VELO-CITY GLOBAL 2012 VANCOUVER CANADA JUNE 26-29

Bike-Sharing Systems in Beijing, Shanghai and Hangzhou and Their Impact on Travel Behavior

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Outline:

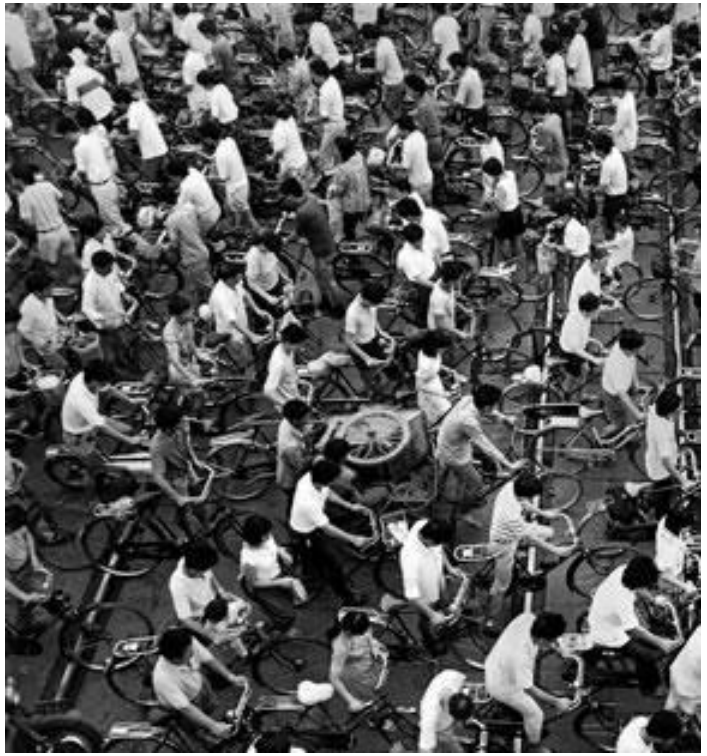
- Cycling and Bike-Sharing in Chinese Cities
- Literature Review
- The comparison between the three bike-sharing systems in Beijing, Shanghai and Hangzhou
- The impact on travel behavior
- Lessons learn from these three bike-sharing systems

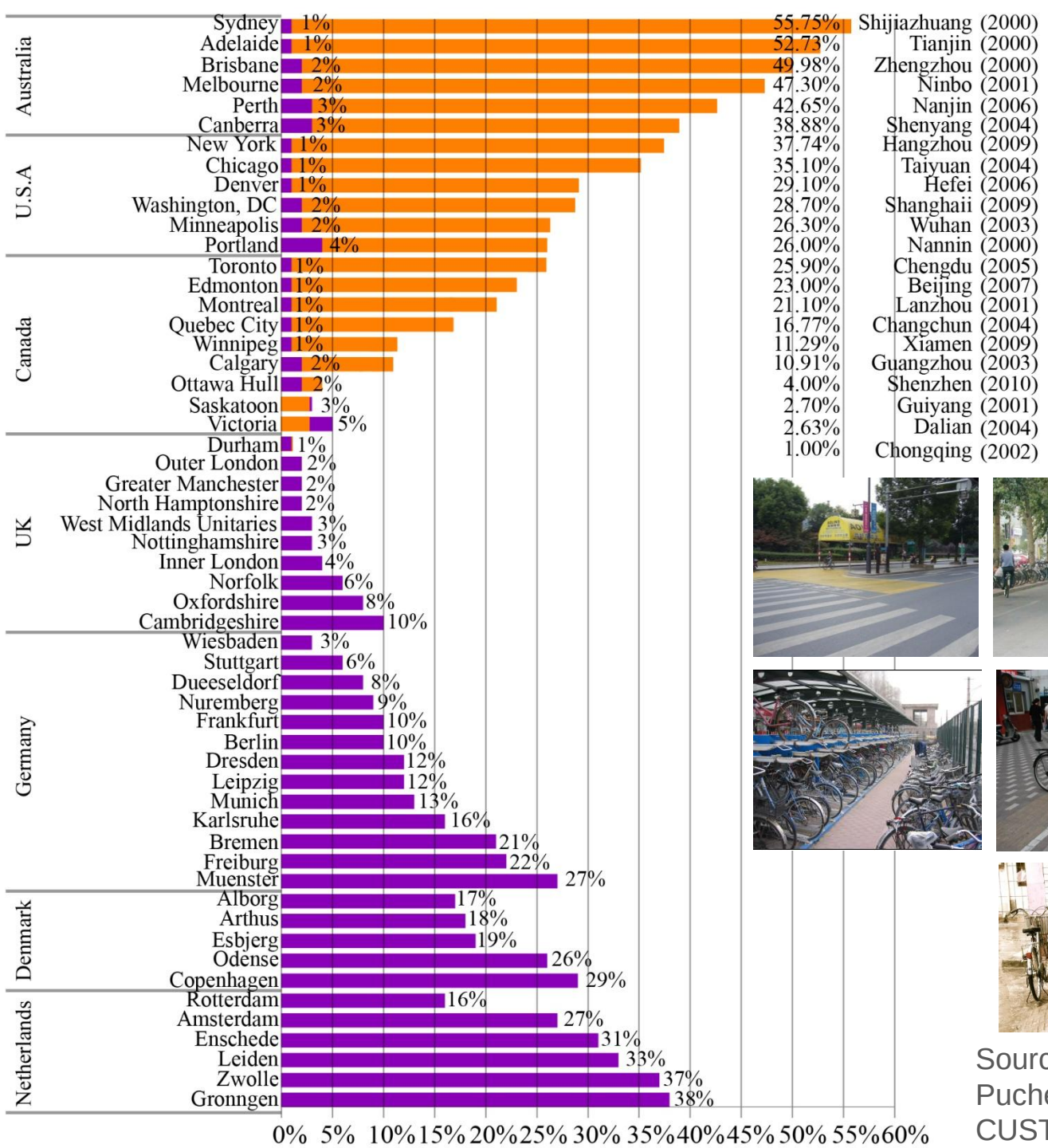
Cycling and Bike-sharing in Chinese Cities

Cycling is high efficiency, environment friendly, healthy, low pollution, and could help to reduce congestion, parking needs and energy use; it was regarded as the bright future of the transportation system in our future cities.

The city abandon bike will loose her future.

China was named “the kingdom of bicycles” in 1980s





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Important Commuting Mode

Comparison of bike share of trips between some Chinese central cities and other international cities.




Bicycle box
Separated bike lanes
Bicycle parking
Bicycle repair shops

Improved Facilities

Source: John Pucher, 2008, CUSTReC, 2007

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Due to the fast motorization and urbanization in China, bicycle mode share has begun to decrease. In some cities it has dropped sharply.

Beijing's bicycle mode share reduced from 50% in 1986 to less than 23% in 2007.
Hangzhou, from 43% in 2000 to 33.5% in 2007, it's only seven years. (raise to 37.74 in 2009)

Why cities are interested in bike-sharing?

1To facilitate green transportation

2 To encourage the use of bicycles

3 To provide an alternative travel mode to alleviate the traffic congestion

4 To fill the service gap of public transit or promote convenient transfer for the transit system

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In 2005, China's first bike-sharing system began operating in **Beijing**.

With China's recent effort to encourage green transportation, more and more Chinese cities show an interest to build their own bike-sharing systems.

So far there are **more than forty** cities that have established bike-sharing systems.

Bike-Sharing System in Chinese Cities

Source: http://www.chinabikesharing.org/

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	New Establised bikesharing Projects
Before 2009	**3**
2009	**4**
2010	**16**
2011	**18**
2012 till now	**4**

And these systems are growing very fast, Up to the date of Jun 2012 there are 60600 shared bikes and 2431 stations in Hangzhou. And they plan to expand this system to 200,000 bikes till 2020.

In Shanghai Minhang district, we have 594 stations, 19,170 bikes, over 220,000 registered members (nearly 10% of the local residents) till the end of 2011. Doubled compare with the data of 2009.

Overview of Chinese city's' bike-sharing systems

45 established projects (170,680 bikes) and other 22 on going

	Start Time	Number of Bike-sharing Stations	Number of Bicycles	Rent Times each bike per day
Beijing	Aug-05	1000**	10000**	2.32*
Hangzhou	May-08	2431**	60600**	5~6*
Shanghai(Pudong)	Sep-08	80**	1200**	2.5**
Shanghai(Minghang)	Mar-09	594**	19100**	4**
Wuhan	Apr-09	1218	70000	5
Nanchang	Aug-09	30	1800	4
Zhoushan	Oct-09	12	500	
Taizhou (Linhai)	Feb-10	52	2200	
Dujiangyan	Apr-10	100	1500	
Guangzhou	May-10	45	2000	
Zhangjiagang	Jun-10	152	3200	
Taizhou (Jiaojiang)	Jun-10	200	10000	
Tianjin (Gang City)	Jul-10	11	360	
Yinchuan	Jul-10	7	320	
Guangyuan	Jul-10	33	1000	
Suzhou	Aug-10	96		
Foshan	Aug-10	50	2000	
Yantai	Sep-10	300	15000	
Qingzhou	Sep-10	200	3000	
Nanjing	Sep-10		200	
Shenzhen	Sep-10	16	360	
Foshan (Chancheng)	Oct-10	158	7600	
Chengdu (Jinjiang)	Dec-10			

	Start Time	Number of Bike-sharing Stations	Number of Bicycles
Kaixian	Jan-11	28	1000
Haikou	Jan-11	4	60
Xian	Mar-11	30	800
Jiangxia	Apr-11	46	2000
Changshu	May-11	150	3000
Chongqing (Shuangqiao)	Jun-11	25	500
Nantong	Jun-11	30	1000
Shaoxing	Jun-11	26	1500
Zhuzhou	Jun-11	1000	20000
Nanchang County	Jul-11	20	1000
Kunshan	Aug-11	150	4000
Jiaxing	Oct-11	50	
Linwu	Oct-11	70	500
Zhongshan	Oct-11	180	4000
Haiyan	Nov-11	50	1600
Chenzhou	Nov-11	70	500
Taizhou (huangyan)	Dec-11	35	1500
Shenzhen (Yantian)	Dec-11	160	4000
Kunming	Jan-12	2	20
Liuyang	Jan-12	50	1000
Shanghai (Zhoupu)	Feb-12	33	660
Wujiang	Mar-12	68	1000

*The bike-sharing systems will also be established in these China mainland cities: Changchun, Shenyang, Taiyuan, Zibo, Jinan, Zhengzhou, Mianyang, Chongzhou, Suining, Hefei, Chizhou, Ningbo, Ninghai, Hangzhou(Xiaoshan), Fuyang, Tonglu, Chun'an, Changde, Liling, Xiamen, Huizhou, Zhuhai

Source: **from the operator's website or their reports, the other Chinese cities' data from http://www.chinabikesharing.org/.

Literature Review

Booming so fast, hard to count.

Shaheen (2010) **:** at present, there are approximately**101** bike-sharing programs operating in an estimated **125** cities around the world, with over **139,000** shared bicycles.

Mobiped (Oct. 2010): **460** services, **20,3000** bicycles. **Data should be updated**

There still lack of systematic studies evaluating the effectiveness of these programs.

Despite the limited study of the social and environmental benefits of bike-sharing, recent surveys document:

1) **reduced auto use**; 2) behavioral shifts towards increased bicycle use for daily mobility; and 3) a growing perception of the bicycle as a convenient transportation mode.

In western cities, bike-sharing systems provide the citizens a good opportunity to reuse bicycles.

Amstrong (2010) emphasized the **potential of bike-sharing program for influencing mode share.**

Cevero et al. (2009) found that the single strongest predictor for bicycle use is the availability of a bike.

Some data from international cases review:

The impacts of bike-sharing programs are hard to assess, as they are often accompanied by expansion of the bicycle network in anticipation of increased bicycling.

The result shows a great increase of cyclists in these cities after the implementation of the bike-sharing systems, which **raised 250% in Paris, 75% in Lyon and 135% in Barcelona.**

The proportion of trips by bicycle increased from 0.75% to 1.76% in Barcelona (Romero, 2008) and from 1.0% to 2.5% in Paris (Nadal, 2007; City ofParis, 2007).

In **Paris**, **trips made by car decreased by 5 %** in the first 10 months after the implementation of the bike-sharing system.
The image and acceptance is very high with 98 % and Parisians are proud to mention "their" bike sharing program
But **3,000 bikes had been stolen**, damaged or put out of service [mid 2008.

In Barcelona, 10% of the shared bicycle use is shifted from cars.

A study of the OYBike in **London** showed that **40% of users shifted from motorized modes** (Noland and Ishaque, 2006).

Research question:

1 What's the difference between the three case cities' bike-sharing systems (using different management model)?

2 Customer characteristics and why they choose the bike-sharing system?

3 Has the bike-sharing system change local residents' travel behavior?

4 What lesson we could learn from these cases?

The comparison between the three bike-sharing systems in Beijing, Shanghai and Hangzhou

- Management
- Network Distribution
- Facilities
- Fare System

Management

Beijing: "Private Company-Led Model"

Operated by local Private companies. Based on metro stations, no cooperate between each other.

2nd generation bike-sharing system.

No governmental involvement, rely on the advertising revenue.

Shanghai: "Operator Company-Led, Government Aid Model"

Established and operated by a bicycle manufactory company.

Located at the far southern end area of Shanghai's fist metro line.

The local government purchase service and rent facilities from the company. ("5 year contract")

Serve the local residents and employees only.

Hangzhou: "Government-Led Model"

Established by Hangzhou government (government direct investment is 180 million RMB, and also provide 270 million RMB discount government loans) and operated by the government's public transit company.

The operator tries to combine it with the public transit system and promote the "Bus and Ride" (B+R) trips.

Serve local residents and tourists.

Use permanent smart card which could also be used in public transit.

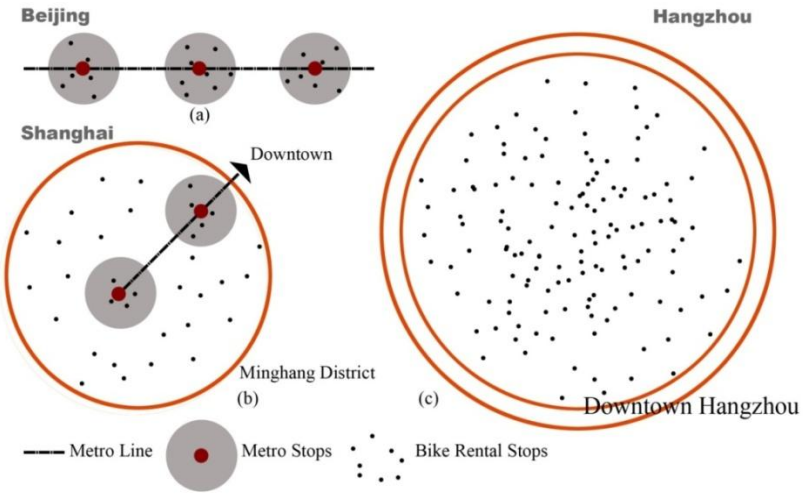
Advertisement is allowed to bring revenue.

Network Distribution

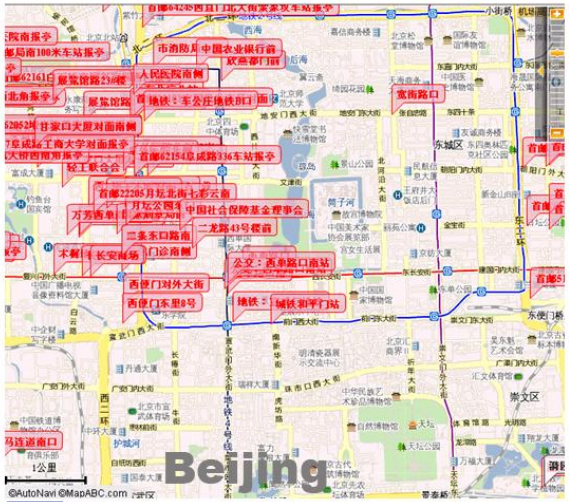
Beijing's system is formed by a series of bike-sharing service groups around the metro stations.

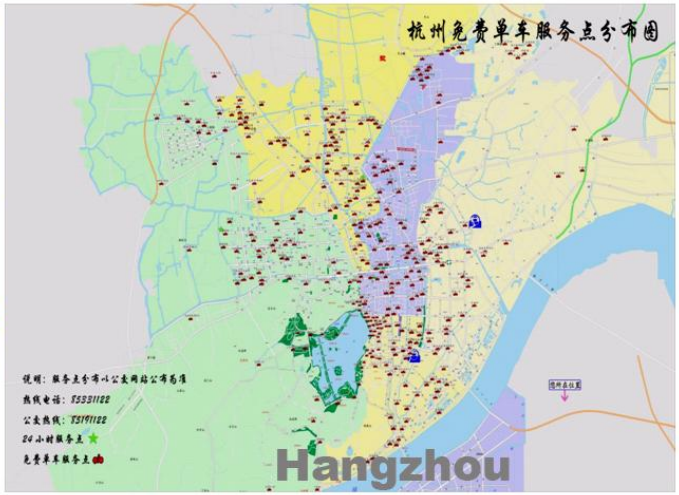
Shanghai's system is a huge bike-sharing service group located in the end of the city public transit corridor, which highly depends on the rapid connection with the downtown area.

Hangzhou's system is the only citywide system during the three; all those popular travel destinations are within the bike-sharing service area.



Different structures of the three bike-sharing systems





Metro Station (a) (b) (c)

Source: http://www.fangzhoubike.com/; http://www.chinarmb.com/; http://www.hzzxc.com.cn/

Facilities

Beijing

Shanghai

Hangzhou

Facilities

Gated stations:

9 stations in Shanghai (Minhang) Capacity : 4814 bikes.

Bike Redistribute Vehicle in Shanghai

Facilities：backstage and information service

西湖大道(自...

在"西湖大道(自行车)"附近500米的所有自行车服务点共14个：

周边距离 ○ 50米 ○ 100米 ○ 300米 ◉ 500米

№1003	西湖大道	可租	2 辆	可还	9 辆
№1019	涌金广场	可租	13 辆	可还	2 辆
№1004	劳动路口	可租	5 辆	可还	13 辆
№1088	涌金门	可租	11 辆	可还	10 辆
№1134	将军路五六号	可租	8 辆	可还	22 辆
№1174	延安路一二七号	可租	9 辆	可还	12 辆
№1039	嘉和里路口	可租	1 辆	可还	20 辆
№1005	延安南路	可租	* 辆	可还	* 辆
№1151	将军路延安路口	可租	9 辆	可还	16 辆
№1097	青藤茶室	可租	3 辆	可还	18 辆

Shanghai:
Backstage management system and software.

Hangzhou:
Real time information searching website for bus and bike-sharing system.
Http://www.hzbus.cn

Fare and Service

Fare (unit: RMB)

System	30 min	1h	1.5 h	2h	3h	4h	5h	10h	12h	20h	24h	>24h
Beijing*	1 per 30 minutes (hourly card) or 0.3~1 per day (monthly or year card), depends on the membership**											
Shanghai***	+1 credit (max 2 credits per day)				-10 credits		-30 credits			-50 credits		-100 credits
Hangzhou*	Free		1		2	3/hour						
Compare with the three European systems (unit: euro)												
Velib (Paris)	Free	1	3	7			31	71		151		
Velo'v (Lyon)	Free	0.5~2 per hour, depends on the membership										
Bicing	Free	0.3	0.6	0.9			9.9	24.9		54.9		

Free or bonus zone

Penalty zone

*Visitors available, purchase a temporary card for 200 RMB deposit plus a 100RMB balance.

**Use the bike no more than 24 hours, year card and half year card members could keep using the bike for no more than 3 days

***Only serve the local residents, no visitors. Every local resident could apply a card with 100 original credits. ¥100 for a new card.

B+R Discount in Hangzhou: Get additional 30 minutes for free if transfer from public transit.

Fare and Service

Although the Chinese bike-sharing systems are still in the stage of encouraging riding and building its own customer base, the strategy of providing a long no-charge time and set the overtime penalty charges at a low level is open to discussion.

According to the users' data, the operator in Minhang decided to reduce the original 2 hour no-charge time to 1 hour from 2012.

It's recommended to use the price mechanism to guide the use of shared bikes in the future.

The credits reward system in Shanghai shows us another approach could attract the bike-sharing trips generate in the appointed time and place.

But unfortunately, Minhang government decide to change the credits charging method from this August, all old users should spend 200RMB deposit to renew their membership card.

The impact on travel behavior

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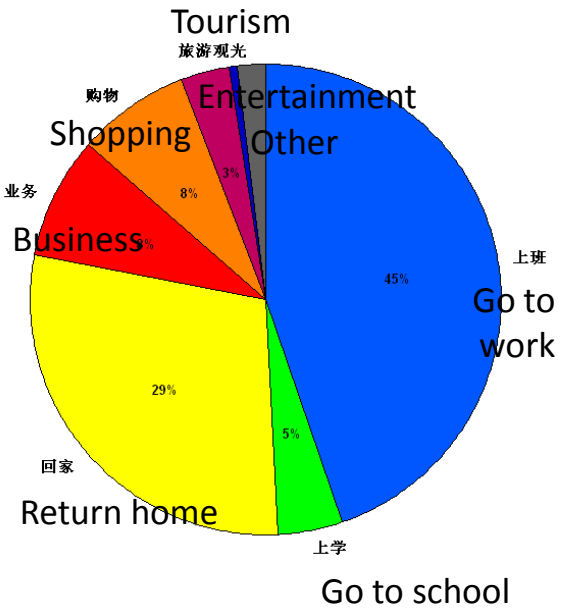
	Samples of questionnaires
Beijing	154
Shanghai	218
Hangzhou	275

The findings are based mainly on our one day questionnaire survey in these three cities.

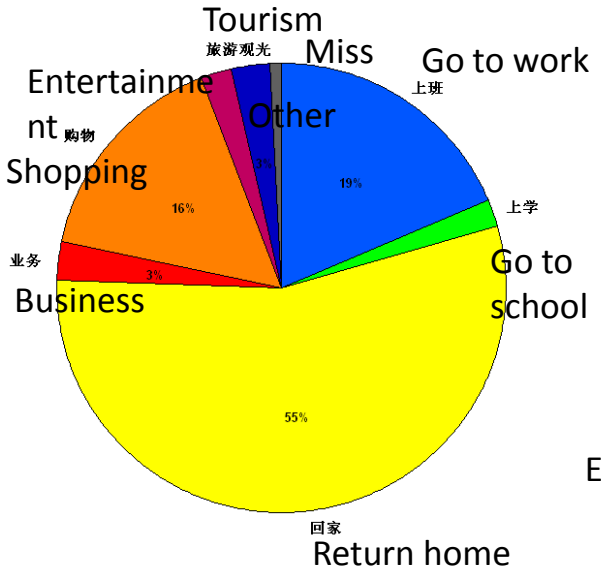
The main customer base of the bike-sharing system in Beijing, Shanghai and Hangzhou could be described as the white-collar workers between 20~39 years old, monthly income between 2,000 RMB to 4,000 RMB. (Female 45% VS Male 55%)

Beijing



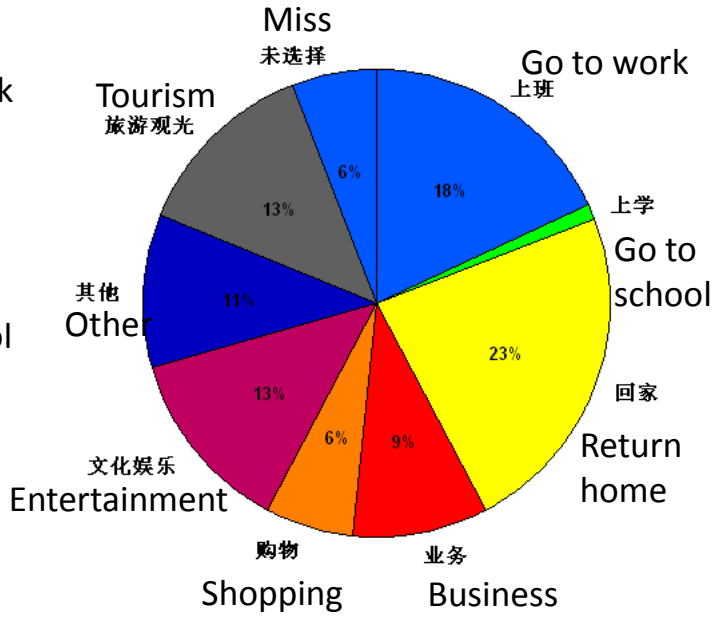
79% are commuting trips

Shanghai



75.4% are commuting trips

Hangzhou



Very diverse purpose

Travel Purpose

The bike sharing systems really Changed residents' travel behavior, they are well combined with public transit, especially the metro system.

In Beijing, 58.4% of the respondents usually use bike-sharing system to transfer to metro, and 55% of the respondents did so in Shanghai.

In Hangzhou, those shared bike costumers who transfer from the public transit will be rewarded additional 30 minutes free of charge time.

Statistics of the Reasons to Select Bike-sharing System *(Multiple-choice question)*

Reasons to Select Bike-sharing System		Beijing	Shanghai	Hangzhou
Travel Cost	**Saving time**	**47.40%**	**51.38%**	**31.88%**
	Saving money	16.88%	**32.57%**	12.32%
Trip Organization	Direct	29.87%	27.98%	11.59%
	Convenient for transfer	**40.91%**	27.06%	**35.14%**
Travel Quality	Safe	3.90%	0.92%	2.90%
	Convenient	1.95%	5.50%	15.94%
Green Transportation Mode	Healthy	12.99%	26.61%	12.68%
	Environmental friendly	12.99%	20.64%	17.75%

Mode Shift Statistics

	Beijing	Shanghai	Hangzhou
Pedestrian	**22.73%**	**26.15%**	**16.30%**
Private Bicycle	8.44%	14.22%	8.33%
E-bike or Motorbike	2.60%	5.05%	2.54%
Motorcycle	0%	0.92%	0%
Bus	**34.42%**	**40.37%**	**51.45%**
Metro	14.29%	2.75%	0%
Taxi	2.60%	1.83%	3.99%
Private Car	**5.19%**	**0.46%**	**3.99%**
Unlicensed Taxi	2.60%	3.21%	0%
Community/Company/Supermarket Shuttle Bus	1.95%	3.21%	0%
Car-shareing or Car-polling	0%	0%	0%
Other	0%	0.46%	0.36%
Not Selected	5.19%	1.38%	13.04%

Compared with the purpose of encouraging green transportation, the bike-sharing systems may not impact the single occupancy vehicle users as much as expected. **Most of the shared bicycle use is shifted from walking or public transit, not cars.**

But think about the total car mode split in Chinese cities is still not so high nowadays, such mode shift are still so **encourageable.**

Lessons learn from these three bike-sharing systems

Organize and management

In Chinese cities, the **support from government** is very important.
Space, utility, finance, promotion, advertisement, etc..

Reasonable scale and distribution of the system

Free public service or not?

Sustainable finance plan
Advertisement seems to be needed to work profitable and guarantee low fares, ongoing maintenance and a high service-level.

Competition of potential service supplier

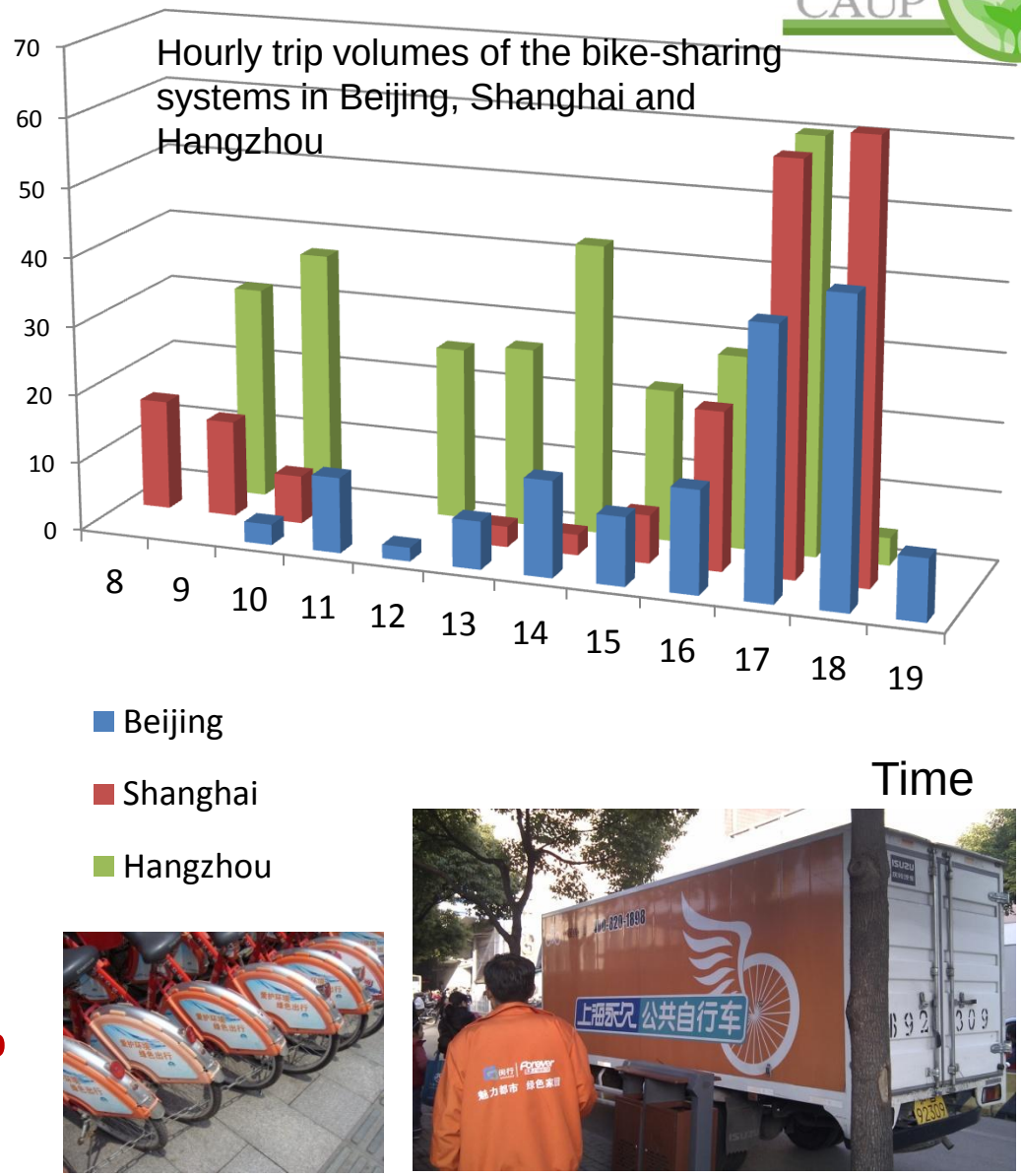
External supervision

Balanced Trip Flows

Imbalanced trip flows (both regionally and hourly), especially in the peak hours, will pose major problems to the redistribution problem, cost a large amount of money and undermine the bike-sharing system,

- Travel demand research should be done to design a more reasonable distribution of bike-sharing stations.
- There should be some storage space in those popular stations to store excessive bikes and to supplement shortage when needed.
- The credits reward method (implemented in Shanghai) could also be introduced to alleviate the imbalanced flow problem.

It was reported, in Hangzhou, **80%** of the bike-sharing trips concentrated in peak hours.

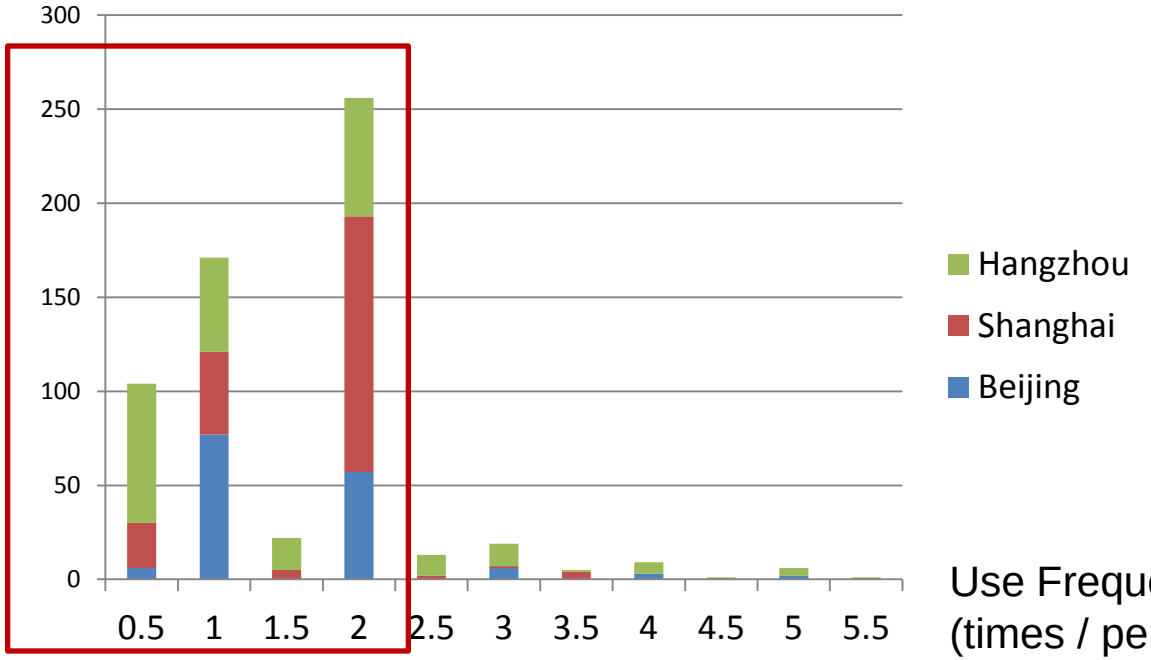


Excessive bikes in the peak hours in Hangzhou

Bike redistribution vehicle in Minhang

Commute? More Diverse Trip Purposes

Most of the users use the shared bike less than twice a day.



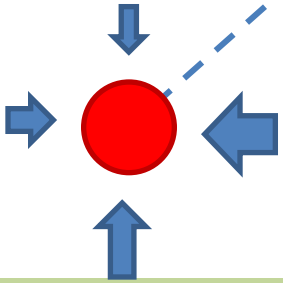
Use Frequency
(times / person day)

More diverse trip purposes will help generate more travel trips, and support a more reasonable distribution of bike-sharing stations, which will help alleviate the imbalanced flow issue.

	Average Use Frequency (times / person day)
Beijing	1.54
Shanghai	1.62
Hangzhou	1.38

79% are commuting trips in Beijing

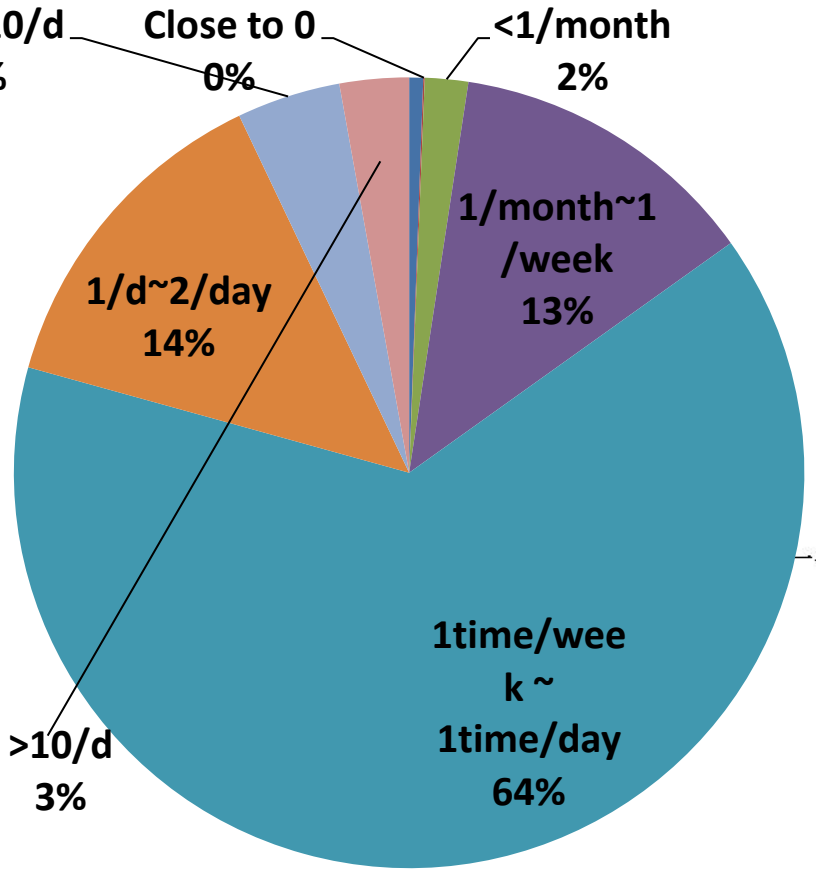
75.4% are commuting trips in Shanghai



Centralize to the metro station in the morning peak and reverse in the evening peak

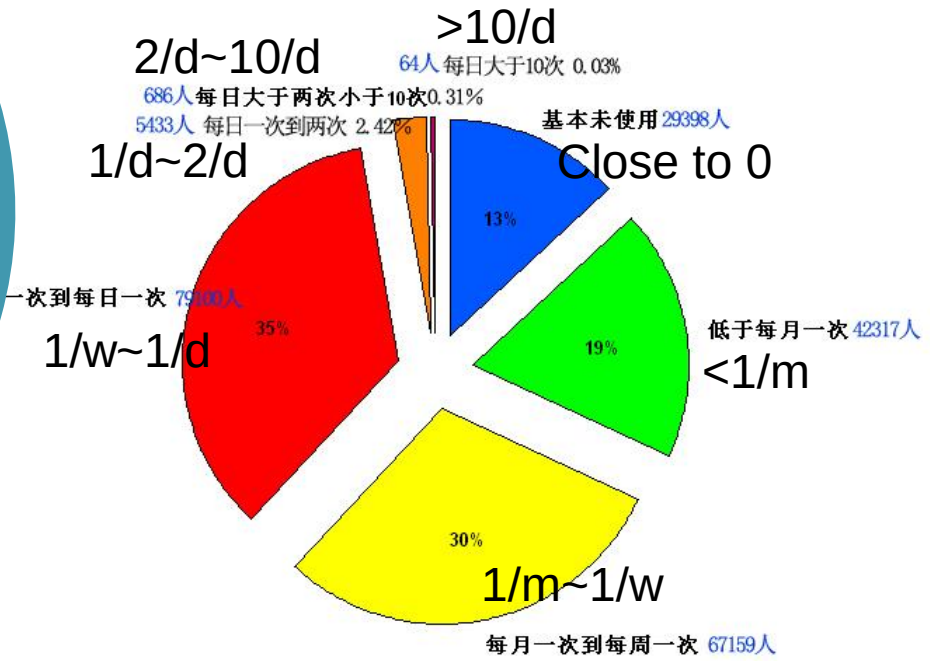
Commute? More Diverse Trip Purposes

Trip counts distribution based on frequency classification



Shanghai

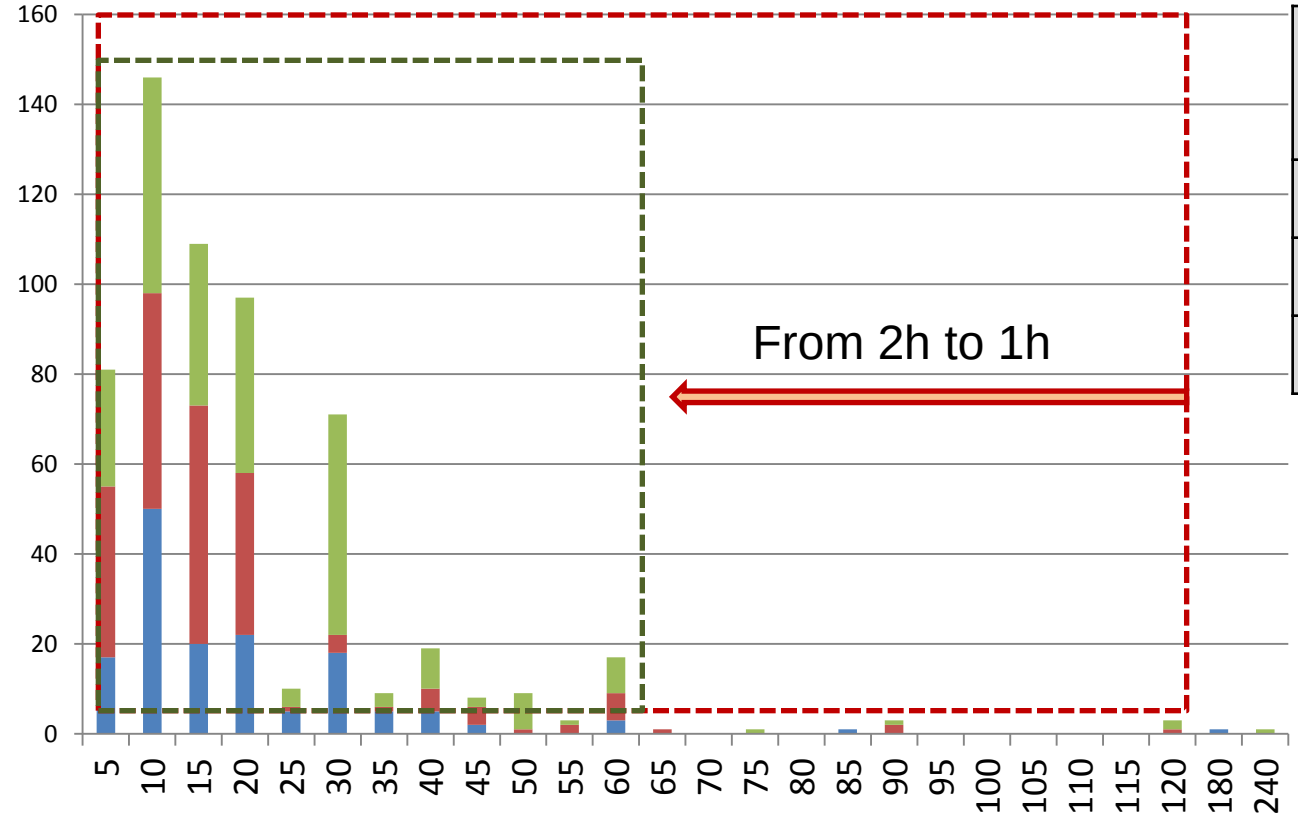
Number of users distribution based on frequency classification



Reasonable No-Charge Time

Most shared bike trips in the case cities are less than one hour in duration (which means free in Hangzhou, and free in Shanghai from this year), and the average time per trip is around 20 minutes.

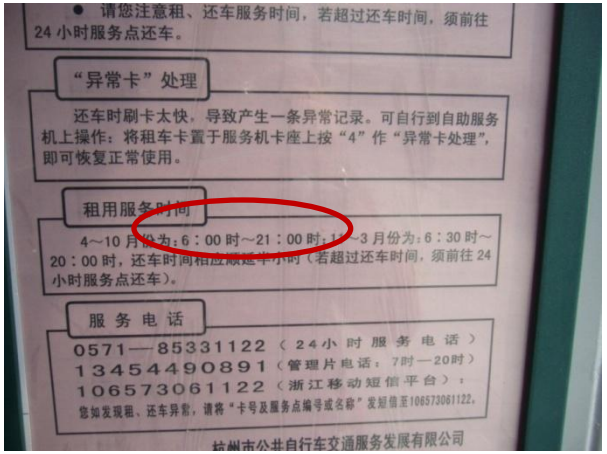
The point is keeping the bikes in use as frequently as possible, and shorten the time of each ride. **1 hour free ride is enough** for most single trips.
Give some **rewards** to those who help redistribute the bikes in peak hours



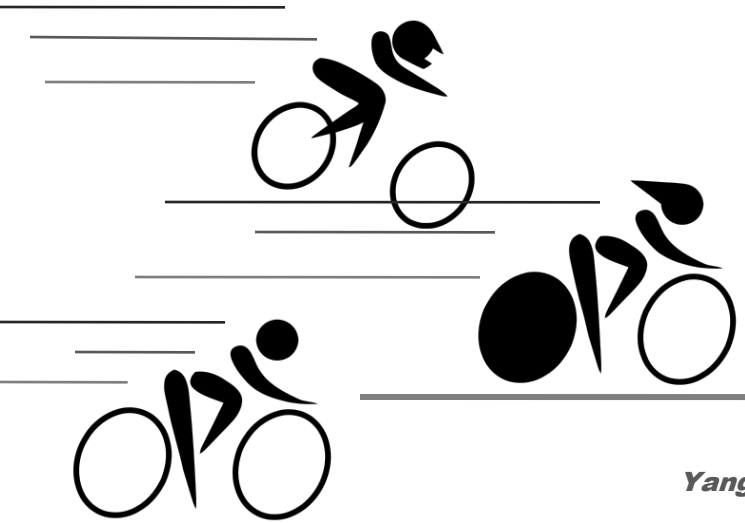
	Average Use Time (minutes / time person)
Beijing	19.38
Shanghai	17.75
Hangzhou	23.35

Facilities and Service

We should always provide good bike-sharing facilities and promote the service. For example, the storage facilities in each bike-sharing stations should be considered in the planning period. Use digital information and management technique to better manage the system. And do not forget to provide the 24 hours service.



And also don’t forget our urban cycling infrastructures.



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Thank you for your attention!

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