							32.8%							0.8%							21.7%						

g Matrix of relationship between cycling attributes and persuasive feature in habitual activity phase

(The complete table of table 4-7) Persuasive features 代號參照前表

Attribute(12)/Persuasive feature	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
40 Show with an extra specialty								1	3																			9
41 New route or goal without previous experience			9								1														3			
42 Full of vitality after exercises			3				9																					
43 Image records of memorable journeys						9	3																					
44 Advanced cycling activity			9		3						1																	
45 Purchasing new bike or upgrade			9								1											3						
46 Training based on accumulated ability and experiences					9		3																					
47 Level and speed progressed from simple to advance		1	9		3																							
48 Flexible timing for participation																								9				3
49 Recruit someone else to join the activity together																								3		9		1
50 Control and adjustment of heart beat and speed status					9		3																					
12 Enjoyment throughout natural journey			1			3	9																					
Proportion of weight in each feature (%)	0.0%	0.7%	26.5%	0.0%	15.9%	7.9%	17.9%	0.7%	2.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	7.9%	2.0%	6.0%	0.0%	8.6%
Proportion of weight in each category (%)	68.9%							4.6%							0.0%							26.5%						

h. Female cyclists' values with of weight corresponded to consequence

(The complete table of table 4-8 and table 5-20)

Consequence/Values	Warmness	Social contact	Enjoyment	Enrichment	Growing up	Relaxation	Curiosity	Uncomplicated	Accomplishment	Self confidence	Carefree	Reliable
Warm and Friendly			1	1			1					
Companionate		1	1	1	1	1	1					
Interactive	1		1	1					1			
Building Friendship		1	1	1	1	1						
Enjoyment in Journey			1			1						
Making Steady Progress			1				1					
Ease Body and Mind			1			1						
New Experience				1	1				1			
Enliven The Life				1	1		1		1		1	
Explore The Unknown				1	1				1	1		
Simple Activity				1					1	1		
Ability Proving				1					1	1		
Explore and Challenge						1		1			1	
Be Invited						1		1			1	1
Reward					1			1			1	1
Incentive	1					1		1			1	1
Without Prepare		1					1	1				1
Directive or Guiding	1										1	
Support and Assistance						1					1	1
Professional Advice		1		1	1							1
Close to Nature	1	1										
Increase Personal Qualities				1	1			1	1	1		
Bonus		1									1	
Achievable											1	
Encouraging				1	1							1
Opportunity for Start	1		1		1					1		
Sum	5	6	8	12	10	8	5	6	7	5	9	7
Average	5.7%	6.8%	9.1%	13.6%	11.4%	9.1%	5.7%	6.8%	8.0%	5.7%	10.2%	8.0%

Appendix D

a. Matrix of relationship between cycling consequence and persuasive feature in preliminary participate phase

(The complete table of table 5-13) Persuasive features 代號參照前表

Consequence(26)\Persuasive feature(28)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Warm and Friendly	0	0	0	0	0	0	0	0	0	1	4	0	3	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0
Companionate	0	0	0	0	0	0	0	0	0	1	4	0	3	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0
Interactive	9	4	0	0	0	0	0	0	0	0	3	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Friendship	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0
Enjoyment in Journey	0	0	0	0	0	1	0	0	3	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Making Steady Progress	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ease Body and Mind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Experience	0	0	9	0	0	4	0	0	3	0	1	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Enliven The Life	0	0	9	0	0	4	0	0	3	0	1	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Explore The Unknown	9	0	0	0	0	1	3	0	3	0	3	9	9	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Simple Activity	9	0	0	0	0	0	3	0	0	0	4	9	3	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0
Ability Proving	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0
Explore and Challenge	0	1	9	0	0	6	0	0	0	0	2	0	3	0	0	0	0	0	0	0	0	9	0	9	0	0	0	0
Be Invited	9	0	0	0	0	0	3	0	0	1	4	0	3	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0
Reward	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Incentive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Without Prepare	9	0	9	0	0	3	3	0	0	0	5	9	3	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0
Directive or Guiding	19	7	0	0	0	0	3	0	0	1	10	9	3	19	0	0	0	0	0	0	0	0	0	20	0	0	0	0
Support and Assistance	19	7	0	0	0	0	3	0	0	0	3	0	0	19	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Professional Advice	10	7	0	0	0	0	0	0	0	0	3	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Close to Nature	0	0	0	0	0	1	0	0	3	0	1	0	12	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0
Increase Personal Qualities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bonus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Achievable	10	4	0	0	0	3	3	0	0	0	4	9	3	9	0	0	0	0	0	0	0	9	0	11	0	0	0	0
Encouraging	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0
Opportunity for Start	10	4	9	0	0	6	3	0	0	1	8	9	3	9	0	0	0	0	0	0	0	9	0	20	0	0	0	0
Sum of scores	113	35	45	0	0	32	24	0	15	7	66	54	75	85	0	0	0	0	0	0	0	36	0	167	0	0	0	0
Total weight of each feature(%)	15.0%	4.6%	6.0%	0.0%	0.0%	4.2%	3.2%	0.0%	2.0%	0.9%	8.8%	7.2%	9.9%	11.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%	0.0%	22.1%	0.0%	0.0%	0.0%	0.0%
Total weight of each category(%)							33.0%							40.1%							0.0%							26.9%

b. Matrix of relationship between cycling consequence and persuasive feature in gradual involvement phase

(The complete table of table 5-14) Persuasive features 代號參照前表

Consequence(26)\Persuasive feature(28)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Warm and Friendly	0	9	0	0	0	0	0	18	3	0	0	3	0	15	0	0	0	0	0	0	0	1	0	0	0	0	0	3
Companionate	0	10	0	0	0	0	0	9	3	0	2	0	3	16	0	0	0	0	0	0	0	0	9	9	3	25	0	2
Interactive	1	21	12	0	0	1	1	27	3	0	13	6	0	47	0	0	0	0	0	0	0	10	9	0	7	19	0	6
Building Friendship	9	1	3	0	0	0	0	0	0	0	1	3	0	24	0	0	0	0	0	0	0	9	0	0	3	21	0	3
Enjoyment in Journey	0	19	20	3	0	3	15	9	3	0	1	0	3	3	0	0	0	0	0	0	0	9	0	0	3	9	0	3
Making Steady Progress	0	12	3	0	0	1	10	18	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Ease Body and Mind	0	0	11	0	0	3	15	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Experience	0	10	12	0	0	0	3	0	0	0	2	0	7	0	0	0	0	0	0	0	0	9	0	9	0	0	0	0
Enliven The Life	9	10	27	3	0	3	18	0	9	0	1	0	4	0	0	0	0	0	0	0	0	9	0	9	0	0	0	0
Explore The Unknown	0	1	9	0	3	0	0	0	0	0	1	0	0	9	0	0	0	0	0	0	0	0	0	0	0	3	0	0
Simple Activity	18	9	12	0	3	0	0	0	0	0	1	0	0	1	0	0	3	0	0	0	0	0	0	0	0	3	0	0
Ability Proving	0	0	12	3	0	3	9	0	0	0	1	0	0	1	0	0	0	0	0	0	0	9	9	0	3	1	0	0
Explore and Challenge	0	11	18	0	3	0	3	0	0	0	3	0	6	9	0	0	0	0	0	0	0	0	0	9	0	3	0	0
Be Invited	9	0	3	0	0	0	0	0	0	0	1	3	3	9	0	0	0	0	0	0	0	0	0	9	0	0	0	1
Reward	0	9	3	3	0	3	12	9	12	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	9	0	1
Incentive	0	0	0	0	0	0	0	27	3	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Without Prepare	18	9	12	0	3	0	0	0	0	0	2	0	3	1	0	0	3	0	0	0	0	0	0	9	0	3	0	0
Directive or Guiding	0	30	1	3	0	0	1	0	0	0	2	0	6	10	0	0	0	0	0	0	0	0	0	9	0	3	0	0
Support and Assistance	10	13	12	0	0	0	1	0	0	0	12	6	0	42	0	0	3	0	0	0	0	0	9	0	4	16	0	2
Professional Advice	1	21	12	0	0	1	1	0	0	0	12	3	0	26	0	0	0	0	0	0	0	10	0	0	4	0	0	1
Close to Nature	9	10	23	3	0	3	15	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0
Increase Personal Qualities	0	0	3	0	0	0	0	9	0	0	0	0	1	3	0	0	0	0	0	0	0	9	0	0	0	0	0	1
Bonus	0	1	11	0	0	3	15	9	12	0	1	3	0	12	0	0	0	0	0	0	0	9	0	0	3	9	0	3
Achievable	19	20	22	3	3	3	3	0	0	0	1	3	0	20	0	0	3	0	0	0	0	9	0	0	0	6	0	0
Encouraging	0	0	0	0	0	0	0	27	3	0	1	0	0	9	0	0	0	0	0	0	0	0	0	0	0	9	0	3
Opportunity for Start	0	1	0	0	0	0	0	0	0	0	1	0	3	12	0	0	0	0	0	0	0	0	0	9	0	12	0	1
Sum of scores	103	227	241	21	15	27	122	162	60	0	61	30	42	296	0	0	12	0	0	0	0	93	36	81	30	151	0	35
Total weight of each feature(%)	5.6%	12.3 %	13.1 %	1.1%	0.8%	1.5%	6.6%	8.8%	3.3%	0.0%	3.3%	1.6%	2.3%	16.0 %	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	5.0%	2.0%	4.4%	1.6%	8.2%	0.0%	1.9%
Total weight of each category(%)							41.0%							35.3%							0.7%							23.1%

c. Matrix of relationship between cycling consequence and persuasive feature in habitual activity phase

(The complete table of table 5-15) Persuasive features 代號參照前表

Persuasive feature(28) Consequence(26)\	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Warm and Friendly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Companionate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	9	0	1
Interactive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	9	0	1
Building Friendship	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	9	0	1
Enjoyment in Journey	0	0	1	0	0	12	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	9	0	1
Making Steady Progress	0	1	36	0	24	0	6	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0
Ease Body and Mind	0	0	4	0	0	3	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Experience	0	0	9	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Enliven The Life	0	0	31	0	3	12	21	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0
Explore The Unknown	0	0	18	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Simple Activity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ability Proving	0	1	27	0	15	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
Explore and Challenge	0	1	27	0	15	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Be Invited	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
Reward	0	0	4	0	0	3	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Incentive	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
Without Prepare	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Directive or Guiding	0	1	18	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
Support and Assistance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Professional Advice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Close to Nature	0	0	19	0	0	3	9	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0
Increase Personal Qualities	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
Bonus	0	0	13	0	0	3	18	1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	3	9	0	10
Achievable	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Encouraging	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Opportunity for Start	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum of scores	0	4	225	0	63	36	108	3	9	0	15	0	0	0	0	0	0	0	0	0	0	9	0	27	21	45	0	32
Total weight of each feature(%)	0.0%	0.7%	37.7%	0.0%	10.6%	6.0%	18.1%	0.5%	1.5%	0.0%	2.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	0.0%	4.5%	3.5%	7.5%	0.0%	5.4%
Total weight of each category(%)							73.0%							4.5%							0.0%							22.9%