# FACES
## by Kathleen Martin, Donna Bearden, and Bill Craig

*I found this microworld in three publications - all of which came from the same source - the work of Kathleen Martin and Donna Bearden. I first saw it several years ago in Microquests (V. 1, No. 7) and I was reminded of it when I saw another description of Faces (Making Faces— Hundreds of Them) in a recent issue of Classroom Computer Learning, (March, 1989. Bill Craig also wrote about this microworld in the Virginia Mathematics Teacher Journal.*

"Probability in the primary grades? Why not? Although young children cannot be expected to find formulas or make complex mathematical calculations, they are ready for an introduction to the world of permutations and combinations. The old "Potato Head" game suggests an approach that encourages children to learn about attributes, make comparisons, and practice grouping and organizational skills as they explore combinations of facial features."*(Making Faces - Hundreds of Them, CCL, 3/1989, p. 56)*

The first procedures that students will use draws different features of the face:

| | |
|---|---|
| HEAD | erases the screen and draws a blank face. |
| CROSSED | draws crossed eyes |
| SLEEPING | draws sleeping eyes |
| WINKING | draws winking eyes |
| TRIANGLE | draws a triangular nose |
| NORMAL | draws normal eyes |
| BUTTON | draws a button nose |
| PLAIN | draws a plain nose |
| SMILING | draws a smiling mouth |
| FROWNING | draws a frowning mouth |
| SINGING | draws a singing mouth |
| BUSHY | draws busy eyebrows |
| ARCHED | draws arched eyebrows |

Students of all ages will want to experiment with the procedures to see what the different combinations look like. (Students knowledgeable in Logo programming may want to add their own facial attributes (e.g. freckles.)

Some questions that might be appropriate to ask:

How many different combinations of eyes and eyebrows are possible?
How many combinations of eyes and eyebrows are possible if there are no crossed eyes?
How many different combinations of eyes and mouths are there?
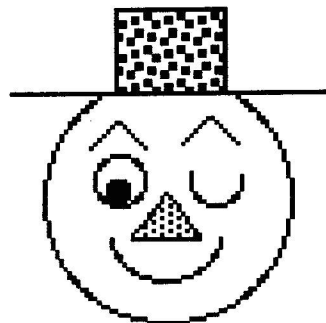


Students might initially answer these questions by listing and counting the possibilities but soon realize that the number of combinations is equal to the product of the features.

The use of the RANDOM statement allows students to simulate probability experiments. Procedures can be written that pick at random each of the features. For instance, the probability of either eyebrow comes up is 1/2 and the probability of any noses is 1/3. These procedures allow students to conduct probability experiments similar to flipping coins and rolling dice. Note that BROWS will pick at random either bushy or arched eyebrows.

Terrapin Logo

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TO BROWS
MAKE "NUM RANDOM 2
IF :NUM = 0 BUSHY PR [BUSHY EYEBROWS]
IF :NUM = 1 ARCHED PR [ARCHED EYEBROWS]
END
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Similar procedures can be written for the eyes, mouth, and nose.

Questions:
What is the probability of getting a button nose?
What is the probability of getting bushy eyebrows?
What the probability of getting bush eyebrows and a button nose? Δ

*In the Virginia Mathematics Teacher article, Bill Craig thanked Betty Blanton and her students at Beulah Elementary School in Chesterfield County for making faces!*