Airplane Boarding: An Agent Based Model

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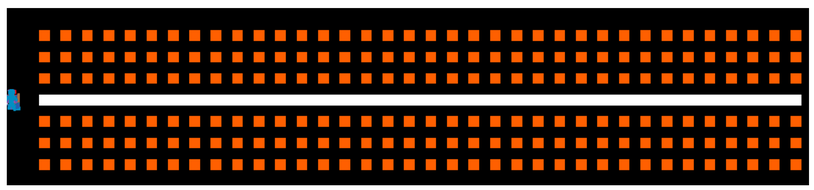
Motivation: The terminal parking rate for an aircraft is roughly $30 per hour (Steffen & Hotchkiss, 2012). A change in boarding strategy may affect boarding efficiency and enhance the airplane's turnaround time, which may lower airline costs.

Introduction

The user has a lot of freedom with this model. Using this model, the user can configure a single-aisle single cabin (Economy) airplane with a minimum of three rows and two seats per row and a maximum of one hundred rows and 10 seats per row.

The model was capable of simulating four distinct strategies: random, front to back, back to front, and window to aisle.



Why ABM?

Each turtle follows the same set of rules, which result in system-wide behavior.

Emergent Behavior

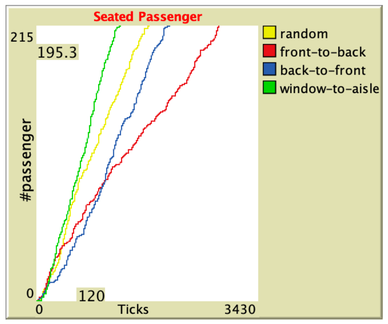
When passengers (turtles) produce a jam (handle carry-on luggage or wait for those sitting next to them to clear the way), a waiting period will occur in the aisle, blocking all passengers behind it and reducing boarding efficiency.

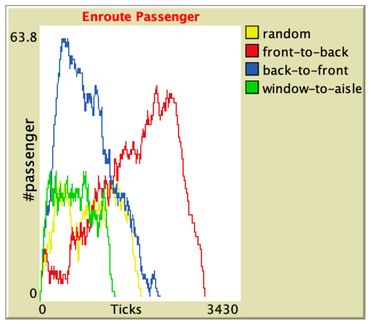
Results

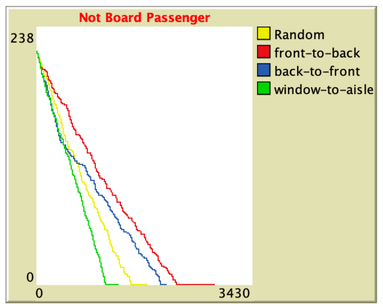
This run is simulating Airbus A321 with 216 seats and 216 passenger without priority boarding passengers.

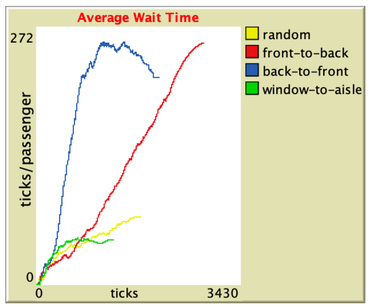
Ending Variable

Random	front-to-back	back-to-front	window-to-aisle
ending ticks: 1746	ending ticks: 2821	ending ticks: 2062	ending ticks: 1293
total wait time: 15494	total wait time: 55133	total wait time: 47246	total wait time: 10141
average wait ti...: 71.731	average wait ti...: 255.245	average wait ti...: 218.731	average wait ti...: 46.949
revenue: 202.8	revenue: -1087.2	revenue: -176.4	revenue: 746.4









Discussion/Conclusions

After running the model numerous times, it appears that windows to the aisle are the most effective and profitable method to board an aircraft, followed by random, back to front, and front to back.

Allowing priority boarding appears to have little effect on boarding time when less than 8% of passengers board early.

Carry-on luggage is the most time-consuming task on an airplane; if the airline does not allow carry-on bags, the time utilization is drastically decreased.

Boarding time is significantly affected by the size of the plane; when comparing the average wait time per passenger on a full 216-seat plane to a 1000-seat plane, the waiting time has doubled or even tripled.

Reference

International Air Transport Association. (2018, October 24). *IATA forecast predicts 8.2 billion air travelers in 2037*. Retrieved June 3, 2022, from https://www.iata.org/en/pressroom/pr/2018-10-24-02/

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