bicycle sharing systems
an introduction

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once there was...
once there was...
once there was...
once there was...
once there was...
once there was...
once there was...
once there was...

CENTRAL POSTAL SERVICES
a new paradigm of mobility

CENTRAL TRANSPORTATION SERVICES
What is a bicycle sharing system (BSS)?
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what is a bicycle sharing system (BSS)?
why do we want a BSS?

**improve PT service**
- as an alternative to PT
- as a supplement to PT (DC)
- to bridge the last mile

**change behavior**
- as a catalyst of change
- to improve public health

**environment**
- to reduce congestion (DC)
- to reduce CO₂ emission
popularity in time
popularity in space (2013)
risks?

- effective design
  - density
  - good infrastructure
  - availability
- climate
- stakeholder management
- regulations
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DC’s pilot in 2008 was not successful

why?
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why?

- 10 stations
- large covered area
- restrictive opening hours
infrastructure: station design

- DC’s pilot in 2008 was not successful
- why?
  - 10 stations
  - large covered area
  - restrictive opening hours

lessons learned?
infrastructure: station design

≈ 300 m between stations suggested
infrastructure: bike lanes
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perhaps too expensive...
infrastructure: bike lanes

retrofitting lanes on existing infrastructure

Figure 20. Seville Bicycle Infrastructure

Figure 21. Buenos Aires Bicycle Infrastructure
infrastructure: complex problem
infrastructure: complex problem

design problem is not straightforward!
infrastructure: complex problem
how would you improve DC’s BSS?

Fig. 2: Bike-Share System Performance:
Trips per Bike vs Trips per 1,000 Residents

- **High Performance:** High market penetration and high infrastructure usage
- **Moderate Performance:** High market penetration but low infrastructure usage
- **Low Performance:** Low market penetration and low infrastructure usage

- **High Performance Cities:** Barcelona (11), Lyon
- **Moderate Performance Cities:** Madison, London, Mexico City, Montreal
- **Low Performance Cities:** San Antonio, Boulder, Minneapolis, DC, Chicago, Boston, NYC, Rio de Janeiro, Paris
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availability: station saturation

a thursday in DC... (11:55 am)

What’s going on?
availability: station saturation

a thursday in DC... (5:00 am)
availability: station saturation

a thursday in DC... (9:10 am)
availability: station saturation
availability: station saturation

- target groups

<table>
<thead>
<tr>
<th>requirements problem</th>
<th>commuters</th>
<th>leisure</th>
<th>errands</th>
<th>tourism</th>
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<tr>
<td></td>
<td>dense network</td>
<td>24/7</td>
<td>dense network</td>
<td>POI</td>
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<td></td>
<td>rush hour</td>
<td>price</td>
<td>carrying capacity</td>
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repositioning trucks
1 truck solution
how important is repositioning?

<table>
<thead>
<tr>
<th>cost</th>
<th>share</th>
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<tbody>
<tr>
<td>repositioning</td>
<td>30 %</td>
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<tr>
<td>bike maintenance</td>
<td>22 %</td>
</tr>
<tr>
<td>station maintenance</td>
<td>20 %</td>
</tr>
<tr>
<td>back-end system</td>
<td>14 %</td>
</tr>
<tr>
<td>administration</td>
<td>13 %</td>
</tr>
<tr>
<td>replacements</td>
<td>1 %</td>
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</table>
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climate: temperature/seasons

- comparing system availability over time across different systems

availability through the year by city avg yearly $T$

![Bar chart]

- available all year
- limited availability

below $11^\circ$ C — above $11^\circ$ C
climate: temperature/seasons
climate: rainfall

![Graph showing the mean number of trips over time of trip start, with separate bars for not raining and raining conditions.](image-url)
climate: humidity

![Graph showing mean number of trips per hour vs. relative humidity at trip start. The graph has two lines: one for casual user trips and another for registered user trips. The y-axis represents the mean number of trips per hour, ranging from 0 to 300, and the x-axis represents relative humidity (%) at trip start, ranging from 0 to 100. The graph indicates a decrease in the mean number of trips as relative humidity increases.](image-url)
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- regulations
potential competitors
▶ other bike rental companies
▶ PT operators
▶ involve them asap to form partnerships

customers
▶ segment and select
▶ send out questionnaires (POIs, $, priority, ⋯)

operators
▶ assign tasks
▶ define SLAs

consultants
▶ task forces of various skills
▶ they make a feasibility plan

administration
▶ permits are required
▶ input necessary for strategic design

sponsors
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stakeholders: PT partnerships

▶ integrated planners
▶ complementary coverage
▶ joint access programmes
modal mix DC including BSS (2 modes)
stakeholders: operators

- can be the municipality
- but outsourced most of the time

Figure: operator market sample Europe
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conclusions

- what is a BSS
- why do we want a BSS
- how does it fit in a service oriented paradigm for mobility
- what are the main challenges
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<td>ITDP, UC Davis (2015)</td>
<td>report</td>
<td>A Global High Shift Cycling Scenario (The potential use for dramatically increasing bicycle and e-bike use in cities around the world, with estimated energy, CO2 and cost impacts)</td>
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<td>Lin et al.</td>
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<td>Optimizing bike sharing in European cities</td>
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<td>the impact of weather conditions on Capital Bikeshare trips</td>
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