Equalspeak: math-aware LaTeX 2ε accessibility (version 0.1 alpha)

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The following is a demonstration of using LaTeX2_ε to help make math communication accessible.

In the first example I create the following command in LaTeX 2_ε. Don't worry about what it means but know that many math content creators communicate in this way.

```
\begin{align*}
    \pmat{ 5.2 \\ 0 \\ 4.3 }+\pmat{ 1 \\ 1 \\ 1}-
    a\cdot \pmat{ 5.2 \\ 0 \\ 4.3}+b\pmat{ 1 \\ 1 \\ 1 }
\end{align*}
```

Traditional LaTeX 2_ε converts that code into visible symbols as shown below, but when read aloud by standard software it becomes confused, misleading, even wrong.

$$span\left\{\begin{pmatrix}5.2\\0\\4.3\end{pmatrix},\begin{pmatrix}1\\1\\1\end{pmatrix}-a\cdot\begin{pmatrix}5.2\\0\\4.3\end{pmatrix}\right\}$$

Now you may not understand the math, and that is not the point!

But I can tell you that the way I read the symbols out loud was wrong, very wrong. It it can even be worse on other read-aloud programs. And that is because math symbols are not read left-to-right, top-to-bottom but use a mix of directions, orders of operations, and historical pronunciations.

Now without changing any of the content, we instead use Equalspeak to tell LaTeX 2_ε to instead print out words that would be associated with reading the mathematics aloud. Our example comes out like this.

---

span the set of the matrix 5.2 end row O end row 4.3 end matrix,
comma the matrix 1 end row 1 end row 1 end matrix,
minus a, times the matrix 5.2 end row O end row 4.3 end matrix,
end of set

Yes, that last example might still be confusing, but now all that confusion is down to what we do or don't yet know about the math. It is in fact a faithful description of what the visual equations tell a reader, but done in words.

The good new is that math content creators really know how to explain the math confusion, so we can let them now do what their good at.

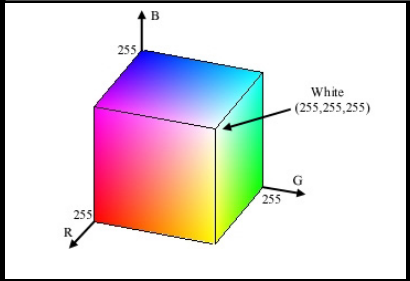
It is important to explain that the original content, the math expression, is the same snippet of LaTeX2ε code in both examples.

Thus content creators can write their usual formulas and then at a later time decide how to output the results, producing perhaps one or more versions appropriate to the needs of accessibility.
There can even be hybrid versions.

The next example concerns images, which because those are created outside of LaTeX2ε will require content creators to help label the image with useful alternative text. Here is our example.

```
\includegraphic[
    width=2in,
    alt={A cube with exposed faces shown as a gradient of c
    changing from red in the lower left, to yellow lower
    middle, green lower right, cyan upper right,
    blue upper middle, purple upper left, and
    white in the center.}]
    {colorcube.jpg}
```

The result in a visual only mode is an image. In some viewers like Adobe Acrobat and Apple Preview this will have also assigned alternate text to the image so that on mouse over or clicking we get the clarifying information.



By changing the mode to be read-aloud, LaTeX2$_\varepsilon$ can instead remove the image and print just the alternate text.

A cube with exposed faces shown as a gradient of color changing from red in the lower left, to yellow lower middle, green lower right, cyan upper right, blue upper middle, purple upper left, and white in the center.

The system is not perfect, in fact there are still a lot of hacks. But we know enough to know it works and will get better.

Content creators of mathematics can use what we have with minimal changes to their normal and practiced modes of working and achieve this result because LaTeX2$_\varepsilon$ content is dripping with the information necessary to communicate in numerous modalities.

If you have questions or suggestions we are open to reading **and** listening.