Development of a Simple Numerical Model to Test Braess' Paradox and Traffic Flow

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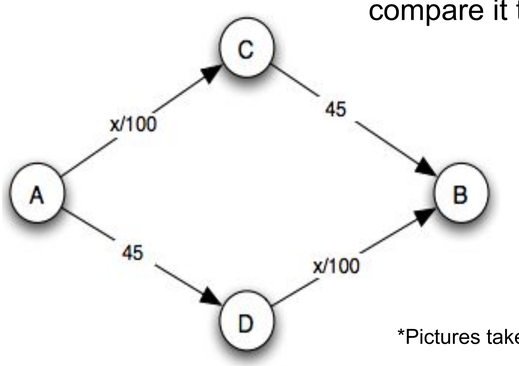
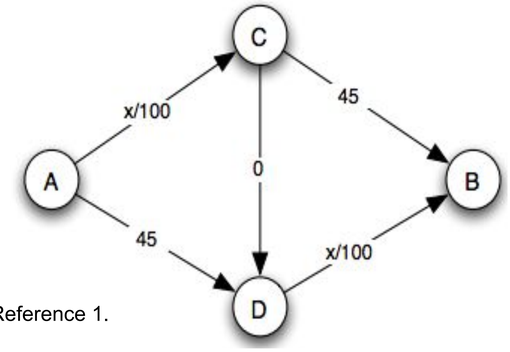
Braess' Paradox Analyzed Through Game Theory

We plan to model Braess' Paradox through numerical calculations and compare it to real situations.



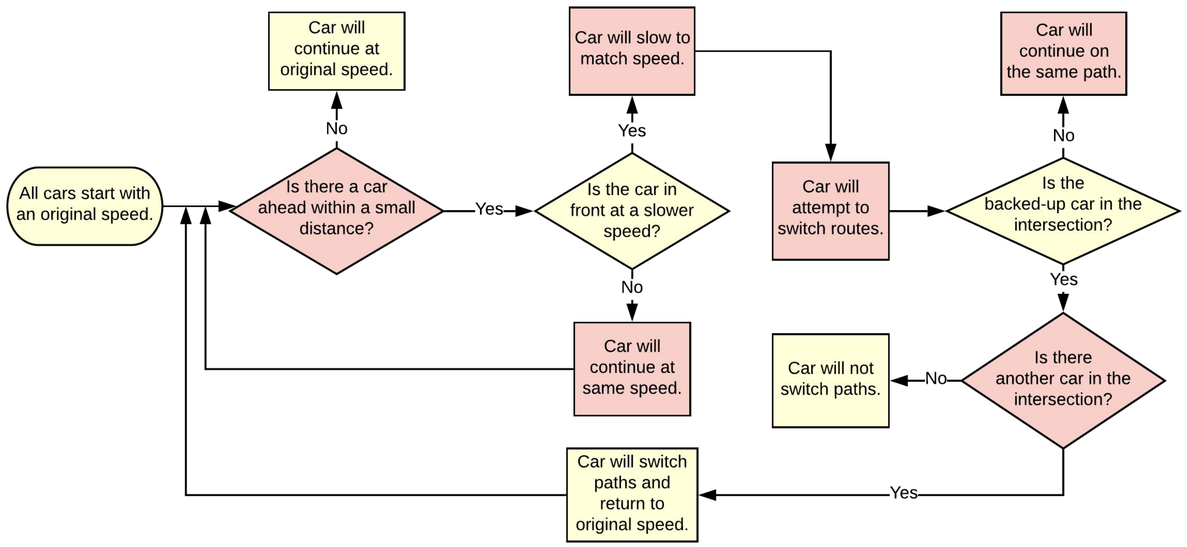


*Pictures taken from Reference 1.

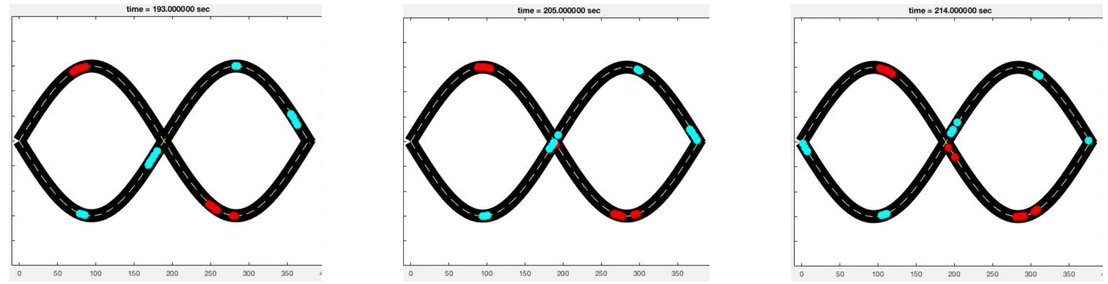
When 4000 cars need to get from A to B, they divide evenly over the two routes at equilibrium, and the travel time is 65 minutes.

Although the highway system has been "upgraded," the travel time at equilibrium is now 80 minutes, since cars use the route through point C to point D.

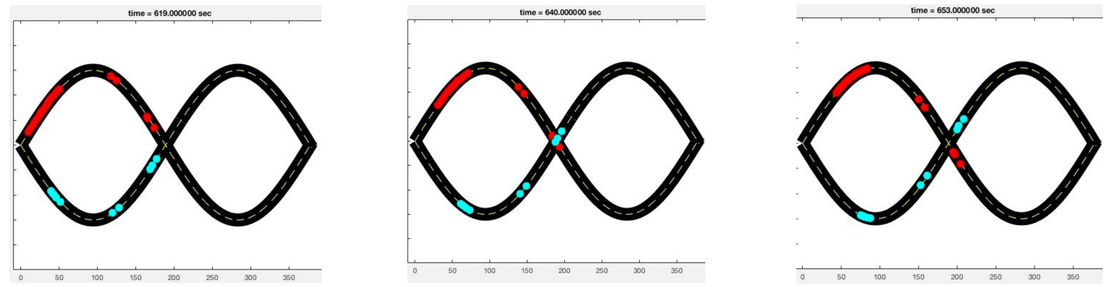
Conditions



Model Development



As blue cars approach the intersection, two of the blue cars switch lanes and become red cars.



Backed up cars, both blue and red, approach the intersection. They do not switch roads because the intersection is already occupied.

Future Research

- The simple numerical model incorporates a set of parameters, such as speed, number of cars, and available paths. The future goal is to:
  - Incorporate various configurations of intersections with personalized parameters to predict whether or not the addition of a road will cause Braess' Paradox to occur
  - Eliminate unnecessary roads from being built and decrease overall travel time
  - Decrease the release of emissions related to the functioning of automobiles
- Our next steps will include comparing the overall changes in travel time when including the ability to switch roads versus not having that ability.

References: [1] Easley, D. & Kleinberg, J. (2010). *Networks, Crowds, and Markets: Reasoning about a Highly Connected World* (pp. 229-240). Cambridge University Press.

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