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Science and Engineering Division Notes

July 1, 2019

# Introduction

The method for typesetting mathematics as a blind person without sighted assistance takes several software packages to set up. It does work well with refreshable braille and the output is high quality that can be submitted for publication, saved as a PDF file and shared with other engineers or scientists, or saved as a PDF and e-mailed to a professor if it is a problem set or homework. One important thing to stress is that the mathematics are editable as a blind person. A sighted colleague using only the programs MSWord and MathType could make changes and the blind person could read or edit as necessary. My personal experience is using Windows 10 with the various software programs. I personally use the Duxbury Braille Translator from www.duxsys.com to generate a .brf file. The .brf file displays the math notation in the Nemeth Braille Code. I review the .brf file with refreshable braille opened in notepad or I send the .brf file to a braille printer and review it in hard copy. I use the Brailliant BI 40 refreshable braille display from Humanware at www.humanware.com and recommend it. I have asked a sighted assistant countless times to typeset several pages of handwritten math notation in MathType with MSWord. Sometimes I will ask an assistant to type up the equations on a few pages in a textbook so that they are readable using this method. Neil Soiffer is a long time poster to blindmath@nfbnet.org and a good resource for MathType questions. He writes part of the discussion below. Emily Schlenker recently reported to me that she is typesetting math independently using NVDA and reviewing her output with speech only. Below I also provide some notes from Emily about the tools she is using.

I have used Matlab from Mathworks to make plots for engineering school assignments or to do calculations at work. Personally I use Matlab by opening it from the Windows command prompt with "matlab -nodesktop".

Some report that the user experience is good when the Java Access Bridge has been properly installed on your computer. This should allow stepping through Matlab code in the debugger and other useful features of the typical Matlab experience.

I include a note from Timothy describing how to install the java access bridge.

Jonathan Godfrey writes about the meaning of independent access to math. A section is also provided about efficiently using Windows 10.

# Typesetting and Editing Math Documents

Louis Maher has an interest in creating and editing math documents as a blind person.

You can reach Louis Maher at mailto:ljmaher03@outlook.com.

Louis Maher wrote the following brief note:

Hello,

One way to write mathematics is to use Microsoft Word with the MathType application "http://www.wiris.com/en".

You might also need MathPlayer

"http://www.dessci.com/en/products/mathplayer/download.htm".

Traditionally NVDA worked best with these tools; however, JAWS have improved its mathematical capability.

Regards

Louis Maher

Louis Maher posted to nfbcs@nfbnet.org on June 21, 2019 the following message.

He was replying to Jim Fettgather Jim Fettgather at jfettgather@alphapointe.org.

Hello Jim,

I have not used MathType that much. Here is a part of a note from Neil Soiffer and Doug Miron.

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You can use Word+NVDA+MathPlayer+MathType to author and read math if you are willing to learn the math component of LaTeX. If you already have a document with math in it, then the above combination will work for \*reading \*and navigating the math by speech. If you want to author math, then in Word you can type in some LaTeX between $ $ and use MathType to convert that into MathType math (so it looks nice), which can then be spoken and navigated. Given that it is easy to make a mistake in LaTeX, hearing the math gives you a way to know that you have typed it correctly. If you didn't, then you covert it back into LaTeX and edit it and listen again.

FYI: changing between LaTeX and vice-versa is done with "Toggle TeX" which has the keyboard shortcut alt+\. As the name "Toggle" implies, alt+\ will also change the MathType equation back to TeX.

Here is a concrete example, if you want to write "the integral from 0 to 10 of x times e to the negative 2x power, d x", you would type into Word:

$\int\_0^{10} x e^{-2 x} dx$ alt+\

Press left arrow to move before the math to make NVDA read the math to you.

If you made a mistake, type alt+\ and move right to edit the LaTeX.

FYI: when I initially typed the example, I made a common TeX error of not putting the "10" inside of {}s. Be careful to add braces to any subscript or superscript that is more than one character.

Neil Soiffer

Use insert equations to start entering an equation.

under home paragraph put exact line spacing for accurate latex hearing.

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Doug Miron sent the following note about entering equations in MathType.

I don't use the alt-backslash before typing LaTex. I've been successful starting the LaTex with $ then typing \begin{equation} or \begin{align}, typing

the equations, \end{...}, $. Then, with the cursor on the $, I use alt+backslash to convert to math symbols. Before I do the conversion, I copy the equation(s)

to the clipboard in case of errors, because I can't reverse the conversion to get the LaTex back. I'm using Windows 10, Word 2016, MathType 6.9 and MathPlayer,

current version. Good luck.

Regards,

Doug Miron

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Regards

Louis Maher

# User Experience with Typesetting and Editing Math

Emily Schlenker is an undergraduate student in biology at Wichita State University in Kansas. She is knowledgeable about lab work in microbiology and has a minor in chemistry. Emily sent the following note to me on June 26, 2019.

Hello,

I would say I am quite new to this math thing, but I would be happy to share my experience. I will try and answer all of your questions the best that I can, but I am not currently using a refreshable braille display. I am using the latest version of NVDA. The add-on is called access eight. I have the most recent version of math player, but I cannot find the actual number. Math player helps NVDA to work with math ML if I understand correctly. I use either word 2016 or office 365. I have the latest version of MathType, but again I cannot seem to read the number. It was not very accessible to install or license. I am hoping to get a braille display soon to use at school.

I hope this helps, and feel free to get back with me with questions you might have.

Emily

# Installing the Java Access Bridge

Timothy Breitenfeldt wrote the following note about installing the java access bridge on June 21, 2019 to nfbcs@nfbnet.org.

The java access bridge can help make the Matlab program be more accessible.

This could help with a more friendly Matlab experience.

Hello,

I don't know a lot about the java access bridge, but I do

know how to enable it. the java access bridge comes prepackaged with

the latest versions of java, all you have to do is enable it. First,

if you have not already, you will need to download java. I am not sure

if you can get away with just downloading the java run time or if you

have to download the java JDK. The JDK is for if you want to develop

java programs, which is what I am most familiar with. There is

supposed to be a way to enable the java access bridge from the control

panel in Ease of Access, but I was never able to find the setting in

Windows 10, and I don't know about Windows 7.

If you have the JDK installed, I know that you can go to:

C:\Program Files (x86)\Java\jdk1.8.0\_181\jre\bin

or something similar if your JDK is a different version. Inside that

folder is a bunch of executable and libraries, you are looking for:

jabswitch.exe

You need to open the command prompt in this directory. Tip, if you

opened the directory in file explorer, a quick way to open the command

prompt in that directory is to press

alt+d, then type cmd and press enter.

and run the command:

jabswitch /enable

You should get the output:

The Java Access Bridge has been enabled.

Not sure why you would want to, but likewise, you can run:

jabswitch /disable

to disable the java access bridge.

It should work now. I have had problems recently with swing

applications not working with jaws for some reason with the java

access bridge enabled, not sure if it is just my machine, or if it is

some versioning problems.

Hope it works,

TJ Breitenfeldt

# Working With Matlab From Mathworks

Matlab from Mathworks can be used to make plots for engineering school assignments or to do calculations at work.

5.1 Opening Matlab

A good blindness accessibility environment can be achieved by calling Matlab from the Windows command prompt with: “matlab -nodesktop”.

5.2 Generating a Plot in Matlab

The example script “runPlotParabola1.m” pasted below, creates an x y plot. The plot is an upward facing parabola that holds water. The line is solid and blue.

% Matlab code for the script runPlotParabola1.m:

x1 = -4:0.1:4;

y1 = x1.^2;

% Recall that the default line type is solid and blue.

% To get the default line type just skip including the line type in the plot command.

% Some line types that can be found with help plot are:

% - -> solid, : -> dotted

% Some colors are:

%b -> blue, r -> red, g -> green, y -> yellow, k -> black, w -> white

% some shapes are:

% x -> x mark, + -> plus symbol, o -> circle, . -> point

s1 = '-b';

plot(x1, y1, s1);

xlabel('x','fontSize',12);

ylabel('y','fontSize',12);

title('plot of f(x) = x^2')

The example script “runPlotParabola2.m” pasted below, creates two x y plots. Both plots are upward facing parabolas that holds water. One parabola is solid and blue, the other parabola is dotted and red.

% Matlab code for the script runPlotParabola2.m:

x1 = -4:0.1:4;

x2 = -4:0.1:4;

y1 = x.^2;

y2 = x.^2+2;

% Recall that the default line type is solid and blue.

% To get the default line type just skip including the line type in the plot command.

% Some line types that can be found with help plot are:

% - -> solid, : -> dotted

% Some colors are:

%b -> blue, r -> red, g -> green, y -> yellow, k -> black, w -> white

% some shapes are:

% x -> x mark, + -> plus symbol, o -> circle, . -> point

s1 = '-b';

s2 = ':r';

plot(x1, y1, s1, x2, y2, s2);

xlabel('x','fontSize',12);

ylabel('y','fontSize',12);

title('plot of f(x1) = x1^2 and f(x2) = x2^2+2')

5.3 Saving a Plot From Matlab

When matlab displays a plot to the screen the plot can be saved as follows. After running the plot command Matlab will create a window named ‘Figure 1’. Bring the window ‘Figure 1’ into focus with ALT-TAB.

To save a plot as a PDF, under File select Save As, select the file type PDF from the dropdown, enter the file name in the dialog box, and type enter or click save to save document. It will automatically choose the Matlab working directory as the destination to save. Note that braille embossers from ViewPlus [www.viewplus.com](http://www.viewplus.com) such as the Tiger, support embossing PDF plots such as from Matlab.

To copy a figure into MSWord, under ‘EDIT’, select ‘Copy figure’. Open MSWord and type ‘CTRL-V’ at the desired location of the figure. In MSWord it is possible to resize the figure to a desired size. To do so, hover over the figure and right-click. Select the ‘size and position…’ option, which will bring up the size options. Incidentally, I found the output to runPlotParabola1.m generated a figure with a height of 4.37” and a width of 5.82” in MSWord. The following edits shrink this figure to 90 percent of its original size. Under height absolute, type in the desired height in inches, such as 3.93”. Under width absolute, type in the desired width, such as 5.24”. There is another way to size the image in MSWord using the scale option. Under scale option, select the desired scale factor as a percentage, making sure the fixed-aspect box is checked. Type Enter or click OK to apply the changes and close the dialog box. To scale an image by 50 percent, set scale with value of 50.

To copy a figure into powerpoint, under ‘EDIT’, select ‘Copy figure’. Open powerpoint and type ‘CTRL-V’ at the desired location of the figure. The powerpoint desired slide will now contain the figure. It can be helpful for the figure to be centered horizontally and vertically. Select a picture that you want PowerPoint to center for you. Click the "Home" menu, followed by "Arrange" and then "Align." Select "Align Center" to center the picture horizontally in the slide. Select align middle to center the picture vertically in the slide.

5.4 Using multiple folders

I have been working with sighted peers who use the standard visual interface for working with Matlab.

Matlab can find a function and execute it successfully if the function is in a folder that is part of the Matlab path. In the visual interface there is a choice for adding recursively to the Matlab path a specified folder and all of its subfolders. The equivalent startup option is:

matlab -nodesktop -r "addpath(genpath(pwd))"

A slightly improved command experience suppresses some information at Matlab startup such as Matlab version with the command:

matlab -nosplash -nodesktop -r "addpath(genpath(pwd))"

I execute this command within the top folder of interest. My sighted peers select the top folder itself to configure this choice.

I have installed Matlab 2018a on my Windows 10 pc.

When opening Matlab with the usual visual GUI, there is a way to add subfolders to the path recursively. To do so, at the file explorer on the left, get to your target folder, right-click the add to path option. There are suboptions "selected folders" and "selected folders and subfolders." Be sure to select the suboption "selected folders and subfolders." This is a toggle option that will allow you also to remove all files and subfolders from path. After adding all folders and subfolders, the toggle option will display remove from path. It again has the suboptions "selected folders" and "selected folders and subfolders."

# Meaning of Independent Access to Math

Jonathan Godfrey posted to blindmath@nfbnet.org on June 24, 2019 providing an answer to the question:

"I am trying to define what access to mathematics means for blind students. Can you help me?"

Hello,

You might be excused for thinking this would prove to be an easy question for many people on this list to answer. I for one am surprised someone hasn't responded yet.

First, I would say that a definition that fits mathematics is likely to serve for many scientific disciplines and given the amount of crossover that exists into the social sciences and some business related disciplines, the question starts to get quite difficult to answer in a concise way. So, my definition uses STEM and any extensions into other disciplines are relevant but not necessary.

Second, the definition is surely dependent on the context to which it must be applied, but perhaps we might manage to word smith to get a definition that encompasses the most elementary beginnings through to the most advanced university courses and on into research or application in employment.

Third, I suspect that my gold standard for access will be seen as a ridiculously unattainable position. Fair enough, so we need a definition that allows us to move from the current position towards my admittedly Utopian target. While we're on that journey, different people will decide that what they have is "access" while others will say it is not sufficient.

My gold standard:

<starts>

Full access for a blind person applying techniques commonly taught in STEM related courses, either in educational or employment settings, as well as for the sheer pleasure of science, can only be verified if the following conditions are met in a way that ensures the blind person's independence and dignity.

1. All material presented by another party must be able to be read by a blind person using whatsoever hardware and software tools provide an equitable outcome as that attained by their sighted peers.

2. A blind person must be able to collect, analyse, interpret, and manipulate scientific data in order to answer scientific questions and communicate the knowledge gained from their results in a way that can be read by their sighted peers.

<ends>

I consider that consumption of what the world has to offer is necessary but not sufficient for the definition. Being able to consume the work of others does not lead to employment or at least constrains the employment options of blind people.

I think my definition is aimed at capability not capacity. That is, we must be able to, not that we must do. For example, there are tools we must understand, but are unlikely to employ because they do not suit our individuality. I love graph theory (nodes and edges etc.) but I do understand that a blind person who cannot manipulate them in their heads may find the idea of manipulating a directed graph to be an absurd method for solving a problem.

I think that at present, many of us have solutions that are reliant on another human. That challenges the independence, but hopefully it isn't challenging the dignity of blind people. All too unfortunately, the reliance on other humans is something we currently have to grapple with in educational settings; the ability to have the same opportunities in employment (or the lack thereof) are (in my experience) often overlooked by blind people. My independence and dignity when completing the STEM aspects of my job are improving; it is a pity that my ability to do the administrative tasks expected of me which now all use technological systems has degraded over the last ten years. I'm all too aware that use of human assistants to meet shortcomings in technology is all too often seen as an acceptable means to gain access. Not having the right human to assist has consequences for a person's dignity let alone our independence.

I hope this provides a good starting point. I welcome the views of others who propose an alternative definition.

Best wishes,

Jonathan

# Efficiently Using Windows 10

You can run a windows bat file by pressing windows-r, typing cmd, and enter to open the windows command prompt. Then type the base name of the bat file such as mn for mn.bat or n for n.bat. This will execute the desired bat file. This is only true if the bat file is in the current directory. You can add your favorite bat files to a directory such as utils and make sure that this directory is included in the path variable. The file mn.bat opens Matlab from the windows command prompt with the -nodesktop option. The following is the text of mn.bat:

matlab -nodesktop

It can be helpful to quickly open a notes file for editing. The file n.bat opens the text file c:\myFolder\notes.txt in notepad.

The following is the text of n.bat:

cd C:\myFolder

notepad notes.txt