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Simulating and analyzing chaos in Indian traffic condition

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Aim

Traffic congestion in urban areas is a major problem.

The most cited issue by drivers is the concept of lanes and the associated (in)discipline.

- **Competitive spirit**
- **Sense of entitlement from size and type leading to egocentric driving.**

The aim of this research paper is to study the use of the lane system of the Indian Roads. Conducting studies where we want to study behaviour of the users, it can take a lot of logistics and cost. So in this study, we have tried to find out the usefulness of today's lane system in Virtual Reality which is a low cost solution and gives us a lot of leverage on the condition creation and managing the data.

Past Work

- **Research on modelling traffic flow at the micro-macro level has been exhaustive for homogeneous traffic mostly for drivers trained to follow rules. In most of the studies, mathematical models have been used to emulate the vehicle movement programmed to follow rules of interactions, speed, acceleration, situational awareness and leader follower behaviour as noticed in real-life drivers**
- **A review of the various microscopic driving models and the applicability to Indian traffic types states that these models do not consider all the complexities of (in)homogeneous traffic and the dynamic strategies drivers apply.**
- **A simulation designed for European traffic was modified for Asian traffic and it was found that traffic-jam density depends on the surface area of the vehicles as well as mix of vehicles.**
- **Other studies include one on modelling the traffic stream with no lane discipline and a non-lane based microscopic modelling under heterogeneous traffic conditions to know how vehicles move in heterogeneous conditions. The important aspect to study is the behaviour of the drivers in mixed traffic conditions.**

Research Gaps and Our Proposition

- **The models proposed by these studies suggest how better lane discipline translates to lower congestion but does not consider issues from mandatory lane discipline in the mixed traffic as seen on Indian roads.**
- **The Indian roads at any time has buses, trucks, 3-wheeler public and goods vehicles, 2-wheeler motorbikes or scooters, cars of different engine capacity, non-motorised push-carts/bicycle, pedestrians and animals. To follow lane discipline is impossible in India as there is inconsistency in the each vehicle's engine capacity and driver behavior.**
- **There are situations where fast moving vehicles are forced to follow slow-moving vehicle. If there is dense and fast traffic on both sides of the fast moving vehicle, then the vehicle is stuck as it cannot overtake and is forced regulate its slow-down.**
- **With constraints imposed by the heterogeneity, lane rules would lead to higher traffic congestion. In the study reported in this paper, we demonstrate the issues with lanes discipline policy.**

Driving Simulators

- **Driving simulators are important tools which can provide the immersive environment for a driver, while allowing the researcher to manipulate the situations .**
- **To qualitatively measure real-time driver behaviour, verification of the parameters used in the various models requires controlled conditions and ways to collect perceptive data from the drivers.**
- **Traffic simulators are mid-way solutions used by researchers both for training and to understand driver behaviour in controlled situations.**



Experiment

- **For this study keeping in view the conditions to be tested, a controlled experimental setup on the virtual simulations emulating real-life traffic situations is implemented using the Unity3D game engine and presented on virtual reality glasses (Oculus rift).**
- **Naturalistic traffic noise and individual vehicle sounds with effects were the auditory inputs to the participants.**
- **The participant decisions on discretionary lane change to overtake an immediate lead vehicle, which is a slow-moving car/autorickshaw, were recorded and the time taken to reach the destination.**
- **They encountered one of three conditions: a) no lanes, b) designated lane changing stretches and c) barricaded lanes.**
- **A timer is there to record their timings and goal of people is to reach the destination. Analysis is done based on their timings.**

Scenarios



First person view



Scenario 1



Scenario 2



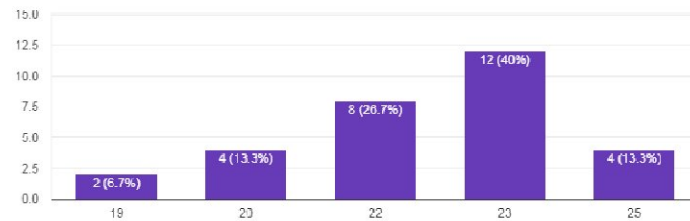
Scenario 3

Participants

For this experiment, the participant age group ranged between 19 years to 25 years, with the following breakup: 2 people were of 19 age group, 4 of 20 years, 8 of 22 years, 12 people of 23 year age group and 4 people of 25 years old. Out of these people, 56.7 % people knew how to drive and around 36.7 % were female gender.

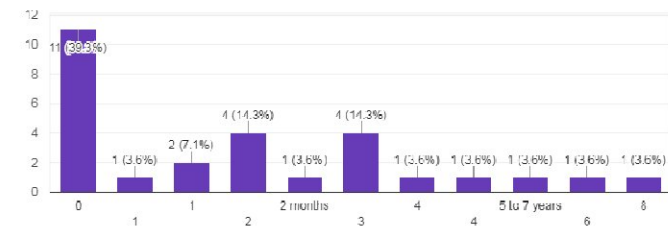
Age

30 responses



Years of experience

28 responses

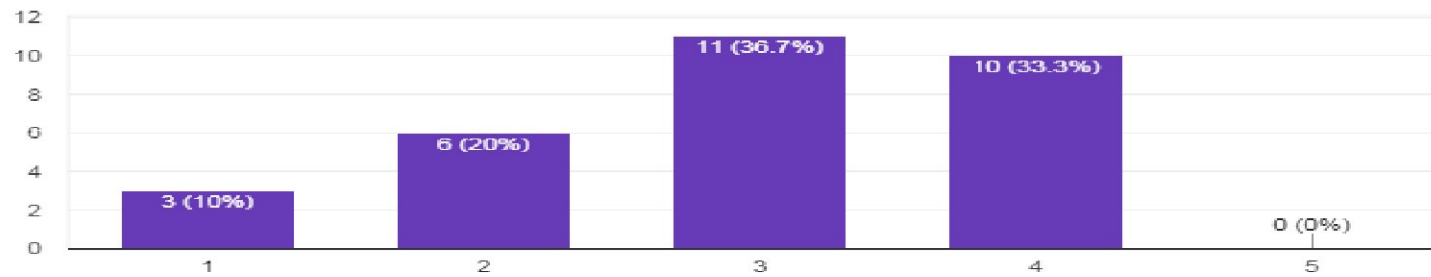


Results

Conditions	Average time to reach destination
Scenario 1 (no lane)	38.7 sec
Scenario 2 (specific stretch for lane change)	334 sec
Scenario 3 (physical barricades for lanes)	645 sec

What was your anger(or irritation) level (level 1 to 5)

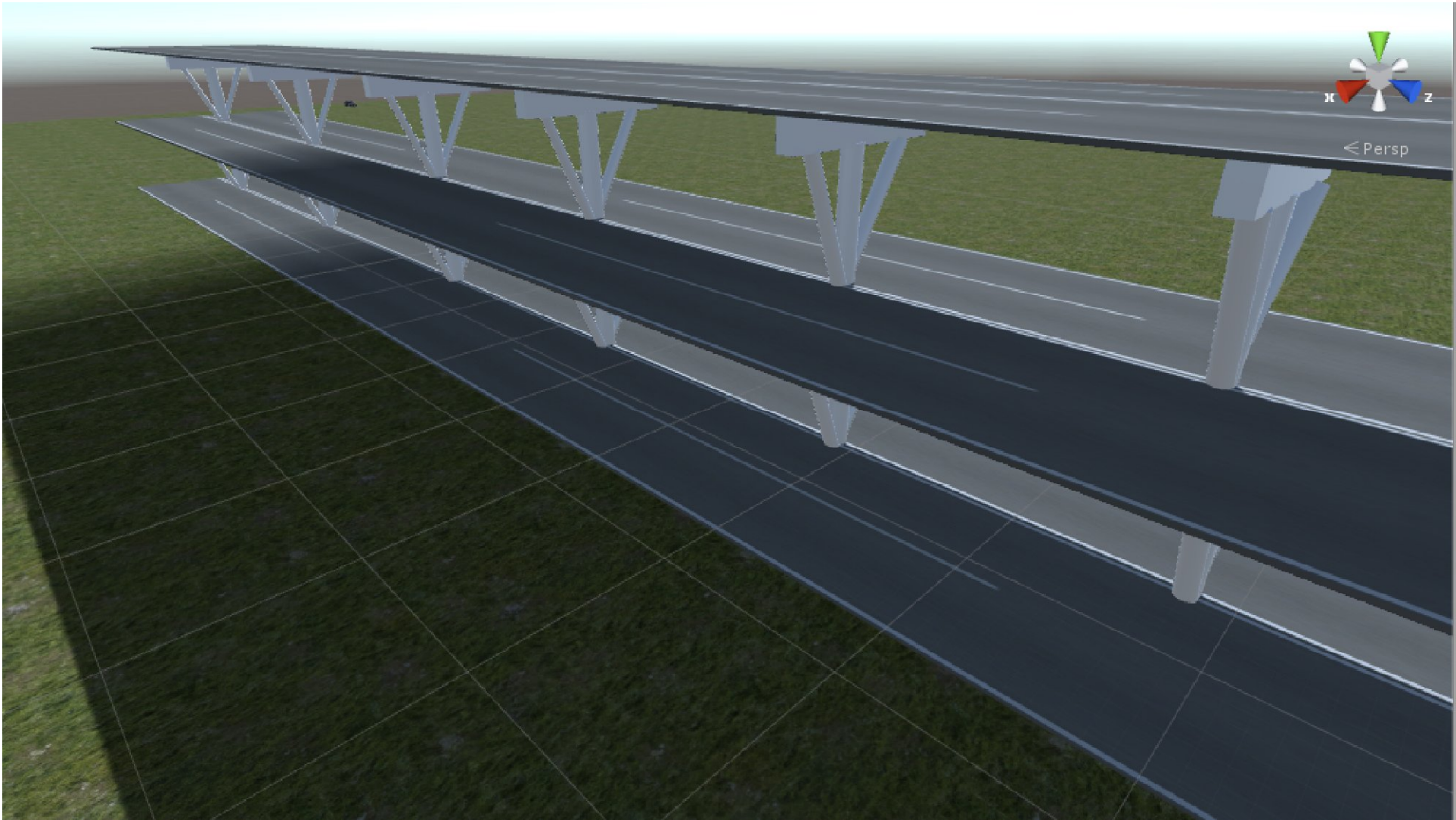
30 responses



Discussion

A strict lane is not conducive unless we increase number of lanes or we base it on engine capacity but that is not possible due to heterogeneity among vehicles. We do not advocate the removal of the lane rule, as the absence of it would lead to accidents and confusion, rather it is to suggest the need for alternate mechanisms.

The most important factor to evaluate is the cost of road widening in congested cities in terms of social upheavals due to land acquisitions, real estate prices and ever increasing population.



Limitations

- **Virtual driving simulators with haptic feedback have some limitations especially in their ability to represent the real-traffic parameters for the immersive experience.**
- **A study towards this compared the reaction time in the virtual simulator and in real driving experiment and found the results were near similar for both conditions with reactions times in the virtual simulator being just slightly better than in the real-driving experiment, as expected.**
- **In the simulator implemented for this study, the 360 degree view in the virtual reality glasses, the auditory input supported by the haptic feedback from the steering wheel and driving in first-person view added to the immersiveness. But, it should be acknowledged that some behaviours in the virtual world might be more aggressive than in real-life as the fear of physical harm is not accounted for.**

Thank You

