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ACCESSCITY— A Systems Enquiry & Response on Urban Transport in Indian Megacities

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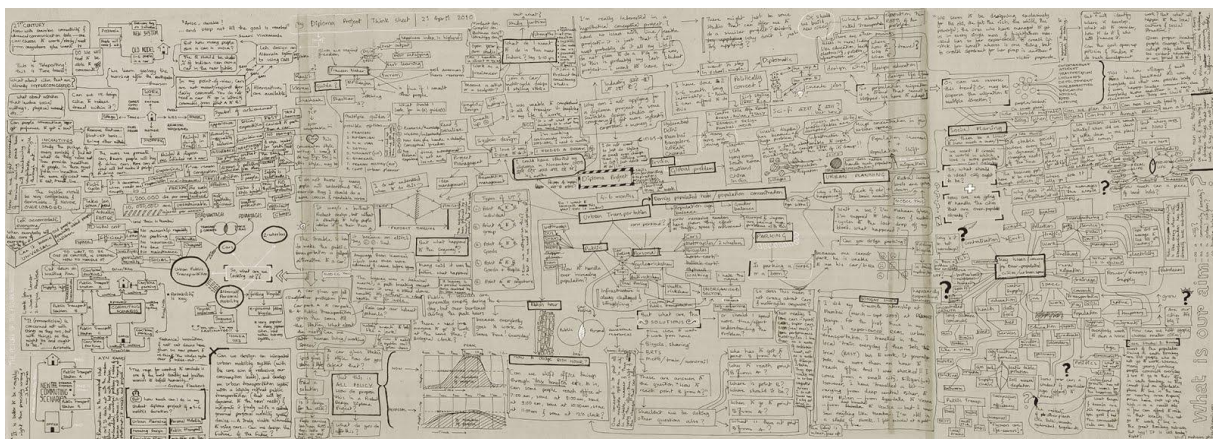
Introduction

There is enormous inertia—a tyranny of the status quo—in private and especially governmental arrangements. Only a crisis—actual or perceived—produces real change. When that crisis occurs, the actions that are taken depend on the ideas that are lying around. That, I believe, is our basic function: to develop alternatives to existing policies, to keep them alive and available until the politically impossible becomes politically inevitable. — Milton Friedman (1982)

Project ACCESSCITY is based on a hypothesis — as commute-durations keep increasing in Indian megacities (cities with >10million population) there will be a crisis soon; where an individual will commute for 6-8 hrs a day, work, and sleep, with barely any time to do anything else. Our crisis in question here: *Congestion*, isn't a speculative problem of the future, but is affecting us today. It is urgent & important.

Congestion is a rampantly escalating problem, especially in *Hyperdense* megacities. It's a completely useless and ineffective time-tax (Delhi NCR loses over 150,000 man-hours /day) that it is paid to no one, and no one benefits from it. In developing nations with high-population, the globalized automobile industry's parabolic growth is consequently harming the citizens and customers (in *Hyperdense* situations) – leading towards a disruptive crisis.

From within, the automobile industry seems to have gone in an expedient mode, which primarily triggered this project. In my pursuit to become a car designer, I began my second car-design internship at a French car manufacturer's design studio at Saki-Naka, Mumbai. There was endless congestion down at one of the busiest intersections of Mumbai right outside, and yet we were pervasively sketching cars all day. I grew up in the small town of Siliguri (population: 0.4m), and had spent considerable time in Ahmedabad (5.8m), and sometime in Milan (8.1m) — but what I saw in Mumbai (21m) was completely unnatural and unacceptable. People were commuting for 4-5 hrs daily, and it is considered OK. I had to find out, how and why!



ThinkSheet: Pre project analysis and synthesis of the context.

Hyperdense Megacity

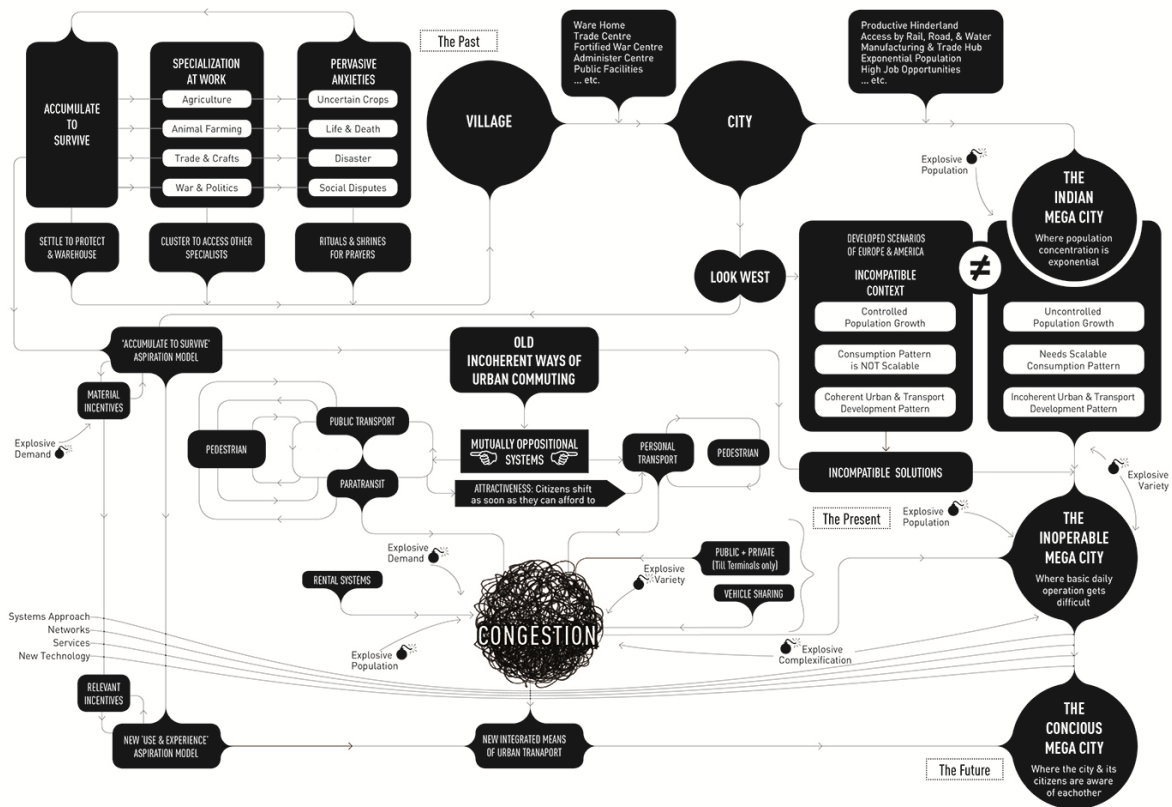
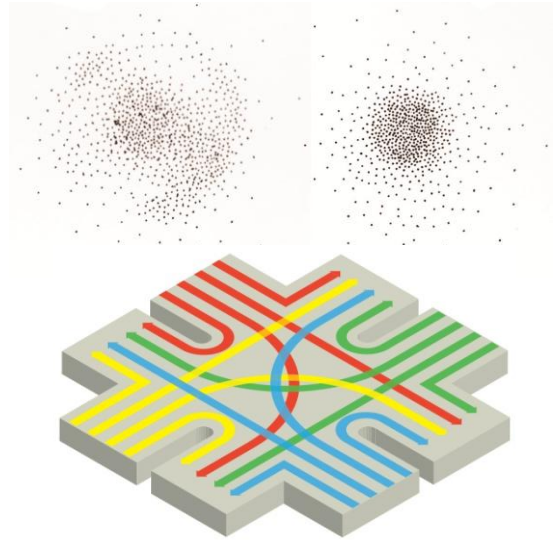
Project ACCESSCITY's core aim was to explore and study the emerging context of *Hyperdensity* in and around many megacities; specifically the incoming of people from adjoining areas of the metropolitan. I had spent months on-road during multiple visits and studies in 3 of the most populated urban agglomerations of India:

a Mumbai MMR: 21 million

b Delhi NCT: 16 million

c Kolkata KMA: 14 million

I went hunting for congestion, trying to understand its ground realities and socio-economic repercussions on people's life. Further studies, conversations, data, and macro-micro analysis revealed some eye-opening insights about this new kind of human settlement behavior.



Systems Model about the evolution of human settlements and the origin of congestion, Stafford Beer style.

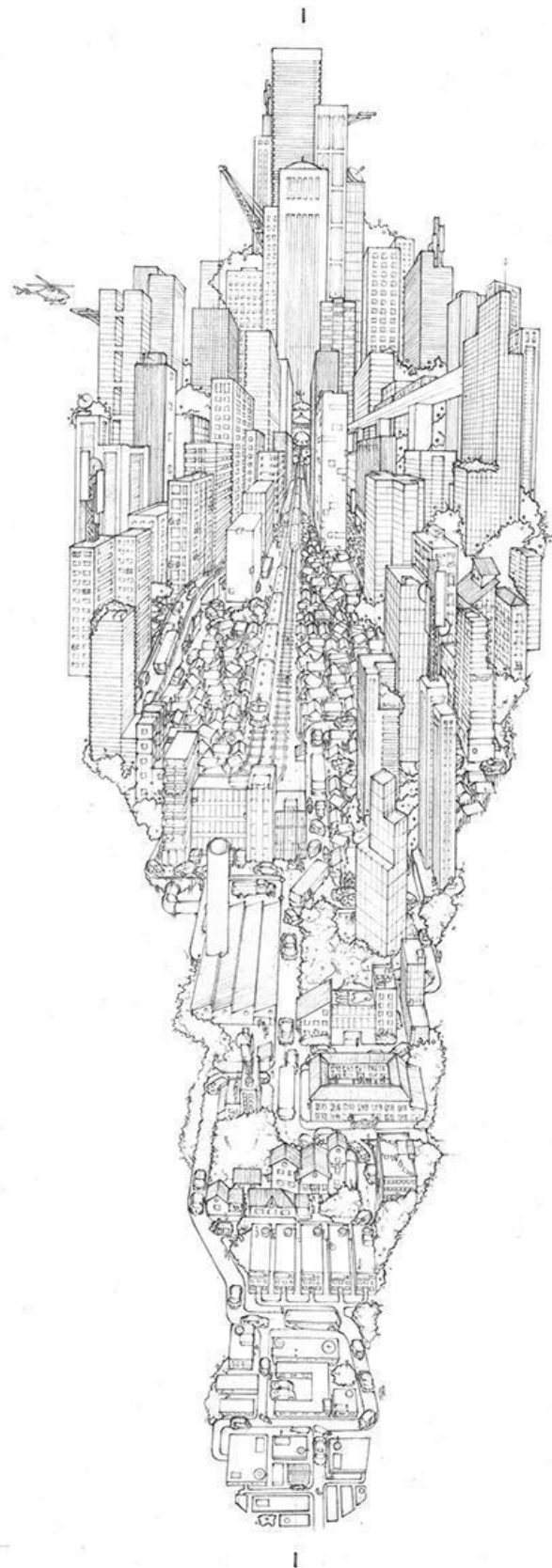
System Synthesis

The synthesis began with a few simple questions: What is the utility of a city? Mumbai Metropolitan has nearly the same population as the whole of the Australian continent – What attracts people to cluster so closely?

A city offers a citizen access to a social-life, job opportunities, healthcare, service & educational options, shopping & recreational facilities, etc. At the same time, the city also makes this particular individual accessible to all the other citizens, job market, service market, real estate industry, healthcare & educational institutions, etc. This *Mutual Accessibility* is the core utility of a city. And the denser the cluster, the more attractively accessible it becomes. Let us bring another parameter: *Timing*. History (and practical reasons) have lead us to specific activity timing for increased interaction (like office hours) – which clusters us even closer, in extreme densities. These intra-city clusters naturally occur in small areas, exponentially increasing accessibility. This exact high-volume flow of people, through the limited street-networks of a megacity, leads us to our primary concern: *Congestion*.

The *Complexity* of the situation is even graver. Teilhard de Chardin (1959) elucidates, “...(Complexity depends) not only on the number and diversity of the elements included in each case, but at least as much on the number & correlative variety of the links formed between these elements.” So, we’re not dealing with just the number of vehicles and their physical footprint, but the variety of their relationships, which grows exponentially.

When I was searching for a metaphor, to express the inherent complexity of a city’s daily operation – our human-body fitted appropriately. In the *Humanopolis* model (shown here), a megacity’s transport-system is compared to our body’s circulatory-system – both the systems are not the primary concern, but indispensable for their meta-systems’ survival.



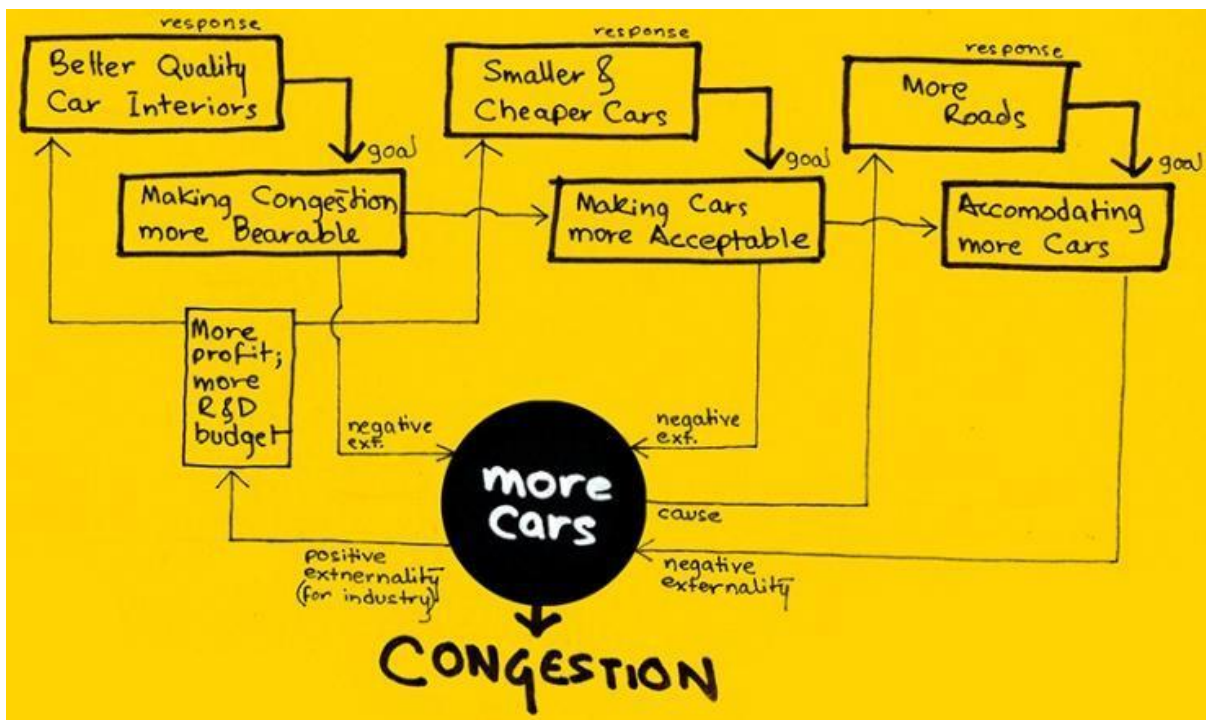
System Analysis

The whole system around transportation in a megacity was analyzed at many points and perspectives. We will look at few of these studies here.

1 Backfiring Solutions

3 responses to congestion that seem effective in the short-term, but backfire in the long-run:

- a **Better, more comfortable car-interiors:** making it 'congestion-ready',
- b **Cheaper small-cars:** so more people can afford to drive, which again increases congestion.
- c **More roads:** which in-turn makes private-vehicle usage more attractive for some time, eventually increasing congestion.



2 Skewed Indian Aspirations

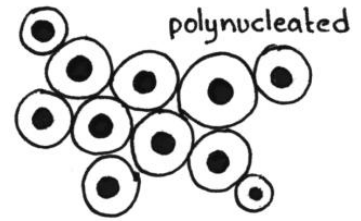
Private-vehicles also feed the skewed aspiration-models of the rising Indian middle-class. With unhindered access to all media, Indians are inspired by the lifestyle of developed nations, which does not necessarily match our context. For example, what if we are actually successful in achieving the goal of emulating the USA? Well, it translates to about 10,000,000 cars in Greater Mumbai, which works out to a physically impossible *17 cars per square meter!*

3 Public Transport & Geography

Even public transport systems have issues in Indian megacities. History shows that public-transport facilities in major European cities started by early 1800s — a century before automobiles became popular. This defined the settlement & transportation patterns of large cities, with a prominent Central-business-district. This densification at a single area encouraged investments in high-capacity public-transport.

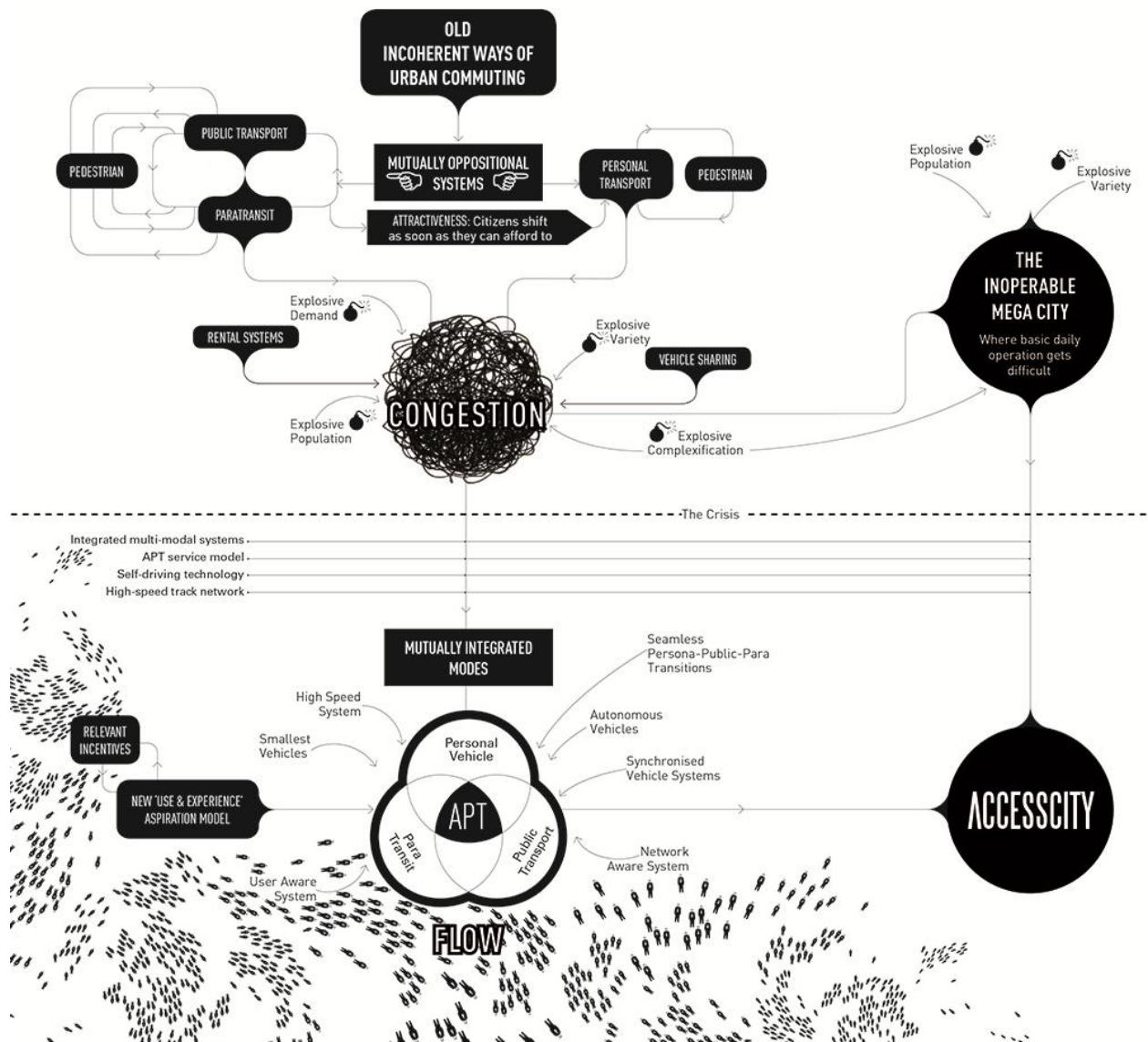


Indian megacities started taking their current shape very late. They are often an agglomeration of erstwhile villages, which crystallized as polynucleated cities (cities with multiple centres). This high variety polynucleated pattern of Indian megacities makes it difficult for any public-transport network to be able to match corresponding geographical-layout. They still function, thanks to the vital and dynamic support of Para-transits like Taxi, auto-rickshaws, and cycle-rickshaws etc.



Systemic Responses

What actually causes congestion? The truth is, we ourselves generate congestion – during rush-hour each entity on the road imposes a minuscule congestion effect on the other. However, it is not the outright number of commuters, but the number of operators (drivers/riders independently operating individual vehicles) that increase chaos. Since the number of commuters/citizens are growing exponentially, the only way the emerging rampant variety can be checked is by achieving a high ratio between *Commuter* >> *Operator* (like in a bus, the bus-driver is the only *operator* managing hundreds of *commuters*).



Systems Model of the Advanced Para-Transit (APT) System, in relation to the context.

We looked into the concepts of Internet-of-People, Train-traffic-control-systems, and Destination-coded-vehicles (from Airport/Factory logistics), to look for appropriate systems. If chaos can be minimized, a swift flow of volume needs to be achieved. With increasing numbers of commuters, and static street-network real-estate – the only variable can be *Speed* – brute speed, but precisely coordinated.

For all the vices of private-vehicles, they have two serious virtues:

a Undecidability: The freedom of not having to decide the time and route of travel, &

b Terminal-Access: The freedom of starting from/stopping anywhere.

Para-transits (Taxi, auto-rickshaws, etc.) also provide undecidability& terminal-access, but unlike private-vehicles there is no buying, loan, insurance, driving, parking, or fueling. However their unavailability at times is an issue.

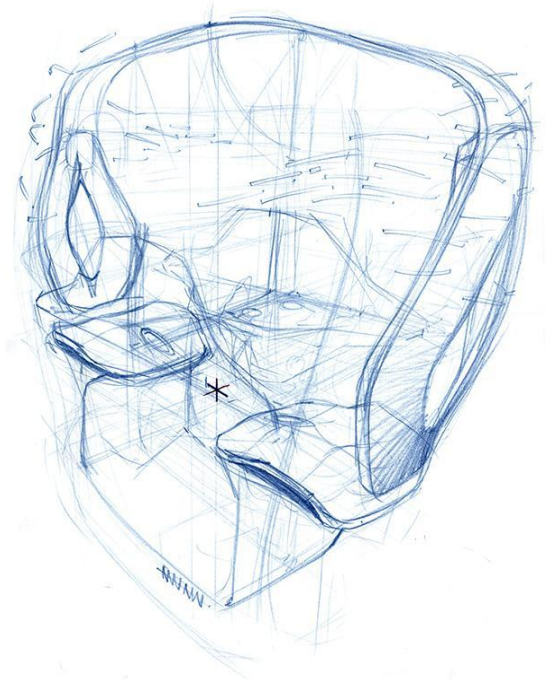
1 Advanced Para-Transit

Mating the above characteristics of Speed, Undecidability, and Terminal-Access, with the organized low-variety (Commuter >> Operator) of public-transport systems – lead us to a dual-mode solution (running both on regular roads, or dedicated maglev tracks). APT is an on-demand pay-per-trip service-system that will only come into the picture when necessary (and go away once done with the commute). It is an autonomous vehicle (like Google self-driving cars), based on self-balancing technology from Segway/GM (making the package ultra-short - 1.2m in length). We can accommodate 4 such vehicles in a regular lane, in the length of an average SUV. The unique sociopetal seating arrangement allows better interaction between the two occupants and a great fit with existing vehicle architecture and road-lane spaces.





Amit Krishn Gulati and Prof MP Ranjan, sitting inside the full size space-frame, built for size evaluation. An interior sketch (right).



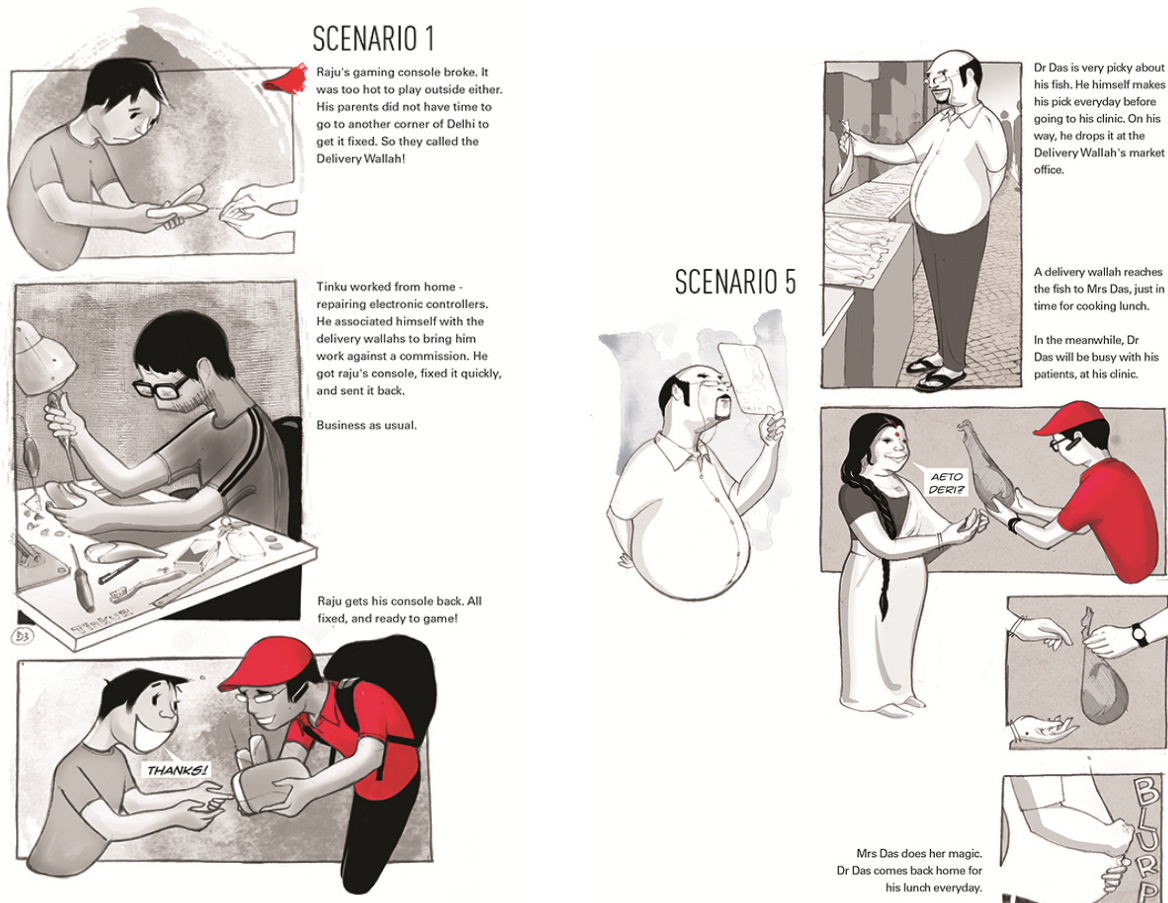
2 Wako

For existing efficient public-transport, last-mile connectivity is the key. I imagined a light-weight personal-mobility product (intended for individual use only), using Honda's self-balancing omni-directional wheel technology (developed by Honda Fundamental Research Centre, Wako, Japan), with which an unskilled user can also walk faster and effortlessly. The aim was to make the product small enough, so that a user can walk with it directly in a car, subway, shop, or office. It's the key distinction from existing personal-mobility devices is its ability to change levels (like stairs) — making this a go-anywhere mobility solution.



3 Delivery-Walaah

(‘Walaah’ is a Hindi suffix, meaning ‘provider of (-prefix)’, like ‘newspaper-walaah’ provides newspaper.) To rethink clustering in a city itself, an on-demand intra-city delivery service system was proposed – a network of people, who physically deliver items. The core idea was to reduce the need to travel, until-&-unless one’s physical presence is necessary. This is designed to be a foundation upon which new product-service businesses can be built, without a shop-front, thus negating the need to cluster businesses in markets. Look at this like an intra-city same-day postal service.



Conclusion

Congestion is a wicked problem, where too much information can paralyze designers, and too little understanding can lead to unfit solutions. The systemic pace-of-change is slow, especially in the hardware end of the automotive industry. Even if all transport systems change to smarter networked solutions from tomorrow instantly, the current fleet of vehicles: cars, busses, auto-rickshaws, etc, will still ply on the roads for (say) two decades more. The effective cause-&-effect time difference is prolonged for a wicked problem of this magnitude.

ACCESSCITY is meant to be a jump-start module for fresh projects (both academic and industrial), which intend to dive into the deep end of congestion. This can lead to a collection of complimenting design proposals, which when woven together, can be something bigger — A cross-institute, cross-disciplinary global meta-project. Why do this? So that, tomorrow when citizens politically demand for an alternative to congestion, we have ideas to share and execute. Milton Friedman says it best (refer to the opening quote of this paper).

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