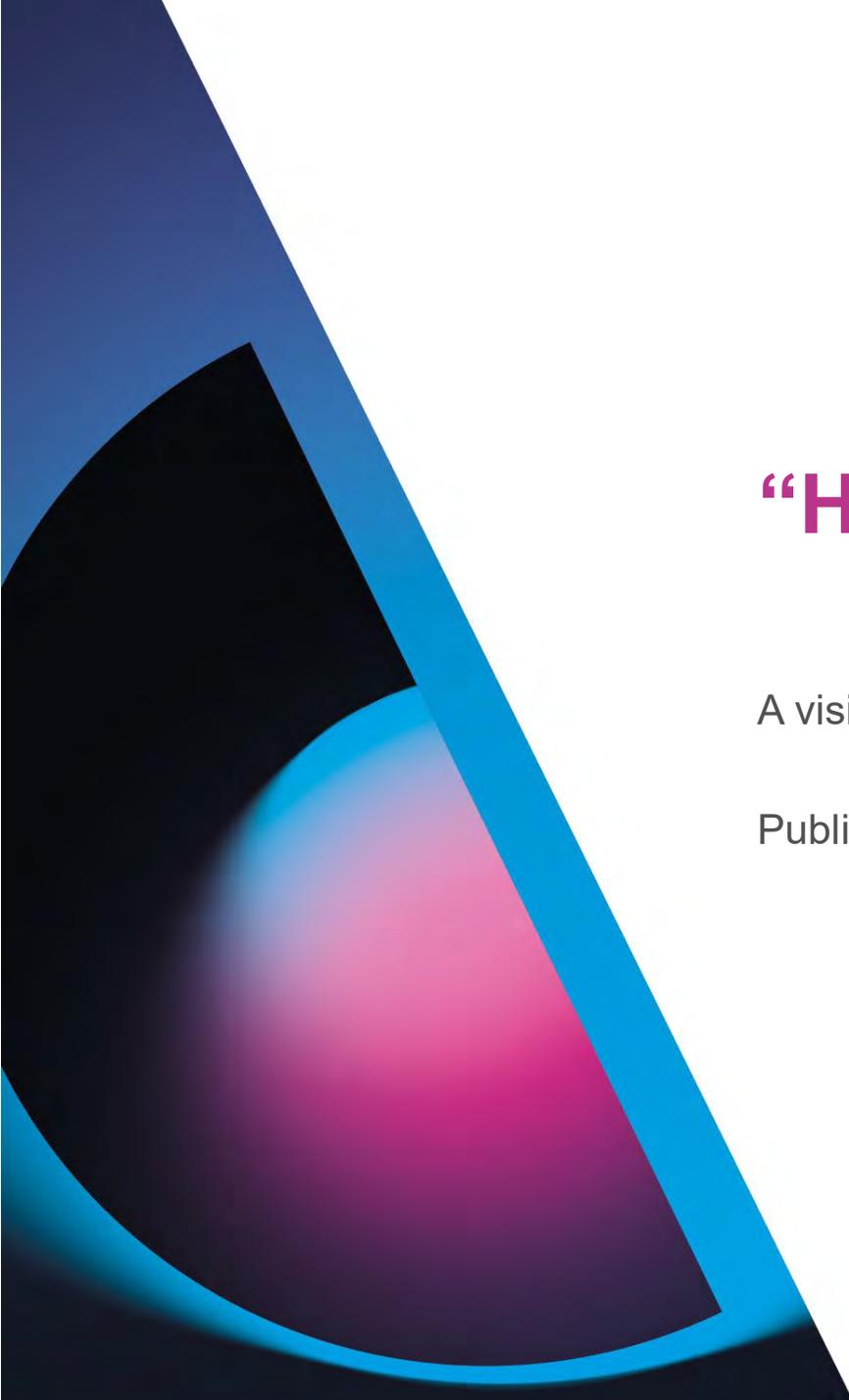




“HORIZONTAL ELEVATOR”



“Horizontal Elevator”

A visionary approach to public transport – project sketch

Publication of an idea to make public traffic more individual

Classic concept of public transport

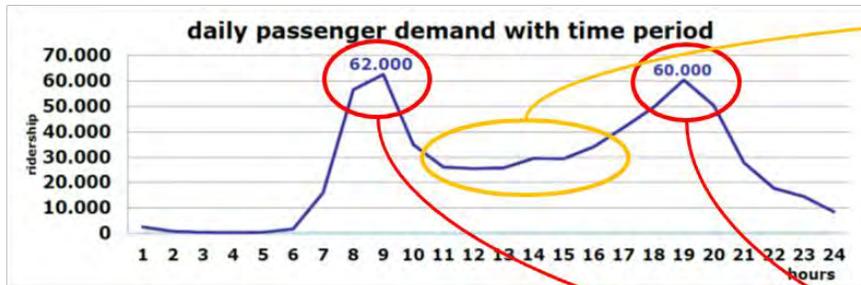
in a city



- Current concept
 - bus or tram on fixed route
 - in fixed intervals
 - defined bus stops, of which nearly everyone has to be a stop for the bus
- Consequences:
 - in our sample the way to walk is nearly the same as to go by bus
 - you have to wait for the bus (intervals between 5min. In centre and up to 30 min at periphery, depending also on daytime)
 - to ensure passenger comfort bus stop distances are between 500m and 350m
 - bus is in permanent stop-and go, for electric vehicle no problem, but lengthens travelling time
 - for many destinations traffic mean has to be changed, often several times, means more walking distance, more time loss compared to individual traffic
 - a given passenger frequency can be approached in two ways:
 - higher frequency with smaller units = higher cost, more passenger comfort
 - lower frequency with bigger units = lower cost, lower comfort

Classic concept of public transport

Further implications: daytime fluctuation



Reference: Mümin Kahveci: Metro-Bus System, Cost Effectiveness and Revenues; 7th UITP International Bus Conference, April 2012, Istanbul/TR



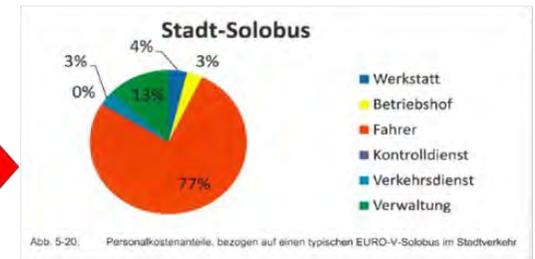
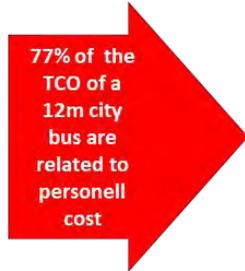
| Type | Length | Traffic Area | Capacity [Persons] | From this Seated |
|------------------------|-----------|---|--------------------|------------------|
| Single bus | 12m | 30,6m ² | Circa 90 | 55 |
| Double-decker bus | 14m | 36,7m ² | 110 - 130 | 90 - 105 |
| Single bus | 15m | 38,3m ² | Circa 125 | 45 |
| Articulated bus | 18m - 21m | 45,9m ² - 53,6m ² | 150 - 200 | 50 - 65 |
| Bus with trailer | 22m | 56,1m ² | Circa 185 | 70 |
| Double articulated bus | 24m - 25m | 61,2m ² - 63,8m ² | Up to 190 | 70 |

Reference: Christian Vana: Elektromobilität für Großfahrzeuge im Personenverkehr (electromobility for large vehicles in public transport); 2nd traffic days MTZ-symposium, Klagenfurt/Austria 2011

Reference: Veronica Vana: Quantitative Analyse des Marktpotentials intermediärer Transportsysteme des öffentlichen Personennahverkehrs (Quantitative Analysis of the Market Potential of Intermediate Transport Systems in Public Transport); Diploma Work at University of Vienna for a Master Degree in International Business Economics, 2009



New concepts as Lohr Crystal



Reference: Pütz, Ralph, strategische Optimierung von Linienbusflotten, Alba Fachverlag, 2010

Comparison to car (individual or taxi)

Requirements by the true public transport customer, the passenger



- „I go by bus as I have to“ (in German a rhyme):
 - By economical reasons
 - By restrictions
 - ...other constraints
- Vehicle has to be economic to allow to establish an economic bus service and cheap tickets, public funding is getting scarcer
- By ecological believe
 - Vehicle has to be proven much more ecological than any private traffic to convince → Life Cycle ZEV as ideal
- As it offers more comfort than the own car
 - Often improvement strategy for public transport is to restrict artificially private traffic forcing customer attractiveness – bad and undemocratic
 - Use like a “Taxi” or better a limousine service by high comfort
- Biggest challenge, to compensate natural public transport lacks by other comfort features. Vehicle has to offer best appeal and maximum comfort, but also the rest of the bus system by minimized waiting, safe and comfortable bus stations, easy ticketing etc.

Comparison to car (individual or taxi)

Other items



Crowded bus vs. splendid insulation

- **“Money may not buy happiness, but I’d rather cry in a Jaguar than on a bus.”**
Citation attributed to the famous French novelist Françoise Sagan

Comparison to car (individual or taxi)

Potential, between two non-prominent addresses in Vienna as a sample

- Results, evaluated at the navigation function offered free by a prominent supplier at an average daytime:
 - Public transport: between 44 and 46 minutes
 - Car: between 25 and 28 minutes
 - Despite:
 - longer way by restrictions to individual traffic
 - frequent traffic with partial stops
 - Public traffic needs 176% time of individual traffic – house to house travel given, as possible by taxi.

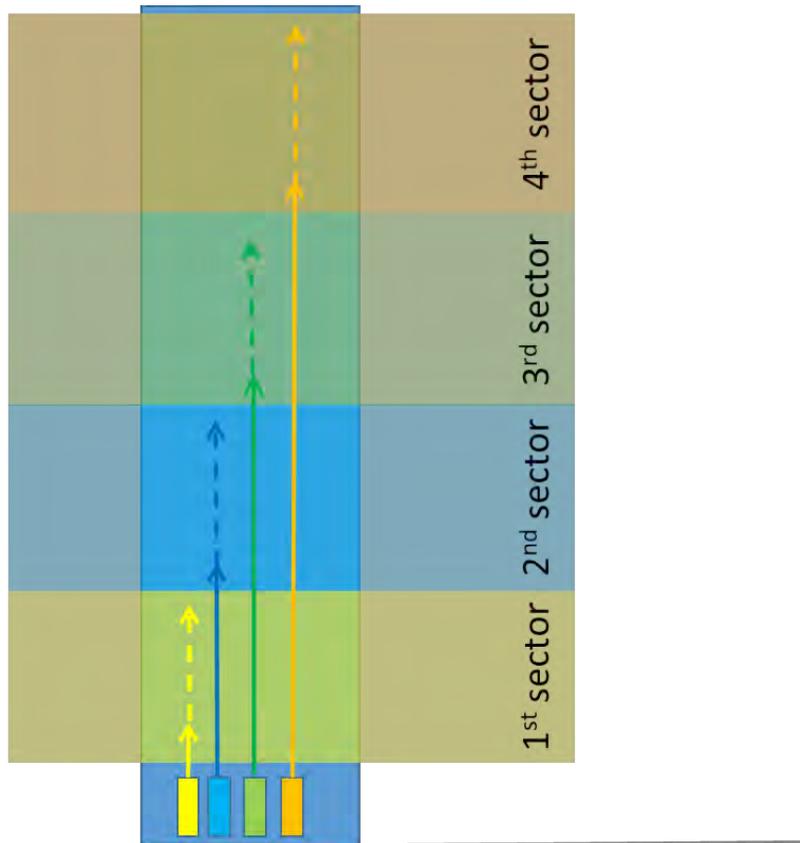
System advantages to unite:
direct travel + low fare + good use of vehicle capacity (traffic space)



today: hailed shared taxi

Future version?

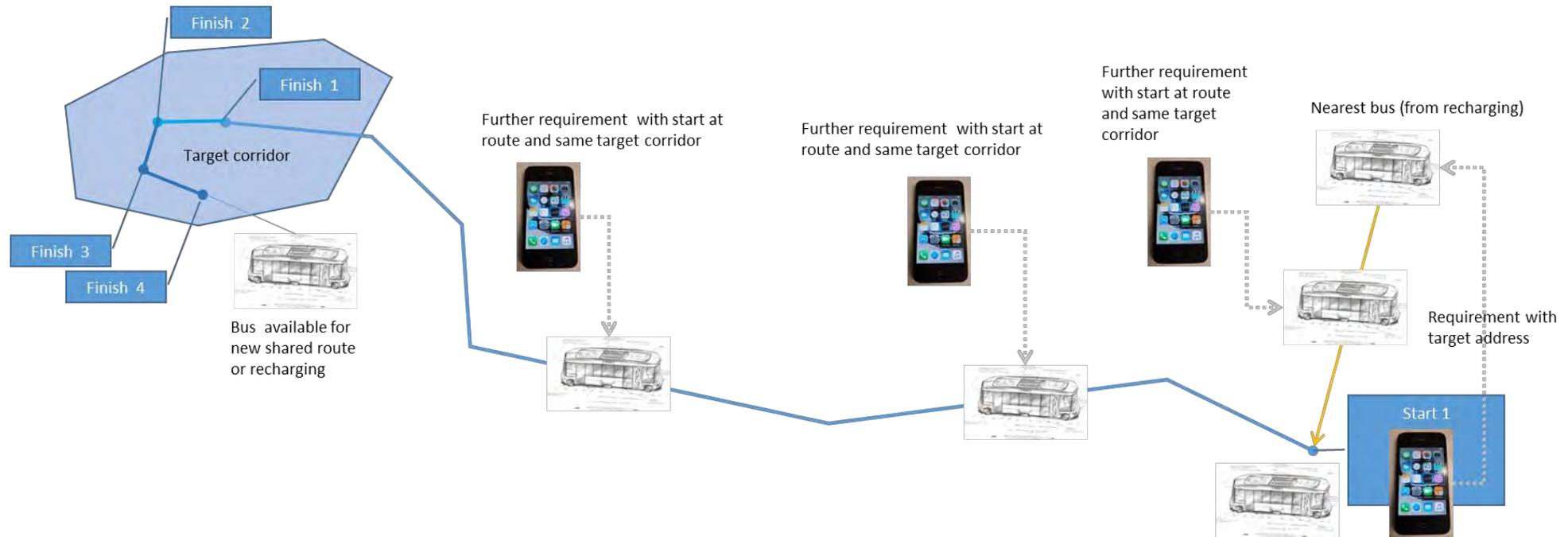
The basic to derive from



- In high buildings as skyscrapers the elevators generally are arranged in groups. Each elevator group does service for a certain sector of floors. It goes quick to the attributed sector of floors and then any floor there can be served.
 - By this the travelling time is reduced considerably.
- A similar concept today is just in use in public traffic, e.g. at Bus Rapid Transit systems, where rapid lines only stop in selected sectors at any station

“Horizontal Elevator”

New derived concept on sample of a start demand in a chain



- Complete fleet of (mini-)buses available throughout the city.
- On demand vehicle can be booked exclusively at higher fee, e.g. for safety reasons at evening

“Horizontal Elevator”

New derived concept – properties, +/-

- autonomous electric driving – no driver cost, 24h service possible
- ideally bus permanently in move by following requests, until recharging necessary
- recharging stations roadside necessary
 - can be shared with private electric cars
- complete fleet of buses on demand distributed about whole service region
- short waiting time
- door to door service possible
- ticketing via demand-app
- high flexibility to daytime demand changes with enough vehicle available at parking position
- safety provision necessary
 - → exclusivity demand at extra cost?
- at critical battery level bus has to stop service to leave for demand
 - → before a new demand is accepted, battery level and nearest charging opportunity to be checked automatically
- autonomous driving yet to be fully developed, technically and legally
 - vehicles are available and yet in services, though often under legal restrictions
- consumes additionally parking space and needs charging net
- good organisation concept with care for other traffic necessary
 - organisation concept and app are the development topics

Further doings

Next steps

- Development of a detailed concept for the call- and service-system including ticketing with any payment card
 - Including user-app for smart phone
 - Including organisation software
- Development of the vehicle concept, either new or derived from existing autonomous minibus
 - Fully electric
 - Autonomous driving
 - Bidirectional drivability would be an advantage
- Development of a charging strategy including grid connection strategy
- Development of a detailed service strategy
- Development of an implementation strategy to the city



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