**3. Description of the Model**

To simulate the behaviors of people during an Apero, social force model that has been suggested by Helbing **[Ref no],** is used with some modifications. This model explains the motion of people due to force fields occurring from their destination, obstacles and other people. During an Apero, all the people have destinations, either food or an empty table, their motion is limited by the walls, tables and the position and motion of other people. Thus, this model is thought to be suitable for this simulation.

**3.1. Force due to destination**

In real life, people go towards their destination by facing to that point, and trying to move around a constant velocity. This force model acts like a simple proportional controller, where the inputs to this controller are the actual velocity vector and the desired velocity vector.

Desired velocity direction, can be defined as in **Eq[x]**, where as denotes the actual position, indicates the position of the destination of the pedestrian α

So the force on a pedestrian can be written as the multiplication of a constant with the difference of desired velocity vector and the actual velocity vector, as in **Eq[x+1],** where is the desired speed and is the actual speed of the pedestrian α

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**3.2. Force due to other pedestrians**

Another important thing that effects the motion of a pedestrian is the behaviors of the other pedestrians. People get uncomfortable due to other people mainly in 2 cases. First, if somebody is too close to them; second, if somebody is moving towards them.

By using these 2 facts, force exerted by a person on other people are defined to be occur from a monotonic decreasing force field with elliptical shape, where the major axis of the ellipse coincides with the velocity vector of the person who exerts the force. Monotonic decreasing part makes the force weaker when the distance between 2 people increases. Elliptical shape makes the force stronger on the points which towards closer to the direction of the person velocity. This effect can be shown as in **Eq[x+2]**



is the force exerted from pedestrian to pedestrian α, is any monotonically decreasing function, is the position of β with respect to α and b is the length of the semi minor axis of the described ellipse which is defined in equation **Eq[x+3].**

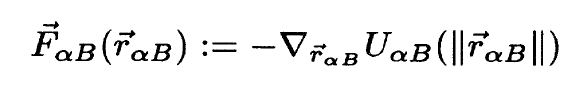


If force is defined like this, a person would be effected same as other people who are behind him/her as the people who are in front of him/her. To avoid this, calculated force is multiplied by a coefficient w, which is defined as :



Where c is taken a value between 0 and 1.

**3.3 Force due to obstacles and walls**

People gets uncomfortable as they gets closer to the walls and obstacles. This effect can be visualized as a force coming from the obstacles whose magnitude increases monotonically as the distance between people and obstacles decreases. Thus, similar to the force between people, force due to walls can be described as follows:  
  


Where is the force between pedestrian α and obstacle B. And is any monotonically decreasing function with respect to distance between pedestrian and obstacle. Details of that function is explained under the implementation section.

**3.4. Total Force**

Resultant force at a time instant on a pedestrian is simply the sum of force due to objective, forces exerted by all of the obstacles/walls and forces from every person in the room. This is shown in **Eq[x+6]**

