# Chope or Don’t Chope – Determining the effects of ‘choping’ culture on the state of food centres in Singapore

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| **Abstract**  The paper presents an agent-based modelling approach to simulate the behaviour of customers in Singapore’s food centre. The simulation is run on different models of customers’ demographics, each with their own ‘choping’ probability. The resulting state of food centre over time are observed. Once the system reaches steady state, data of various aspects of the customers and food centres are collected. The collected data are then analysed using certain metrics to calculate efficiency of the system given the demographics and the initial state of the food centre. The optimal demographics for a given initial state is then determined using these metrics. |

**1. Introduction**

The culture of ‘choping’ seats in a food centre is one that is unique to Singapore. It refers to the act of reserving open seats in a food centre prior to ordering food. ‘Choping’ are commonly done by placing everyday objects, such as tissue packets, on the table or the chair of food centres. However, other objects, ranging from lanyards to school bags, are sometimes used to reserve seats as well.

Despite the claims of many Singaporeans that ‘choping’ culture is part of their national identity, criticisms have nonetheless been launched, targeting the economical aspect of said culture. Critics claimed that the culture itself is harmful to the economy by making the process of ordering and consuming food in the food centre longer and more complicated that it should be. However, given the locality and uniqueness of the problem, there has been very little studies done on the culture.

This paper aims to provide the answer to such criticism and investigate if there is indeed a negative economic impact of ‘choping’ seats in food centres. This paper proposes the use of an agent-based modelling to simulate the behaviour of the customers as well as their interactions with the food centres and with each other. The simulation is then run over multiple times, each time with different customers’ demographics. In each run of the model, the proportion of customers who prefers to ‘chope’ seats and those who do not are varied. The resulting state of the model is then recorded over time and analysed to determine whether ‘choping’ behaviour has negative impacts on the customers.

**2. Background**

Agent-based modelling is a type of computational models for simulating the interaction of autonomous agents with their environments as well as with each other. The agents receive inputs from their environment, which includes objects as well as other agents. These agents as well as their environments may possess certain attributes, which may be static or dynamic. Static attributes are those that remain constant over time while dynamic attributes may change over time, either independently or through interaction with other objects or agents.

The model used in this paper treats each customer in food centres as an autonomous agent. They operate in an environment filled with other customers, each operating as autonomous agents of their own, and with seats, which are dynamic objects affected by the behaviour of customers.

The customers have three states. They can be looking for seat, queueing for food, or sitting down while eating their food. The order of these actions may vary among customers. Those customers who ‘chope’ will look for seats first before queueing and finally sit down and eat their food. Meanwhile, those customers who do not ‘chope’ will queue for food first before looking for seats and sitting down to eat their food.

As all these interactions occur, the states of the seats will change. Once a customer sits down or ‘chope’ a seat, the seat will change state and become unavailable for other customers. Once the customer finish eating their food and leave the food centre, the seat will change state and once again becomes available for customers to either ‘chope’ or for them to sit and eat their food.

The model aims to simulate these interactions and observe a phenomenon known as ‘emergence’, where these micro-scale interactions will eventually produce a macro-state for the food centres. These macro-states are then analysed to determine whether any demographics of customers with their proportion of ‘choppers’ and non-choppers’ have any significant impact on these macro-states.

**3. Model**

*3.1. Model architecture*

The model consists of a fixed number of agents and objects, each with their own respective states. In addition, there are a few other hyperparameters, which are:

1. Max inflow rate: The number of customers entering the food centre range from zero to this value
2. Number of stalls: Total number of stalls in the food centre
3. Food preparation time: Time taken for each stall to prepare food for one consumer
4. Eating time: The time taken for customers to completely finish their food

By modifying these hyperparameters one at a time and observing the resulting states, the sensitivity of the system with respect to its initial state can be determined.

*3.2 Assumptions*

To simplify the calculations and achieve a reasonable run time for the model, a few assumptions are made. Here are the tables containing all the assumptions as well as reasons for assumptions.

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| ***Assumptions*** | ***Reason for assumptions*** |
| All agent has perfect knowledge of their environment | Most food centres are relatively small, making it easy for customers to see most of the food centre |
| All agents have instantaneous travel time across the food centres | Simplification of parameters to increase speed of model |
| All agents do not reserve seats for other agents who are not in the food centres | Simplification of parameters to simplify the model and reduce computational requirements |
| All agents aim to maximise efficiency by always sitting down on an available seat | Reasonable assumption for customers who want to minimise the time they spend in the food centres |
| All agents immediately leave the food centre once they finish their food consumption | Reasonable assumption for customers who want to minimise the time they spend in the food centres |
| All agents show no preference on which seats to sit down on | Reasonable assumption for customers who want to minimise the time they spend in the food centres |
| All agents have instantaneous decision-making process | Simplification of parameters to increase speed of model |
| All agents have the same eating time, queueing time | Required assumption as controlled variables |

*3.3 Model logic flow*

The model consists of a loop, where each loop represents one minute. At the beginning of each loop, each customer’s time in the hawker centre is updated. For customers who are looking for seat, the time that they spent looking for seat is increased by one. For customers who are queueing, waiting time until they can leave the queue is reduced by one. For customers who are eating, the time until they finish eating is reduced by one.

Once the update of time is done, any change of status is then carried out. For ‘choppers’, those who find seats begin queueing for food and those who finish queueing go to their ‘choped’ seats to eat. For ‘non-choppers’, those who finish queueing begin to look for seat and those who find seats will sit down and eat their food. Once customers finish eating their food, they leave the hawker centre.

For the hyperparameters selected, the model is ran for choping probability ranging from 0 to 100, with a step of 0.1, for a total of 1000 choping probability. Each choping probability is ran for 30 times each and the average waiting time a customer spent waiting for food and seat per run is averaged for all 30 runs. The choping probability value represents the probability that any incoming customers will decide to chope a seat or not. For example, a choping probability of 60 means that each incoming customer, independent of each other and the state of the hawker centre, have a 60 percent chance of ‘choping’ a seats and a 40 percent chance of not ‘choping’ and instead go straight to queue for food.

At the end of the time step, a few customers equal to the inflow rate is added to the hawker centre. Then, for all the customers looking for seats, they are randomly selected and matched to an empty seat in the hawker centre, if there are still available seats. If there are no more available seats, they will continue to look for seats into the next time step.

**4. Results**

Preliminary results of the data seem to suggest that the act of ‘choping’ does not have any effect if the hawker centre is not fully occupied. If there are still available seats for customers, either for ‘choppers’ or ‘non-choppers’, the act of choping does not influence the average waiting time that customers spend in the hawker centre. As seen in the diagram below, when number of seats is large enough, the choping probability have no impact on the average waiting time.

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| Given the hyperparameters used, for total seats of 70 and above, the average waiting time is constant regardless of choping probability | |

However, when the hawker centre reaches full occupancy, the act of ‘choping’ begin to influence the average waiting time. As initially expected, an increase in the ‘choping’ probability results in an increase in the average waiting time. However, for each run where ‘choping’ probability have an impact on average waiting time, the average waiting time seems to drop from choping probability of around 60-70 percent all the way to 100 percent. As seen in the diagram below, when total number of seats are low, the average waiting time seems increase over time until choping probability of around 60 to 70, where it begins to drop until choping probability of 100.

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| Given the hyperparameters used, for total seats of 60 and below, the average waiting time is affected by choping probability | |

**5. Conclusion and discussion**

The model seems to show little to no effect of choping probability on customers’ average waiting time for when the hawker centre is not fully occupied or around full occupancy. However, the choping probability displays an interesting behaviour for when the hawker centre is severely overloaded, where a significant increase to average waiting time is observed, most likely due to the build-up of customers. However, this is unrealistic as customers will not enter hawker centre if it is visibly full. Some may even leave if they are unable to secure seats or if the queue is not moving fast enough.

Given the assumptions used in this paper as well as the results observed, this paper concludes that ‘choping’ culture has little to no effect to customers’ average waiting time.

However, it is important to note that real-world food centres are very complex systems with autonomous agents making decision every second, where these decisions will influence their behaviour and the behaviour of those around them. As such, the model presented in this paper might not fully capture the richness of the interaction between customers in the hawker centres and their environments as well as with each other.

Further research may want to incrementally relax the assumptions used in the model as well as include more minor hyperparameters which may influence customers’ decision making in real-world food centres, such as walking speed or customers coming in groups.

Also, further research may conduct a full-run data collection on actual hawker centres: monitor their inflow and outflow as well as the activity of individual customers in the hawker centre. Such real-world data may be beneficial in ensuring that the model is realistic and successfully replicate the real-world hawker centre to a reasonable degree of accuracy.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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