

CAKE-BAKING EXPERIMENT

14. More General Models

The goal of the experiment is to study the impact of baking time and temperature on the taste of the cakes. The baking time and temperature occur at three levels each, low, center, and high. However, the quality of cakes does depend also on some other factors such as humidity of the room the cakes are baked, or the amounts of ingredients used to bake the cake. Factorial designs provide a useful framework in which to add and delete factors as a study progresses.

For instance, an experimenter may wish to learn the effect of humidity on the cakes. If the humidity of the room can be controlled, this factor might be studied at two or three levels. The experimental design is then displayed in a three-way table. If the experimenter notices that the quality of the cakes is not much affected by realistic variations in baking time, the time factor could be eliminated and a two-factor study involving temperature and humidity pursued.

The quality of cakes also depends on the deviations of the amounts of ingredients used in the cake from the values specified in the recipe. The amounts of some of the ingredients such as butter, corn oil, flour, milk, and baking soda seem to be critical for the quality of the mix. It is possible that even small deviations from the values specified in the recipe may change significantly the quality of the cake.

On the other hand, the cake will perform well for a wide variety of users if the mix bakes satisfactorily *at ranges* of baking temperatures, time, and amounts of ingredients. We assume here that the ranges are not very wide, but correspond to inaccuracy of measuring equipment (scale, cup size) and imprecision commonly observed in the kitchen conditions. Therefore, a more general model might be developed with the amounts of ingredients as additional factors. Each of these factors would occur at three levels, low (10% below the value stated on the cake mix package), center (the value stated on the cake mix package), and high (10% above the value stated on the cake mix package). Based on this model, it would be possible to say which ingredients are critical to the performance of the cake mix.