Commuting by bicycle in Shenzhen

A study based on the theory of planned behaviour

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Preface

To begin with, I would like to make a remark that is as true as it is unimaginative, namely that our visit to Shenzhen has certainly been an amazing experience. But I am also very glad that this thesis project gave me the opportunity to combine such an adventure with deepening my scientific knowledge in the field of transportation.

Doing research in China and writing this thesis would not have been possible without the help of others. First and foremost, I would like to thank my supervisors, Arnold Reijndorp and Chingwen Yang. Without their guidance, I could not have presented this thesis in its current form. I would also like to thank them, Linda Vlassenrood and all others involved from the University of Amsterdam and the International New Town Institute for making this thesis project possible. Many thanks as well to the Shenzhen Center for Design and in particular to Weiwen for inviting us to China, arranging workspaces for us, giving insightful comments regarding the thesis itself and inviting us to participate in excursions and workshops.

Students from the Shenzhen University have also greatly contributed in making the research for this thesis possible. I would like to thank Liqi for translating the questionnaire into Chinese, as well as Catherine and especially Ray for helping me with the task of handing out the questionnaire, boring and uneasy as it might have been at times, as well as helping me to conduct interviews.

I cannot thank everyone with whom I was in Shenzhen here individually for their contributions in a more personal sense, but I would like to mention 迎迎, who has also rescued me like an angel by helping to conduct another important interview in the very last weekend, and 王杰, who also provided the calligraphy on the front cover.

My hope is that this has resulted in an insightful thesis. I wish much enjoyment reading it!

Daan Goedkoop

Amsterdam, July 2014

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1 Introduction

The bicycle is a very environmental friendly mode of transportation, and therefore it is useful to have scientific knowledge about the factors that affect the choice whether to use the bicycle or another way of transportation, in particular for the daily commute. A lot of research has already covered this question. However, it mostly focuses on the relationship between the built environment and the transport mode choice, even though it has been known for quite some time already that so-called "soft aspects" also play a major role and might even be the decisive influence on both residential location choice and transport mode choice. Research on the relationship between these soft aspects and transport mode choice has also been done, but it has often been limited to only car use and to a western context. In particular, non-motorised transportation in non-western countries seems to be a blind spot.

This thesis will employ a case study in Shenzhen, China to shed some light on exactly this situation and to see whether the knowledge about soft aspects regarding the bicycle in a western context can be generalised. The case of Shenzhen is interesting, because it is a city that focuses on environmental friendly developments, but at the same time the modal share of the bicycle share has dropped dramatically over the last two decades.

The next chapter will discuss the literature, both regarding the relationship of the built environment and transportation and the influence of soft aspects. This is followed by the research question and the research methodology. The results chapter is structured in analogy to the discussion of the literature, with first a description of the built environment of Shenzhen, followed by an analysis of the soft aspects. The conclusion will show how everything fits together and the thesis will end with a discussion, which includes possible policy implications.

2 Theoretical framework

2.1 The societal issue

The city of Shenzhen indicates that it wants to be a modern, world-class city with a focus on ecology and environmental quality, among other things (Ng & Tang, 2004). Life-cycle environmental costs for transport modes (excluding rail) have been calculated for China. Normal bicycles are the cleanest mode of transportation by any measure, often by far. Public transportation by bus, motorcycles and cars can be arranged in that order from cleaner to more polluting. The picture of electric bikes is inconclusive, but it is not a particularly clean mode of transport (Cherry et.al., 2009). In Shenzhen, however, transport surveys[1] have indicated that the modal share of cycling has evaporated between 1995 and 2005, leading to an increase in walking but especially to an increased share of motorised transportation, which includes car usage and public transport (Tranbbs, 2012). To improve ecology and environmental quality, it would be logical to try to stop and reverse this trend.

As a side note, it has also been noted that the high-density cities in East-Asia just cannot even come close to providing the same amount of road space per inhabitant that western cities have, so that private car usage also cannot even come close to western patterns if severe congestion problems are to be avoided. This can better accomplished by mass transit systems instead of cycling and/or walking (Gaubatz, 1999; Barter, 2000; Zacharias, 2002). However, that does not call into question that non-motorised transport modes are to be preferred from an ecological point of view.

The aforementioned normative goals are mostly one of policy content. Of course, a policy cannot achieve success without a successful process of constructing and implementing it. But on the other hand, it means that it makes sense to focus especially on the question what knowledge could be of use while designing the policy content. Questions about what a good policy design process is, regardless of the content and the aims, are less relevant from this point of view.

2.2 Transportation and the built environment

Even though it will not be the main focus of this research, it should be noted that in urban planning, much has been written about hypotheses how the built environment could influence transportation. For example, Le Corbusier already proposed high densities to reduce trip distances (Le Corbusier, 1929/2007). In a more contemporary setting, the notion of sustainability, especially in an ecological sense, has lead to new ideals of urban development linking transportation to urban form. Terminology differs and includes "smart growth", the "compact city", "transit-oriented development", "mixed land use" and "multiple (intensive) land use" but the general picture is clear: higher densities, smaller blocks (meaning a denser street network) and intermingling of land uses (such as residential, commercial and office use) as fine-grained as possible, leading to a better jobs-housing balance, shorter trip distances and thus more

[1] 深圳市居民出行调查 1995, 2001, 2005

feasibility to use public transportation or preferably to even go on foot or by bicycle, thereby reducing the net ecological impact of traffic (Jenks et.al., 1996; Coupland, 1997; Danielson et.al., 1999; Priemus et.al., 2000; Neuman, 2005).

In general, evidence (Heinen et.al., 2010) suggests that mixed land use, a good balance between employment and housing and short actual commuting distances are correlated with less motorised transport. However, for urban density or a fine-grained street network, the evidence of a relationship, whether positive or negative, is not convincing (Cervero, 1996; Heinen et.al., 2010).

As for the causal mechanism, the first step involves the relationship between commuting distance and transport mode choice. This is in fact as much a law as it gets in the field of transportation. It has been noted already decades ago that, on an aggregate level, travel time budgets are surprisingly constant, meaning that faster transportation correlates longer and/or more trips (Hupkes, 1982; Mokhtarian & Chen, 2004; Van Wee et.al., 2006). However, it is not an absolute law. For example, travelling can be fun and people might therefore even travel for the sake of travelling ('undirected travel') instead of going from A to B. This could lead to an increase of someone's travel time budget (Mokhtarian & Salomon, 2001).

The second causal step concerns the influence of mixed land use and a good jobs-housing-balance on travelling distances. They can very well be related to each other, meaning that a good jobs-housing-balance can indeed make shorter commuting distances possible and thus stimulate non-motorized transport. However, it is not a sufficient condition, because even with a good jobs-housing-balance towns might still not be "self-contained", in other words, a majority of the population might still keep commuting over longer distances (Cervero, 1996).

Cervero (1996) suggests that this can happen if the houses are not affordable for the local workers. Something like racial discrimination on the housing market could also prevent people from living close to their work (Brueckner & Zenou, 2003). However, these constraints of actual possibilities are by far not the full story. Many people do in fact have a choice, and then soft aspects play a major role. These are discussed in the next section.

2.3 The role of soft aspects

For example, it has been noted that in the United States, almost all people do not want to live in apartment buildings but rather have a strong wish to live in the suburbs, whose infrastructure and function separation mainly caters for car users. In Europe this effect is not so extreme, but high density mixed use developments in city centres, sometimes called "urban villages" (not to be confused with Chinese urban villages, discussed further below), still only attract very specific audiences such as students, yuppies and so-called empty-nesters (Coupland, 1997) – I think the creative class (Florida, 2004) would also fit that description.

This phenomenon has a large impact on transportation issues as well. It means that attitudes (taken in a broad sense) influence both transport mode choice and the choice of residential location, and that this has a much larger influence than the direct effect of the built environment on transportation (Kitamura et.al., 1997), which has later become known under the term of residential self-selection. Subsequent research has lead to many hypotheses about the mutual influences of attitudes, residential location choice and transport mode choice, without a conclusive answer (Cao et.al., 2009).

To put this issue in a broader perspective, I will make use of Ajzen's theory of planned behaviour, a theory from social sciences about how human behaviour, in general and on an aggregated level, comes about. It tells that behaviour is influenced by actual behavioural control (possibilities), perceived behavioural control (which might be the same as, or different from, actual behavioural control) and intention, with intention being influenced by again perceived behavioural control, subjective norms (what is assumed of others' expectations) and attitudes (personal opinion) that can be split in evaluative and affective attitudes. These three influences on intention, in turn, are influenced by beliefs related to expected outcomes. The theory focuses on the origins of behaviour, so any influence of habits found in a concrete application ought to be seen as imperfections of the model. The theory itself is thus not circuitous. Leaving out the element of perceived behavioural control results in the earlier theory of reasoned action (Ajzen, 1991).

In the Netherlands, Ajzen's theory has been used in a western context to explain car use (Steg, 2005). It has also been used in a study to the attitudes related to bicycling and walking in a case in the UK (Gatersleben & Uzzell, 2007) and in a study to bicycle commuting in the Netherlands. The latter study again focuses on attitudes. Subjective norms and perceived behavioural control are not dealt with in any detail and the role of status is even put under attitudes instead of subjective norms (Heinen et.al., 2011). Apart from that, attitudes in both studies consist of concepts like health and environmental benefits, low costs, pleasure, relaxation and excitement.

These theories of reasoned action and of planned behaviour create some order for sensible approaches to the unclear interaction between attitudes, choice of residential location and choice of transport mode. These theories start with attitudes and have behaviour as result, explicitly without allowing feedback loops. Figure 1 gives a schematic summary of the concepts from the theory of planned behaviour. The issue of residential self-selection indicates that residential self-selection influences the context of the decision process regarding transportation mode choice. However, to show both decision-making processes separately including this link to indicate residential self-selection, the diagram would become too complex.

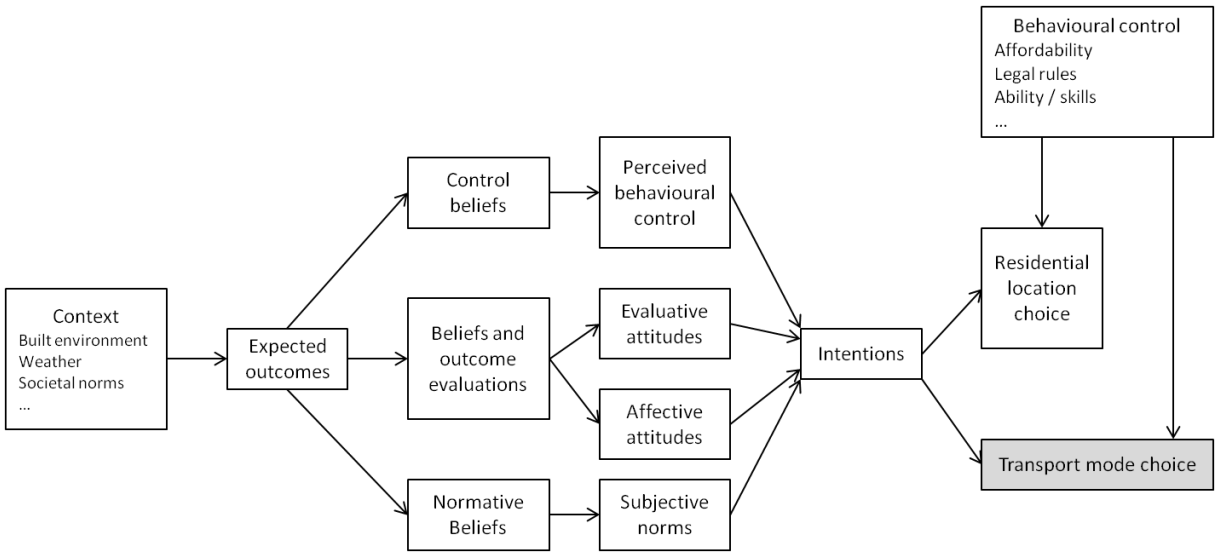


Figure 1: Schematic summary of general theory on soft aspects and transport mode choice

2.4 The question of generalisation

Parts of the aforementioned theory, like Ajzen's theory of planned behaviour, are very generic. However, much is also empirical evidence from a western context. But can those insights be generalised? To try and answer that question, the situation in China will now be discussed, a country with a rather different culture and governance compared to the western world.

2.4.1 The built environment and transportation in Chinese cities

Presence of a relationship between the job-housing-balance, mixed land uses, actual commuting distance and presence of bicycling paths on the one side, and the share of bicycling and walking, has been confirmed in Beijing. A relationship between residential density, job density or a fine-grained street network and the modal share of bicycling and walking was not found, however (Zhao, 2013). In other research, it turns out that people in traditional danwei units (单位, factory buildings and worker dormitories combined within one urban block) –not surprisingly– tend to commute over short distances and not have a car, or that people in pre-1949 neighbourhoods have very average commuting distances yet still tend to have no car, simply because of a lack of parking space (Wang et.al., 2011). Evidence from Beijing and Guangzhou points out that suburbanization of employment, which contributes to a better job-housing-balance in the suburbs, can lead to much shorter commuting distances, namely in the case of manufacturing workers. But for higher-income groups, commuting distances might rather become longer (Li, 2010; Zhao et.al., 2011).

So far, this is in line with the theory about the relationship between the built environment and transportation as discussed earlier, including for example Cervero's (1996) remark that a good jobs-housing-balance is not a sufficient condition for self-containment. However, there are also hints at differences. For example, why do precisely the commuting distances for manufacturing workers decrease

with suburbanisation in China? At least part of the answer seems to lie in soft aspects, which will be discussed next.

2.4.2 'Soft aspects' related to housing and transportation in Chinese cities

The pre-1988 situation of state housing and danwei units meant that the 'privilegentsia' would live in the city centre whereas low-income workers would live further outside (Gaubatz, 1999). The housing market has changed significantly in the period between 1988 and 1998, with a shift from state housing and danwei units towards land use rights that can be traded and mortgaged (Wu, 2002; Li, 2010). This has lead to the urban form of xiaoqu (小区, literally "small district"), meaning an urban block that consists of a gated community, with on its inside a communal open space in which several apartment buildings are located. Their residents are not necessarily white-collar employees. They can also be home to blue-collar workers (Miao, 2003), for example when factories buy housing on the market in order to rent them at a discounted rate to their employees (Gaubatz, 1999).

However, the positive image of living in the city centre has become part of the culture and is thus still highly valued, also by high-income households, while low-income workers remain in the suburbs, where land is cheaper (Gaubatz, 1999; Li, 2010; Zhao et.al., 2011). More specifically, the modern ideal in Chinese society seems to be having a decent income so that one can afford to own an apartment in an inner-city gated community, to own a car and to travel (Li, 2010; Elfick, 2011; Zhu, 2012). A housing price analysis in Jinan, as a "revealed preference" research, also suggests a preference for quiet, mono-functional residential neighbourhoods (Kong et.al., 2007).

2.4.3 Urban villages in Chinese cities

The aforementioned Chinese ideal can be contrasted with another type of urban fabric in Chinese cities: urban villages. The scientific literature about them in this subsection will not suggest any relationship with the theme of this thesis, but the empirical results will show that this view needs to be nuanced and that there is in fact a strong relationship.

Urban villages are a product of the rapid expansion of Chinese cities. In northern cities, such as Beijing or Shanghai, there has been the tendency to expropriate the villagers completely and accommodate them as new urban residents. Southern cities, including Shenzhen, have taken a different approach, where the city acquires the farmlands surrounding the villages, but does not expropriate the villagers themselves, in order to save costs. The villagers, now deprived of their traditional means of subsistence, have often turned to converting their farmhouses into multi-storey apartment buildings (Tian, 2008).

In the aforementioned development, three stages can be distinguished. The first stage is the traditional village, the second stage is the replacement of farmhouses with apartment buildings of 3-4 storeys, the third and by far most common stage in Shenzhen is the urban tissue of 'handshake houses' that can be up to 10 stories high, or even more (Tian, 2008; Hao et.al., 2011).

The resulting urban villages are typically described as unsafe places (in terms of crime, fire prevention and health) whose main role is the provision of affordable housing for the "floating population", that is, for low-income rural migrants who, lacking local urban Hukou status, don't have access to formal social housing provision (Tian, 2008; Hao et.al., 2011). They would generally earn between ¥500 and ¥1000 per month and only in very few occasions more than ¥2000 per month (Tian, 2008) and the only affluent people living in urban villages would be the villagers themselves, acting as real estate investors and landlords (Hao et.al., 2011).

2.4.4 The role of cycling in Chinese cities

The role of the bicycle in Chinese cities is not very clear. Supposedly, it has been seen by "local leaders" as "backward, a remnant of the lean years of socialism" (Zacharias, 2002: 311) and as inducing lethal traffic incidents and disrupting both pedestrian and motorised vehicle flows. Especially in the Pearl River Delta, this has lead to "draconian measures" to stimulate bicyclists to switch to public transport (Zacharias, 2002: 311), but it is unclear what that exactly means. It also doesn't tell if this view still prevails and if so, whether it extends from the policy makers to the rest of the population. The questionnaire in the article of Zacharias investigating the attitudes of bicyclists is not very useful, because it only prioritises ten predefined reasons why bicycle users might want to switch public transport. It does give some hints, though, namely that weather and costs play a large role and speed not so much (Zacharias, 2002). The work of Elfick (2011) also doesn't give firm conclusions in this regard, as it considers only the issue of car ownership, not actual car use.

2.4.5 Summary

To summarise, it is known that the relationships between built environment and transportation generally hold true in the Chinese context as well. However, the scientific literature differs quite much between a western and a Chinese context when it comes to classifying types of urban form and their audiences. This is shown in figure 2, below. It should be noted that the category of *xiaoqu* encompasses both owner-occupied apartments and formal rental housing.

However, such a classification is almost inevitably somehow stereotypical. Doesn't having children play a role for Chinese citizens? How about western households that belong to the creative class but also have children? Isn't there such a thing as the creative class in Chinese cities? How do small entrepreneurs such as shopkeepers fit into the picture?

The main aim of figure 2, however, is to show that there are still a lot of unknowns even when taking such stereotypical classifications for granted. For example, is the choice of Chinese manufacturing workers about where to live the expression of certain soft factors, or don't they have a choice at all? What is the relation between urban villages and transportation mode choices, especially the choice between walking, cycling and using public transport? Are the *xiaoqu* only suitable for car use, or are they also a good

environment for using other modes of transportation? And what are the actual, direct attitudes and subjective norms regarding the usage of different transport modes, especially other ones than the car?

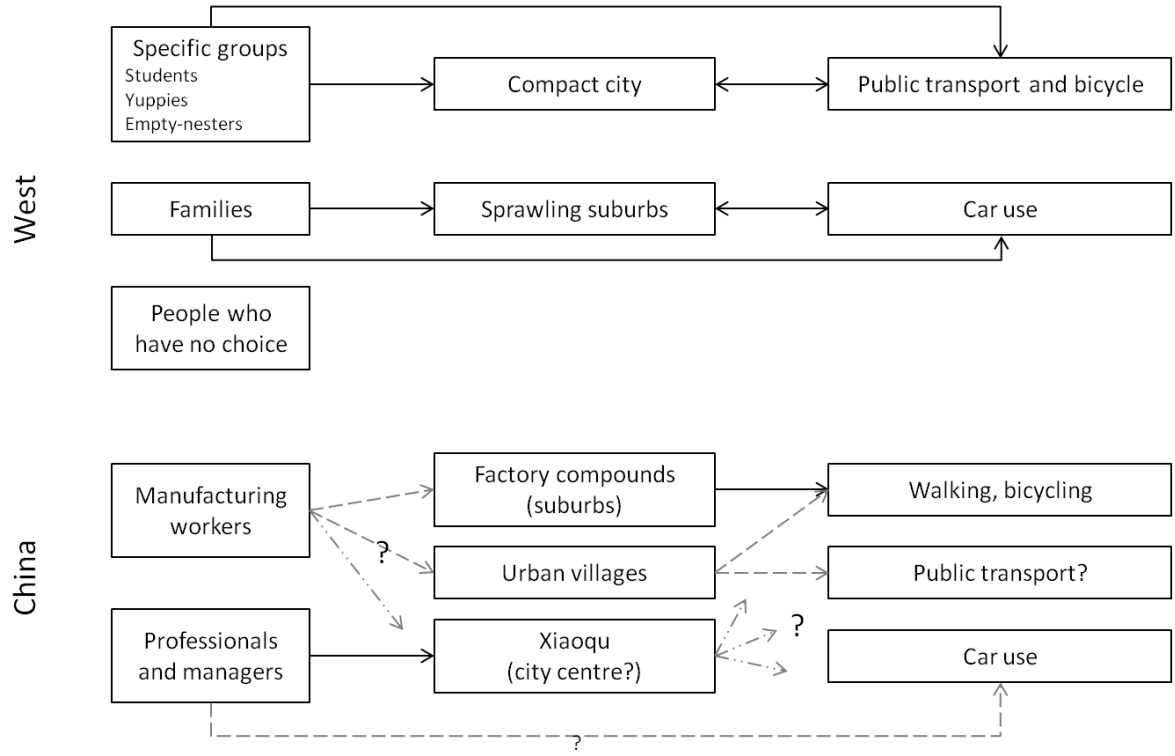


Figure 2: The main target groups, types of urban environment and transport modes in a western context and in China, from the literature

Not all of these questions are equally important for this research, as I am most interested in soft aspects and bicycling. Thus, for example, the link from manufacturing workers to a certain urban form is only of interest to me, if it influences the choice about whether or not to cycle, and if soft aspects relating to transportation play a role in the choice of those workers for a particular urban form.

3 Research question, research design and research method

This chapter describes how the research has been set up. It starts with the research question, followed by the research design and method.

3.1 Research question

The aim of this thesis is to address some of the questions that have been raised at the end of the previous chapter, by means of a case study in Shenzhen. From a scientific standpoint, the main aims are to contribute to fill in the lack of knowledge about the relationship between soft aspects and the bicycle in a non-western context and to test whether results that have been found in a western context can be generalised. To do this, I will try to answer the following research question:

Which soft aspects influence the decision whether or not to use the bicycle for commuting in the context of Shenzhen, China?

It has the following sub-questions:

- What kinds of people actually use the bicycle to commute in Shenzhen?
- What soft factors contribute to their usage of the bicycle?
- What can soft factors tell about the reasons for other people to not use the bicycle for commuting?
- Is there an indirect effect of attitudes through residential location choice in the answer of the three sub-questions above?

3.2 General research design.

The general research design is a case study with a single case: Shenzhen. It will be a typical case (Bryman, 2008) because the literature does not tell much about the research topic of soft aspects related to bicycle commuting in China, so there is no reason to assume otherwise. In terms of the secondary aim of this research, to test whether the results from a western context can be generalised, the case will rather be a critical case. Inside this case, a cross-sectional setup is used.

3.3 Units of analysis

The size and diversity of Shenzhen makes it impossible to base this research on random sampling of commuters. Therefore, the research has been narrowed down by only taking white-collar employees as the units of analysis. This group, called the "professionals and managers" in figure 2, is the group that most likely will have a choice at all, when it comes to the type of house in which they live and the transportation mode that they use for commuting.

Another possibility would have been to work backwards, starting with people who commute by bicycle. However, this seemed impractical. During rush hour, any commuter is unlikely to have 15 minutes time (see below) to fill in a questionnaire. During the rest of the day, however, most bicyclists aren't commuters – something that also applies to most customers of bicycle stores.

3.4 Variables

The main part of the research is based on the practical methodology for the theory of planned behaviour, as outlined by Francis et.al. (2004). This methodology focuses on the middle three columns of figure 1, further above. However, for my research it seems better not to look at intentions as dependent variable, but rather the actual behaviour. It can be measured easily in my case and furthermore I am most interested in the actual outcomes rather than intentions that might not materialise. Moreover, it is useful to take the context into account, because beliefs do not come about in a void.

Figure 3 below shows the conceptual scheme with the research variables that results from these considerations. The variable of transport mode choice is the dependent variable of my interest. In the two columns to the left of that are the independent variables. Residential location choice is also shown in the diagram, to take the possibility of residential self-selection into account.

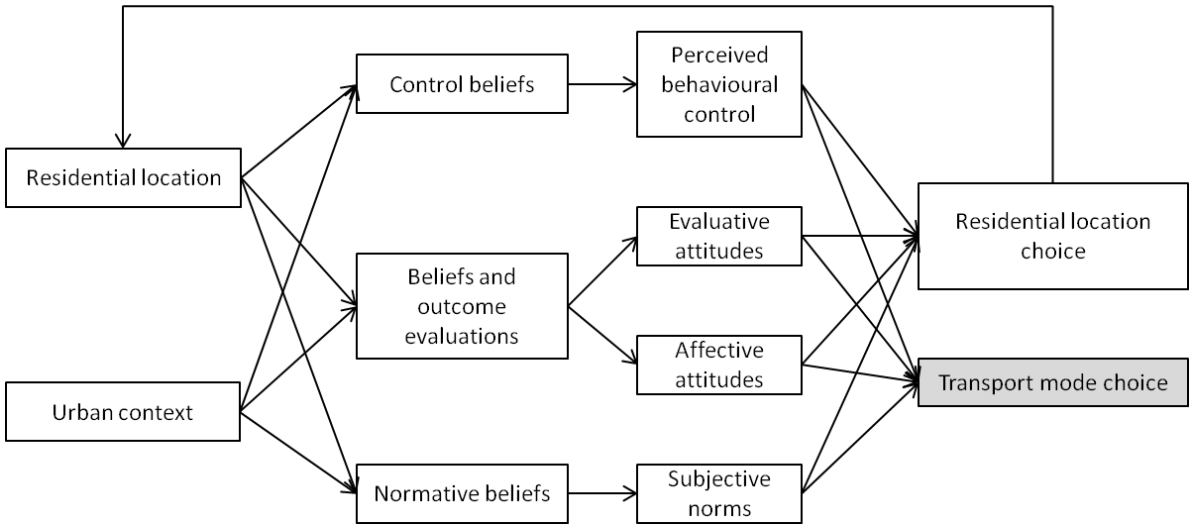


Figure 3: Conceptual scheme of variables

Compared to figure 1, not only the intentions have been left out, but the role of actual behavioural control has as well. It seems rather time-consuming to test every respondent's actual ability to ride a bicycle from their home to their work and practically impossible to measure their actual abilities regarding residential location choice. However, the actual limitations can still surface through the variable of control beliefs insofar they are relevant.

3.5 Location selection

Shenzhen is much too large for random selection of white-collar employees anywhere in the city. Therefore, I have chosen to do my research in one particular location (or possibly two) within Shenzhen. This location should ideally be representative and not lead to trivial results.

The following criteria have been used to find a suitable location. First, the area in question needs to be developed already, because otherwise a questionnaire cannot be done at all. It has to be flat and there should be a comprehensive and interconnected bicycle infrastructure, so that there is the potential for

cycling to be possible and comfortable. There has to be a mixture of work and housing, at least in the near vicinity, so that commuting distances and living in factory dormitories cannot be the only explanation for not using the bicycle. The urban form has to be as representative for Shenzhen as a whole, meaning that there should be offices and housing estates with green in between, interspersed with urban villages. Finally, a mixture of high-tech and manufacturing would be ideal.

The central areas of Futian and Luoho do not seem to be representative, with their high density urban form without green between the buildings, and a large amount of public and commercial facilities that attract a public which is not of interest for my research. A quick scan in the rest of Shenzhen resulted in three possible cases:

1. The part of Nanshan district north of the university
2. The central district of Longgang
3. The Guangming New Town.

I have taken a closer look to these. To see whether there is a suitable mixture of land uses, I have used the Shenzhen structural plan 2010-2020, of which the land use map is shown in figure 4. For the bicycle network, I have used the map from the 2012 Shenzhen bicycle plan, as shown in figure 5. Using Baidu Maps, I have made a list of companies located in the north of Nanshan and in central Longgang.

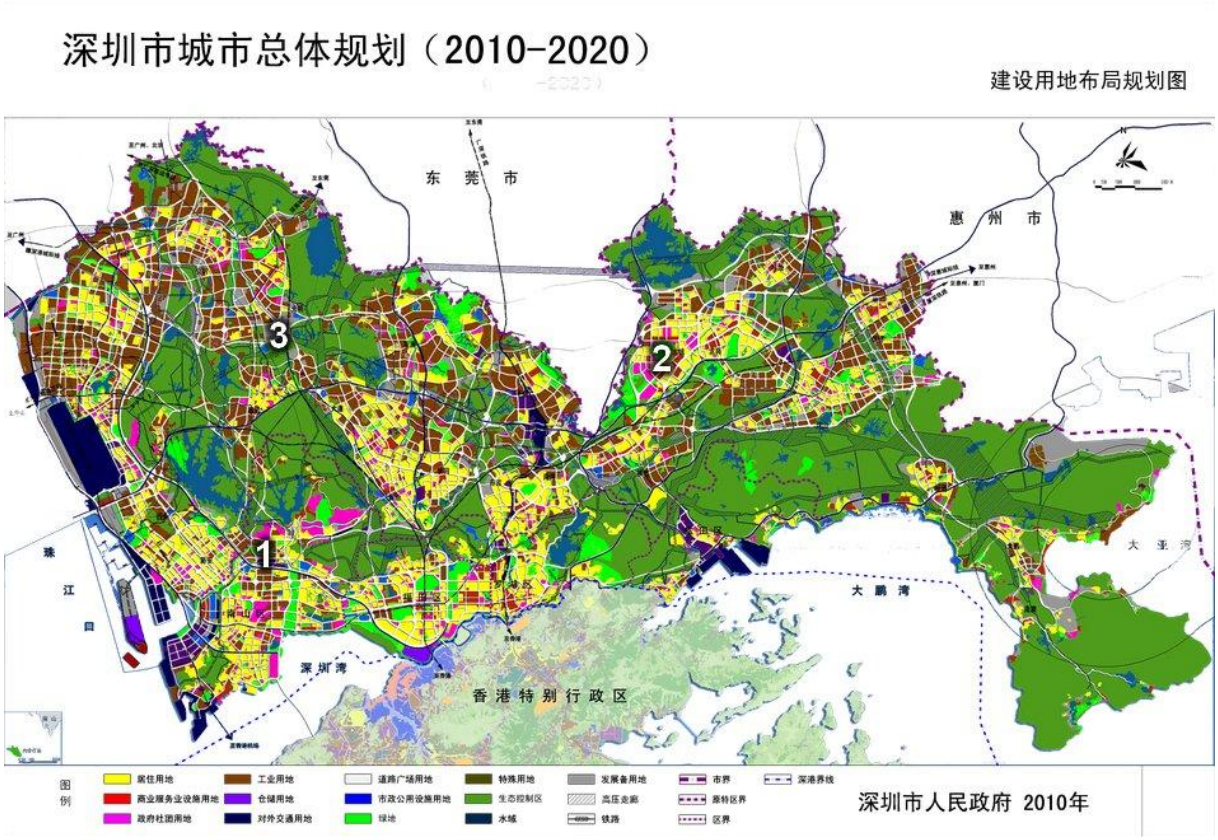


Figure 4: Land use plan for Shenzhen

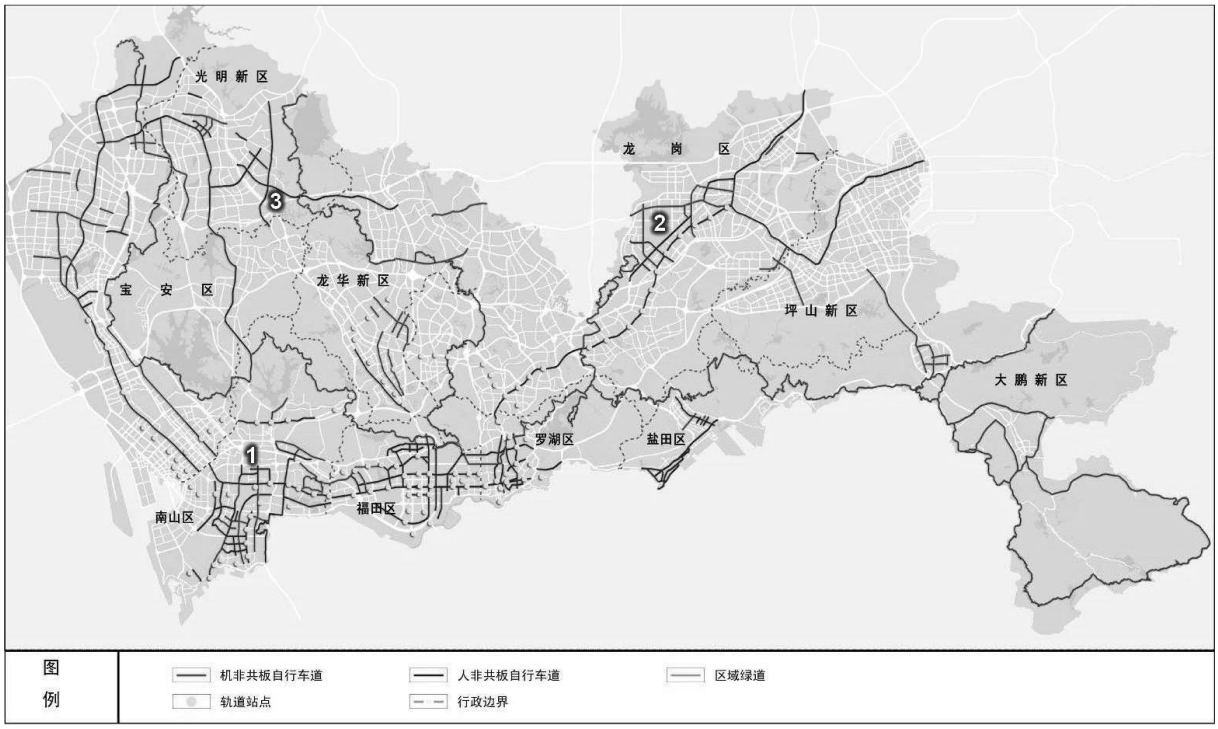


Figure 5: Bicycle network in Shenzhen

The north of Nanshan ticks just about all the boxes. There are two minor issues, however. The practical usability of the bicycle paths could be dubious. Also, the area is pretty much focused on high-tech. Here one can find companies like Tencent (IT), Grentech, Evoc Technology (both IT hardware) and a Shanghai Automotive office building. There aren't any manufacturing plants located there.

The central district of Longgang is quite different. It has an excellent bicycle infrastructure, but the mixture of functions is skewed here as well. The land use is mostly residential and most companies located in this area are manufacturing plants in all their diversity, producing goods from aluminum windows to CNC equipment, from kitchen utensils to watches and from decorative lights to plastics. There is also a rather new high tech office location, called Tian'an Cyber Park, but that is not representative for the area as a whole.

The Guangming New Town is still in the early phases of development. For now, the area is partly empty and partly composed of the typical urban form of manufacturing industries, albeit with a much sparser and more fragmented bicycle network than in central Longgang.

Thus, the location in Nanshan has been selected as the most representative. It was also planned to do some investigations in central Longgang, in order to also cover an area containing manufacturing and having an even better bicycle network, but unfortunately this was not possible for practical reasons.

3.6 Design of the questionnaire

The practical guide of Francis et.al. (2004) suggests using closed questions, for example using a 5-point 'Likert' scale, to investigate the perceived behavioural control, attitudes and subjective norms – the middle

column of figure 3. To guarantee reliability, it has been suggested to let questionnaires have each (closed) question multiple times with a slightly different wording and to do the questionnaire multiple times with the same group of respondents. On the other hand, because of practical considerations the questionnaire should also not feel too long and too repetitive (Francis et.al., 2004). Thus, it is necessary to find the right balance. Considering that the questionnaire already needed to be rather long because it investigates the role of soft aspects on the usage of not one but multiple transport modes, making the questionnaire multiple times longer by also asking each question multiple times for reliability would make filling it in much too time-consuming.

For beliefs, the first column of figure 3, the proper way of designing the questionnaire would be to first organise an elicitation study to get an overview about the prevailing views in the target group, and create Likert-scale questionnaire items upon the most common of those views. However, such an elicitation study usually takes weeks by itself (Francis et.al., 2004), leaving no time to design and carry out the actual questionnaire. Therefore, the measurement of beliefs has partly been left out of the questionnaire and has partly been based on views from the literature, on questionnaires from other surveys and on some remarks from people in China outside the study area.

The questionnaire also contains some questions necessary about the behavioural outcomes. In this case that means the mode of transport that has been chosen to commute to work and the residential location choice, which as far as my research is concerned, primarily means the type of housing (e.g. urban village, dormitory or owner-occupied apartment) and the distance of the home from the workplace.

There are also some questions to collect some general information about the respondents, because the theoretical framework shows that soft aspects can differ between different groups of people.

Finally, some questions were included to investigate the possibility of residential self-selection. These are very limited in scope, though, because housing preferences in general are not the topic of this thesis.

3.7 Practical preparation

Before the survey could be carried out, it was of course necessary to get the questionnaire translated into Chinese and adopt the general layout to a form that is familiar to Chinese people. One of the students of the Shenzhen University has helped with translating, and finished this on Saturday, April 5. Chingwen and the Shenzhen Center for Design (SCD) have also looked over the questionnaire. This lead to some small changes in wording.

The second part of the questionnaire, concerning the opinions on the different transport modes, looks quite daunting. The SCD advised to replace the five checkboxes for each Likert scale with the numbers from 1 to 5. A questionnaire of a Chinese student in the hostel confirmed that this is the usual practice in China. It did not help much, however, in making the second part of the questionnaire look friendlier.

Another Chinese student has been asked to fill in the questionnaire a first time, to see if there are any problems. This again led to some minor adjustments, including fitting the whole questionnaire onto one double-sided A4 paper. The time for filling it in amounted to about 6 minutes for the first part and 7 minutes for the second part. Thus, even though the second part is on the edge of looking too daunting, it still is within the limits of being reasonable when it comes to the time that is needed. In total, it takes up to 15 minutes to fill in the entire questionnaire.

All in all, at Wednesday, April 9 the questionnaire was ready for use. The full questionnaire is included as appendix II.

3.8 Executing the questionnaire

After finishing the questionnaire, I have experimented with how to get people to fill it in. The target audience consists of white-collar employees using different kinds of transportation for commuting and living in different kinds of housing. To make sure that indeed the housing and transportation are varied while the working environment is kept constant, the plan has been to survey employees at their working place. This means that they need to be approachable and to have time and be willing to spend 15 minutes on filling in the questionnaire. This limits the possibilities significantly. For example, a home owner is quite likely to live in a gated *xiaoqu* and use subterranean parking garages both at home and at the office, so that there is simply no opportunity at all to approach them at a public site.

Therefore, I have decided to approach my potential respondents during the lunch break. These tend to be quite long at Chinese companies, generally from noon until 2pm. In practice, many white-collar employees can be seen at the streets surrounding the offices from about 11:30am until 1pm.

The main working location within northern Nanshan is the High Tech Park, located just north of the university. It is particular in the sense that it does not only have offices. Those are intermingled with residential buildings that have a commercial function on the ground floor. In many cases, small restaurants can be found here, where the office workers will come to eat lunch in said timeframe of 11:30am to 1pm. Figure 6 shows the locations of the restaurant strips. Especially the period when guests are waiting for the food they ordered to arrive, proved to be an excellent opportunity to spread the questionnaires.

Questionnaires were mainly handed out at each of the locations shown in figure 6. Some were also given directly to employees at office buildings or to employees that are taking a break during lunch.

It turned out to be nearly impossible to hand out the questionnaires without help of a Chinese person. This help was a bit difficult to arrange, because handing out questionnaires is not the most interesting kind of field work and the limited time frame per day made things even more difficult. However, with this help available, there were only two or three cases of non-response, so any bias in that regard is not to be expected.

Figure 6: Restaurant strips (red) in the High Tech Park. Based on Baidu Maps.

3.8.1 Possible issues

Some additional questionnaires have been distributed at the university, just south of the high tech park, to students using the bicycle. This seemed the only practically feasible way to include more than just two or three bicyclists in the survey. Because the students of today are the white-collar workers of tomorrow and because the university is located right next to the High Tech Park, this should not be a problem regarding the representativeness of the attitudes part of the questionnaire. However, all students, including the few of them in the sample from the High Tech Park, have been excluded for general statistics such as age, income, housing situation and choice of transport mode for commuting.

There seem to have been issues with the understanding of two questions. First, the question whether a transport mode is cheap, has been translated as “price”, which can be interpreted in two different ways. On the one hand, a high score can signify a good price, meaning cheap transportation, as intended. But a high score can also signify a high price. Respondents have used both ways of understanding. Under the assumption that walking would be cheap, it is possible to reconstruct many of the responses. However, it is not completely methodologically correct, so this variable has never been taken into account in aggregate measures in the rest of this thesis.

The question about the skill to use public transportation has also lead to misunderstandings. The rate of negative answers suggests that it has often been understood as the ability to drive a bus or metro train. This variable has therefore not been used at all.

3.9 Interviews

As has been explained before, the part of the questionnaire regarding beliefs could not be optimal. Therefore, I have also prepared a small questionnaire such as one would use in an elicitation study, catering for all kinds of beliefs: control beliefs, beliefs and outcome evaluations, and normative beliefs. The exact questions can be found in appendix III.

The first few interviews based on this questionnaire did not go very well. They more or less confirmed some views but did not really give interesting new insights, so I decided to spend less time on them and instead focus on getting more questionnaires filled in.

To still get some qualitative information on the bicycle culture in Shenzhen, I have conducted interviews with shopkeepers of bicycle stores. For this information to be as representative as possible, I tried to interview bicycle shops that are as close to the High Tech Park as possible. However, even the closest cycle shops are quite far away. Figure 7 and table 1 show the bicycle stores that I found and that were potential candidates for my interviews.

I decided to start the interviews at the southern area, with shops 5 – 9, as it seemed the best opportunity to do many useful interviews at once. The other stores seemed to be quite far apart or didn't seem to be exactly the right kind of shop (such as numbers 2 and 4). Within the available time of my translator, I managed to interview the shops with the numbers 5, 7 and 9. The Format brand store (nr. 6) refused to cooperate. Because I later noticed how many people use Merida mountain bikes for commuting, I have also done an interview at one of the Merida brand stores, namely the number 11 on the map.

The list of questions asked at the shopkeepers can be found in appendix III as well.

Figure 7: Bicycle stores near the High Tech Park. Based on Baidu Maps.

Number	Description
1	XdS brand store
2	Small store in an urban village, mostly focused on electric bike repairs
3	Merida brand store
4	Electric bicycle store (also sells non-motorised bicycles)
5	XdS brand store
6	Format brand store
7	NEO motion brand store
8	Small neighbourhood bicycle store
9	Large and modern bicycle store
10	Giant brand store in Baishizhou
11	Merida brand store

Table 1: List of bicycle stores near the High Tech Park

4 Results

This chapter will start with a short description of the general data about the respondents of the questionnaire. After that, a description of the built environment in Shenzhen will follow. Even though this is not directly related to the research question, it is still necessary because, as has become clear in the theoretical framework (see figure 1), soft aspects do not exist in a void but are rather embedded within a context of 'harder' factors. Those soft aspects are covered subsequently, guided by the research question and its sub-questions.

4.1 General data about the respondents

In total, 83 questionnaires were filled in. Not everyone has answered every question. The generic questions such as gender and education level were filled in by all 83 respondents, but the questions on attitudes were generally only filled in by about 60 of the respondents. The question about income was only answered by 41 people.

Among the respondents, there were 61 males and 22 females. There were two respondents who were workers with only high-school education. All others have been to the university and 9 have followed postgraduate education. In total, the sample contains 67 working people and 14 students. 20 respondents have a relationship and 18 still live with their parents. The average age of the respondents is 20.6 for students and 26.8 for employees. To compare, the average age of inhabitants of Shenzhen and of, for example, all research and development employees at Huawei, is around 28 years (CIIC, n.d.).

The average wage of the employees among the respondents is ¥8062 per month, but as has been mentioned before, non-response to this question was high. Still, it is much higher than the average wage of ¥4918 per month in Shenzhen (China Statistics Press, 2013). More respondents have answered the other questions regarding employment. Employees that have been mentioned more than once are Tencent, Kingsignal Technology, IBM, Taiwan Business Bank and To8to. All in all, they seem to be indeed a decent representation of the white-collar employees that has been aimed for.

4.2 The built environment in Shenzhen in relation to transportation

This section will describe the built environment, in a sense as wide as necessary and as narrow as possible to cover the relationship with transportation and to understand, in the sections further below, how people's attitudes and other soft aspects could be influenced by this context. The first subsection covers some basic statistics about housing and transportation. The second subsection will cover the bicycle infrastructure in Shenzhen, because cycling is the main topic of this thesis.

Because commuting is a necessity, the choice to commute by bicycle can only be seen in relationship with the choice whether or not to use another mode of transportation. Therefore, the subsequent subsections will cover the most prominent other aspects, as evident from the questionnaire, of the built environment of Shenzhen related to this weighing up of different transport modes: owner-occupied apartments and car

use, urban villages and the public transport system. This will be followed by a discussion of self-containment and the theory of travel time budgets.

A discussion about the built environment and transportation in Shenzhen cannot be complete without covering factories and blue-collar workers, so the final subsection will be dedicated to those. This last subsection is fairly long, because the situation in this group is mostly determined by 'hard' factors, whereas the situation of the managers and professionals will be investigated more thoroughly in the next section about soft aspects.

4.2.1 Transportation and housing statistics

Figure 8 shows the modal split of Shenzhen as it has changed through the years. The data are based upon the Shenzhen Residents Travel Survey[2] as found in different sources (Tranbbs, 2012; SZPL, 2012a). It should be noted that the data do not include a category for "other" transport options. Moreover, electric bikes are considered bicycles in the data for 2010, whereas it is unclear how they were categorised in earlier years. Also, it is only known for 2010 how the motorised traffic is divided into car traffic and public transportation, so it cannot be shown in the graph of figure 8.

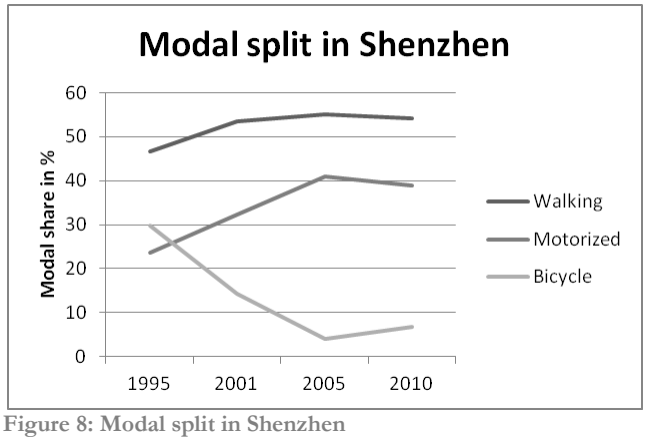


Figure 8: Modal split in Shenzhen

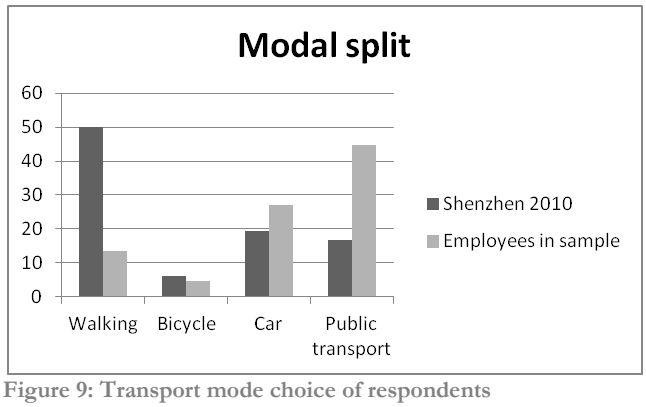


Figure 9: Transport mode choice of respondents

These statistics include all of Shenzhen and all kinds of trip purposes, and are therefore unlikely to reflect the mode choice of the professionals and managers when it comes to commuting. Therefore, figure 9

[2]深圳市居民出行调查

shows the commuting modal split of the employees among the respondents of the questionnaire, compared to the data for Shenzhen as a whole.

These two statistics together show some interesting developments. First, the amount of bicycling has dropped dramatically since 1995. The respondents in this research clearly are no exception to this development. On the other hand, public transportation is very popular with them, much more even than the average of Shenzhen shows. Third, walking seems to play a rather limited role.

Figure 10 shows the housing situation of the "managers and professionals", as evident from the questionnaire. The fraction of those who live in an urban village is only little short of an absolute majority. Other large groups are the home-owners, as expected. The "Other" section is also quite large. Not all respondents who ticked this box made further specifications, but all of those who did, mentioned "rental" as their type of housing.

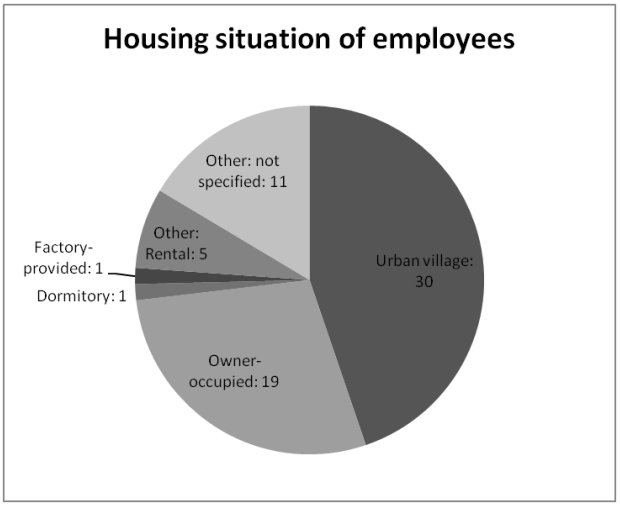


Figure 10: Housing situation of employees

	% modal split		Z
	Owner	Urban village	Owner – urban village
Walking	10%	13%	0,416
Cycling	5%	10%	0,685
Car use	52%	13%	-3,012**
Bus	10%	40%	2,400**
Metro	24%	23%	-0,039
*Black *: Test with H_0 that the modal split is exactly the same for both housing environments*[3]			

Table 2: Differences in modal split for different types of housing

Table 2 combines the statistics on housing and transportation. It shows that driving a car is particularly popular among the respondents who live in an owner-occupied apartment, whereas for the residents of

3 The mark ** indicates a difference that is significant to a level of $\alpha = 0.01$ if prior knowledge gives reason to consider this particular comparison on its own, and to a level of $\alpha = 0.05$ if the modal split as a whole is compared without any prior expectations about the individual comparisons. The latter is applicable here. For more information, see appendix I.

urban villages, the bus has by far the largest modal split. Walking and cycling are rather unpopular with both of these groups, and metro usage also doesn't show a significant difference.

4.2.2 Cycling infrastructure in Shenzhen

The previous subsection has made it clear that cycling is not very popular in Shenzhen, without much difference between groups. One reason could be, that the physical circumstances in this city are just not suitable for using the bicycle. This subsection describes the situation in this regard.

China has traditionally been very generous in terms of building bicycle infrastructure. It has been mentioned in the 1990's already, that this contributes to environmental friendly cities (Gaubatz, 1999). The wording suggests that it was not an argument in the Chinese policy but merely a judgement from a Western context. Hence, at the time it could have been seen by Chinese policy makers as just a convenient argument from Westerners to discourage China from developing a modern traffic system.

Figure 11: A cycle path on the sidewalk, between the white lines.

Figure 12: A bicycle parking at an office location

Since the early 1990's, when Chinese cities were confronted with the issue of congestion, the response of a number of them has been to discourage bicycle traffic and try to persuade cyclists to switch to public transportation instead. The rationale for this has been the efficiency of land use: a bus with a capacity of 100 passengers would only take up as much road space as 12 bicycles (Gaubatz, 1999). Hence, cities have embarked on capital-intensive plans to improve public transportation while bicycle traffic has been forbidden altogether in some places (Gaubatz, 1999; Zacharias, 2002).

This seems to have affected Shenzhen as well, even though there is not a complete absence of bicycle infrastructure. Figure 5 shows that the Nanshan district has a comprehensive network of cycling paths. In fact, by far not all cycling infrastructure is shown on that map. Almost every road that surrounds a block is equipped with bicycle infrastructure. However, the quality of these bicycle lanes often leaves much to be desired. Usually, it means that a cyclist has to share the sidewalk with pedestrians, such as shown in figure 11. Because of the inconvenience of this solution, people often choose to cycle on the main road between the car traffic.

Cycling infrastructure also includes parking facilities. These are generally available at office locations. Figure 12 shows an example of a bicycle parking lot with CCTV and a guard (not depicted) at an office location. In this case, there is not much capacity left to cater for growth in the number of bicycle commuters.

Policies have been different in other districts. For example, the Longgang Central District Bicycle Transportation Plan acknowledges that space usage is one of the major disadvantages of bicycle traffic. According to this plan, one bicycle utilises 8 m^2 of road space, compared to 80 m^2 for a car but 1.5 m^2 per person for a bus (SZPL, 2012b), which amounts to an advantage of the same order of magnitude as mentioned above. However, the plan also recognises the environmental benefits of cycling, even in comparison to public transportation. It shows that at least some Chinese policy makers nowadays recognise that the transportation system serves multiple interests, and that this can make the balance tip again in favour of providing a decent bicycle infrastructure again, with wide bicycle lanes that are separated from both car traffic and pedestrians (SZPL, 2012b).

Another issue is the weather. Statements in the literature (Zacharias, 2002), in other surveys (Tranbbs, 2012), in policy documents (SZPL, 2012b) and in interviews suggest that it might just be too warm in Shenzhen to comfortably use the bicycle. This is an unchangeable 'hard' factor by itself, but also bears a relationship to the built environment. For example, it has been suggested in the interviews that there is a lack of facilities at companies to change clothes and to take a shower. Such infrastructures would contribute to making the bicycle a better feasible option in a warm climate.

One interviewee remarks that the infrastructure is suitable for recreational use, suggesting that it is not really up to the task for being used intensively by commuters. Indeed, Shenzhen does have decent facilities for recreational facilities nowadays, such as the Guangdong Greenways network or the cycling routes through the coastal park, such as shown in figure 13.

Figure 13: Recreational cycling in the coastal park of Nanshan

Another recent development has been the introduction of public bicycle schemes, of which an example can be seen in figure 14. However, they are not particularly attractive for last-mile transport combined with public transport. The rental statios are often not located at subway entrances, and the price for lending a bicycle for an entire working day – the first hour for free but at least ¥1 for each subsequent hour – is multiple times higher than, for example, a return trip by bus.

Figure 14: A public bicycle scheme

4.2.3 Owner-occupied apartments and car infrastructure

As the statistics further above have shown, one of the major groups of white-collar workers who do not use the bicycle, are those who live in an owner-occupied apartment and drive a car.

Shenzhen, as a modern city, has ample wide avenues and freeways. Office locations often have subterranean parking garages for their employees. As far as housing within the formal urban planning system is concerned, the *xiaoqu* is indeed the predominant urban form. In Shenzhen, these blocks often have parking garages for the residents below the whole complex, with both the residential towers and the

semi-public spaces on top of them. Sometimes they also have public facilities like schools and they often have publicly accessible retail spaces facing the streets that surround the block.

This urban design makes driving not only feasible, but turns it into an experience where the white-collar employee, living in an owner-occupied apartment, does not need to leave the feeling (Miao, 2003) of comfort and security of private and semi-private spaces at any point of the daily commute.

Figure 15: Apartment buildings in Shenzhen

Figure 16: A gated entrance to a residential block

The photos above show some examples. In figure 15, one can clearly distinguish between the mid-rise buildings in the foreground, that closely resemble the typical factory and dormitory buildings, and the high-rise apartments a bit further away, surrounded by green. This type of urban form seems to have been inspired by Le Corbusier, at least in part. Figure 16 shows the entrance to one residential complex, where the character as a gated community can clearly be seen.

The white-collar employees among the respondents who live in an owner-occupied apartment have a median income of ¥5000. Only few of them have a single-person household. Some live together with a partner but many also still live together with their parents. The latter even concerns some respondents above 30 years of age.

While the questionnaire shows that quite a large fraction of the white-collar employees live in such owner-occupied apartments and drive a car, it is not possible to conclude backwards that this type of urban form can be characterised by such residents only. As has been mentioned in the theoretical framework already, factories nowadays also tend to buy nearby apartments to provide housing for their blue-collar employees. The respondents who indicated "rental" as their housing situation are also likely to live in such xiaoqu apartments.

4.2.4 Urban villages from the viewpoint of white-collar employees

The results of the questionnaire indicate that urban villages are at least as important a form of housing for the professionals and managers as the apartments described in the previous subsection.

This fact by itself already means that the views from the literature about urban villages should be nuanced. They are not merely providers of affordable housing for the floating population, consisting of blue-collar workers, but play a major role in the housing of white-collar employees as well.

The employees living in urban villages have a median income of ¥5000 per month, according to the questionnaire data, and they usually have a single-person household. This is in line with the results of one of the master's theses of last year (Veeken, 2013), which found that most household incomes in the urban village of Baishizhou, near the High Tech Park, fall within the ¥4000-¥6000 range, with higher household incomes than that often being the result of a dual-income household composition. This means that the respondents of the questionnaire are probably very average residents of such an urban village in terms of income.

Figure 17: An urban village from above

Figure 18: A street in an urban village

This is an order of magnitude more compared to the ¥500-¥1000 income bracket, that has been mentioned in the literature as by far the most common among inhabitants of an urban village (Tian, 2008). It also contradicts the statement that the only wealthy inhabitants of urban villages would be the original villagers now acting as landlords (Hao et.al., 2011) – in the study mentioned earlier, the highest income bracket is that of ¥2000 per month upwards (Tian, 2008).

The built environment of housing in urban villages is very different compared to the modern apartments. In Shenzhen, most urban villages are those of the third generation, consisting of a grid of square apartment buildings of up to and over 10 stories high with often only narrow alleyways between them, where one cannot drive a car at all. Figure 17 shows an aerial view on a typical urban village. As far as there are streets, they are often also narrow (figure 18) with parking facilities only in a few places. Entrance to urban villages is often regulated, with the entire village serving as a paid parking zone with barriers at the entrances.

4.2.5 The public transport system

The public transport system in Shenzhen consists of two main components. On the one hand, there is the bus system. As has been shown further above, it is the most popular way of commuting for those who live in urban villages, whereas the car is the most popular among those who live in owner-occupied apartments. The other component is the metro system, which comes second in popularity for both of the aforementioned groups. Both types of public transport are covered in this subsection.

As has been mentioned in the subsection about bicycle infrastructure already, the 1990's could be characterised by a shift in Chinese cities to solve traffic congestion by providing incentives to switch to public transportation, by both discouraging cycling and investing in capital-intensive public transportation systems.

Shenzhen seems to be no exception to this. The city has a rapidly expanding network of very modern metro lines, covering the inner city and parts of the suburbs. The system uses modern technology, such as platform edge doors, and it is clean and well-organised. Signage and digital information provision is provided to a high standard and the trains run very frequently. Operating hours are generally between 06:30 and 23:30. Figure 19 shows a photo from inside the metro system.

Figure 19: Inside the metro

Most riders on the metro are rather young and well-dressed. Sometimes one can see elderly people, mostly when they travel to an intercity railway station during holidays. Sometimes one can also see a poor person who uses a single-ride ticket instead of a prepaid chip card, but that is the exception.

Parallel to the metro, there is also an extensive bus system. It is quite different from the metro. There are short lines to provide access within a neighbourhood (such as the orange buses within the OCT area) but also bus lines (such as J1) that run across the entire city and have a route length of more than 50km. The buses generally don't have their own right-of-way and can get stuck in traffic jams. The first departure is often around 6:30, which is comparable with the metro, but in contrast to the metro the last departure is often at 22:00, 21:00 or even 20:00. The buses themselves are often quite modern and innovative, with a fair number of hybrid and even fully electric buses (see figure 20). Chances for being able to sit down seem to be better than in the metro, but the system as a whole does not provide a modern and sparkling clean atmosphere in the same way the metro does.

Figure 20: An electric bus in Shenzhen

Bus stops generally have a shelter with a display that shows the following for each bus line that stops there: the line number, a route strip containing the name of all bus stops and the time at which the first and last bus of the day depart from their starting point (see figure 21). Additionally, sometimes a map for the surrounding area is provided, similar to those in metro stations. The information at a bus stop does not include frequencies or departure times, maps showing the bus network or an estimation of the journey times.

Figure 21: Information display at a bus stop

Still, the bus has its advantages. For example, at the SCD it has been pointed out that the Tencent company organises public transport bus lines that directly connect the residential locations of employees with the High Tech Park. This seems to hint at such bus lines as the b683, of which the route is shown in figure 22 and which runs from 6:15 until 23:00, longer than most other bus lines in Shenzhen.

Figure 22: Route of bus b683. Source: Baidu Maps

4.2.6 Self-containment and travel time budgets

The theory of the fixed travel time budget means that environmentally friendly but rather slow modes of transportation, such as bicycling, are only a feasible option if commuting distances are short, in other words, they are only possible in so far as a district is self-contained. The questionnaire has been carried out in an area with mixed land use, so that this necessary factor for self-containment is fulfilled. This paragraph will investigate what the results of the questionnaire can tell about actual self-containment.

Table 3 shows some statistical data about commuting distances and times for the two primary housing situations as evident from the questionnaire. Neither variable shows a statistically significant difference.

	Average		**Stdev**		**Welch's t**	**p**
	Owner	Urban village	Owner	Urban village	Owner – Urban Village	Owner – Urban Village
Distance in km	9,1	9,5	7,7	9,3	-0,158	0,875
Time in minutes	32,5	38,4	23,3	30,1	-0,812	0,420

Table 3: Commuting times and distances

In both situations, the average commuting time is quite long. The average daily travel time budget is supposedly a little more than one hour (Mokhtarian & Chen, 2004), so the respondents of my questionnaire would, on average, already use it up completely with one round trip commute. This does not really leave any time for a switch to slower, non-motorised transportation such as the bicycle. This leads to the conclusion that there is a lack of self-containment in the urban area in which the High Tech Park is located.

According to the literature, one typical reason for this to happen, despite mixed land use, is a mismatch between the employees and housing near to their working locations in terms of affordability (Cervero, 1996). This plays a role in Shenzhen as well. For example, one interviewee has mentioned the real estate prices in Shenzhen as a reason to live further away. However, there is more to this story. The median income is the same for both the employees who live in owner-occupied apartments and those who live in an urban village, but in other respects they are quite different. The latter often live in a single-person household whereas the former often live together with parents or a partner. Also, the median commuting distance (as opposed to the average distance, shown in table 3) is 5km for respondents from an urban village, compared to 8km for those living in owner-occupied apartments. The variance in distance and commuting time is also larger for the former than for the latter.

This means two things. First, nearly half of all respondents live in an urban village and at least half of those live within five kilometres from their work, which is within the range that can be covered by bicycle (Zacharias, 2002; KiM, 2007). This means that self-containment is, at least partly, not only a real possibility but also a reality. On the other hand, the options for home ownership seem to be very constrained by the constraints of affordability and travel time budgets.

Second, it suggests that the housing situation is not just a question of income, even though a single income of ¥5000 might not be enough to buy an apartment. Rather, there seems to be the possibility to choose between either living independently and close to work in an urban village, or to pool together multiple incomes to afford an owner-occupied apartment, generally further away from the place of work. Both are apparently equally viable opportunities with the same level of income.

This second implication hints at a role of soft aspects, which will be dealt with in the next section. But before moving on to that, the next subsection will cover the situation of factories and blue-collar workers, as the last part of this discussion about the built environment of Shenzhen.

4.2.7 Factories and blue-collar workers

So far, the physical environment regarding cycling has been discussed, as well as the main competing modes of transportation from the point of view of a white-collar employee. This group has been chosen as the audience for the questionnaire on soft factors, under the assumption that they are the most likely to have any choice regarding transportation and housing, and thus any opportunity to base such a choice on soft factors at all. This subsection looks into the second large group of employees in Shenzhen, the blue-collar workers. Their opportunities to choose, or the lack thereof, can tell whether the aforementioned assumption holds true. The question how this influences self-containment and transport mode choices in Shenzhen will be covered as well.

Starting point for the analysis of this topic is the urban form of Chinese cities in the era of Mao, between 1949 and 1978. The essence of the urban fabric built in this period, is a rectangular network of wide avenues surrounding large urban blocks. Each of these blocks would contain a *danwei* unit, which is a walled complex consisting of a factory together with accommodation for its workers and related amenities, such as health care and supply of groceries. Thus, the *danwei* compound would be a self-contained unit, inaccessible to the outside world and basically without any need for its inhabitants to leave, and the avenues would only see very sparse traffic of public transport and bicycles (Gaubatz, 1999). In terms of land use mixing and self-containment, this would be an ideal situation, if it weren't for the lack of freedom of residential location choice for the employees.

The very existence of Shenzhen is related to the end of the Mao era and the policy changes of his successor, Deng Xiaoping. However, as the land use plan of Figure 4 further above shows, the urban pattern of Shenzhen is still very much based on the grid of large rectangular blocks surrounded by wide avenues. Shenzhen is also still mainly an industrial city with a large secondary sector (Ng & Tang, 2004) especially compared to old Chinese cities with a similar income level, which have shifted more towards the tertiary sector (Gong, 2011).

To understand the urban form and the commuting patterns related to factories and blue-collar workers in Shenzhen, it is again necessary to make a distinction between the formal urban planning system and urban villages. It has already been shown above, that urban villages can attract a wider range of residents than, as suggested by the literature, just the floating population of blue-collar workers. But their role should be nuanced in another way as well.

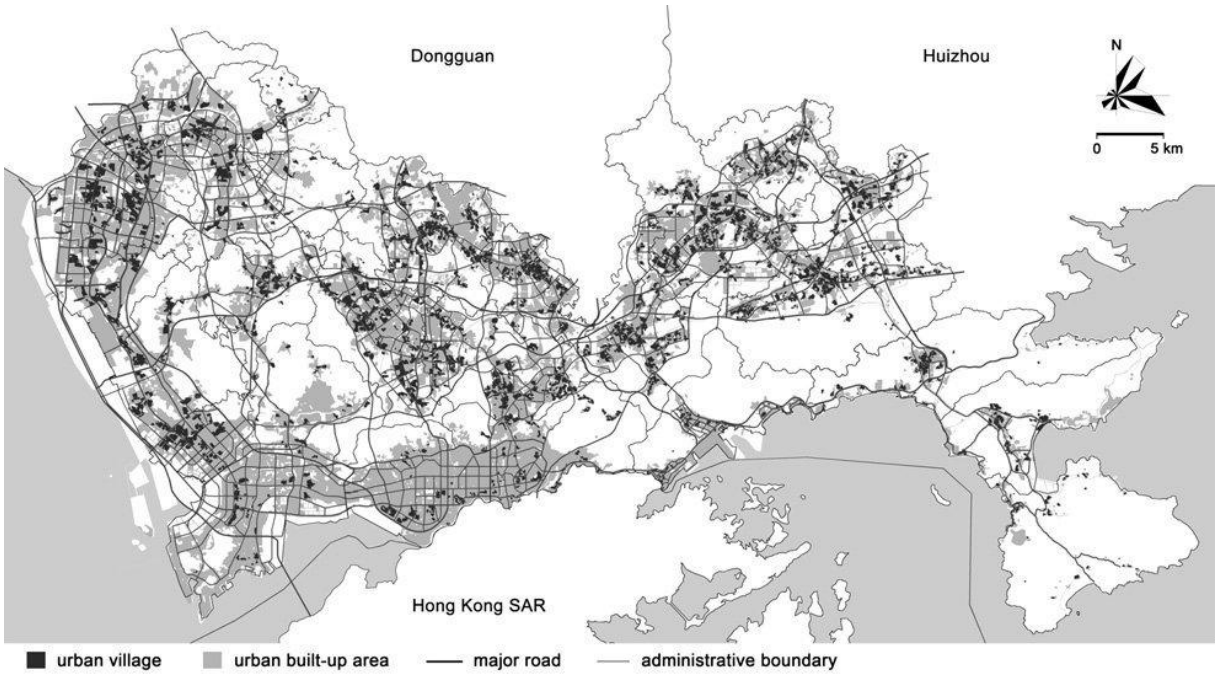


Figure 23: Urban villages in Shenzhen according to Hao et.al. (2011)

Figure 23 supposedly shows a map of all urban villages in Shenzhen, based on data from the Shenzhen Urban Planning Bureau. But in fact, these data only show the location of the urban fabric of third-generation urban village apartment buildings, the 'handshake houses'. For example, the middle part of northern Baishizhou, which consists of former factory buildings, is not shown on the map as being part of the urban village.

Other urban villages break even much more radically with this stereotypical understanding, which equates urban villages with third generation handshake houses, and accommodate industry as well. One example is an urban village in central Longgang (龙岗中心), between Qinglin and Qingsong roads. As has been pointed out at the SCD, this is a very typical example of industries in urban villages in Shenzhen.

A map is shown in figure 24, below. On the left side, marked with the letters "UV", the traditional third generation urban village tissue can be seen. However, it is only a small part of the whole complex. The big majority of the land is used for a different urban form, consisting of factories, workers' dormitories and amenities such as shops and restaurants. The buildings for these – rectangular in shape and about 4 stories in height – closely resemble that of the traditional *danwei* units from the 1949-1978 period, as described earlier. However, these are actually quite different from real *danwei* compounds. Multiple factories can be accommodated within one single block. The block itself is not walled and the interior streets are publicly accessible. Likewise, most amenities are also publicly accessible and run by third parties, rather than by the factories. Only the factory and dormitory buildings themselves each have their own gated entrance.

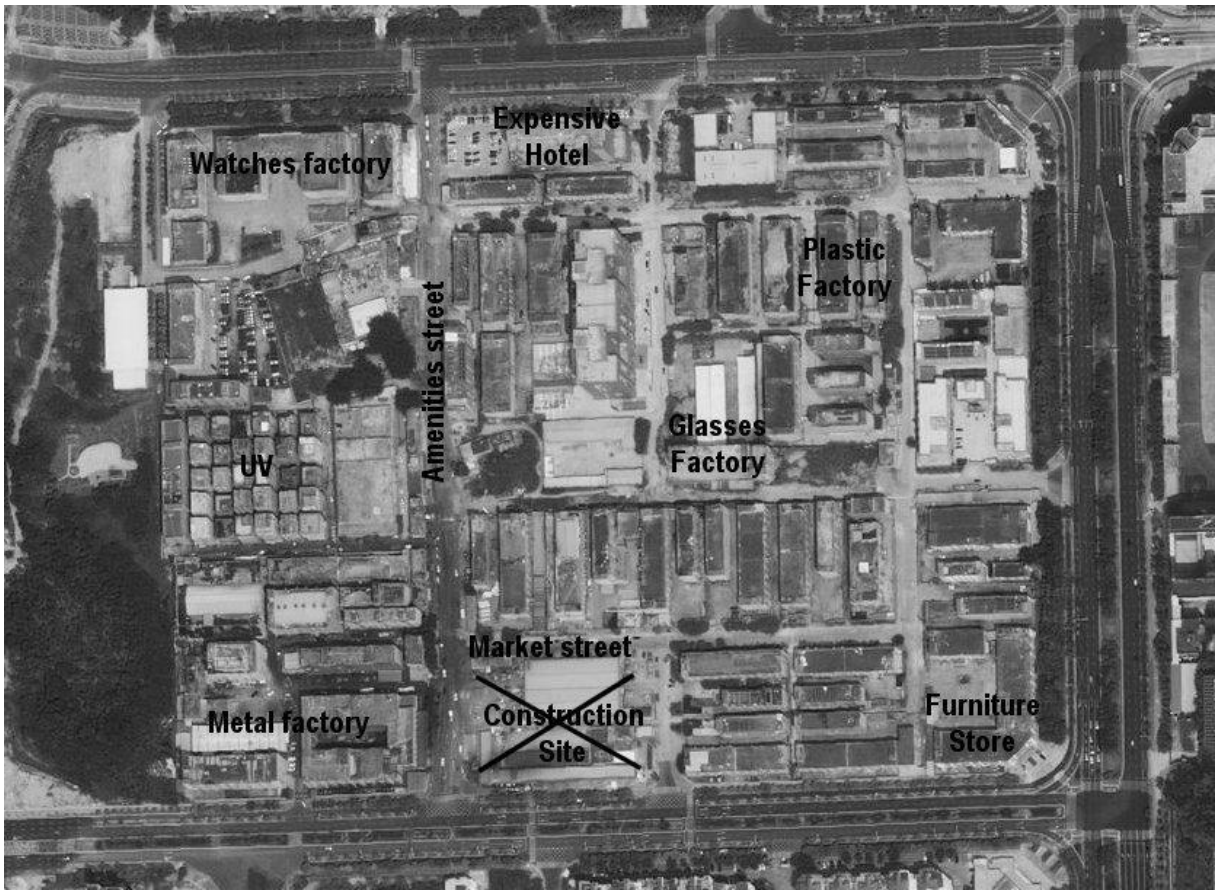


Figure 24: An urban village in central Longgang

Observations show that the overwhelming majority of all employees working at these industries are blue-collar workers. The flow of people during changes of shifts goes too fast to count, but as a rough estimate about $^{2}/_{3}$ to $^{3}/_{4}$ of all workers live within the block, in the dormitories or in the urban village proper. From those who do leave the block after work, still about 9 out of 10 walk home. The rest go mainly on bicycle. Together, this means that about 97% of all workers walk and about 3% commute by bicycle. Only very few people drive a car or take a bus.

Unfortunately I have not been able to conduct interviews to get insight in the reasons behind this, but especially job offer descriptions (Hanson, 2009; 2010a; 2010b) of the metal factory in the area in question can at least allow an educated guess. Wages seem to be around the minimum wage level, which is about ¥1800 per month (about €210) in Shenzhen (FSOA, 2014), supplemented by bonuses, for example for overtime work, night shifts or perfect attendance. Restaurants in the main street provide meals for about ¥8–¥10, but the factory probably also has a cafeteria with even cheaper meals. Housing is also provided by the employer, in the form of dormitories for between 4 and 8 workers. Some opportunities for recreation are also provided within the block. For example, there are many pool tables in the main street, where quite a lot of workers will meet after work for about one hour before they go home.

This urban fabric thus differs from the *danwei* concept in its relative openness of the urban block and the intermingling of the workers of different factories. But in terms of self-containment, they are very similar.

Factories, housing and amenities are provided so closely together that workers can access all their needs on foot. On the other hand, the wages could well be so low that workers also simply cannot afford to live further from their work and commute by car or public transportation or even by bicycle.

The situation is slightly different when it comes to industrial land use in the city proper. For this, I will use the example of a glasses factory located a bit southwards from the urban village above. This factory with surroundings is shown in figure 25. As becomes clear from the financial statement of this company (Arts Group, 2014), it indeed falls within the formal planning system of the city, rather than being located in an urban village.

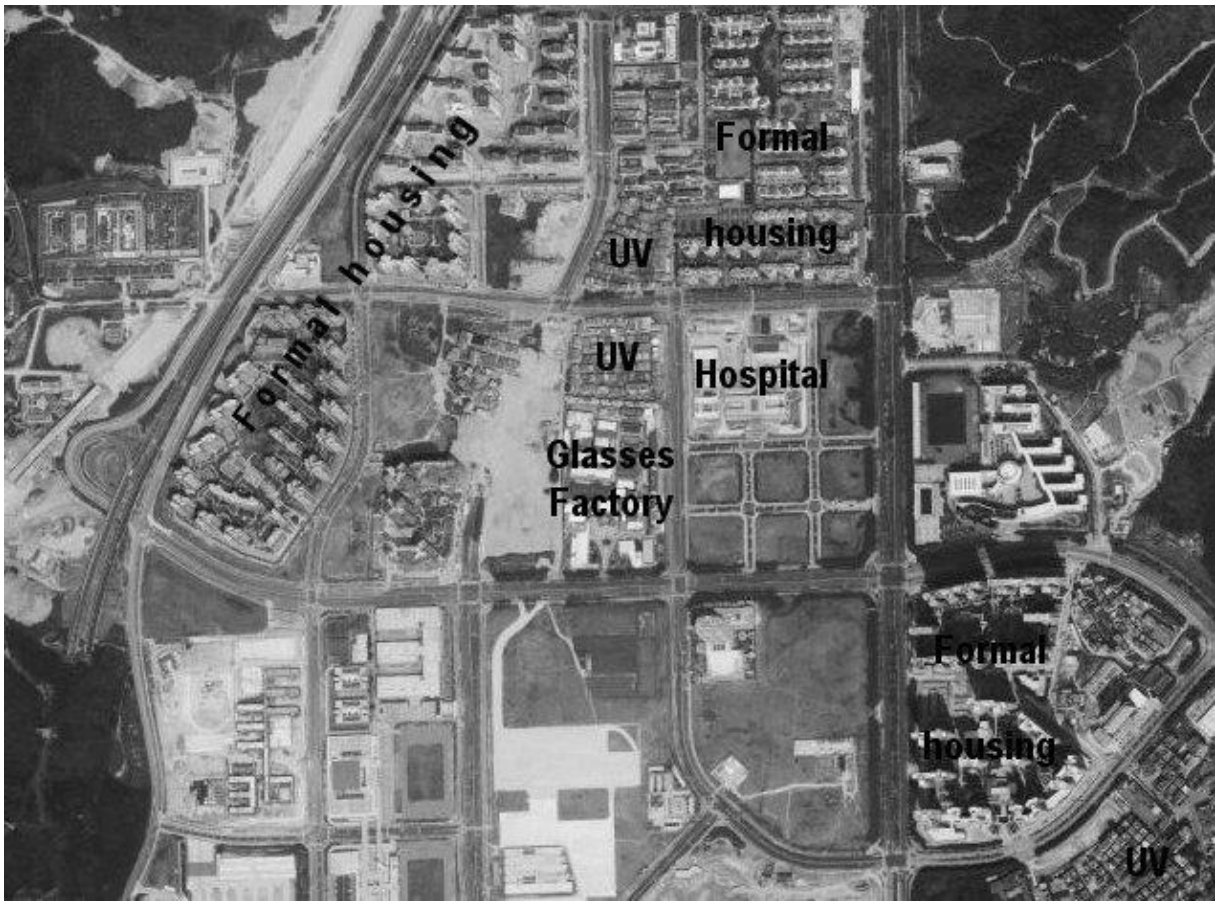


Figure 25: A factory and its surroundings in central Longgang

According to the company description as found on a job vacancy website (Arts Group, n.d.), the factory does provide a number of dormitories and other amenities such as health care, recreational facilities and a library. However, most of the housing does not seem to be located within the block. Most workers leave it after work, and while many people walk, similar to the metal factory, there is also a substantial share of workers who commute by bicycle, across distances that are mostly within a range of about 2 km. The bicycles they use are generally simple ones.

The reason for this difference lies in the reforms of the Xiaoping era, after 1978, which meant the end of the construction of *danwei* compounds. As has been mentioned in the theoretical framework already,

reforms have included the introduction of long-term land leases, so that home ownership and market-oriented real estate development have become a possibility. There has also been an emphasis on function separation. This has also lead to the situation where factories no longer provide workers' dormitories on the factory site. The workers now need to live in the market-oriented apartment developments elsewhere. Because of high real estate prices, however, there has also been a tendency for factories to buy such apartments and rent them to their workers for rates below market level (Gaubatz, 1999). It has been confirmed at the SCD that this is indeed the typical arrangement in Shenzhen as well. However, the situation would even be more pronounced, as the city of Shenzhen would enforce a strictly monofunctional land use plan (see figure 4) where the designations of industrial and residential land use are understood as dedicated land uses that do not allow any intermingling of them at all. The increased commuting distances resulting from this would also be the main reason for the rather large share of cycling among the workers – even if the majority can still commute on foot.

Still, regardless whether factories are accommodated by the formal urban planning system or in an urban village, their blue-collar employees generally have the opportunity to live close to their work and access all amenities they need in the near vicinity, reducing the need for any other kind of transportation than walking. Just as with the *danwei* units from the Mao era, this represents quite an ideal situation in terms of mixed land use (especially in the case of urban villages) and self-containment as factors contributing to short commuting distances and environmental friendly transportation. But the counterpart to this is that this is also a forced self-containment. As these workers generally only earn the minimum wage, they are also not likely to have much of a choice but to take the opportunities mentioned above, and even use the bicycle only if they really have to. Living anywhere else and commuting by other means is probably not a realistic option for them. This confirms the assumptions on which the decision has been based to take white-collar employees as the target audience of the questionnaire.

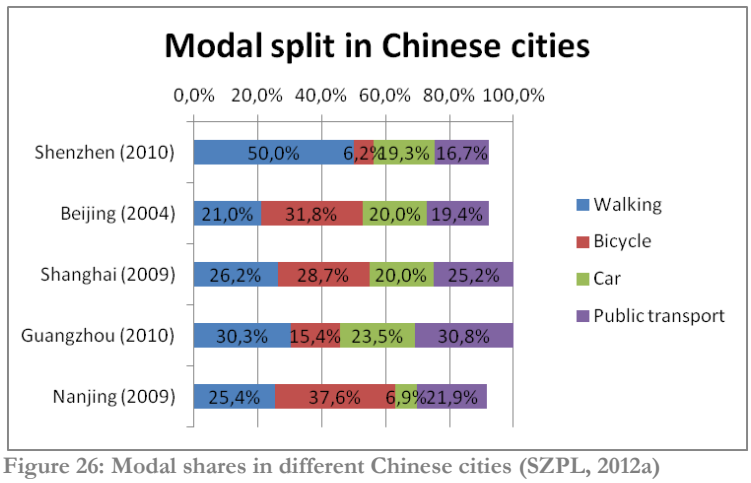


Figure 26: Modal shares in different Chinese cities (SZPL, 2012a)

Nevertheless, this also has profound implications for the modal split in Shenzhen as a whole. As the modal split of the questionnaire respondents has shown (see table 2), both walking and cycling are not very popular among the white-collar employees in Shenzhen. However, walking plays an important role in

Shenzhen as a whole, as could be seen in figure 9 already. This is likely caused by the large share of the secondary sector in the economy of Shenzhen. This relation is further underlined if the modal split of Shenzhen is compared to that of other Chinese cities, as shown in figure 26. It is Shenzhen, with its large secondary sector compared to the other, older cities in that diagram, that has a unrivalled large share of walking. The counterpart is a relatively small amount of car use, by a small margin the least amount of public transport use, and in particular by far the smallest modal share for bicycling.

4.3 Soft aspects

This section covers the main issue of this thesis. It will start with a description of actual bicycle use in Shenzhen, to answer the first of the sub-questions. This is followed by a regression analysis covering all four aspects of the theory of planned behaviour at once. It will show how, in general, the different kinds of soft aspects in the theory of planned behaviour influence transport mode choice in Shenzhen. This will roughly cover the right-hand part of the conceptual scheme from figure 3. After that, each of the soft aspects – perceived behavioural control, evaluative attitudes, affective attitudes and subjective norms – will be examined separately to see how they differ between transport modes and what relation they have to the context, in particular the built environment. This will roughly cover the left-hand part of the conceptual scheme in figure 3. Finally, the issue of self-selection is addressed, in order to answer the fourth sub-question.

First, however, a note about walking. The results of the questionnaire indicate that attitudes towards walking are generally very similar to those about cycling. However, there are no significant differences between subgroups of the respondents and the KiM (2007) report does not provide any data on walking to compare with. The questionnaire thus merely gives some data on walking in general but cannot provide any deeper insights, especially not about the question why one would cycle instead of walking. Therefore, even though the data about walking will be provided when relevant, this way of commuting will not be discussed in detail in this section.

4.3.1 Bicycle use in Shenzhen

This subsection tries to answer the question which kinds of people use the bicycle to commute in Shenzhen, the first sub-question of this thesis, on the basis of the questionnaire data, observations and the interviews.

The questionnaire respondents include only three white-collar employees who commute by bicycle. This is only slightly less than what could be expected on the basis of the modal share of bicycling in Shenzhen as a whole – see figure 9 – but such a small sample cannot be the basis of any conclusive statements.

However, it is possible to give a short description of this sample. They are all male and not married. They all live on their own, two of them in an urban village (the third one in an "other" kind of housing). They are all professionals: Two work as engineers for a bank and earn ¥5000 per month, one works for an

internet company and earns ¥4000. They all live between 3,5 and 4 kilometres from their work and need about 15 to 20 minutes for their daily commute.

	Nanshan High Tech Park		**Longgang Cyber Park**	
	Central intersection		Path to bicycle shed	
	29-04-2014 / 8:44 - 9:00		18-04-2014 / 17:40 - 18:10	
	Male	Female	Male	Female
Normal bike	9	4	3	11
Electric bike	3	2	2	2
Folding bike	8	7	4	7
MTB	17	0	12	1
Very old bike	0	0	1	0
Racing bike	0	0	1	0
Public bike	0	0	0	0
Total	37	13	23	21

Table 4: Bicycle commuters according to gender and type of bicycle

Another way to gain some insight in the composition of the group of bicycle commuters, are observations during rush hour. Table 4 shows the bicycle usage of white-collar workers during peak hours at two different places in Shenzhen, broken down according to gender and type of bicycle. The type of clothes that the bicyclists wear has also been recorded, but because by far the most white-collar workers wear casual clothes when they ride the bicycle, these data have not been included in the table. The data from both locations are quite similar, which reassures that the Nanshan High Tech Park, where the questionnaire has been performed, is representative for high tech office locations in all of Shenzhen, rather than being a unique place.

The largest category in both cases consists of males commuting by mountain bike. As the interview at the Merida store has shown, affordable mountain bikes are in fact seen as normal bicycles in Shenzhen. Women rather use normal bicycles, in the Dutch notion of the word, and folding bicycles. The latter are also quite popular with males, although not nearly as popular as mountain bikes. One of the other shopkeepers has mentioned that the risk of theft or damage by the weather is one reason to ride on a folding bike that can be taken inside. The rather large amount of folding bike users, coupled with the observation that barely anyone takes the folding bike on a metro train, confirms this. On the other hand, especially males apparently do not always mind taking the risk of using a flashy and expensive bicycle to commute. This could in part also be facilitated by the availability of guarded parking lots for bicycles in at least some of the office locations.

The bicycle store owners that have been interviewed, have casted doubts whether these people, who commute by mountain bike, actually buy these bicycles for commuting. They suggest a very different story, in which cycling is a specific niche of dedicated fans. They would buy the bicycle for recreational use and to become part of a recreational culture where they can meet similar-minded people. They would spend as

much as they can on a bicycle, up to half of a monthly income, and often like to tinker with the parts of the bicycle. A few of them – but not many, because of financial risks of the bike getting stolen or damaged by the weather while parked – would then also use the bicycle to commute to their work, but the main use would still be recreational, either in one of the dedicated facilities in the city or for long-distance trips. This story can well explain the presence of the quite large group of male mountain bike users among the bicycle commuters.

One shopkeeper has mentioned that this development has accelerated in pace since the Universiade was held in 2011. Before that, hiking was by far the most popular form of outdoor recreation, but since then there has been a shift in the balance towards the bicycle.

The results from the interviews that have been covered so far, have not yet told much about females. The shopkeeper at the XdS brand store also clearly distinguished between both genders, with mountain bikes for males who enjoy the bicycle culture on the one hand, and on the other hand colourful female bicycles, with accessories such as a basket, suitable for example for house wives who need to bring the children to school or do grocery shopping. None of the interviewees, however, told anything about females who work, even though the data from table 6 show that in fact quite a substantial number of bicycle commuters are females.

It should also be noted that the factory workers, when they commute by bicycle, never seem to use mountain bikes. In this group, even the male workers use normal bicycles. This is another hint that there is a division in Shenzhen between a group of mostly male bicyclists that see cycling as a lifestyle and who want to own the best mountain bike they can afford for that, and another group of mostly females and blue-collar workers who see the bicycle as an utility and choose to buy an affordable but not very flashy model.

4.3.2 Regression analysis

The first step in understanding the influence of soft aspects on bicycle use, is an analysis of the general relationship between those soft aspects and transport mode choice. For this purpose, two different conditional logistic regression analyses have been performed. Details about the exact methodology for this analysis can be found in appendix I.

Variable	Description	Coefficient	Wald t	Significance
EVAL	Evaluative attitudes	0,814	7,714	0,005***
AFFECT	Affective attitudes	-0,383	3,226	0,072*
SUBJ	Subjective norms	0,523	3,534	0,060*
PBC	Perceived behavioural control	0,416	3,267	0,071*

n = 223
p < 0,001 compared to constant model
Table 5: Results of the conditional binary logistic regression analysis for categories of attitudes

First, the four categories of attitudes are taken as the independent variables. For this analysis, for every observation the score of each of these categories has been calculated as the average of the questions within it, ignoring any missing items. Their correlation with the odds of using a certain mode of transportation has been estimated by means of the regression analysis. The results are shown in table 5.

Each of the categories gives a significant contribution, with a highly significant contribution from the evaluative attitudes. Surprisingly, the coefficient for affective attitudes is negative, meaning that positive affective attitudes are actually associated with a decreased odds of choosing the transportation mode in question for commuting.

The second model consists of all variables individually, of which table 6 shows the results. The overwhelming majority of the variables turns out not to be significant. This means that while it has been shown that each of the categories as a whole gives a significant contribution, the responses of the sample in this research are not sufficient to tell by means of regression analysis how those contributions are distributed across the individual variables.

Variable	Description	Coefficient	Wald t	Significance
	EVALUATIVE ATTITUDES			
QUICK	Quick	0,495	2,239	0,135
CONV	Convenient	0,062	0,037	0,848
PUNCT	Punctuality	0,057	0,035	0,851
SAFE	Safe	0,099	0,156	0,693
HEALTH	Healthy	-0,468	2,536	0,111
	AFFECTIVE ATTITUDES			
RELAX	Relaxing	-0,146	0,288	0,592
NOSTRESS	Not stressful	0,044	0,031	0,860
FUN	Fun	0,358	1,256	0,262
COMFORT	Comfortable	-0,275	1,470	0,225
	SUBJECTIVE NORMS			
GREEN	Environmental friendly	0,378	1,470	0,225
STATUS	Status	-0,207	0,516	0,472
LIFESTYLE	Lifestyle	0,483	5,162	0,023**
	PERCEIVED BEHAVIOURAL CONTROL			
SKILL	Skill	-0,116	0,082	0,774
WEATHER	Weather	1,133	2,707	0,100*
INFRA	Infrastructure	-0,187	0,435	0,510
PBC	Total PBC	0,292	0,553	0,457

n = 156
p < 0,005 compared to constant model
Table 6: Results of the conditional binary logistic regression analysis for all individual variables.

There are only two exceptions to this. First, the opinion on the suitability of the weather to use a transport mode is significantly related to the odds to use this transport mode for commuting. Second, the lifestyle variable is highly significant, even stronger than the category that it belongs to.

At this point, one could also look at the coefficient for health, for example, and hypothesise that it would fit better under the affective attitudes. It is impossible to test such a hypothesis, however, because stating a hypothesis based on a certain dataset and testing this hypothesis using exactly the same data would lead to an overestimation of significance and would therefore not be methodologically sound.

Instead, the following subsections will examine how transport modes differ in terms of the four kinds of soft aspects and what the cause for these differences could be.

4.3.3 Perceived behavioural control

The section about the built environment has shown that the physical conditions for the different transport modes are quite dissimilar and not on the same quality level. It is likely that this influences perceived behavioural control, or in other words, the extent to which people think that they can use a certain mode of transportation.

One of the most prominent issues regarding the physical environment has been the deliberate policy to invest in public transport infrastructure and discourage cycling, which is reflected in Shenzhen as well, for example in the only fair infrastructure for bicycling in contrast to a modern and rapidly expanding metro system. A logical hypothesis, following from this, is that perceived behavioural control is better for public transportation than for bicycling.

As a side note, the last question, asking for the total perceived behavioural control, is not just a summary of the other three questions. It also encompasses issues such as not having a driver's license as an obstacle to drive a car, or the commuting distance making walking or cycling practically impossible.

	% agree			**Z-score**			
	Walking	Cycling	Car	Public Transport	Cycling – Public Transport	Bicycle - Car	Bicycle – Walking
32. I can use this transport mode (skills)		81%	59%			-2,951***	
33. The weather here is suitable to use this transport mode	85%	74%	84%	92%	2,769***	1,380	-1,535
34. The infrastructure here is suitable to use this transport mode	63%	56%	74%	76%	2,494**	2,131*	-0,777
35. All in all, I can use this transport mode to go to work / school	57%	62%	56%	82%	2,509**	-0,739	0,554

*Black *: Test with H_0 that all components of perceived behavioural control are the same for both groups that are compared*

Table 7: Perceived behavioural control

Table 7 shows the perceived behavioural control for the different modes of transportation. It also shows the results for testing the difference between both aforementioned modes of transportation. This proves that perceived behavioural control is indeed greater, in all aspects, for public transportation than for the bicycle.

Louis van Gaal famously once asked: "Am I so smart or are you so stupid?" This gives the assist for the next question regarding perceived behavioural control: does the difference that has been found mean that public transportation is judged so positively, or that the conditions for bicycling are thought to be so appalling? For example, subjectively the 74% that agrees that the weather in Shenzhen is suitable for bicycling does not seem to be very little, especially considering that Shenzhen did have quite a large share of bicyclists in the past.

	Average			**p**	
	Netherlands	Owner-occupied apartment	Urban village	Netherlands – Owner-occupied apartment	Netherlands – Urban Village
Perceived behavioural control regarding cycling	3,4	3,3	3,9	0,671	0,075*

Table 8: Perceived behavioural control compared between the Netherlands and Shenzhen

Unfortunately, the material available for comparison seems to be few and far between. Only for perceived behavioural control in general regarding bicycle usage, the study of Heinen et.al. (2010) gives a value for the Netherlands that can be compared with. Because the section on the built environment in Shenzhen has shown that both owner-occupied apartments and urban villages are popular residential locations for white-collar employees and because the general data from the questionnaire have shown that the employees living in urban villages often take the bus whereas those living in owner-occupied apartments often drive a car, both are considered separately from each other. The results of the comparison can be found in table 8. The inhabitants of urban villages in Shenzhen show a slightly greater perceived behavioural control regarding the bicycle than Dutch citizens, whereas the difference between residents of owner-occupied apartments and the Dutch is negligible. As a consequence, the difference between the bicycle and public transport in terms of perceived behavioural control must thus indeed be sought in the particularly good score of public transportation.

	% agree			**Z-score**		
Public Transport	Metro	Bus	Bicycle	Bus – Metro	Bicycle – Metro	Bicycle – Bus
33. The weather here is suitable to use this transport mode	100%	94%	92%	-0,855	-1,022	-0,257
34. The infrastructure here is suitable to use this transport mode	100%	89%	58%	-1,195	-2,513**	-1,938*
35. All in all, I can use this transport mode to go to work / school	100%	89%	83%	-1,146	-1,417	-0,439
*Black *: Test with H_0 that all components of perceived behavioural control are the same for both groups that are compared*						

Table 9: Perceived behavioural control for bicycle, bus and metro

The description of the built environment of Shenzhen in the previous section also indicated that the bus and metro systems are quite different from each other, both in terms of the transport system itself and the types of users. This logically leads to the hypothesis that the bicycle might actually stack up very differently against the bus and against the metro. Unfortunately, the questionnaire has not asked about attitudes separately for bus and metro, but this issue can be solved by constructing a score for the bus system by taking only the responses from bus users about public transport, and correspondingly for the metro. Of course this also means that, for the values to remain comparable, only the answers from actual bicyclists can be taken into account for the scores for the bicycle. All of these limitations lead to a strong decrease in statistical power. The results are shown in table 9.

At least as far as perceived behavioural control is concerned, the bus and metro are not significantly different from each other, but in terms of infrastructure provision, especially the metro performs better than the bicycle.

Now that public transport has been covered, with the bus being particularly popular amongst residents of urban villages, it is time to look at the car. As table 2 above has shown, it is mostly popular with those who live in owner-occupied apartments and thus forms a counterpart to the bus.

The results in table 7 give an ambiguous view regarding the comparison between cycling and car use. There are more people who can ride a bicycle than those who can drive a car, but on the other hand the infrastructure for driving a car is regarded more positively than the bicycle infrastructure. For overall perceived behavioural control, there is no significant difference between the bicycle and the car.

However, the physical differences between *xiaoqu* apartments and urban villages are large, especially when it comes to the possibility and practicality to use a car. Together with the fact that those who live in owner-occupied apartments particularly often drive a car, one could hypothesise that perceived behavioural control regarding car use, compared to the bicycle, is also different in both kinds of urban environment.

The data to test this hypothesis can be found in table 10, which consists of four smaller tables that break down each of the questions of perceived behavioural control according to the housing situation of the respondent and the transport mode about which the respondent answers. This means that, while observations are independent when compared horizontally or vertically, the same does not apply for each table as a whole. The tables are therefore not true cross-tabulations and more holistic statistical methods, such as logistic regression or two-way ANOVA, cannot be used.

Still, the results demonstrate that especially the respondents who live in the owner-occupied apartments can drive a car just as often as they can ride a bicycle, and that they also consider the car advantageous compared to the bicycle in terms of climate, infrastructure and general ability to commute. The respondents who live in an urban village, on the other hand, are better at riding a bicycle and are less often

able to drive a car. The other items show that they think one could just as well use a bicycle as a car. Altogether, this shows that perceived behavioural control is indeed quite skewed towards the car in apartment complexes with good provision of car infrastructure.

It would be possible to accommodate public transport and walking in this comparison as well. However, none of the soft aspects related to those two modes of transportation are significantly different between respondents living in owner-occupied apartments and those living in urban villages. Incorporating them in table 10 and similar tables in the next subsections would therefore not lead to any new insights.

	% agree		Z
	Owner-occupied	Urban village	Urban Village – Owner
32. I can ride a bicycle (skills)	65%	91%	2,115**
32. I can drive a car (skills)	71%	57%	-1,027
Z Car – Bicycle	0,442	-2,686***	
33. The weather here is suitable to use the bicycle	53%	80%	1,812
33. The weather here is suitable to use the car	90%	90%	-0,051
Z Car – Bicycle	2,677***	0,886	
34. The infrastructure here is suitable to use the bicycle	35%	65%	1,802
34. The infrastructure here is suitable to use the car	90%	76%	-1,175
Z Car – Bicycle	3,474***	0,787	
35. All in all, I can use the bicycle to go to work / school	38%	65%	1,642
35. All in all, I can use the car to go to work / school	71%	59%	-0,849
Z Car – Bicycle	2,064**	-0,394	

*Black *: Test with H_0 that in both kinds of urban environment, all components of perceived behavioural control are the same for both modes of transportation (vertical comparison) respectively that for both modes of transportation, all components of perceived behavioural control are the same in both kinds of urban environment.*

Table 10: Perceived behavioural control of car and bicycle split up according to housing situation

4.3.4 Evaluative attitudes

The second category of soft aspects in the theory of perceived behavioural control are the evaluative attitudes.

	% agree				Z		
	Walking	Cycling	Car	Public Transport	Cycling – Public Transport	Cycling – Car	Cycling – Walking
19. Speed	24%	30%	75%	82%	5,870***	5,158***	0,722
20. Cheap	91%	74%	23%	28%	-4,736***	-5,250***	-2,232**
21. Convenience	38%	41%	56%	68%	2,930***	1,641	0,380
22. Health benefits	88%	80%	16%	22%	-6,534***	-7,066***	-1,171
23. Arrive on time	44%	53%	56%	58%	0,535	0,311	1,002
24. Traffic safety	69%	54%	64%	75%	2,452**	1,080	-1,706*

*Black *: Test with H_0 that all evaluative attitudes are the same for both groups that are compared*

Table 11: Evaluative attitudes

Similar to the case of perceived behavioural control, evaluative attitudes probably also have a relationship to the built environment. Based upon this physical context in the case of Shenzhen, one could therefore hypothesise that both the car and public transportation would perform better than the bicycle in terms of evaluative attitudes. Exceptions are to be expected, though. It is likely for the car to be considered expensive and for non-motorised transport to be considered more healthy than motorised modes.

Table 11 shows that this hypothesis holds true, in particular regarding public transport. For the car, the picture is more nuanced. It only performs well in terms of speed, but it is not considered particularly convenient, punctual or safe compared to the bicycle.

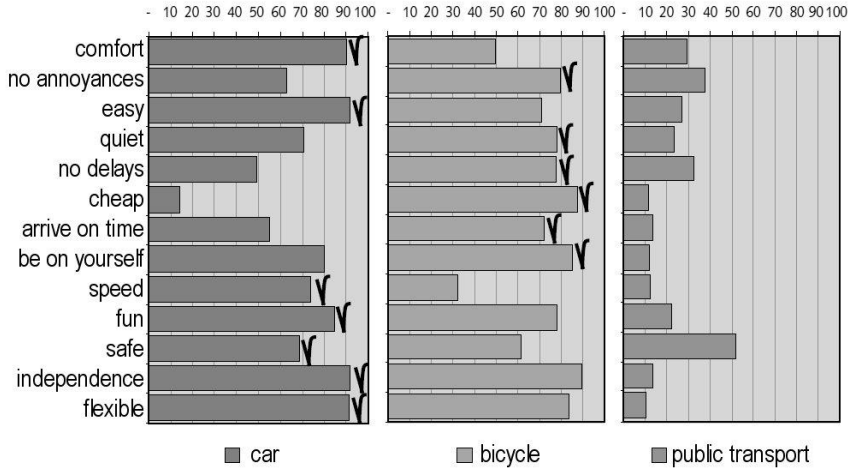
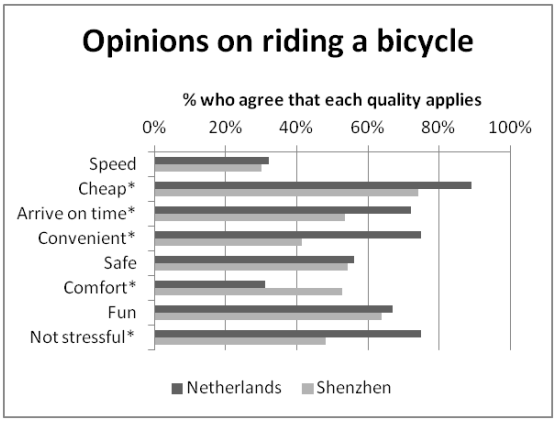


Figure 27: Attitudes in the Netherlands (KiM, 2007). Numbers are the percentages who agree.

The results from the questionnaire in terms of evaluative attitudes can be compared with data from another location. The report "Experience and Image of Mobility"[4] (KiM, 2007) shows both evaluative and affective attitudes regarding different modes of transportation in the Netherlands. The graph with the main results is shown in figure 27. As can be seen, cycling receives top grades for aspects such as absence of stress and arriving on time, whereas public transport consistently ends up as being the worst performing mode of transport.

Figures 28, 29 and 30 show the comparison of these data with the corresponding results from the questionnaire in Shenzhen. An asterisk denotes any difference that is significant to at least the 95%-level. The results show that evaluative attitudes towards cycling are better in the Netherlands than in Shenzhen, whereas public transport in Shenzhen performs much better than in the Netherlands on all aspects of evaluative attitudes. This supports the hypothesis, that the mediocre cycling infrastructure and the investments in public transportation both contribute to make the overall balance of evaluative attitudes tip towards public transport.

[4] Beleving en beeldvorming van Mobiliteit



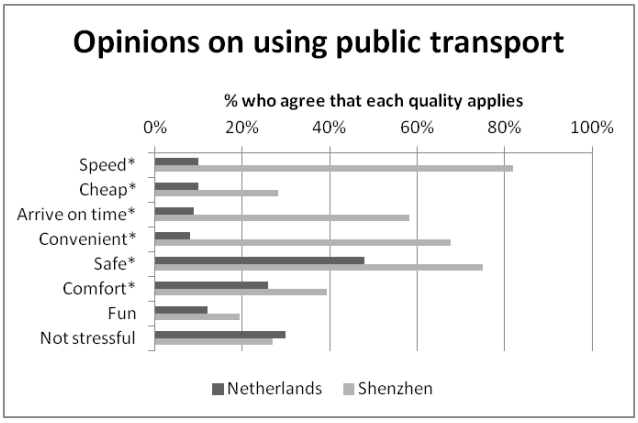
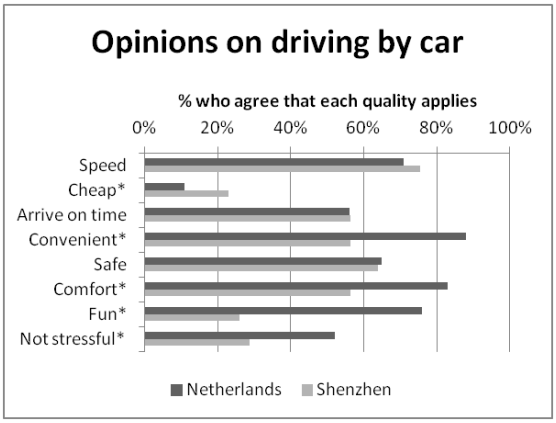


Figure 28: Attitudes towards cycling in Shenzhen and the Netherlands (KiM, 2007)

Figure 29: Attitudes towards public transport in Shenzhen and the Netherlands (KiM, 2007)



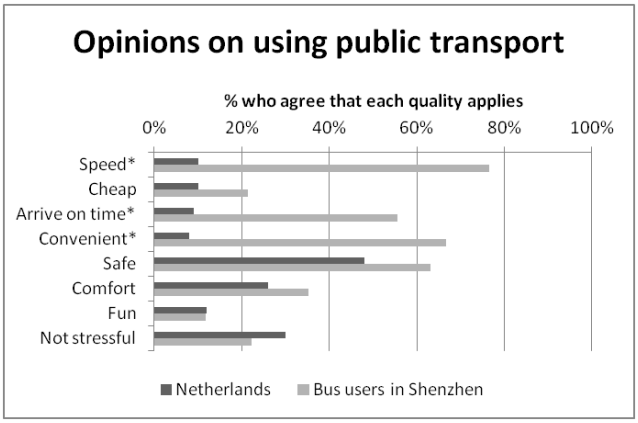


Figure 30: Attitudes towards car use in Shenzhen and the Netherlands (KiM, 2007)

Figure 31: Comparison between the opinion on public transport in the Netherlands (KiM, 2007) and the bus system in Shenzhen

As in the previous subsection, the differences between the bus and metro should also be taken into account. The difference in quality between the metro system and the bus network could possibly mean that only the metro is responsible for the good judgements on public transportation, whereas the bus might not perform significantly better than the bicycle. Table 12 shows the data to test this hypothesis.

	% agree			Z		
Public Transport	Metro	Bus	Bicycle	Bus – Metro	Bicycle – Metro	Bicycle – Bus
19. Speed	100%	76%	67%	-1,810*	-2,191**	-0,582
20. Cheap	0%	21%	50%	1,323	2,227**	1,464
21. Convenience	100%	67%	73%	-2,236**	-1,940*	0,342
22. Health benefits	22%	24%	91%	0,075	3,119****	3,483****
23. Arrive on time	100%	56%	83%	-2,598****	-1,417	1,581
24. Traffic safety	83%	63%	73%	-1,205	-0,616	0,536

*Black *: Test with H_0 that all evaluative attitudes are the same for both groups that are compared*

Table 12: Evaluative attitudes for bicycle, bus and metro

Unfortunately, the results are barely significant if the evaluative attitudes are considered as a whole (based upon the null hypothesis for which the blue asterisks show the significance), without hypotheses for the various components based on prior knowledge. Still, the results suggest that the metro is the best performer of the three and that even the bus is considered to be more or less on par with the bicycle. Comparison with attitudes on public transportation in the Netherlands, as shown in figure 31, shows that the bus system in Shenzhen does indeed perform quite well in terms of evaluative attitudes.

As has been pointed out at the SCD, especially the dedicated bus lines for commuters to the High Tech Park (see the section on the built environment in Shenzhen for more detail) could be an explanation for this.

In the subsection about perceived behavioural control, the differences between the bicycle and the car have been broken down according to the housing situation, because the physical environment of owner-occupied apartments could favour the car whereas that of urban villages could be more suitable for the bicycle. A corresponding comparison should be performed for evaluative attitudes as well.

	% agree		**Z**
	Owner-occupied	Urban village	Owner-occupied – Urban Village
19. Speed (bicycle)	18%	38%	-1,382
19. Speed (car)	83%	73%	0,797
Z Car – Bicycle	4,083***	2,286**	
20. Price (bicycle)	79%	74%	0,324
20. Price (car)	36%	5%	2,242**
Z Car – Bicycle	-2,291**	-4,314***	
21. Convenience (bicycle)	25%	45%	-1,241
21. Convenience (car)	64%	37%	1,712*
Z Car – Bicycle	2,355**	-0,518	
22. Health benefits (bicycle)	76%	82%	-0,410
22. Health benefits (car)	26%	15%	0,875
Z Car – Bicycle	-3,005***	-4,325***	
23. Arrive on time (bicycle)	38%	65%	-1,642
23. Arrive on time (car)	76%	48%	1,906*
Z Car – Bicycle	2,375**	-1,121	
24. Traffic safety (bicycle)	25%	67%	-2,512**
24. Traffic safety (car)	71%	55%	1,092
Z Car – Bicycle	2,799***	-0,765	

*Black *: Test with H_0 that in both kinds of urban environment, all evaluative attitudes are the same for both modes of transportation (vertical comparison) respectively that for both modes of transportation, all evaluative attitudes are the same in both kinds of urban environment.*

Table 13: Evaluative attitudes towards car and bicycle split up according to housing situation

The result of this is shown in table 13. The results are quite distinctive for the different variables. For example, there is universal agreement about the differences between the bicycle and the car in terms of health benefits. On the other hand, only home owners associate the car more with traffic safety than the

bicycle – the employees who live in an urban village do not agree with them, and on their turn they seem to consider the car as being particularly expensive. The other variables are somewhere between both of these extremes.

4.3.5 Affective attitudes

Evaluative attitudes are only one part of all attitudes in the theory of planned behaviour, the other part being affective attitudes. These form a less rational component, compared to evaluative attitudes and perceived behavioural control, so there are less reasons to expect any specific influence of the general characteristics of a certain mode of transport on affective attitudes. However, the hypothesis that fun and relaxation are only possible with good physical preconditions seems to be a logical one.

	% agree				Z		
	Walking	Cycling	Car	Public Transport	Bicycle – Public Transport	Bicycle – Car	Bicycle – Walking
28. Relaxing	77%	68%	39%	45%	2,480**	3,087***	-1,114
29b. Not stressful	46%	48%	29%	27%	2,395**	2,140**	0,263
30. Fun, exciting	42%	64%	26%	19%	4,949***	4,107***	2,396**
31. Pleasant, comfortable	45%	53%	56%	39%	1,448	-0,418	0,814

*Black *: Test with H_0 that all affective attitudes are the same for both groups that are compared*

Table 14: Affective attitudes

Table 14 shows the differences between the modes of transportation. These show that the bicycle, as well as walking, perform well in terms of affective attitudes, in comparison to the car and public transport.

These results are quite interesting, if they are compared to data from elsewhere. Figure 27 has shown that in the Netherlands, the car is seen more positively than the bicycle in terms of affective attitudes, whereas table 14 demonstrates that the reverse is true for Shenzhen. Figures 28 and 30 underline this difference. This means that the positive affective attitudes towards non-motorised transportation in Shenzhen, including the bicycle, is not just a matter of course.

A possible explanation for this could be the following. As has been mentioned before, particularly the recreational bicycle infrastructure is quite good in Shenzhen. Thus, people in Shenzhen might associate the bicycle more strongly with recreation, compared to those in the Netherlands and as a consequence be less inclined to use the bicycle for commuting. In fact, one US study even speaks in terms of a possible "tradeoff between bicycling for transportation and recreation" (Xing et.al., 2010: 75). This could also explain why, as the regression analysis has shown, affective attitudes are actually negatively correlated with the odds for an employee to use a certain mode of transportation to commute. However, an inverse relationship is also a relationship, so there is still reason for a more extended analysis of affective attitudes.

In the previous subsections, there have been significant differences based on the housing situation. Table 15 shows that these differences extend to the affective attitudes. The positive views upon the bicycle in terms of affective attitudes is predominantly carried by those who live in an urban village. Employees who

live in an owner-occupied apartment do not subscribe to them. This suggests that the urban environment, which is more geared towards the car in the case of owner-occupied apartments and more suitable for cycling in the case of urban villages, is indeed related to affective attitudes.

	% agree		Z
	Owners about cycling	Urban Village inhabitants about cycling	Owners – Urban Village
28. Relaxing	36%	80%	2,615***
29b. Not stressful	53%	37%	-0,962
30. Fun, exciting	27%	77%	3,051***
31. Pleasant, comfortable	29%	73%	2,599***

*Black *: Test with H_0 that all affective attitudes are the same for both groups that are compared*

Table 15: Affective attitudes regarding cycling broken down according to housing situation

The previous subsections have also distinguished between the metro and bus, when it comes to public transport, especially in order to gain more clarity about urban villages, where the bus is the most popular way of commuting. This can be done here as well, with the hypothesis that the modern and sparkling clean metro system will perform better than the bus in terms of affective attitudes. Table 16 shows that this hypothesis cannot be proven. The differences between the bus and metro are not significant, but there is strong evidence that bicycling is regarded more positively in terms of affective attitudes.

	% agree			Z		
Public Transport	Metro	Bus	Bicycle	Bus – Metro	Bicycle – Metro	Bicycle – Bus
28. Relaxing	50%	41%	100%	-0,446	2,687***	3,173***
29b. Not stressful	40%	22%	64%	-0,998	1,083	2,230**
30. Fun, exciting	11%	12%	80%	0,050	3,003***	3,546***
31. Pleasant, comfortable	56%	35%	60%	-0,995	0,196	1,248

*Black *: Test with H_0 that all affective attitudes are the same for both groups that are compared*

Table 16: Affective attitudes for bicycle, bus and metro

4.3.6 Subjective norms

The final part of the theory of planned behaviour consists of subjective norms. The scientific literature strongly suggests one particular hypothesis, also in the case of China, namely that the car is the single one mode of transportation that is held in high regard when it comes to status and lifestyle.

	% agree				Z	
	Walking	Bicycle	Car	Public transport	Bicycle – Car	Bicycle – Public transport
25. Gives status to me	15%	20%	63%	24%	-4,793***	-0,510
26. Green, good for the environment	79%	75%	14%	55%	6,555***	2,267**
27. Suits my lifestyle	52%	44%	45%	61%	-0,143	-1,855*

*Black *: Test with H_0 that all subjective norms are the same for both groups that are compared*

Table 17: Subjective norms

Table 17 shows the results from this part of the questionnaire. They show that the car is indeed the only mode of transportation that is strongly associated with status. However, it is also considered to be the only mode of transportation that is not good for the environment at all. In terms of lifestyle, opinions seem to be quite balanced on the first sight.

It is interesting that public transport also shows some small signs of performing better than the bicycle in terms of lifestyle and status. As in the previous paragraphs, we can again formulate the hypothesis that the metro would be the main contributor in this regard, in contrast to the bus. Table 18 shows that the statistical power of this questionnaire is not enough to prove this. The results suggest that the metro scores particularly well on status and lifestyle whereas the bicycle is the winner in terms of environmental benefits. But only the latter can be proven convincingly.

	% agree			**Z**		
Public Transport	Metro	Bus	Bicycle	Bus – Metro	Bicycle – Metro	Bicycle – Bus
25. Gives status to me	45%	12%	27%	-2,011**	-0,886	1,046
26. Green, good for the environment	70%	47%	100%	-1,158	1,879*	2,818****
27. Suits my lifestyle	92%	56%	60%	-2,114**	-1,765*	0,228
*Black *: Test with H_0 that all subjective norms are the same for both groups that are compared*						

Table 18: Subjective norms for bicycle, bus and metro

It is possible to look a bit deeper into the aspect of subjective norms still, by means of the hypotheses that people who actually drive a car and those who live in an owner-occupied apartment would think more positively about the car in terms of subjective norms, than those who don't.

Table 19 shows the results of the questionnaire, broken down according to these categories. It becomes apparent that the ideas about status do not differ much, but both car users and people who live in owner-occupied homes, think more positively about the car than others in terms of lifestyle. These differences cannot close the gap to cycling, though, and splitting up the thinking about cycling in a similar way does not yield much of interest.

As a side note: the distinction between opinions about car use from car users and non-users has only been made here, as such differences were insignificant for the other categories of soft aspects.

	% agree		**Z**	**% agree**		**Z**
	Car users about car	Non-car-users about car	Non-users – Car users	Owner-occupied about car	Urban village about car	Urban village – Owner-occupied
25. Gives status to me	53%	65%	0,838	72%	50%	-1,452
26. Green, good for the environment	25%	11%	-1,231	28%	5%	-1,923*
27. Suits my lifestyle	79%	35%	-2,855****	74%	37%	-2,284**
*Black *: Test with H_0 that all subjective norms are the same for both groups that are compared*						

Table 19: Subjective norms regarding the car split up according to housing situation and car use

To make the results more insightful, table 20 gives a cross-tabulation for just the question about lifestyle. The number of respondents is too low for any statistical analysis, but it seems that driving a car and living in an owner-occupied home are both independently linked to seeing car use as suitable to the individual's lifestyle. On the other hand, while urban village residents apparently think more positively about cycling in terms of lifestyle than those who live in owner-occupied apartments, there is absolutely no clear link between driving a car and the lifestyle-aspect of cycling. Thus, to sum it up, especially the type of housing seems to be a decisive factor in the question whether car use or cycling would be better fitting for someone's lifestyle.

Suits my lifestyle (car)	**% agree**		**Suits my lifestyle (bicycle)**	**% agree**	
	Drives car	Doesn't drive car		Drives car	Doesn't drive car
Owner-occupied	89%	60%	Owner-occupied	17%	11%
Urban village	67%	31%	Urban village	33%	41%

Table 20: Cross-tabulation of car use and housing situation for the question about lifestyle

Moreover, the respondents of my questionnaire do indeed find subjective norms important, although in different ways according to their housing situation. Figure 32 shows a comparison with a Dutch study (Heinen et.al., 2010). Residents of owner-occupied homes in Shenzhen are significantly ($p<0.001$) more occupied with lifestyle considerations compared to Dutch people. For status, it are rather the urban village residents who differ ($p<0.058$) from the Dutch. Regarding the environmental benefits, their score is also significantly higher than both that of the Dutch and employees living in an owner-occupied apartment ($p<0.006$ and $p<0.022$, respectively).

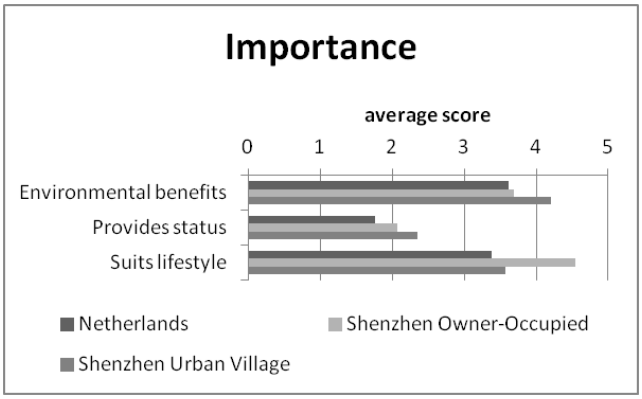


Figure 32: Comparison with Heinen et.al. (2010) of importance of lifestyle and status

4.3.7 Residential self-selection

The results above have shown the existence of many statistical correlations, but at the same time I have been conservative when it comes to stating that causal relationships have been proven. The main reason for this is the concept of residential self-selection. To recall: this principle means that people with a certain mindset might choose a corresponding environment as their home, so that a correlation between people's

preferences, whether stated or revealed, and the built environment does not necessarily mean that the built environment actually influences people's preferences.

This does not put everything into question. For example, intercontinental migration is a big step for anyone and does not apply to any of the respondents, so that residential self-selection can be ruled out as the cause for any of the differences between Shenzhen and the Netherlands that have been found. But it is more complicated for the situation within Shenzhen.

The general data from the questionnaire have shown that there are at least two major groups among the respondents. First, there are those who live in *xiaoqu* and who drive a car. This is the group that fits the view from the literature upon the class of professionals and managers. But there is also another group, which is at least as large, of those who live in an urban village and use the bus to commute. The analysis of soft aspects has shown that these two groups also think differently about transportation in general and about the bicycle in particular. The metro is used by both home owners and urban villagers alike and seems to form a middle ground between both groups It is regarded very positively in terms of perceived behavioural control and evaluative attitudes but quite some metro users even think positively about public transport in terms of status and especially lifestyle.

Residents of *xiaoqu* and urban villages do not only differ in terms of choice of transportation and in their attitudes. The distribution of the skills of driving a car and riding a bicycle is also significantly different in both groups. As has been shown earlier, the median commuting distance is also much shorter for the respondents from an urban village, than for those who live in an owner-occupied apartment – even though differences in variance mean that the averages don't differ significantly.

It has also been shown that the incomes of both groups do not differ very much. Rather, the respondents who live in an owner-occupied apartment often live together with multiple generations or with a partner, whereas those from an urban village usually live on their own.

This leaves an ambiguous picture. Especially for the group of employees who live in an owner-occupied apartment, there seem to be two opposing effects: on the one hand the ideal from the theoretical framework of living in a centrally-located apartment, and on the other hand the factor of affordability pushing them outwards. But as has been mentioned further above, in the section about self-containment and travel time budgets, there is still a choice for them. Instead of living in an owner-occupied apartment further away, it seems to be a realistic possibility for them to choose to live in an urban village that is more centrally located, closer to the working place. However, not all of them choose to do so.

This suggests that residential self-selection does indeed play a role. Apparently some people subscribe to the ideal of living in a modern apartment and driving a car, and are willing to keep living with their parents if this is necessary to achieve that ideal. But for at least almost half of all respondents this does not apply

in one way or another, namely for those who live in an urban village. The literature does not give possible motives for this choice.

Maybe their income is insufficient to buy an apartment, while their parents live too far away for a daily commute, so that they don´t have a choice but to live in an urban village. This means that the role of self-selection would be limited and that the differences in soft aspects regarding both groups would be caused just by the different kinds of built environment, possibly combined with the differences in the way of raising children between those whose parents live near the High Tech Park and those whose parents don't.

A second option is that they consider the independence that is associated with living on their own important enough to justify living in an urban village. This would mean that part of the differences in terms of the theory of planned behaviour, in particular in the area of subjective norms, is caused by residential self-selection, whereas evaluative and affective attitudes and perceived behavioural control are mainly influenced by the built environment.

But it is also possible that residential self-selection plays a much wider role. It would not unthinkable that those people, who hold on to the middle class ideal of home ownership and car use, indeed get their drivers license as quickly as possible and try to live in a modern apartment by any possible means, whereas another group is less interested in conforming to that ideal, is consequently less motivated to learn to drive and thinks more positively about the bicycle instead, and therefore genuinely prefers to live in an urban village, because such an environment is a better match to those preferences. This view is supported by a question such as the importance that respondents attach to the environmental friendliness of transportation. As has been shown in the previous subsection, the employees living in an urban village attach a particularly large value to this issue. This way of thinking is unlikely to be caused by the urban form or to be the result of recent migration to Shenzhen, so the differences in this regard between different kinds of housing is likely a result of residential self-selection.

The questionnaire also contains some questions that are explicitly related to residential location choice, in order to shed some more light on this issue. The results are shown in table 21. It shows that those who live in an urban village find it more important to live close to their work, than the employees who live in an owner-occupied apartment. This confirms that residential self-selection does indeed play a role.

	Average		**Stdev**		**Welch´s *t***	**p**
	Owner-occupied	Urban village	Owner-occupied	Urban village	Owners – Urban Village	Owners – Urban Village
12. Transport convenience	3,6	4,2	1,4	1,0	-1,719	0,095*
13. Convenience of transport mode used today	3,6	4,1	1,2	1,1	-1,466	0,151
14. Distance to work	3,4	4,3	1,4	1,0	-2,357	0,025**
*Black *: Test with H_0 that the importance of all factors of residential location choice is the same for both groups that are compared*						

Table 21: Importance of factors for residential location choice

5 Conclusion

According to the literature, soft aspects play a significant role in transport mode choice, but so far virtually no research has examined the relationship between soft factors and bicycling in a non-western context. The situation in Shenzhen seems interesting in this regard. Whereas China has traditionally been known as the 'bicycle kingdom', the modal share of cycling in Shenzhen has almost disappeared within a time frame of just ten years. This has led me to the following research question:

Which soft aspects influence the decision whether or not to use the bicycle for commuting in the context of Shenzhen, China?

The first two sub-questions are:

- What kinds of people actually use the bicycle to commute in Shenzhen?
- What soft factors contribute to their usage of the bicycle?

The questionnaire results have shown that only very few people use the bicycle to commute. The cyclists among the respondents could be characterised as male, living in an urban village and earning ¥5000 per month, a typical salary for a white-collar employee. However, the small number means that this sample might not be representative for all bicycle commuters.

The interviews with bicycle store owners, combined with the observations of the types of bicycles that are used by the few white-collar workers who do commute by bicycle, have shown that the first sub-question can only be answered from a broader perspective, not just limited to commuting.

Most males who ride a bicycle in Shenzhen, ride a mountain bike. The interviews have made clear that at least adults buy such bicycles mainly as part of a hobby in which they engage enthusiastically, spending as much as they can afford to buy the best bicycle they can get. Consequently, the main purpose of cycling is recreational. They want to tinker with the parts and to make recreational trips to meet similar-minded people. Only few of these people also use the bicycle to commute to their work and some might use a second, cheap bike or folding bike for that, in order to minimise the chances of having their expensive mountain bike stolen or damaged by rainfall. For women and for factory workers, the picture is completely different. They do not seem to participate much in the recreational bicycle culture and use only regular or folding bicycles if they commute by bike.

However, because so few people use the bicycle to commute, the main focus of my research has been the third sub-question:

- What can soft factors tell about the reasons for (other) people to not use the bicycle for commuting?

First, a regression analysis has been performed to analyse the general influence of soft factors on transport mode choice. It has been shown that perceived behavioural control, evaluative attitudes and subjective

norms all correlate with an increased odds of choosing a particular way of commuting, whereas for affective attitudes the relationship is negative. A relationship between recreational traffic and affective attitudes could be a possible explanation for the latter.

Subsequently, for all four kinds of soft aspects, the relationship between them and the physical environment has been examined. This, together with the general data about the respondents from the questionnaire and observations, has shown that different groups of people can be distinguished among the residents of Shenzhen. Each of these groups has its own particular reasons to use (or rather not to use) the bicycle for commuting.

First, one can distinguish blue-collar workers or manufacturing workers from white-collar workers or professionals and managers. The wages of blue-collar workers are generally low. They mostly live in housing that has been provided by the factory where they work. The result is that nearly all of them live within the urban block where the factory is located or at least in the near vicinity, whether in dormitories from the factory itself, in an urban village or in xiaoqu rental housing that is subsidised by the employer. There is generally a decent range of amenities nearby, partly provided on-site by the factories themselves. Consequently, these blue-collar workers have the possibility to live near their work and go everywhere on foot, but their choices are also limited. This amounts to a situation of forced self-containment. Combined with the fact that Shenzhen has a comparatively large share of such secondary-sector manufacturing, this forms the major reason why walking is the most popular form of transportation in Shenzhen and why it is much more popular than in other, older large Chinese cities. In terms of the theory of planned behaviour, the choices of this group are mainly dictated by actual behavioural control.

The white-collar employees, on the other hand, do not form one coherent group. They can be divided into two or three quite different subgroups.

First, there is one group that seems to fit quite closely the story from the theoretical framework about the middle class ideal to own a home and to drive a car. Indeed, the physical infrastructure of such xiaoqu developments is optimally suited for car use. This correlates with a great perceived behavioural control and very positive evaluative attitudes towards the car and rather negative affective attitudes regarding the bicycle. But in accordance with the aforementioned ideal from the theory, it is also very much an issue of lifestyle – one type of subjective norms. The people in this group are particularly lifestyle-sensitive and do indeed think that driving a car gives status and suits their lifestyle, whereas the bicycle doesn't.

But by far not all white-collar employees subscribe to this view. In fact, the most popular type of housing among my respondents is the urban village. The group of people who live there shows very different behaviour and ideas regarding transportation. In general, this group is not significantly more lifestyle-sensitive than, for example, the Netherlands. As another element of subjective norms, they do show great care for the environment. They are also very positive about the bicycle in terms of affective attitudes. But the bus is the most popular mode of transportation for them, even though they do not think particularly

positive about it in terms of subjective norms or affective attitudes. Their reason to choose the bus over the bicycle seems to be based mainly on perceived behavioural control and evaluative attitudes. The differences in this respect between both transport modes are probably the result of a deliberate policy, common among Chinese cities since the 1990's, to discourage bicycle use and reduce space allocated to cycling infrastructure, and to promote and invest in public transport instead. Problems in terms of perceived behavioural control regarding the bicycle are at least not a question of skills, for the questionnaire shows that nearly all white-collar employees who live in an urban village can ride a bicycle.

The metro finds a niche between both groups. On the one hand, it is the pinnacle of public transportation, with its users being exceptionally positive in terms of evaluative attitudes and perceived behavioural control. On the other hand, they strongly see it as suiting their lifestyle, associate it to a certain extent with status, and they see the metro as being closer to the bicycle than to the bus in terms of sustainability. Thus, the metro is also evaluated very positively in the field of subjective norms. As a result, the metro is equally popular among employees living in owner-occupied apartments and those living in urban villages.

Based on these observations, the diagram from figure 2 in the theoretical framework can be updated, with question marks removed but also some of the apparently straight lines splitting up into two directions. The resulting diagram is shown in figure 33.

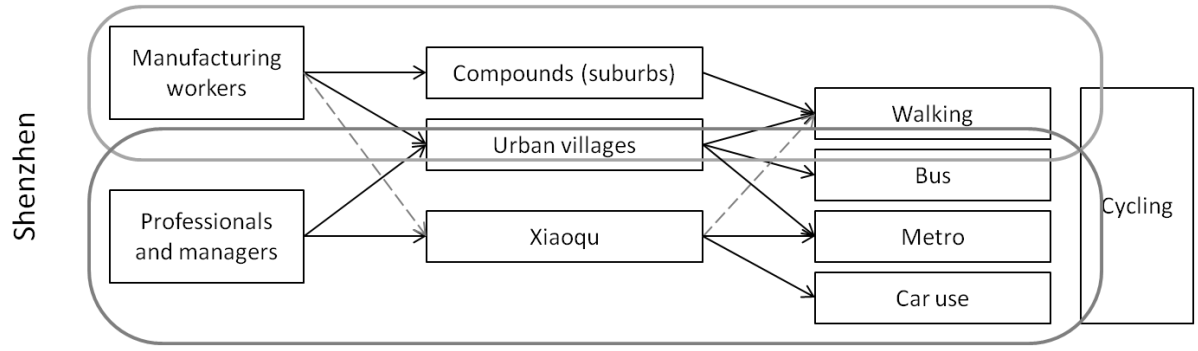


Figure 33: Updated diagram for Shenzhen of main groups of employees, types of urban environment and transport modes

The aforementioned descriptions are mainly based on correlation. The question about causality cannot avoid the discussion of residential self-selection, covered by the fourth sub-question:

- Is there an indirect effect of attitudes through residential location choice in the answer of the three sub-questions above?

Some insights have been gained in comparisons of the questionnaire results from Shenzhen with data from the Netherlands. These include results such as relatively negative evaluative attitudes but positive affective attitudes towards the bicycle in Shenzhen, positive evaluative attitudes regarding public transport including the bus and negative affective attitudes towards car use. These results cannot be caused by

residential self-selection. In the situation of the blue-collar workers, who do not have many choices at all, residential self-selection also cannot play a significant role.

However, when it comes to the differences between groups of white-collar employees in Shenzhen, residential self-selection is a very real possibility.

It has been shown that those living in an owner-occupied apartment have a rather large median commuting distance, but with little variation among the respondents and with an average commuting time that fully utilises the daily travel time budget. This suggests that housing prices in Shenzhen push those who want to live in an owner-occupied apartment as far outwards as possible within the travel time budget constraints. They also quite often still live with their parents.

A substantial part of the respondents from the questionnaire live in an urban village. The literature does not give any suggestions why any white-collar employee would choose to do so. However, the data from the questionnaire indicate that their median commuting distance is much shorter than that of residents of owner-occupied apartments. This means that at least some of these employees have a choice: rather than living in an owner-occupied apartment, they can also opt to live closer to their work, in an urban village. This still leaves open multiple possibilities. Those who live in an urban village might just not have the opportunity to pool multiple incomes in order to buy an apartment in a xiaoqu. They might also value living on their own more than living in a xiaoqu, with the different results in terms of the theory of planned behaviour still as a causal result of the built environment. But it is also possible that they have a different mindset, to which living in an urban village is in fact a better match than a xiaoqu.

The few questions in the questionnaire about residential preferences cannot give all answers. They do show, however, that those who live in urban villages attach more value to short commuting distances than the employees living in owner-occupied apartments. Taken together with the other results of the questionnaire, this confirms that residential self-selection plays a role among white-collar employees in Shenzhen.

Besides answering the research question, a secondary aim of this thesis has been to see what Shenzhen, as a critical case, can tell about the possibilities to generalise results from a western context about soft aspects and bicycling.

Where the results from Shenzhen have been compared with data from the Netherlands, it has turned out that they are the same for some variables but very different for others. This is interesting, because it suggests that some attitudes towards a transport mode are a universal characteristic independent of the factual circumstances in a certain location, whereas others are very different according to those circumstances. For example, we have seen that the unique attractiveness of the bicycle as a cheap, punctual and stress-free mode of transportation, as found in the Netherlands, could not be generalised to Shenzhen.

6 Discussion

This chapter first contains a discussion, what the context of this research could mean for the possibility to generalise from it. This will also lead to suggestions for further research. Finally, some practical policy advice will be given on the basis of the results.

6.1.1 Generalisation and suggestions for further research

The traffic situation in Shenzhen is not the same as everywhere else. It might be more surprising that there are even important differences within China between cities, when it comes to the types of traffic that are allowed at all. And on a global scale, even the terminology for transport modes itself can be problematic.

For example, when one mentions the word "electric bicycle" in the Netherlands, it evokes the image of a bicycle with electronic pedalling support up to 25 km/h. In China, on the other hand, electric bikes are much heavier and look like a scooter or moped, if it weren't for the pedals, which are only present as an alibi device and might even be too tiny and too weak to actually use them if one would want to.

With that possible misunderstanding out of the way, we can take a look at the situation in Shenzhen. Motorcycles are simply not allowed at all in this city (Shenzhen Daily, 2007). There are quite a number of electric bikes, though. Almost all of them look like old-fashioned mopeds. The most common place to find them is at metro entrances, where they serve as a cheap alternative to taxi's to cover the last mile. Another major use for them is the transportation of goods. Electric bikes are not allowed everywhere, though. Because of safety concerns, they have been banned from certain areas in the city, such as the OCT Loft and the university campus. This also means that an electric bicycle is not of much use for an individual, because the extra range and comfort compared to a normal bicycle is compensated by the limitations of where one is allowed to go. This means that there is indeed no intermediate category in the cases in this thesis where the bicycle has been contrasted with transport modes like public transport or the car.

Figure 34: Biking in Guilin

The situation is different in other cities. The city of Guilin, for example, has a good cycling network with wide cycling lanes, separated from car traffic and sidewalks, along all major roads. There are even rain shelters at intersections under which cyclists can wait for the traffic lights to turn green. But the usage is different from what one might initially expect. In Guilin, it is apparently allowed to drive an electric bike or motorbike. The result is that the bicycle infrastructure is used intensively by modern-looking electric and combustion scooters, with only a seldom cheap bicycle between them. Figure 34 gives an illustration of this.

This also gives doubts to the interpretation of the modal shares in figure 26. Do the other Chinese cities in that diagram indeed have such high modal shares for the bicycle, or do those data hint at a situation similar to Guilin, where most 'bicycles' are in fact scooters or mopeds? In any case, it means that the results of this thesis cannot be generalised to the entirety of Chinese cities. If one would do a research similar to this thesis in a city like Guilin, it would probably lead to quite a different story about the decline of the 'bicycle kingdom'.

Other suggestions for further research could be the following. First, it remains unclear whether the weather, or rather the climate, has much influence on the popularity of using the bicycle for commuting. Furthermore, it would be useful to gain more insight in the differences between the stereotypical car-driving home-owner and the white-collar workers living in urban villages. This thesis has been limited to the issue of transportation, but if transportation and residential choices are based upon lifestyle considerations, this suggests that these groups might be different in many other respects as well. Third, the hints for residential self-selection have been only quite tentative in this research. This could be explored further.

6.1.2 Policy implications

The aforementioned uncertainties aside, I think some points of policy advice can be given, based on the results of this thesis.

First, some of the most important soft aspects that do influence commuting mode choice are rational considerations based on factual circumstances. Thus, if one would like to promote bicycling, the infrastructure should be brought to a decent level. The Shenzhen bicycle network guidelines (SZPL, 2012a) give good theoretical considerations on infrastructure design. To clearly exemplify how theoretical presence of infrastructure does not automatically imply practical usability, I will provide some good examples in figure 35, which can be compared with the substandard bicycle infrastructure in the Nanshan district as in figure 11, further above.

It is important, though, to note that piecemeal infrastructure is not sufficient. For the bicycle infrastructure to be useful, thus to actually enable people to commute by bicycle, it should form a coherent network that provides a decent standard for the whole trip. The bicycle plan for central Longgang (SZPL, 2012b) is a good example how such an integrated approach can be used to make an

inventory of missing and sub-standard bicycle infrastructure and, based upon that, make a list of necessary physical measures.

Figure 35: Two examples of bicycle paths

It would be most promising to direct such infrastructural measures towards connections that link offices to urban villages. Many white-collar workers do in fact live in them and they are the sub-group of them of which the most can actually ride a bicycle and who think positively about cycling. They are also less sensitive to arguments in terms of status and lifestyle to prevent them from cycling.

Related to that, it is important to preserve urban villages located near office locations as a means to provide affordable housing, so that the average white-collar worker can afford to live within cycling distance to his or her work, rather than needing to pool together their income with that of others, for example their parents, to buy an apartment on the market in a location which is suboptimal for all who are involved. If urban villages are demolished, it is important that the replacement includes housing that is affordable for white-collar employees without the need to pool incomes. It is also important that the urban form of such housing is bicycle-friendly and that it also doesn't represent a step backwards in other respects of lifestyle for the employees who currently live in an urban village.

In more general terms, an environmental-friendly city is a city that is suitable for walking and cycling. It is a fine-grained city where the living and working places of the inhabitants are located closely to each other. The general wish of Chinese people, and also the inhabitants of Shenzhen, to live in apartments close to their work rather than in a green suburb, is an almost invaluable enabling factor for this. But the "hard" factors, in particular the housing market, should also allow and encourage the different groups of citizens to make this wish reality.

However, a bicycle-friendly urban form extends beyond housing and public infrastructure. Just as important is the infrastructure at the destinations. In the case of offices, this does not only mean parking

spaces. The interviews suggest that facilities at offices themselves, for example to change clothes or even to take a shower, are also an important part of the whole bicycle infrastructure.

On the other track, the image of cycling needs to be improved for it to be able to compete with the car and metro in terms of status and lifestyle. It seems that such a development is already underway. Especially the provision of recreational cycling infrastructure in Shenzhen in recent years has encouraged a hobby culture to appear, of people who spend as much as they can afford on a high-end, flashy mountain bike. However, such a development also risks that the bicycle becomes associated with recreation only. This could lead to positive thinking in terms of affective attitudes but result in less actual bicycle use for commuting. Because recreational bicycle use has not been a major issue in this thesis, I will not give any definitive recommendations, but a closer look seems warranted.

Finally, it should be noted that promoting the bicycle is only a means and not an end. It is important for policy-makers to note the different aims in transport planning, which sometimes can be quite contradictory. For example, both environmental and efficiency considerations give an argument against motorbikes, but as we have seen, both give a completely opposite direction when it comes to the question whether road space should be reserved for buses or for bicycles. In any case, it is good to notice such a contradiction so that a well-thought-out decision can be made. The central Longgang bicycle plan (SZPL, 2012b) can again serve as an example, even though it only lists the different policy aims that would speak for or against cycling. Ideally, it should be made explicit why the advantages outweigh the disadvantages.

Appendix I: Statistical analysis

This appendix details the statistical methods that have been used to analyse the results from the questionnaire. First, a regression analysis has been performed. The other statistical statements are based on the comparison of values between groups.

Regression analysis

To answer the question what soft aspects can tell about the decision of commuters whether or not to use the bicycle – the second and third sub-questions – the most straightforward way would be a logistic regression analysis with the bicycle usage as the dependent variable, all attitudes regarding the different transport modes as independent variables and the general characteristics of the respondents as control variables. Because of the size of the sample, such a regression analysis is not possible and because of the very small number of bicyclists in the sample, even a much simpler analysis with just the bicycle-related variables cannot give satisfactory results.

Therefore, a different approach has been taken, with a much more generic look at transport mode choices. Each transport mode is not considered individually, but the question rather becomes what attitudes on any transport mode mean for the odds of choosing that mode for commuting. In order to do this, the answers of each respondents are split up into four different observations: one for each of the transport modes, together with together with a dummy variable that indicates whether the respondent in question uses that transport mode to commute or not. As a fictive example, the results shown in table 22 could thus be split up with table 23 as the result.

Respondent	Age	Transport mode	Attitude regarding bicycle	Attitude regarding bus
1	24	Bicycle	5	2
2	29	Bus	3	4

Table 22: Fictive questionnaire excerpt

Respondent	Age	Transport mode use	Attitude
1	24	1	5
1	24	0	2
2	29	0	3
2	29	1	4

Table 23: Conversion of the results from Table 22

This has the logical consequence that the observations are not all independent anymore. The conditions for normal binary logistic regression analysis are hence not fulfilled and conditional binary logistic regression analysis should be used instead (Sainani, 2010).

This technique finds its roots in the epidemiological studies. This field of science is interested in analysing how certain risk factors contribute to disease. This terminology might appear strange on first sight, but later and with proper translation it will become clear that this is the right methodology.

One kind of epidemiological study is the 1:M matched case-control study. In such a study, there is a number of respondents – the cases – who have the disease in question. Each of them is individually matched to *M* (often three or four) other individuals – the controls – who do not show the disease but who match with their respective case in terms of control variables. In such a study, a model can be written regarding the influence of the risk factors on the odds of disease. The estimation of the coefficients in this model can subsequently be done through conditional binary logistic regression analysis and the results can be understood in analogy to those of regular regression analysis. There are some differences, though. Neither the value of the intercept can be calculated, nor the influence of the control variables (Collett, 1991).

The data set resulting from the conversion described above can be seen as such a 1:M matched case-control study, with the understanding that transport mode use equals disease and that attitudes and other soft aspects assume the role of risk factors. Moreover, all respondents serve as case (with their answers for the mode that they use) and as their own controls (with their answers for the modes that they don't use). This means that cases and controls match perfectly.

For case-control studies, there is one main precondition for the results to be valid. The likeliness for a case to be included, should not depend on one of the risk factors (Collett, 1991). This condition seems to be fulfilled for the questionnaire in this thesis.

SPSS version 19 has been used as the software for the regression analysis. With this computer application, the Cox Regression function should be used to perform a conditional logistic regression analysis (IBM, 2014). Using this software, two different models have been examined.

First, the canonical model has been tested, which consists of all variables individually:

$$\begin{aligned}\ln(MODEUSE) = \alpha &+ \beta_1 QUICK + \beta_2 CONV + \beta_3 PUNCT + \beta_4 SAFE + \beta_5 HEALTH + \beta_6 RELAX \\ &+ \beta_7 NOSTRESS + \beta_8 FUN + \beta_9 COMFORT + \beta_{10} GREEN + \beta_{11} STATUS \\ &+ \beta_{12} LIFESTYLE + \beta_{13} SKILL + \beta_{14} WEATHER + \beta_{15} INFRA + \beta_{16} PBC\end{aligned}$$

where $MODEUSE$ signifies the odds of using a transport mode and α signifies the influence of the control variables. The result of this analysis are shown in table 6 in the results chapter. Almost all variables turn out not to be significant in this analysis. This has multiple reasons. First, the number of observations is quite small, because any missing value leads to exclusion of an entire observation. Second, the number of variables is quite large in relation to the number of observations. Third, multiple variables are correlated to each other – an issue called collinearity – and the regression analysis cannot tell which one of them exerts how much influence (Harrell, 2001).

This can be solved through data reduction, which entails decreasing the number of variables included in the model. One possible way to do this, is variable clustering, preferably based upon prior knowledge (Harrell, 2001). In this case, it would be only logical to assume on the basis of the literature that the

variables within each group of soft aspects are the most correlated to each other. Therefore, they have been grouped together according to the four different kinds of soft aspects, and for each group a new variable has been computed, containing the average score of each observation on the variables of that particular kind of soft aspects. Missing answers have been ignored in this process.

The model can now be rewritten as follows:

$$\ln(MODEUSE) = \alpha + \beta_1 EVAL + \beta_2 AFFECT + \beta_3 SUBJ + \beta_4 PBC$$

where $MODEUSE$ again signifies the odds of using a transport mode. The outcome of the regression analysis based on this model is shown in table 5 in the results chapter.

These results show, for example, that the contribution of the evaluative attitudes together ($EVAL$) is highly significant, even though each of the variables of which it is composed were not significant at all. On the other hand, the subjective norms as a whole ($SUBJ$) are less significant than the score of lifestyle alone. This might be caused by a negative correlation between the lifestyle suitability ($LIFESTYLE$) and environmental friendliness ($GREEN$) variables.

In the main text, both models are presented in the opposite order because of readability concerns.

Comparison between groups

The Likert-scale items from the questionnaire could be used as ordinal variables, but it is merely an assumption that all five values on the scale would be equally far apart in the psychology of the respondents. Because of this, one cannot properly perform arithmetic such as the calculation of averages and standard deviations. Therefore, in most cases the percentage who agree (numbers 4 or 5 on the scale) or, in case of wording of a question in an opposite way, the percentage who disagree (numbers 1 or 2 on the Likert scale) has been calculated and been used as the basis for the analysis. However, the responses have been used as interval scale data for the regression analysis and in order to calculate averages and standard deviations if this was necessary for comparison with data from other sources.

For the comparison of percentages (also called success rates), the null hypothesis is that the percentage for both populations is the same, and the alternative hypothesis is that they are different. The hypothesis is tested by means of the following formula:

$$z = \frac{\pi_1 - \pi_2}{\sqrt{\pi(1-\pi)\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$$

where π_i and N_1 are the proportion within, respectively the size of each of the samples, and where

$$\pi = \frac{x_1 + x_2}{N_1 + N_2}$$

with the number of successes in each sample as x_i, is the success rate of both groups pooled together. The z value can be compared to the standard normal table (Collett, 1991). At a significance level of $p<0.1$, the null hypothesis can be rejected if $z > 1.65$. For $p<0.05$ it should be $z > 1.96$ whereas $z > 2.58$ is necessary for $p<0.01$ – all based on double-sided hypotheses.

For the comparison of averages, the null hypothesis is that the average of both populations is the same and the alternative hypothesis is that they are different. The hypothesis is tested by means of Welch's t test, which uses the following statistic:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}}$$

where N_i is again the size of each of the samples, and where $\overline{X}_i$ and s_i are the mean and the standard deviation of the samples. To perform the test, an approximation of the number of degrees of freedom is also necessary:

$$v \approx \frac{\left(\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}\right)^2}{\frac{s_1^4}{N_1^2(N_1 - 1)} + \frac{s_2^4}{N_2^2(N_2 - 1)}}$$

Subsequently, a standard *t* table can be used to see if the value of *t*, with *v* degrees of freedom, is significant for a certain significance level or not (Miller, 1986).

Multiple comparisons

The aforementioned methods of comparisons are used many times in this thesis, and when multiple comparisons are performed, care should be taken in order to make a correct judgement about the significance of the results that are found. For example, performing twenty tests to a significance level of $\alpha = 0.05$ *by definition* means that on average one test will give a significant result purely by chance, even if all null hypotheses are true, leading to a type-I error. This means that such an error is in fact very likely to occur and the true significance of all comparisons together is only $p < 0.64$ in this case (Perneger, 1998).

This issue can be dealt with by means of a Bonferroni adjustment. This method increases the thresholds for significance of the individual tests according to the number of tests that are performed, so that the risk of a type-I error can be kept at the desired level for the set of tests as a whole. In addition to its standard form, a sequential method has been developed to preserve as much statistical power as possible (Rice, 1989).

The delimitation of a set of tests depends on the null hypothesis that is being used. For example, if one would want to control for the risk of any single type-I error anywhere in a thesis, all comparisons together

should be taken as a single set and should be adjusted accordingly. However, this is generally considered as too conservative and as inducing too great a risk of type-II errors. Rather, it has been recommended to state sensible hypotheses based upon the literature. If such a hypothesis involves only a single test, no adjustment is necessary. If a significant result for any one of multiple variables is enough to prove the hypothesis or if no hypothesis is used at all when looking for any significant results among multiple variables, then the significance tests for those variables should be considered as a set and should be adjusted accordingly (Rice, 1989; Perneger, 1998).

In this thesis, the results of any tests are marked with * if they are significant to a level of $\alpha = 0.1$, with ** if they are significant to $\alpha = 0.05$ and with *** if they are significant to $\alpha = 0.01$. In cases where the aforementioned theory prescribes an adjustment for multiple comparisons, this has also been done. The respective null hypotheses are mentioned in the results chapter below the corresponding tables, and the loss of significance as a result of the adjustment has been indicated by marking the corresponding number of asterisks grey. For example, ***** would indicate that the influence of a variable is significant to the level of $\alpha = 0.01$ if considered on its own, and to a level of $\alpha = 0.05$ if adjusted for multiple comparisons.

Appendix II: Questionnaire

Questionnaire about transportation.

UNIVERSITY OF AMSTERDAM

Thank you for participating in this questionnaire! The aim is to investigate how people in Shenzhen think about using the bicycle, compared to other kinds of transportation, so that I can help with giving advice how to make Shenzhen a greener city. Your answers will be treated confidentially. Thank you!

Please mark the boxes like this: ☑ . Please try to write clearly

First some general questions:

1. What is your age?	Years
2. What is your gender?	□ m / □ f
3. Are you married / in a relationship?	□ y / □ n
4. How many children are living in your household?	□ 0 / □ 1 / □ 2 / □ 3 (or more)
5. Do you live with your parents?	□ y / □ n / □ other: ……
6. In what kind of house do you live?	□ owner-occupied apartm. □ factory-provided apartm. □ dormitory □ urban village □ other: ……
7. What is the highest level of education that you finished?	□ 初级中学 (or less) □ 高级中学 □ university □ postgraduate

Now some questions about your trips to work or school:

8. What is your current occupation?	□ student □ work □ none of both	
9. How did you go to your work or school today / yesterday?	□ walking □ bicycle □ e-bike □ car	□ taxi □ bus □ metro □ other: ……
10. How long does it take to get from home to your work or school?		minutes
11. How far is it? *You can also point out your home and work place on the map*		Kilometre

If you do not live in a dormitory:

12. When you chose the place where you currently live, how important was transportation convenience for you?	1 2 3 4 5
13. When you chose the place where you currently live, how important was it for you, that it enables you to use the transport mode you answered in question 9?	1 2 3 4 5
14. When you chose the place where you currently live, how important was it for you, that it is close to your work?	1 2 3 4 5

If you work, please also answer these questions:

15. What is your income?	yuen/month
16. What is your profession?	
17. In which organisation do you work?	
18. What is your function in that organisation?	

Please turn over the page.

Second part. How do you think about the following transport modes?

For example, if you think that walking is quick, mark the box like this:

	Walking
19. Quick	1 2 3 4 ⑤

Please fill in:

	Walking	Bicycle	Car	Metro / Bus	Importance
19. Quick	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
20. Cheap	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
21. Flexible, gives independence	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
22. Health benefits	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
23. Arrive on time (without delays)	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
24. Good traffic safety	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
You can make notes here					
25. Gives status to me	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
26. Green, good for the environment	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
27. Suits my lifestyle	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
You can make notes here					
28. Relaxing	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
29. Stressful	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
30. Fun, exciting	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
31. Pleasant, comfortable	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
You can make notes here					
32. I can use this transport mode (skills)		Yes / no	Yes / no	Yes / no	
33. The weather here is suitable to use this transport mode	Yes / no	Yes / no	Yes / no	Yes / no	1 2 3 4 5
34. The infrastructure here is suitable to use this transport mode	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
35. All in all, I can use this transport mode to go to work / school	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
You can make notes here					

Thank you very much!

出行方式问卷调查

UNIVERSITY OF AMSTERDAM

Daan Goedkoop · 硕士论文

您好，我是荷兰-阿姆斯特丹大学城市规划专业的学生。感谢您百忙之中填写问卷，本问卷采用匿名形式，所有数据仅供学术研究分析使用。本问卷意在调查深圳市民**使用自行车出行**的情况，促进深圳的绿色城市建设。

请在空格中打钩：☑.

一、基本信息；

1. 您的年龄？	岁
2. 您的性别？	□ 男 / □ 女
3. 婚姻状况？	□ 已婚 / □ 未婚
4. 有多少个子女？	□ 0 / □ 1 / □ 2 / □ 3（以上）
5. 是否和父母一起居住？	□ 是/ □ 否/ □ 其他:……
6. 您现在居住的住房是？	□ 自己拥有产权的公寓. □ 城中村. □ 工厂或公司提供的单间. □ 其他: …… □ 集体宿舍.
7. 您的学历？	□ 初中（以下） □ 大学 □ 高中 □ 研究生（以上）

关于上班/上学的问题:

8. 您目前的身份是？	□ 学生 □ 上班族	□ 以上都不是: ……
9.您平时采用什么方式上班/上学？	□ 步行 □ 汽车 □ 地铁 □ 自行车 □ 出租车 □ 其他: □ 电动自行车 □ 巴士 ……	
10. 您通勤的时间是多少？	分钟	
11. 您通勤的距离多远？ *您也可以在后面的地图中标注出居住与工作的地点*	公里	

如果你不住在集体宿舍：

12. 当你选择居住地点时，交通的便捷性有多重要？	1 2 3 4 5
13. 当你选择居住地点时，交通的便捷性有多重要，促使你会选择问题 9 里的某种交通方式?	1 2 3 4 5
14. 当你选择居住地点时，靠近上班/上学地点的距离有多重要？	1 2 3 4 5

如果您是上班族，请继续回答下面的问题：

15. 您的收入是多少？	元/月
16. 您的职业是什么?	
17. 您在哪个机构工作?	
18. 您在该机构中的职务?	

请翻到下一页继续

二、对下列出行方式的评价；

示例，如果您认为步行非常便捷快速，请如示勾画空格 ：

	步行
19. 通勤速度	1 2 3 4 ⑤

请下下列空格中打钩:

	步行	自行车	汽车	地铁 & 巴士	重要性
19. 通勤速度	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
20. 通勤价格	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
21. 便捷性	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
22. 对健康的益处	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
23. 能否准时到达	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
24. 安全性	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
其他意见：					
25. 彰显社会地位	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
26. 对环境的益处	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
27. 与您生活方式的匹配程度	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
其他意见：					
28. 放松度	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
29. 压迫烦躁感	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
30. 趣味性	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
31. 舒适性	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
其他意见：					
32. 会驾驶或使用这种交通工具		□ 会/ □ 否	□ 会 / □ 否	□ 会 / □ 否	
33. 当地环境是否适应此种交通方式	□ 是 / □ 否	□ 是 / □ 否	□ 是 / □ 否	□ 是 / □ 否	1 2 3 4 5
34.该交通方式的配套设施完善程度	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
35. 总的来说，对该交通方式的认可度	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
其他意见：					

非常感谢！

Appendix III: Questions for interviews

For behavioural beliefs etc.

1. How did you go to work or to school today? (like: walking, bike, car, metro, bus)

If bicycle:

2. Why do you choose to use the bicycle instead of something else like car, metro or walking?

3. Are there any things you do not like about bicycling?

If not bicycle:

2. Why do you not use the bicycle?

3. Is there anything you do like about using the bicycle?

Note: With the questions 2 and 3, the answer can be rational (like cheap, healthy) or emotional (like fun, boring, …)

4. What is the biggest problem for you, about using the bicycle to go to your work or school?

5. Can you go to bicycle to your work or school? Why?

6. How do other people think of it, when you use the bicycle? Who likes it (approves of it)? Who doesn't? Why?

For shopkeepers at bicycle stores

What kind of bicycles do you sell?

What bicycle do you sell the most, is the most popular?

What do people buy such a bicycle for?

Why do people like that bicycle model?

Do you have bicycles that people buy to go to their work?

Why do you think that this model is so good for going from home to the workplace?

What kinds of people buy such a bicycle? (rich, poor, families, people who find fitness important, people from nearby or from far away, ...)

If that was difficult: what kinds of people in general buy a bicycle at your store?

Why do you think that these people use the bicycle?

Do you think that the circumstances in Shenzhen are good for riding a bicycle?

Appendix IV: Interviews

骑行者自行车 Bicycle store near Haiyue metro station

This store sells mountain bikes and folding bikes. According to the shopkeeper, they are high end bicycles. Prices start at 1300 yuan and the most expensive bicycles are 10000 yuan.

What do people buy such a bicycle for? Do you have bicycles that people buy to go to their work?

Mostly for fun, as a hobby. The bicycles that we sell are too expensive for white-collar workers to use them to go to work, because they could get stolen. Therefore they also use folding bikes. Those can also be carried onto the metro to go to work, which is convenient.

What kinds of people buy such a bicycle?

Youngsters, students, to go to school and home. It is nearby and they have parking spots. They do not always earn much, but spend a big part of their time and money on their bicycle.

Why do you think that these people use the bicycle?

Mostly for sports and fun. Those who change the bike… after more than two years, they know the bike, every part of it. You buy a ready-made bike but notice that you only like some parts, like the frame, so you make your own bike. Changing appearance is very rare, only the real fans do that.

Do you think that the circumstances in Shenzhen are good for riding a bicycle?

Public transport in Shenzhen is very nice, so there is less need for a bicycle. That is probably less so in villages and inland cities. There is too little place to park bicycles. You could take a folding bike into a restaurant, but with big bicycles that is a problem. The weather is very hot, so you get sweaty, and companies don't have a shower or a changing room. In Yantian they use the public bikes a lot. Here in Shekou too, but the cycle paths aren't good. In the inland cities, they have separated lanes for cars, bicycles and walking, that's better.

By the way, the whole industry (buyers and sellers) consists of bike-likers. There is a tendency for biking to become a culture. To travel, make friends, with whom to travel, to talk about it. People go on long-distance travelling and want to meet people there. They want to use small roads, so that there is not so much dust from the cars. They want to see different places. My boss went by bicycle to Lhasa, 10 years ago. Today he is driving to Lhasa by car.

友间单车店 NEO Motion brand store on Houhai Avenue

This store mostly sells mountain bikes and a few folding bicycles. The mountain bikes are in the range of 3000 – 13000 yuan and the folding bikes 1200 – 3000 yuan.

What do people buy a bicycle for? Do you think that the circumstances in Shenzhen are good for riding a bicycle?

Mostly bike-likers, but some of them also use the bike to go to work. Riding 10km to work is still doable, then you don't sweat so much yet.

If you live near to your work and need to park a car, then the bicycle is convenient. But you wouldn't leave an expensive bike outside, where it rains and where it can get stolen. Working people will choose a less expensive bike.

温群波 XdS brand store on Houhai Avenue

This shop sells normal bicycles for about 400 – 500 yuan, and mountain bikes that cost about 1000 yuan on average. There are also cheaper ones for under 700 yuan and much more expensive mountain bikes.

What kind of bicycles do you sell? Do you have bicycles that people buy to go to their work?

We sell normal bicycles for woman to pick up children from school and such things. We also have mountain bikes for men for commuting.

What do people use such a bicycle for?

Even the people who buy an 800 yuan bicycle, are real bike likers, but just people who cannot afford more. So a restaurant waiter will spend about half of their salary on a bike. They don't just buy one to go to work for their utility value. Less than 10% will buy one for work.

Do you think that the circumstances in Shenzhen are good for riding a bicycle?

It is already quite ok, if you ride the bicycle for fun.

Merida (美利达) brand store on 龙苑路

This store sells mostly mountain bikes.

What kind of bicycles do you sell?

We sell normal bicycles *[pointing at mountain bikes in the 1500 – 1700 yuan price range]* and mountain bikes *[pointing at bicycles in the 3000 – 5000 yuan range]*.

What is the difference between the two?

The mountain bikes have more high-end parts than the normal bicycles.

What do people buy such bicycles for?

People buy the normal bicycles to go to school or to their work. They buy the mountain bikes for exercise etc. and/or because they are bicycle fans.

What kinds of people buy such a bicycle?

As for the normal bicycles, it are mostly students (or rather their parents). The mountain bikes are bought by all kinds of people. Both blue-collar and white-collar people. If needed they will do their very best to save enough money.

Why do you think that these people use the bicycle?

People use the normal bicycles because walking is inconvenient (e.g. too far) and to get around traffic jams. The mountain bikes are used because those people are fans and sometimes because they are rich and want the best of the best quality.

Do you think that the circumstances in Shenzhen are good for riding a bicycle?

Yes, for recreation, such as at Shenzhen Bay and at the rest of the coast line (Dameisha, Xiaomeisha, Nanao, Dongchong, and Xichong). There are many bike paths there, and beautiful scenery.

By the way, before the Universiade in 2011, people mostly liked to go hiking / walking. But now they also like to go cycling more.

Interviewee I at the High Tech Park

How did you go to work today?

By bus and metro.

Why do you not use the bicycle?

It is too far.

Is there anything you like about using the bicycle?

Exercise, and it is environmentally friendly.

What is the biggest problem for you, about using the bicycle to go to work?

It is so hot, and too far, and there are no places to park the bicycle.

Can you use the bicycle to go to your work?

No.

How do other people think of it, when you use the bicycle? Who likes it (approves of it), who doesn't?

Friends would approve, if it is less than 20 minutes.

Interviewee II at the High Tech Park

How did you go to work today?

By bus

Why do you not use the bicycle?

I live in Shekou harbour, so the distance is a problem. It would be 1:30 hours by bicycle.

Is there anything you like about using the bicycle?

I like the bicycle, but the distance is a problem.

What is the biggest problem for you, about using the bicycle to go to work?

The distance.

Can you use the bicycle to go to your work?

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How do other people think of it, when you use the bicycle? Who likes it (approves of it), who doesn't?

The rents are expensive in the city centre, where people work. So they live at larger distances. Riding a bicycle is healthier, and rich people can afford a house near their work and where bicycle paths are better (like in OCT). So that's why rich people might like to cycle. For the young generation, the bicycle is comfortable and relaxing but still takes much time. And time is precious in Shenzhen.

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