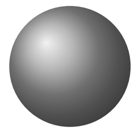

Figure 1: The white ball.

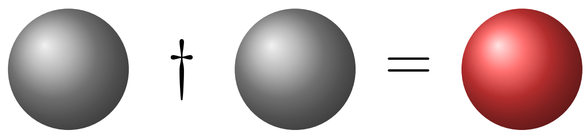

Figure 2: Two white balls in the machine produced a red ball when the $\dagger$ button was pressed.

1 Early encounters

I saw objects sort of like molecules, balls of different colors joined by bars. Pairs of objects were placed in some kind of machine with four buttons, labeled $\star$, $\triangle$, $\bigtriangledown$ and $\dagger$. After the pressing one of the buttons the original objects were gone, replaced by a new object. He showed me many demonstrations of this, pressing different buttons, with differently colored balls coming out connected in various ways. It was clear that he we trying to show me what this machine did, the look on his face said "you see, yes?" I tried to write down as much as I could afterwards, hoping that he would show me more next time. The colors definitely have meaning, there is a structure there. Two white balls make a red ball when you push $\dagger$ and a red and white ball make a blue ball when you push $\dagger$ (whether you blue white in the first or second slot does not appear to matter). He showed me a few with the $\star$ button as well. A red and blue ball with $\star$ makes just joins the balls by a black bar.

I thought I was starting to see the pattern, but then he showed me that a

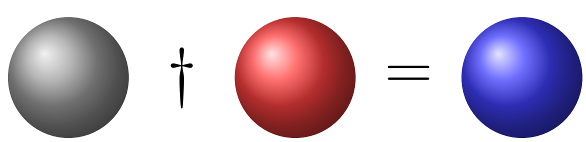

Figure 3: A white and a red ball in the machine produced a blue ball when the $\dagger$ button was pressed.

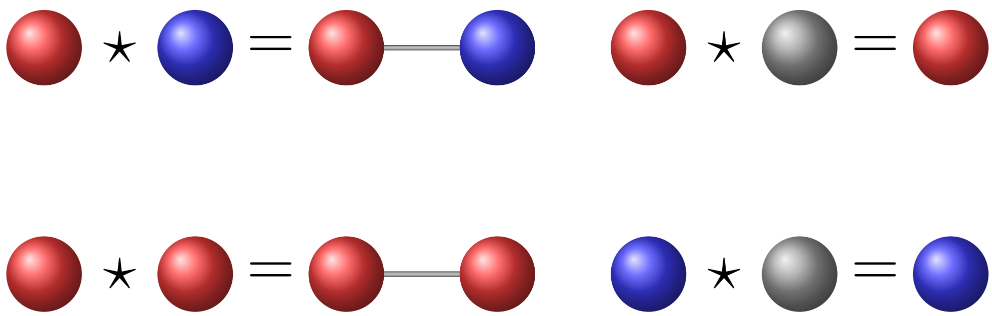

Figure 4:

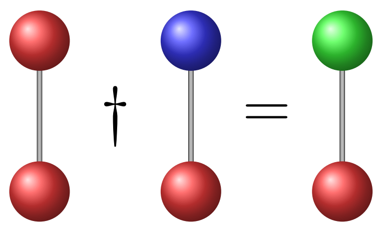

Figure 5:

white and blue ball with $\star$ gives just a blue ball. Then things started to get really weird, with new ball colors appearing with no immediately apparent pattern. He showed my more images than I readily reproduce without it becoming overwhelming.

2 Possible patterns in the noise

After four or five more encounters with this being, I was starting to have some guesses at some basic rules he was trying to communicate through all these examples. Pressing the buttons appears to start some sort of reaction inside the machine that combines the two objects. So, it makes sense to view $\star$ and

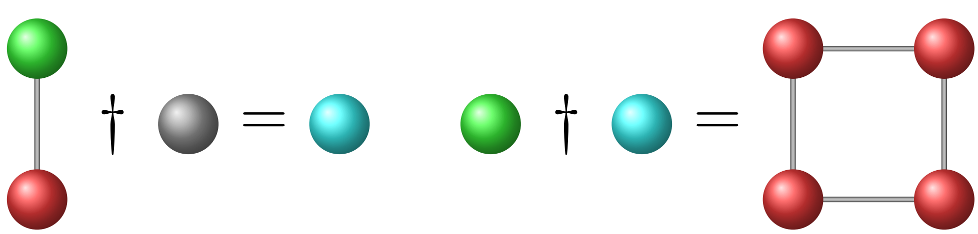

Figure 6:

$\dagger$ is associative	$a \dagger (b \dagger c) = (a \dagger b) \dagger c$
$\dagger$ is commutative	$a \dagger b = b \dagger a$
$\dagger$ is distributive	$a \star (b \dagger c) = (a \star b) \dagger (a \star c)$
$\star$ is associative	$a \star (b \star c) = (a \star b) \star c$
$\star$ is commutative	$a \star b = b \star a$

Figure 7: Some plausible rules I will assume until proven wrong.

$\dagger$ as binary operations. In all the examples I have seen, these operation have nice properties in that they are both associative and commutative. Actually based on the complete structures, they are not quite commutative, but if we consider two objects the same if they have the same number of balls of each color, then the operations are commutative. There is further structure in how the balls are connected by bars that does not behave commutatively, but I don't yet have enough information to even guess at how the operations work with this structure. For now, I am going to call two objects the same if they have the same number of balls of each color.

Definition 1 *A* ball sequence *is a sequence of natural numbers. Each slot gives the number of balls of a given color in order (white,red,blue,green,yellow,cyan,magenta, ...). Of course, these are just approximations of the colors I saw and there were many more. We will add to the list as needed.*

Conjecture 1 *The only ball sequence with a white ball is* $(1, 0, 0, 0, \ldots)$.

Conjecture 2 *The ball sequence* $(1, 0, 0, 0, \ldots)$ *has no effect when using* $\star$*, that is* $(1, 0, 0, 0, \ldots) \star b = b$ *for all ball sequences* b*. In the absence of white balls,* $\star$ *button just adds the values in each slot. That is,*

$$(0, a_2, a_3, \ldots) \star (0, b_2, b_3, \ldots) = (0, a_2 + b_2, a_3 + b_3, \ldots).$$

In particular, $\star$ *never creates new colors.*