///// Compact Overview:

Opportunities and Challenges of Autonomous Vehicles Serving Rural Regions ////

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10 Theses

It's about Rural and Suburbia, Stupid!

- /// Car Dependency we are fighting do not originate in dense inner cities, but in suburbia / office parks / ...
 > the unloved child of urbanism
- /// Need to Re-Focus large Parts of Transportation Debate

//// Suburbia Rules /////



- /// Urban sprawl: key sustainability inhibitor
 - greedy for Land, Time, Energy, Lives
- /// Flipping lifestyle drivers: 1960s dreams re-emerging as 2000s nightmares
- /// Difficult if not impossible to serve by public transportation
- > Overcoming vicious cycles: call for smart, vehicle-based solutions
- > Re-thinking territories, spaces, functions

//// Rising Networks of Green Infrastructure: Data is the New Oil ////



- /// infrastructure deployment fostering dependency on private transport
- /// Retail as we know it is declining
- /// Malls increasingly appearing as dinosaurs of a bygone era
- /// IT-driven service economy gradually taking over
- > Understanding future urban mobility is understanding retail and services
- > the urban vehicle of the future is the delivery van
- > Need to re-consider the political economy of urban territories

2 Customer Focus Matters

- /// Simpler, more intuitive, more integrated, more equitable
- /// Implement systematic learning from customer demand
- /// use data from trips and feed predictive algorithms to make service more efficient
- /// Realize what the real assets of every mode in AV age are



/// New Offers: Has the Problem been Understood? Pseudo-Solution? First Trial? ///



/// AV Safety Discourse: Between Emotion and Protectionism ///



"SAE Level 5 achievable only 50 years from now"

3 New Metrics: System Metrics > People Metrics

- /// Not the overall number of trips delivered matter
- /// Not the type of vehicle matters
- /// but whether users get access to a trip, where and when they need it
- /// Get away from misleading financial targets

A Remove Inefficiencies Built into the Environment

/// Ask: Where has a Technology been born? ///



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/// Infrastructure in an AV Age ///

// Under-Investment: CalTrain, Silicon Valley



/ Av. Seats phpd: ca. 2'500 peak (4 trains)
/ 124 km
/ Traction: Thermic, GE F40PH, ca. 1100 Itrs of gasoline / trip



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How do we weigh Travel Time, Comfort, Externalities?

5 Equity in Access

- /// Ride Pricing in AVs should converge towards level of current transit fares
- /// No Alternative if Rural Space is not to be Given Up
- /// Adopt a broader view and review objectives

6 Integrated Service Delivery, Integrated Ticketing

- III Towards a post-App age:Integrate Back Ends, not only Front Ends
- /// Integrate trip construction and monitoring with fixed route and rail
- /// Integrate DRT and Fixed-Route

// Integration of Shared Modes with Rail Transit: Is it Feasible ? //



// 3'000 Vehicles in 8 classes....

// 1'300 Pods, Nationwide in Switzerland... ///



//....leveraging the Nationwide Rail and Bus Network...//



//....including "Roaming" with a German Operator //



// Switzerland's National Public Transport System: Full Integration of all Modes – Timetable, Ticketing,... //

Mainline Rail

Private Rail Ops.

Rural / Alpine Bus Services







Water Transport (Lakes)

Cable Transport

Urban Transport (Networks



// Core Asset: Simplicity, Ease of Use: One Ticket, one Network, Nationwide //



Fare Media: One Ticket for the Whole Journey, across all Modes

// Nationwide Integrated Ticketing: Simplicity and Ease of Use are Key //



// Full Inclusion of Shared Modes in Customer Value Chain: Fare Media....//



Burgermeister

Catrin 10.04.1989 Public Transit, CarSharing, BikeSharing, Ski, Hiking, Museums,...

Publi Bike

// Switzerland: 100+ Years of Tradition: in Integrating Transport //

// Main Area of Improvement:

No answer yet to Taxi Problem -

- lack of quality and coordination
- too expensive
- not considered part of transit system



// Example for Intermodality: Mobility Pod – Geneva Airport //

<< 300 m to C/I Desks << 100 m to Train

// Example Basel Rail Station: Reserved Drop-Off Spots for Free-Floating Vehicles //



// Example Basel EuroAirport: Reserved Drop-Off Spots for Free-Floating Vehicles //

50 m to Terminal

// Base for Success: Intermodality, Cooperation between all Transport Actors //



//// Expanding CarSharing Options: Mobility Carpool – Ridesharing, complementing Transit ////







Launch: May 2018

7 Quality Focus on All Levels: Competition is Here to Stay.



//// Quality of a Transfer Environment /////



//// Quality of a Transfer Environment /////



8 Pseudo-Solutions: Don't Get Trapped by the Looks.

/// Terminology Wars ? ///



//// eHailing / RideSourcing /////

Uber burns

//// eHailing / RideSourcing /////

Uber burns USD 16 M.

//// eHailing / RideSourcing /////

Uber burns **USD 16 M Every Single Day**.

//// TNCs, Fares and Compensation: Example from Detroit (06/2016) ////

• 14.23 miles

• IRS Std mileage rate = \$ 0.54

Uber pays in Detroit (06/2016): • \$ 0.24 per mile + \$ 0.24 per minute

> 15 miles + 16 minutes \$ 3.60 + 3.84 = \$ 7.44

BUT 15 miles * \$ 0.54 = \$ 8.10

- I had my trip subsidized by driver Michael.
- This does not include waiting times, and empty VMTs for pickup of next customer



FARE BREAKDOWN

RGED	¢0.00
Promotion	-15.12
Booking Fee (?)	2.30
total	\$12.82
е	2.36
ance	9.96
e Fare	0.50

9 Re-Dynamize Rural Service Model: DRT Feeders for High-Capacity Fixed Route

/// Personal Rapid Transit (PRT) ///

// Morgantown PRT, University of West Virginia



/ *1975 (Boeing-Vertol) / 73 Vehicles (4.75m), 5 stations, 4.2 miles

- / modes: On-Demand = Pax Request, Timer 5 Mins after call

 - Schedule = Point-to-Point (Timetable-based ops)

 - Circulation = "Bus" service, Stops at all Stations

/ ca. 150 service disruptions due to tech failures, 98% reliability (2010) / modernization 2015 (Thales), increasing maintenance \$ of guideway (concrete) / positive impact on the dynamics of the city have been demonstrated

/// Learning from Informality ///

// From Jitney to Self-Driving Shuttle:



Manila, Philippines (2015)

Zug, CH (2017)

/ How to Formalize the Advantages of Informality?/ How can the Downsides of Informality be compensated by Technlogy?

/// Post-PRT: Road-Based Shuttles – Operational Logics///

// Implementation Scenario: Leveraging Transit

/ 2017: Phase 1 A > B on-demand Stops

/ 2018: Phase 2 Geofence, Free-Floating Pax Boarf after Call



/ 2018: Phase 3 Geofence, Free-Floating Self-Optimization:

- Connecting to Trains
- Maximising Occupancy



/// From PRT to SDS ///

// Difference PRT ("analogue") to AV-SDS ("digital"):

SDS is a PRT without guideway.

 / This is a Strength: No parallel Infrastructure System to maintain
 / This is a Weakness: Systemic Dependency on the Road Network: no physical ROW, system risks.

/// Demand-Responsive Transit (DRT) ///



/ Intention: Reduction of Costs in Supply of "Direct Travel Minutes"

= New Metrics





10 Formalize and Deformalize

//// Formalization and Deformalization ////

FORMALIZE

- Ramp up Regulation, Governance
- Attribute to Tasks where Strengths provide systemic Advantage
- Integrate into Public Transport Tariff (Fare Media, Data, Maps...)



Private/Corporate Transport

Fixed-Route Bus Transit outside Rush Hours New Fixed-Route Modes BRT-Mix-Services



DEFORMALIZE

- Introduce Real-Time Tracking
- Adapt Regulations (e.g. Curb Drop-Offs)
- Customize to Passenger Demand
- New Eco-Tools such as Flex-Trolleybus

//// Formalization and Deformalization Example: Marshrutki ////



INFORMAL

- No Integration or Coordination
- Low Efficiency, no Oversight
- + Highly Flexible
- + Good Knowledge of Local Terrain

FORMAL

- + Integrated and Regulated
- + Real-Time Tracking, Optimized Operations
- + Highly Flexible > Customer Responsive
- + Structured, Flexible Work on Local Terrain

/// ...but no replacement for Formal Offer! ///



/// Legalized "Kômbi" (Informal Transport) ///



Neta-Takeaways 20 seconds, 5 Overarching Visions

Bottom Line: It's about Our Future, Stupid!

- /// Mobility Actors to Include:
 - policymakers
 - operators
 - regulators
 - industry associations (UITP, APTA, VÖV
 - researchers, consultants, public and private sector
- /// The Better the Framework is Defined, the Better the Outcome
- /// Define what Public Transport is (System Boundaries)
 > Break up Silos

Bottom Line: It's about Our Future, Stupid!

- /// Efficient + Sustainable Transport is Key Factor in buidling and securing Wealth
- /// Future of PTAs is to
 Negotiate
 Apply
 Enforce
 the Societal Manadate for Public Transport
- /// Transit Ecosystem is accountable to Society: Service Level Requirements to be Defined by Social + Economic Externalities

/// New, expanded Customer Focus ///

// Oscar Munoz, United Continental Holdings (CEO United Airlines):

"We need to de-Stress the **Travel Lifestyle**"

///// Thank you /////

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