

Auditory Test Of Processing Speed (ATOPS): Testing A Novel Tool to Assess Cognition in People With Multiple Sclerosis.

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STEM for Everyone, Wednesday April 12th 2023

University at Buffalo (SUNY)

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Overview

- Background
 - Multiple sclerosis
 - Optic neuritis
 - Neuropsychological assessments
- Methods
 - Inclusion/Exclusion criteria
- Results
- Conclusion
 - Future direction and summary
- Acknowledgments
- References

What is Multiple Sclerosis?

Multiple= *many*
Sclerosis= *hardening tumor (lesion)*

“Many lesions”

- Progressive, inflammatory, autoimmune
- Myelin sheath is broken down
 - Damaged myelin= decreased cognitive processing speed

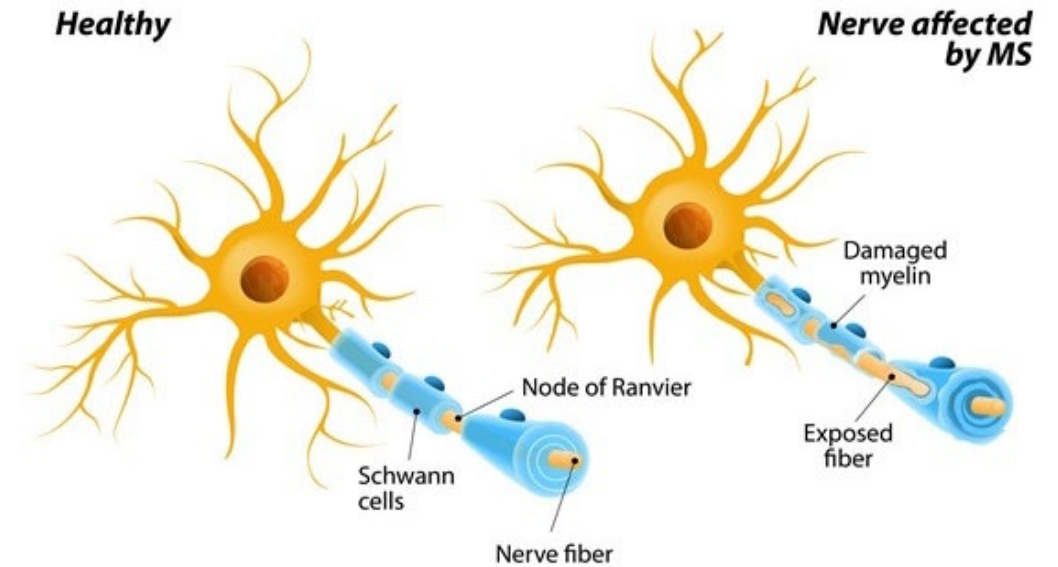


Figure 1. Healthy Neuron & MS Neuron

Optic Neuritis

One of the earliest signs of MS

- Vision loss
- Double vision
- Eye pain
- Blind spots



Figure 3. Clear vision vs. blurred vision

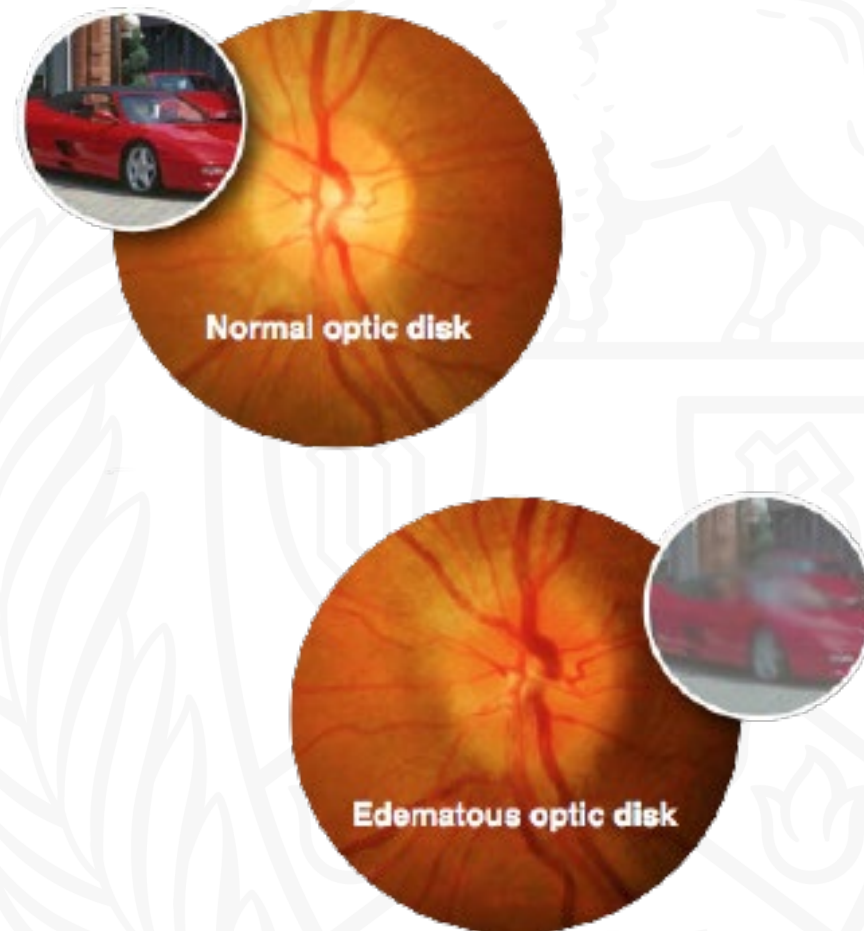


Figure 2. Normal vs. inflamed optic disk

NEUROPSYCHOLOGICAL ASSESSMENTS

Provide additional insight into the
cognitive effects of Multiple Sclerosis.



Neuropsychological Assessments

- Brief Visuospatial Memory Test (BVMT)
 - *Visual learning and memory*
- California Verbal Learning Test (CVLT)
 - *Verbal learning and memory*

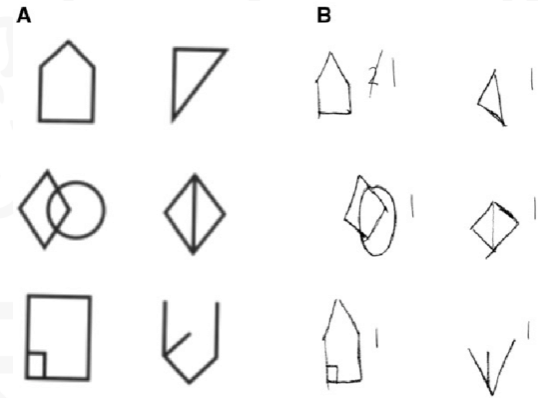


Figure 4. BVMT Sample

CVLT Word List:

- boat
- house
- tree
- window
- mountain
- car
- flower
- sky
- street

Figure 5. CVLT Sample

Symbol Digit Modalities Test (SDMT)

- Gold Standard for assessing **cognitive processing speed** in MS.
- 90 seconds to match as many symbols.
- Number of correct matches= score.

KEY

÷	>	+)	(÷	┌	┐	└
1	2	3	4	5	6	7	8	9

(└	÷	(┌	>	÷	┐	(>	÷	(>	(÷

Figure 6. SDMT Sample

Problem with SDMT.

- Requires visual stimuli
- Optic neuritis can alter assessment of processing speed.

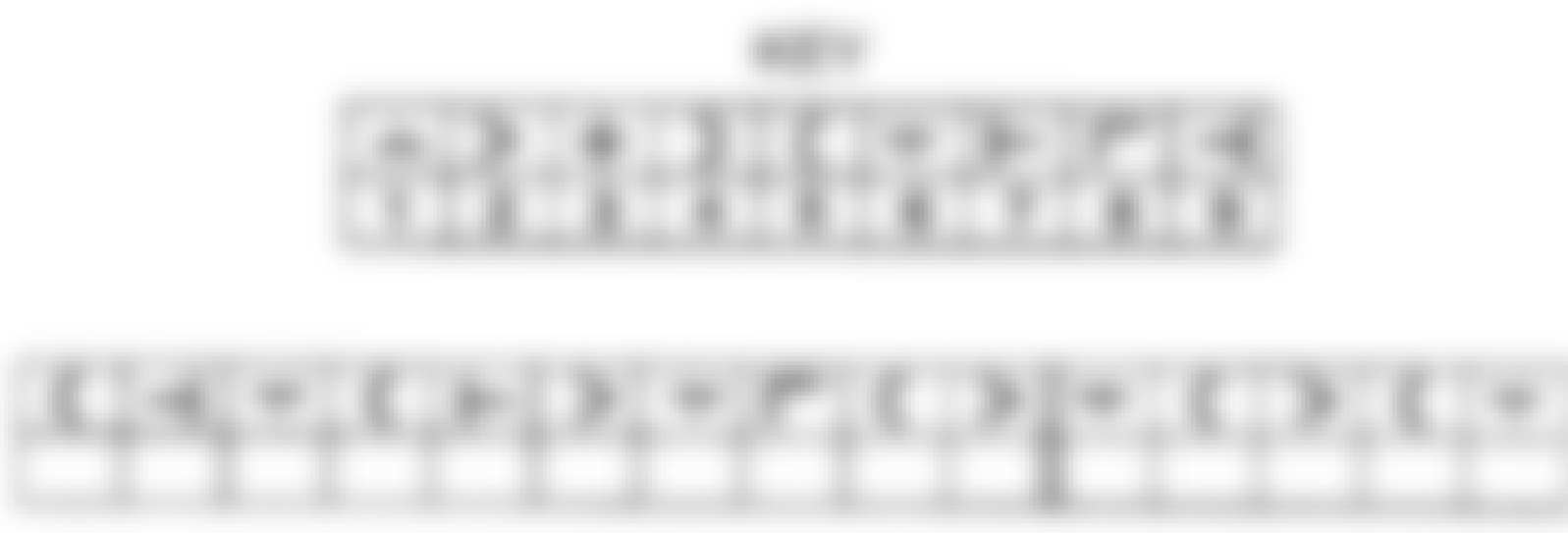


Figure 7. Blurred SDMT Sample

Solution.

- Auditory-based assessment
 - i.e., **No visual stimuli**
- The Auditory Testing of Processing Speed (ATOPS)
- Patient *hears* a series of numbers and answers “Yes” or “No” as to whether the number meets a specific criteria.



Methods

- Recruit healthy controls (HC) and MS patients

Must be over
18 years old

MS diagnosis

At least 20/70
vision

Ability to hear
normal
conversation

Not pregnant

- All participants completed the BVMT, CVLT, SDMT and ATOPS.

Results

- Correlations between the SDMT and ATOPS (Table 1)
- Divergence between BVMT + CVLT and ATOPS (Table 1)
- Score differences between HC and MS patients

Table 1. Pearson Correlation Coefficient	
	ATOPS Average
BVMT Total	-.302
CVLT Total	-.461*
SDMT Total	-.642**

.3= Medium Correlation
.5= Large Correlation

* $p < .05$
** $p < .001$

Future Direction & Summary

- Accessible application for other health professionals
 - Diagnostic tool
- Accessible in other languages
- MS: Neurodegenerative disease, inflamed optic nerve
- Problem: SDMT inaccurate assessment due to optic neuritis
- Solution: Auditory-based test (ATOPS), no visual stimuli

Acknowledgments

- Ralph H. Benedict, Ph.D. ABPP-CN, Mentor
- Michael Jaworski III, M.A. Psychology, Graduate Mentor
- Margaret Youngs, M.S. Psychology, Graduate Assistant
- John Gilles, M.A. Psychology, Graduate Assistant
- Collegiate Science and Technology Entry Program (CSTEP)
 - Grant-funded program sponsored by the New York State Department of Education
- UB Women in STEM Cooperative (WISC) and UB Women in Science and Engineering (WiSE)

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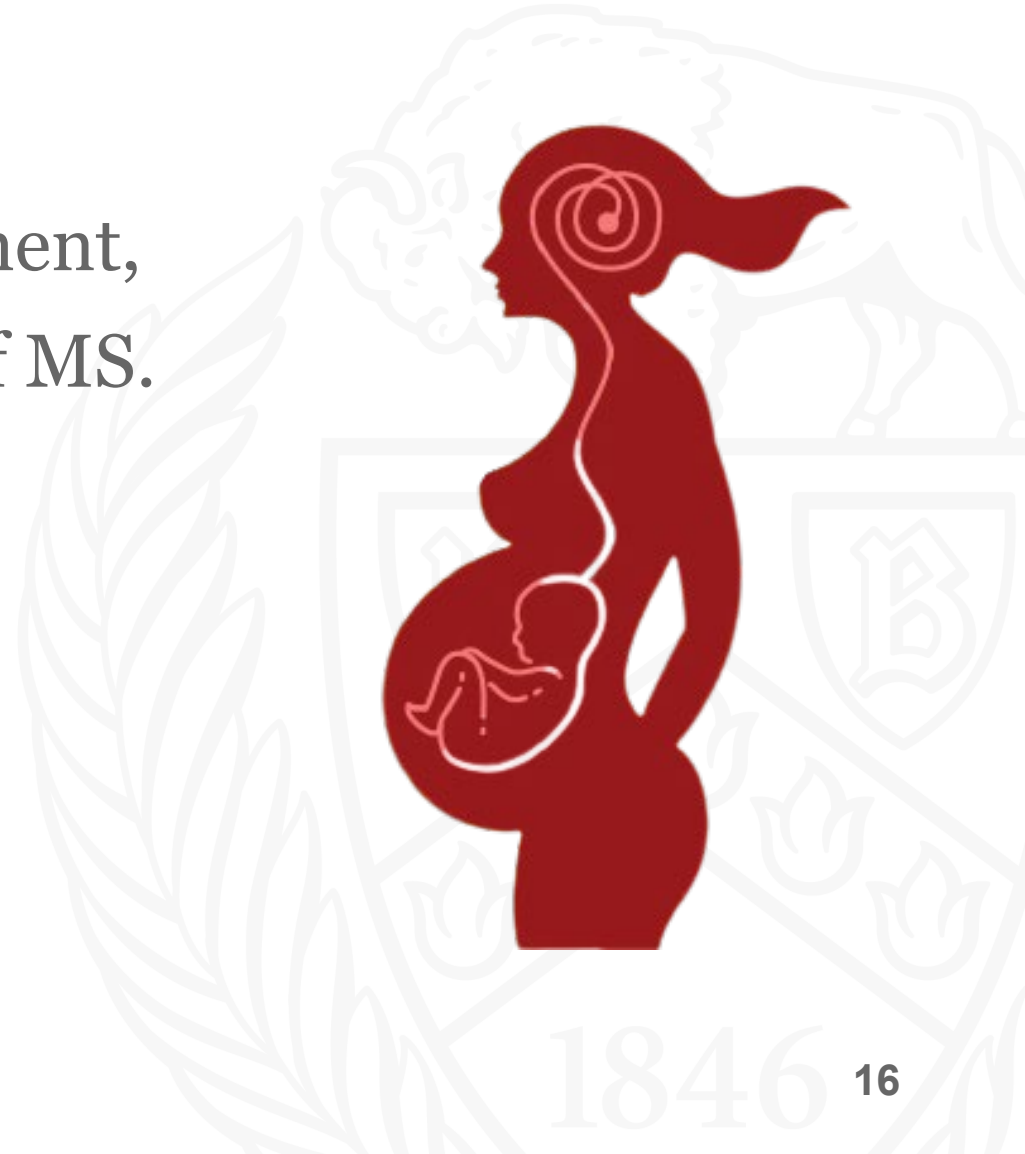
THANK YOU!

Questions can be sent to
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Pregnancy

- MS is known to have a hormonal component, pregnant women **do not** express signs of MS.
 - Autoimmune
 - Extra protective



Why not just wear glasses?

- They can!
- 20/70 vision required for **this study**
- Future assessments can be used for *blind individuals*.



Vision Acuity

- 20/70; someone with impaired vision can see this from 20 feet, but person with perfect vision can see from 70 feet away.

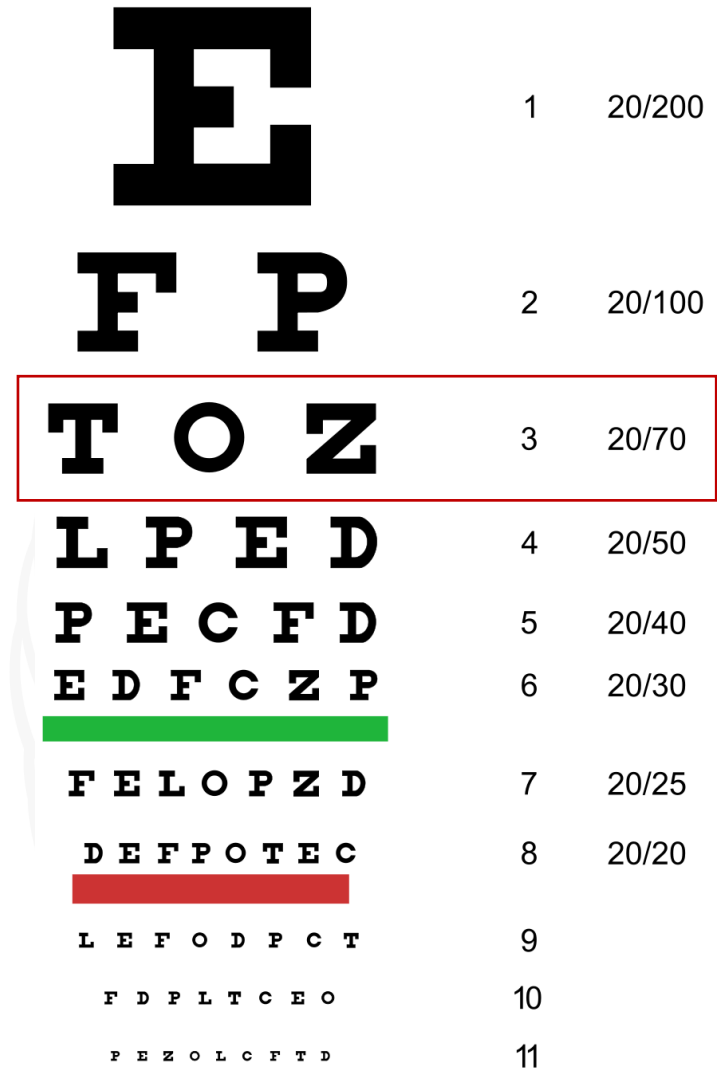


Figure 8. Snellen Eye Chart