



THE READING BRAIN  
IN A DIGITAL WORLD

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100 ANNI  
VITA E PENSIERO  
1918-2018

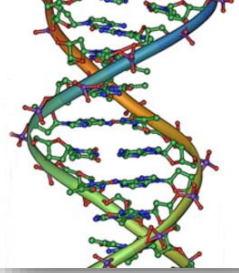


## THE MISSION

Literacy is a basic human right.

Across all learners,  
all ages, all  
backgrounds.

**Gene**



**Classrooms**

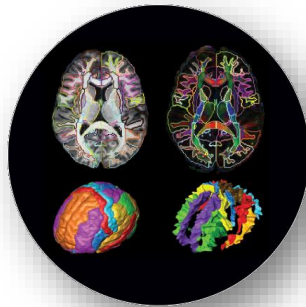


**Cognitive Behaviors**



**THE WORK:**  
Connecting  
Research with  
Education and Vice  
Versa

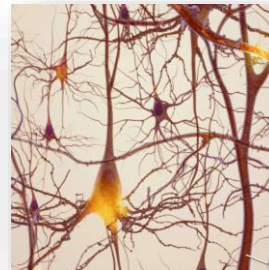
**Brain Areas**



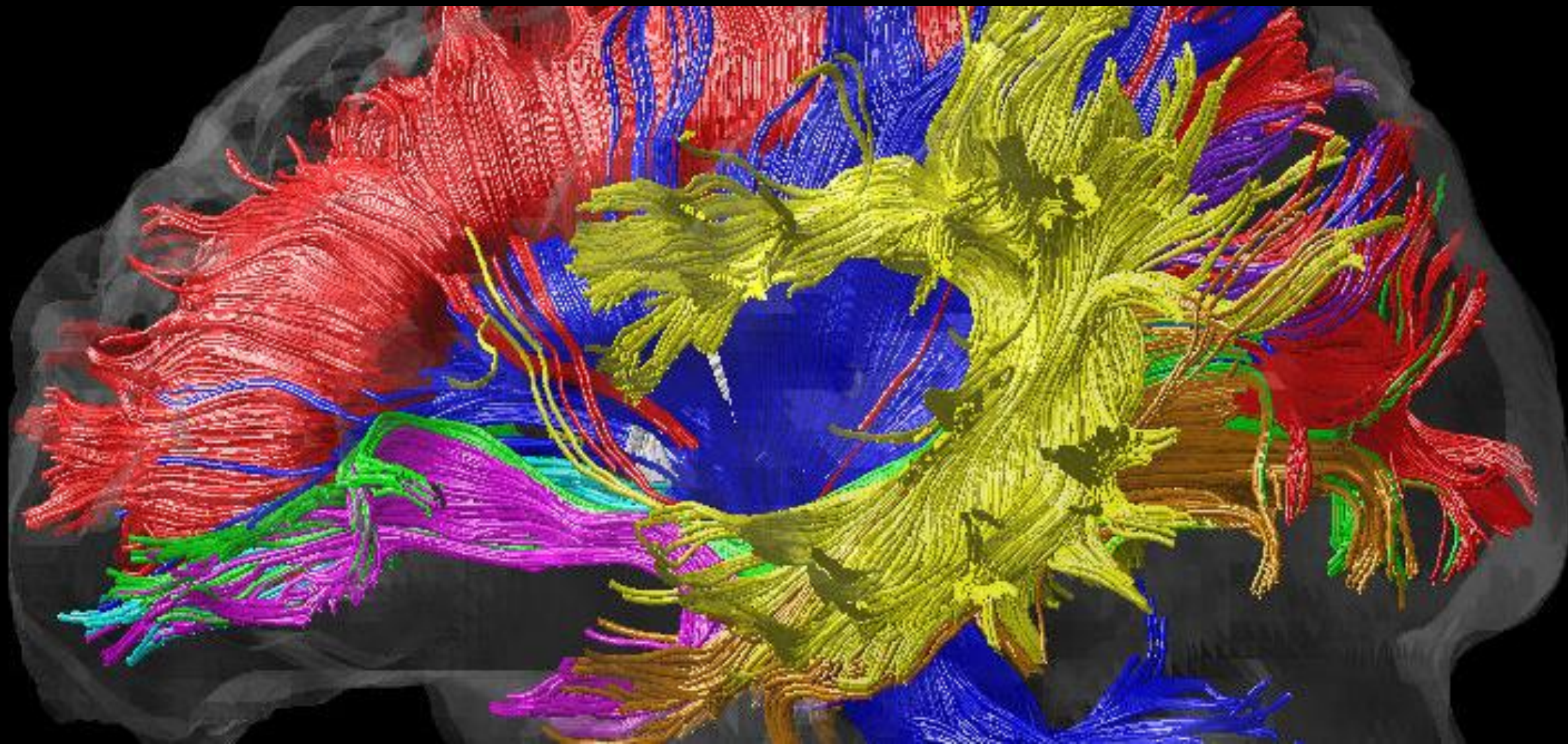
**Cell / Neuron**



**Neural Circuits**



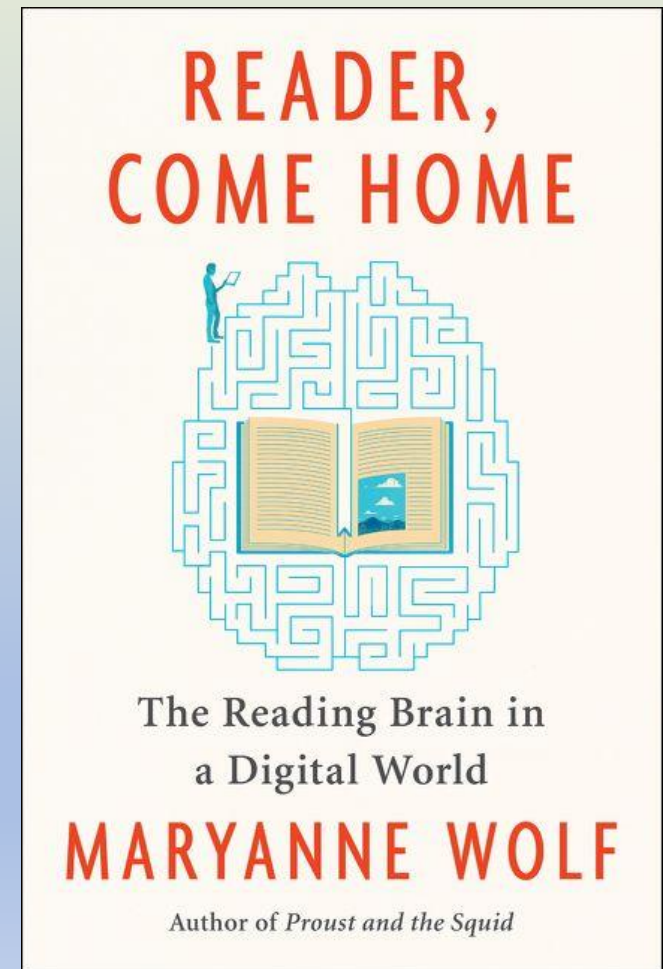
# The Reading Brain Circuit in a Digital World



# Letters for the Present Millennium

## Influences:

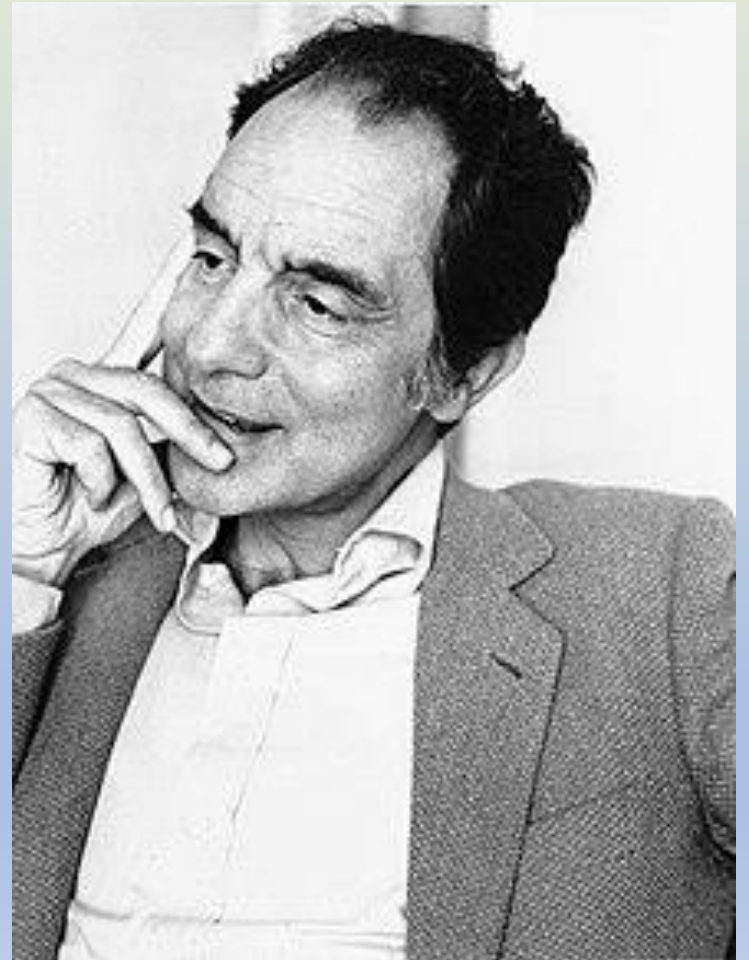
- *Letters to a Young Poet*  
Rainer Maria Rilke
- *Six Memos for the Next Millennium*  
Italo Calvino



## *Six Memos for the Next Millennium*

“In an age when ... fantastically speedy, widespread media are triumphing, and running the risk of flattening all communication onto a single, homogeneous surface... ( we need) a rhythm of time that passes with no other aim than to let feelings and thoughts settle down, mature, and shed all impatience or ephemeral contingency.”

- Italo Calvino, 1986



# Letter as Dialogue Between Author and Reader



“Iron sharpens iron.”  
Thomas Aquinas

“...reading, that fertile  
miracle of communication  
effected in solitude. We feel  
quite truly that our wisdom  
begins where that of the  
author leaves off.”

Marcel Proust



# The HINGE MOMENT: From Print Culture to Digital World

## Great transitions in Communication

1  
Non- language to  
Oral Language

2  
Oral Language to  
Written Language

3  
Written Language to  
Digital Culture





# Reading as the 'Canary in the Mind'

- Literacy changes the brain, which changes the individual, which changes society, which changes the future of the species.

- This has all begun to change.

漢字

𠄎	𠄏	𠄐	𠄑	𠄒	𠄓	𠄔	𠄕
na	a	ša	šu	gal	zi	mu	ma
𠄖	𠄗	𠄘	𠄙	𠄚	𠄛	𠄜	𠄝
bi	an, dingir	kám	im	ú	ši	bad	ri
𠄞	𠄟	𠄠	𠄡	𠄢	𠄣	𠄤	𠄥
ir	ra	ud	dím	ni	aš	hal	mug
𠄦	𠄧	𠄨	𠄩	𠄪	𠄫	𠄬	𠄭
zu	su	šun	ka	ba	la	ád	gu, kú
𠄮	𠄯	𠄰	𠄱	𠄲	𠄳	𠄴	𠄵
bal	zadmin	búi	tar	iti	aššur	arad	ush





# No Binaries

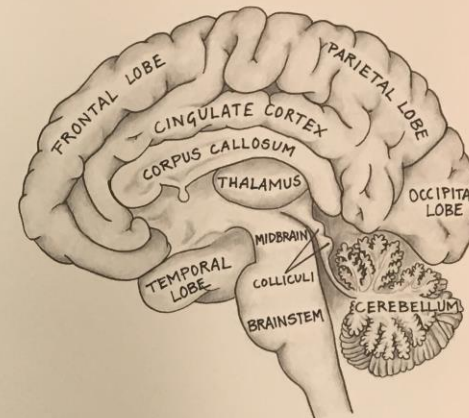
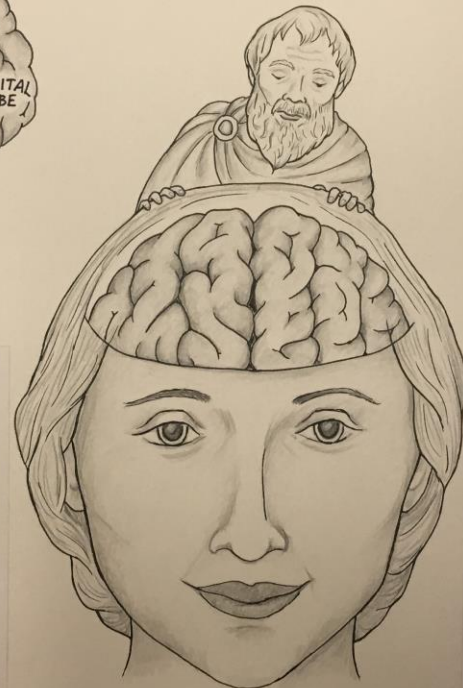
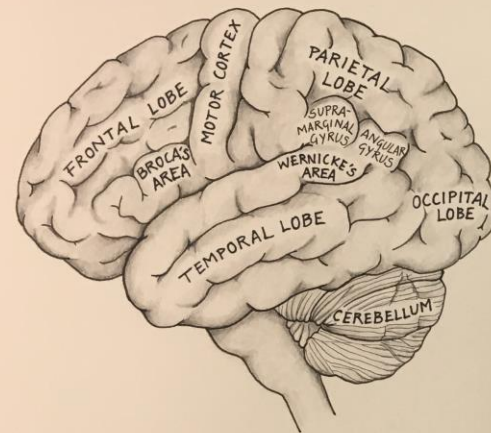


- Past vs. Future
- Traditional vs. Innovative
- Print vs. Digital

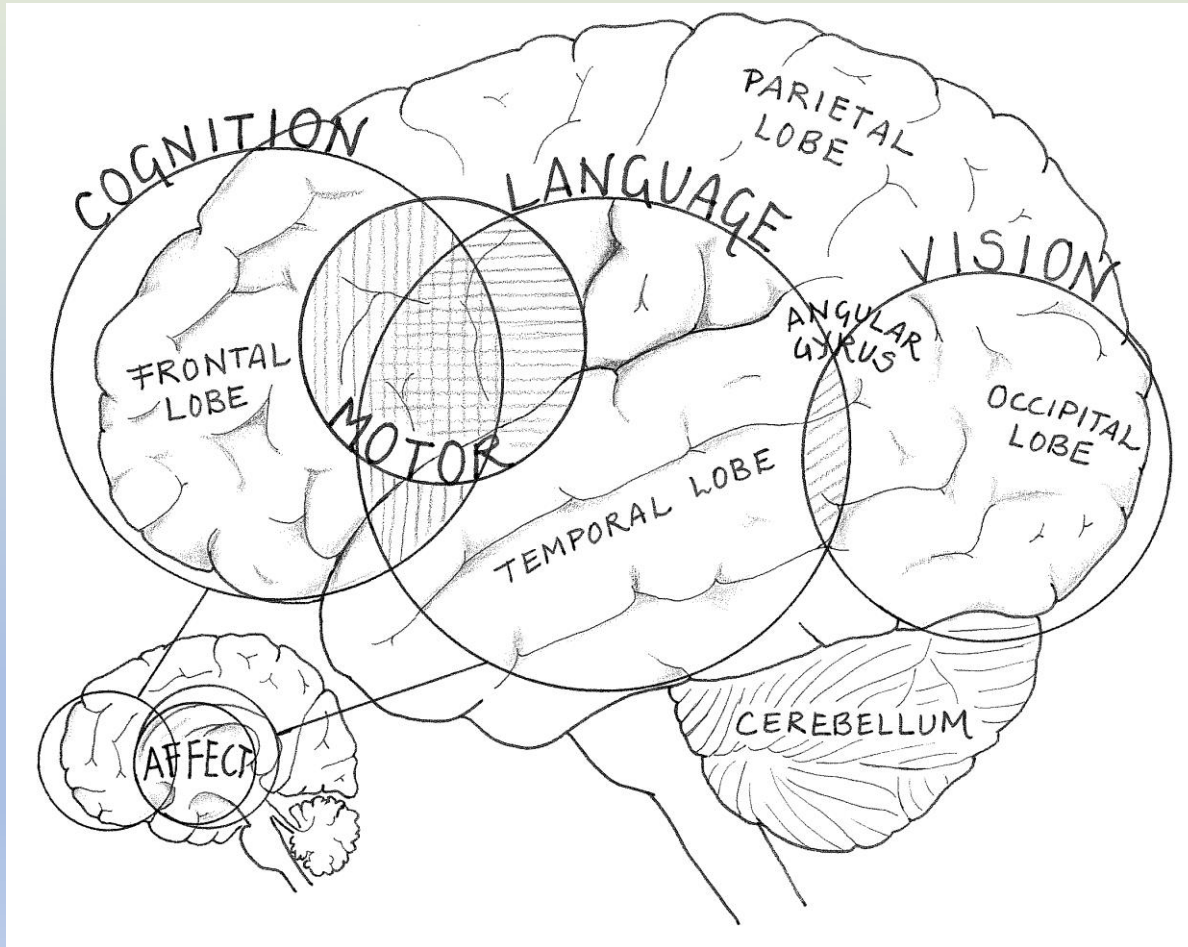
“We transgress not because we try to build the new, but because we do not allow ourselves to consider what it disrupts or diminishes.”

- Sherry Turkle, *Alone Together*

# A Matter of Cognitive Choice



# Beginning with the Reading Circuit



The human brain was never born to read.

---

Each reader creates a new, *plastic* reading circuit from older cognitive and linguistic structures.

# Principles of '*Plasticity Within Limits*' for Reading Brain

**1**

Ability to form  
whole new  
connected  
circuits

**2**

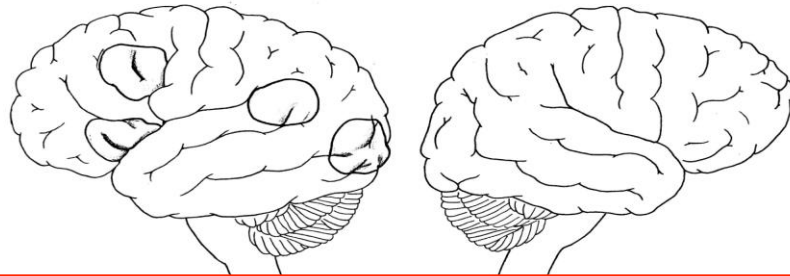
Ability to  
recycle and  
repurpose  
areas

**3**

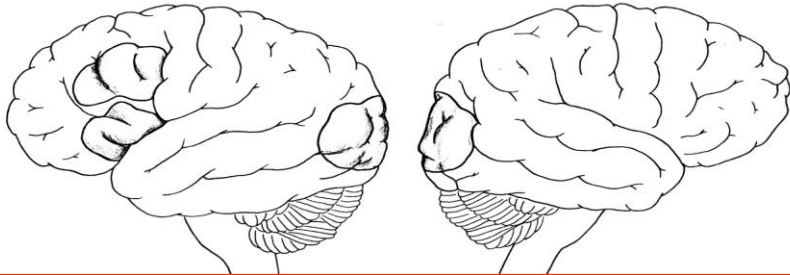
Depends on  
environment/  
characteristics  
(e.g., **writing  
and medium**)

# PLASTICITY: Multiple Circuits Possible

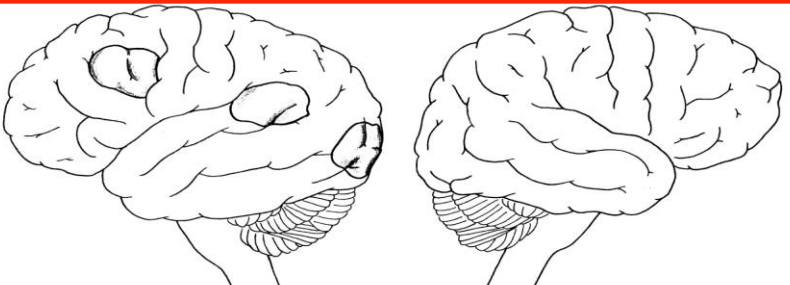
English



Chinese &  
Kanji

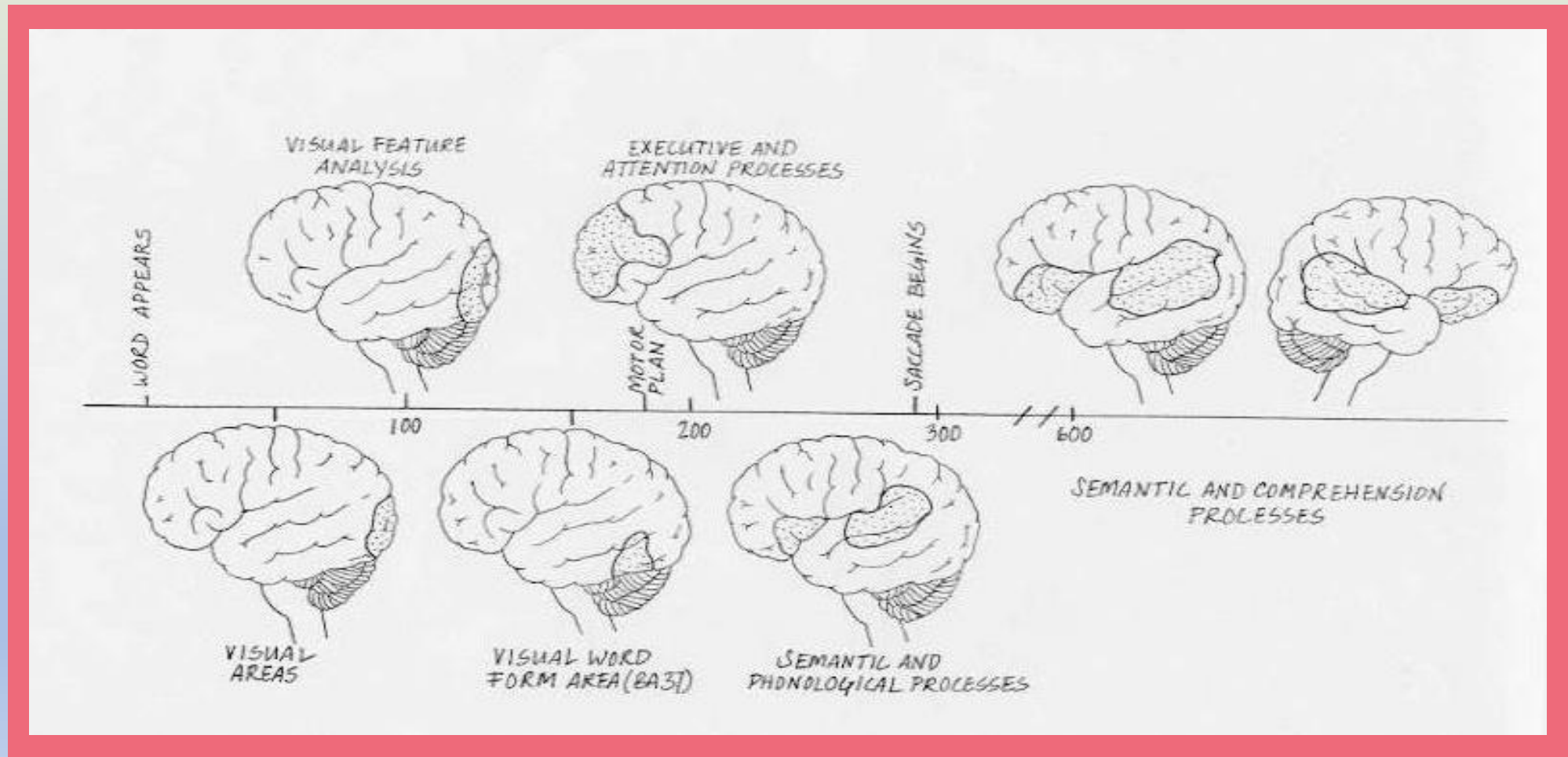


Japanese  
Kana



Brain can rearrange itself in multiple ways to read, depending on **writing system** and **medium**.

# From Basic Decoding Circuits to Elaborated "Deep Reading" Circuits



# Deep Reading. Is it Endangered?

At the heart of reading,  
100 to 200 milliseconds  
allows us

“time to think our own  
new thoughts.”





# Deep Reading

Background Knowledge

Perspective Taking/Empathy

Critical Analysis

Novel Thought

Inference,  
Deduction/Induction,  
Analogical Thinking

Imagery

Insight & Reflection



Going beyond the  
wisdom of the  
author.

# Deep Reading: Background Knowledge

“ Reading is cumulative and proceeds with geometric progression: each new reading builds upon what the read has read before. ”

Alberto Manguel  
*A History of Reading*



# Empathy and Perspective-Taking : Our Moral Laboratory

“Here is the Golden Key. It is the capacity to pass over to others and come back to ourselves. We all have the capacity, but we do not all discover it, come to use it, learn to pass over. “

*John S. Dunne*



# Conversation between Barack Obama and Novelist Marilynne Robinson



“

The trend towards seeing those different as ‘sinister other’ is the greatest danger to continuing our democracy.

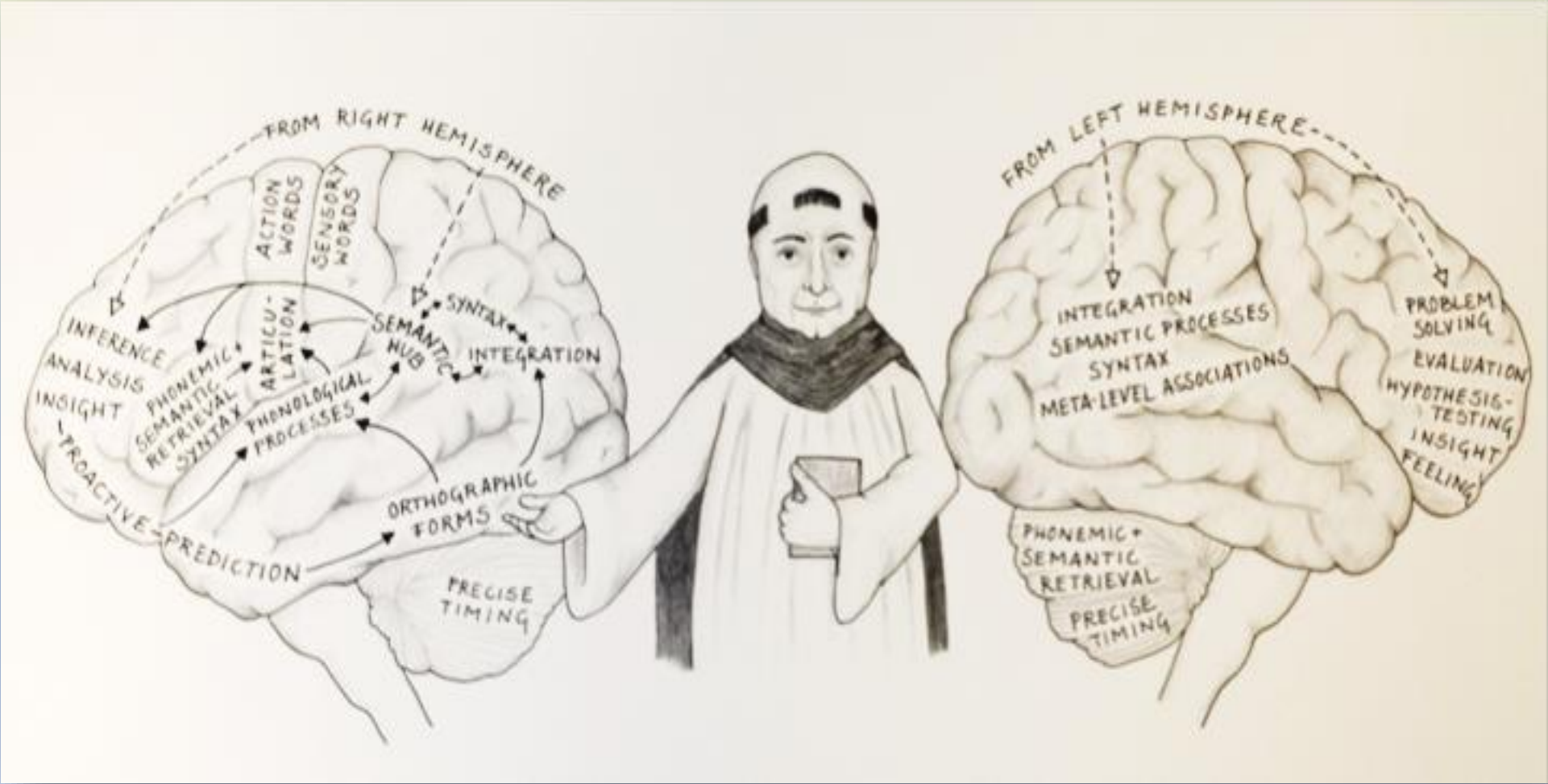
”

# Miss Marple's Secret Sauce: Empathy + Critical Analysis



**Our deep reading brain favors Miss Marple.**

# Deep Reading Brain Circuit and St. Thomas Aquinas





# The Deep Reading Brain

....requires both **milliseconds** during the reading act and years of formation.

It is never a given.

# The Reading Circuit Reflects the Medium



“Every medium has its costs and weaknesses; every medium develops some cognitive skills at the expense of others...the Internet may develop impressive visual intelligence, the cost seems to be to deep processing: mindful knowledge acquisition, inductive analysis, critical thinking, imagination and reflection.”

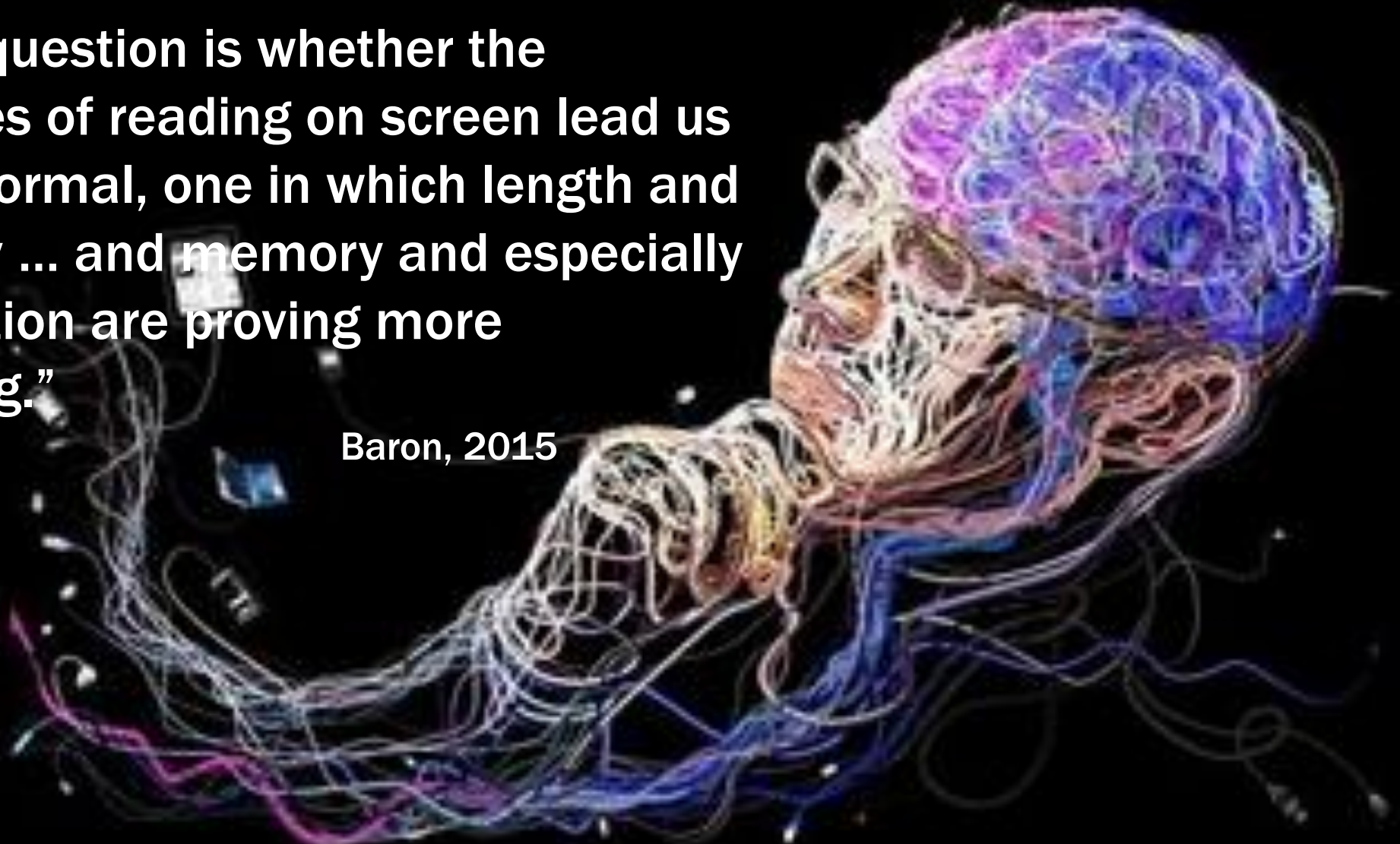
-Patricia Greenfield, 2009





**“The real question is whether the affordances of reading on screen lead us to a new normal, one in which length and complexity ... and memory and especially concentration are proving more challenging.”**

**Baron, 2015**





# “Skimming is the New Normal”

## EVIDENCE

# 1

Information increases along with skimming, browsing, keyword spotting; F or Z pattern of reading.

(Liu, 2005, 2009, 2014)

# 2

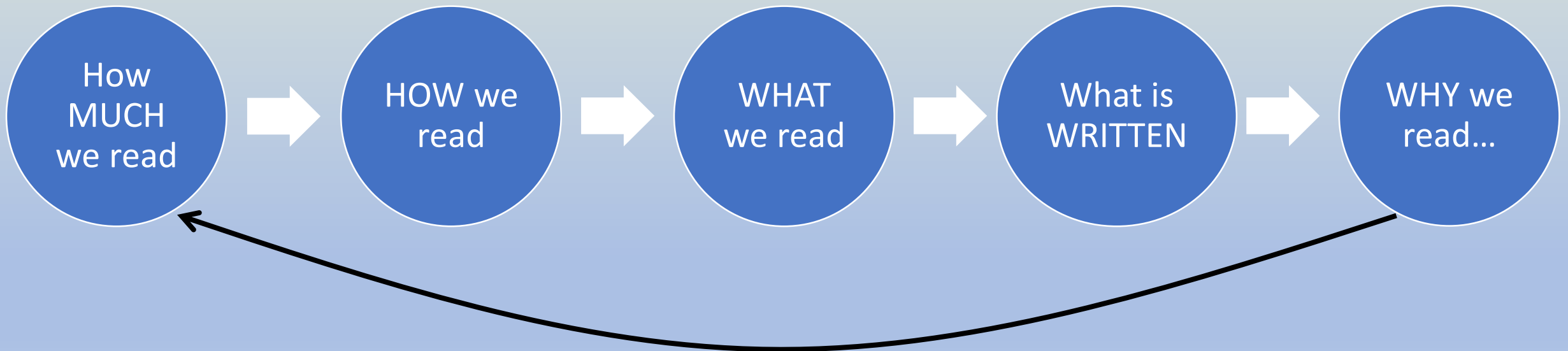
Less time on concentrated reading; more distractions (27/hr)

# 3

Decreased sustained attention and memory.

(Baron, 2014)

# Digital Chain Hypothesis





# Paradoxical Effects of Glut of Information

Increased use of reduced, less dense,  
unadjudicated information

Less exposure to  
alternative perspectives



# Implications for Reader

- If reading largely changes to adapt to digital characteristics:

we will reduce **deep reading**

with less time

to grasp **complexity**,

to understand another's **feelings**,

to perceive **beauty**, and

to appreciate our **cultural heritage**,

# Implications for society

- If **critical analysis and empathy atrophy...**
    - less attention to others' viewpoints;
    - more susceptibility to false information and demagoguery;
    - less understanding of cultural legacies:
- all of which threatens a **democratic society**.



# Implications for the Next Generation



# Evidence from Infancy to Five: Early Language



iPad is the New  
Pacifier

Hirsh-Pasek et al. 2014  
Zuckerman & Radesky, 2017

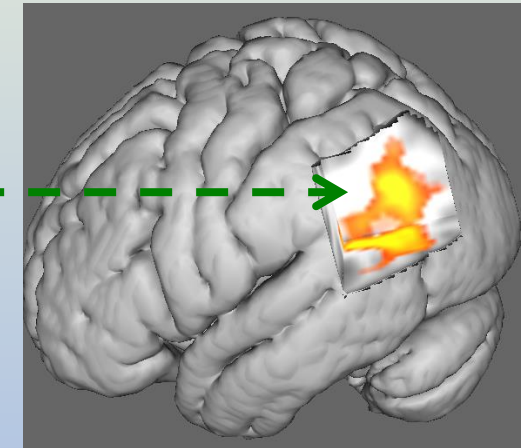
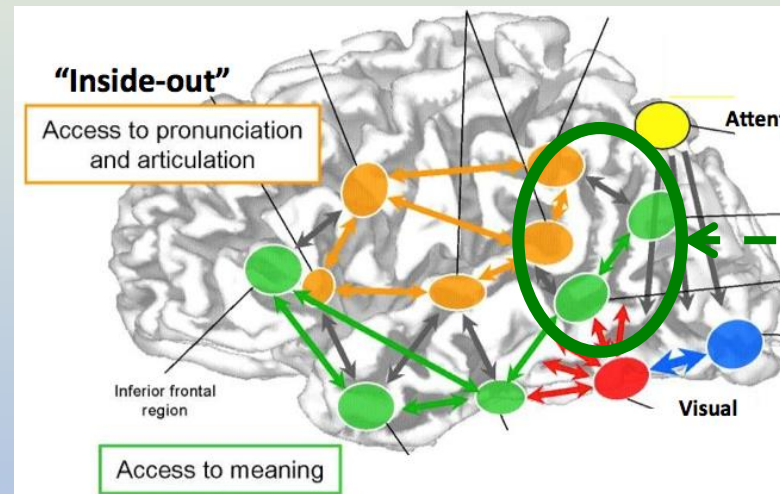


# Effects of Parents Reading to Young

John Hutton et al, Cincinnati Hospital for Children



Left Hemisphere

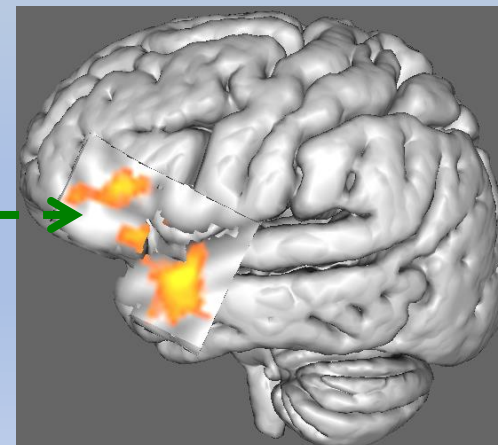
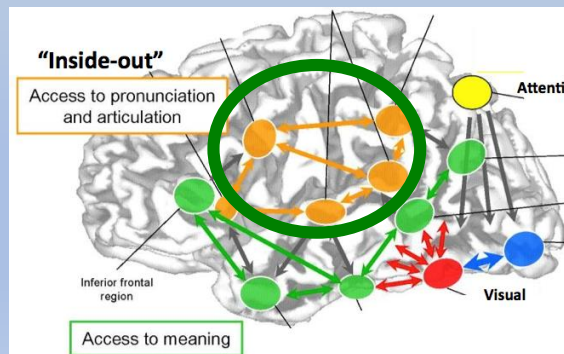


- **Semantic Processing**  
(Understanding)
- **Visual Imagery**
- **Controlled for household income**

# “Goldilocks” Effect in Mediums

Parent Book Reading > Audio Book > Animated Story

John Hutton



- Expressive language
- Complex language processing
- Social-emotional integration
- Working memory/attention

1. Adapted from S. Dehaene, “Reading the Brain,” 2010.  
2. Hutton, et al. *In Submission*, 2016; presented at PAS 2016.

# Evidence in Young : Attention Changes

Continuous partial attention  
and multi-tasking

Requires high levels of  
stimulation

Low-level threshold for  
boredom

Bathed in fight/flight  
hormones

More attention issues



# Evidence in Young Adult Readers from Norway, Israel, and Europe's E-Read Network

Changes in attention

Comprehension of text and sequencing of details better in print than on digital screens

Mangen & van der Weel, 2016

Guernsey & Levine, 2016

Baron, 2015; Katzir, 2018;

Barzillai, Thomson & Mangen, 2018



# Changes in Empathy

40% decline in youth over 20 years, with most in last 10 years.



Sarah Konrath, 2011  
Sherry Turkle, 2015

# “Don’t Throw Away Your Printed Books: Meta-analysis Print and Digital Media On Comprehension”

54 Studies

171,055 Participants

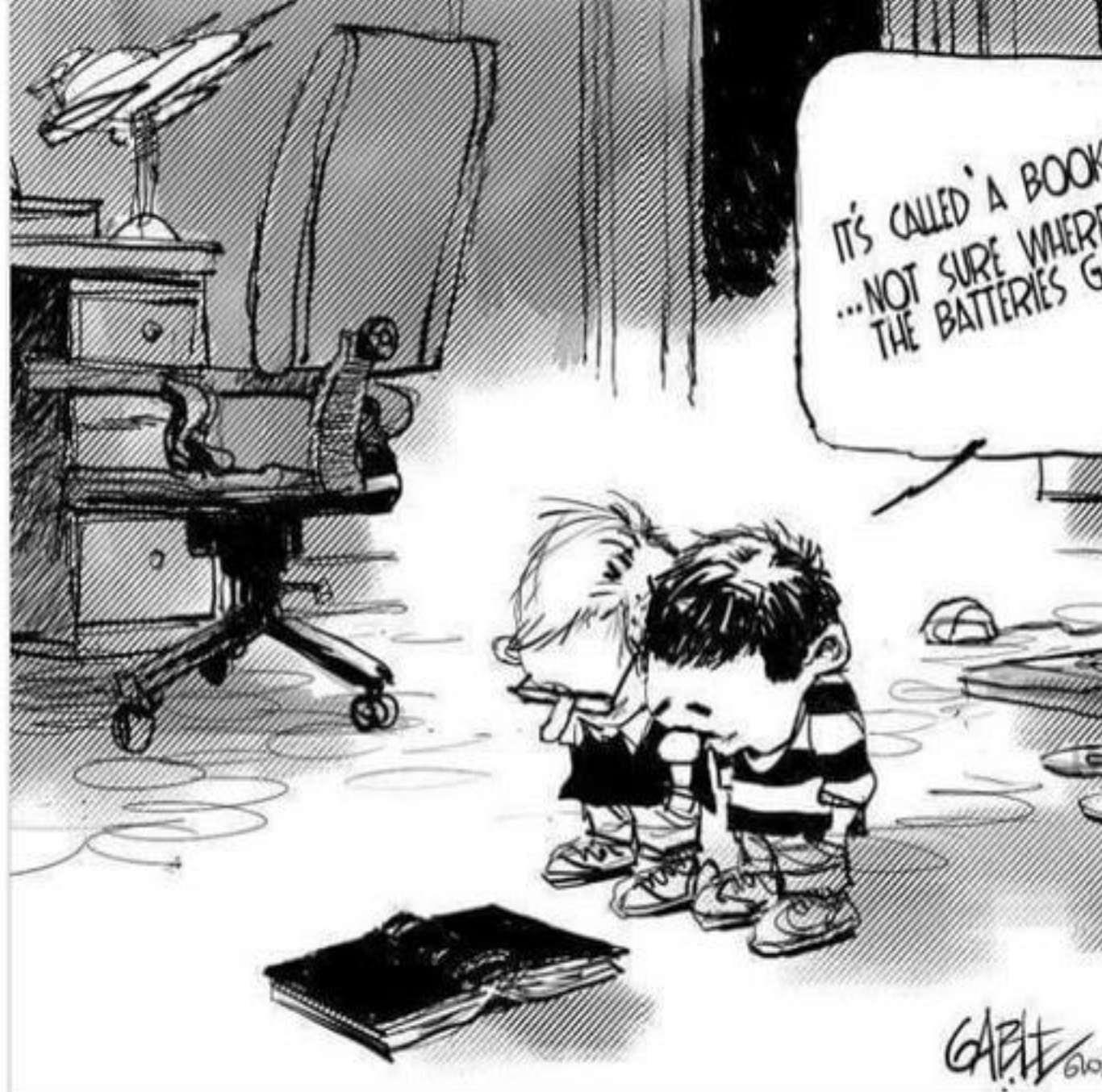
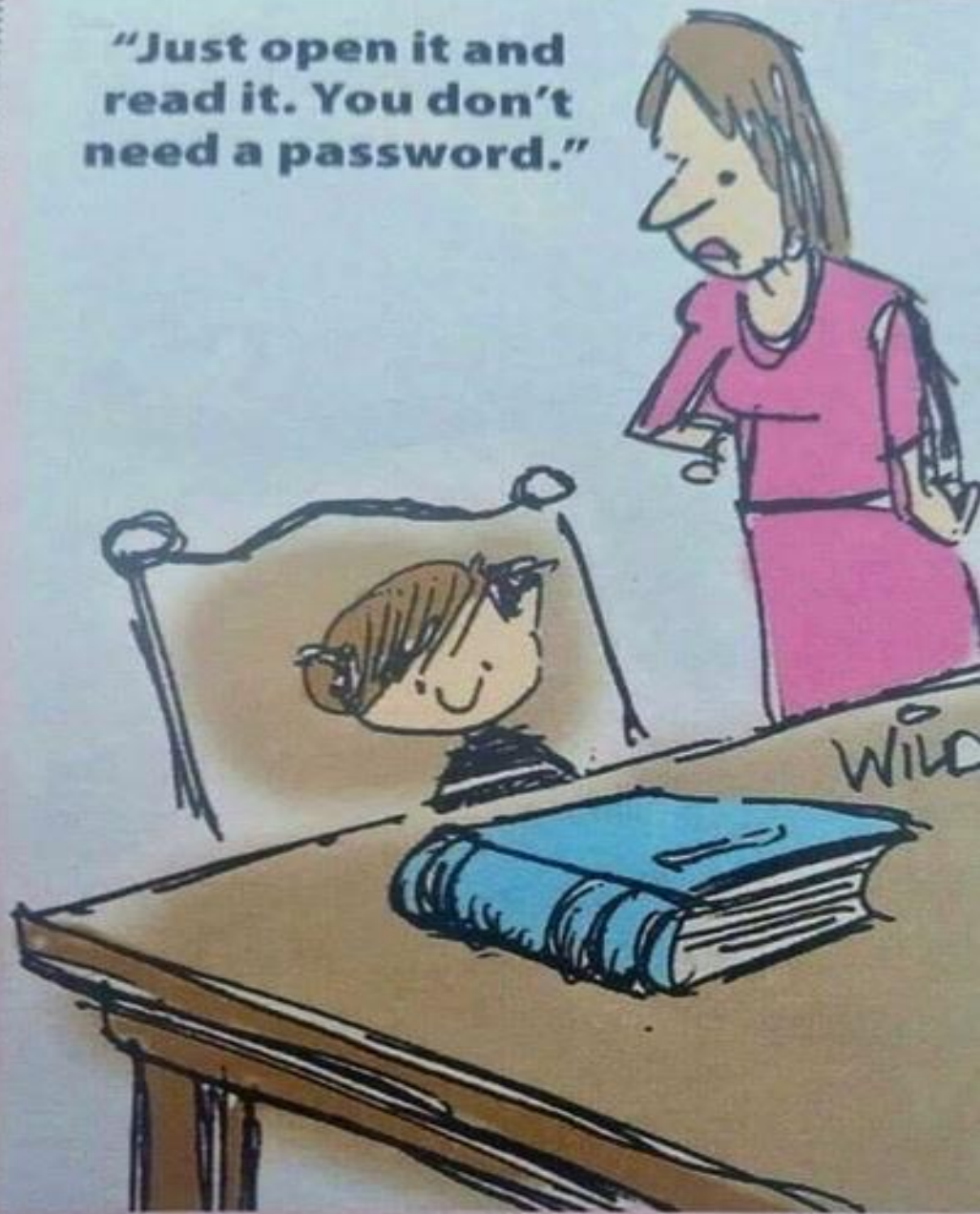
Print better than  
Digital ( $p < .001$ )

- Across genres
- Across timed conditions
- Increasing over the years 2000-2017



Delgado, Vargas, Ackerman, and  
Salmeron; *Educational Research Review*  
(in press)

"Just open it and read it. You don't need a password."



# “Trends in the US Adolescents’ Media Use: The Rise of Digital Media, The Decline of TV, and (Near) Demise of Print”

## Displacement Theory

Read Print Daily

60% (1970s)

16% (2016)

82% today use social media

“Economy of Attention”: Less long  
form, more quick media



Twenge, Martin, Spitzberg,  
*Psychology of Popular Media Culture*



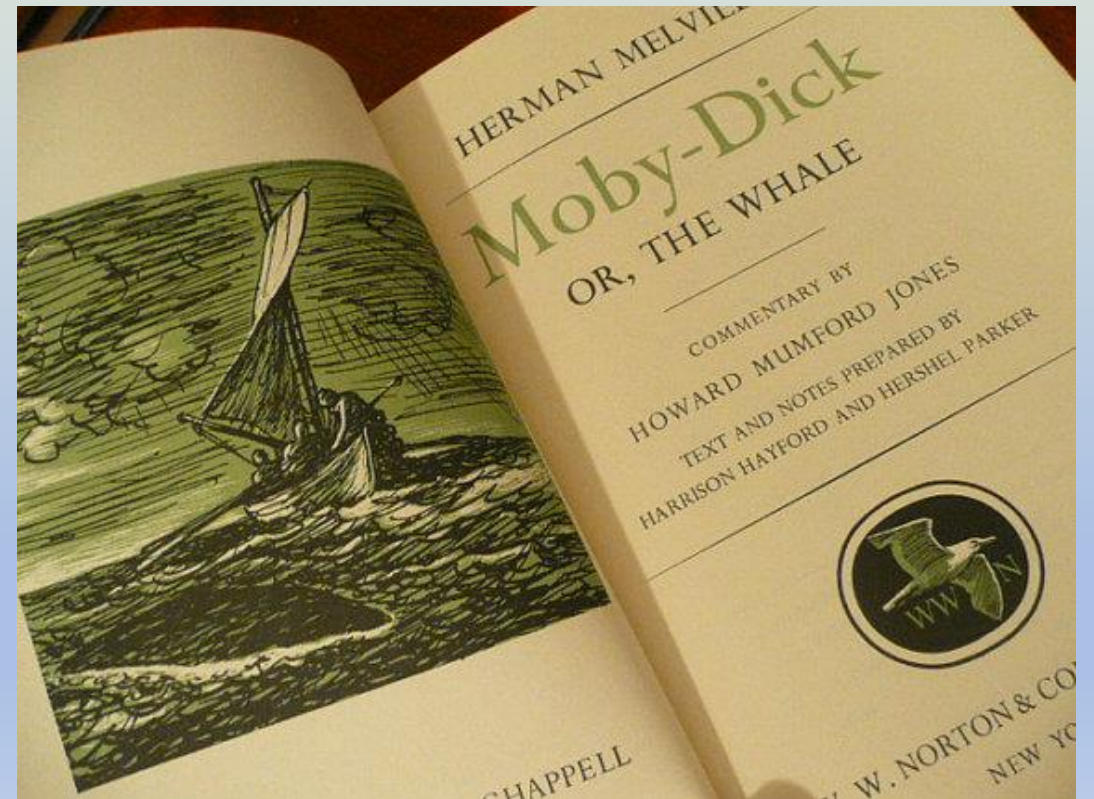
# Large Developmental Questions

Will changes in attention and the immediacy of external platforms of knowledge threaten the formation of INTERNALIZED background knowledge in young digital readers?



# Critical Analysis and Inference

If background knowledge and attention are threatened, will inference and critical analysis decline, with young readers more susceptible to false information and less able to handle sophisticated text?



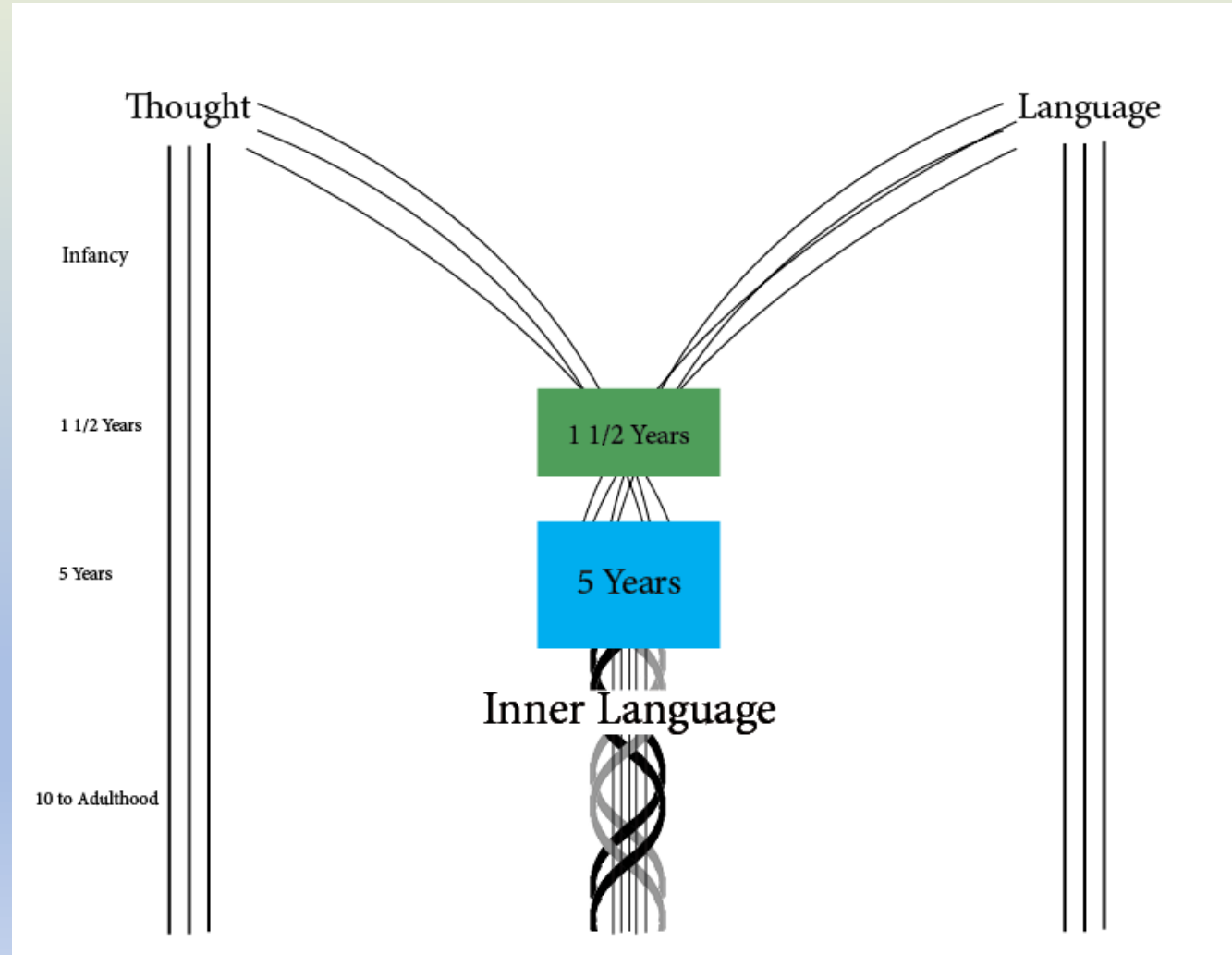
# Preserve and Expand



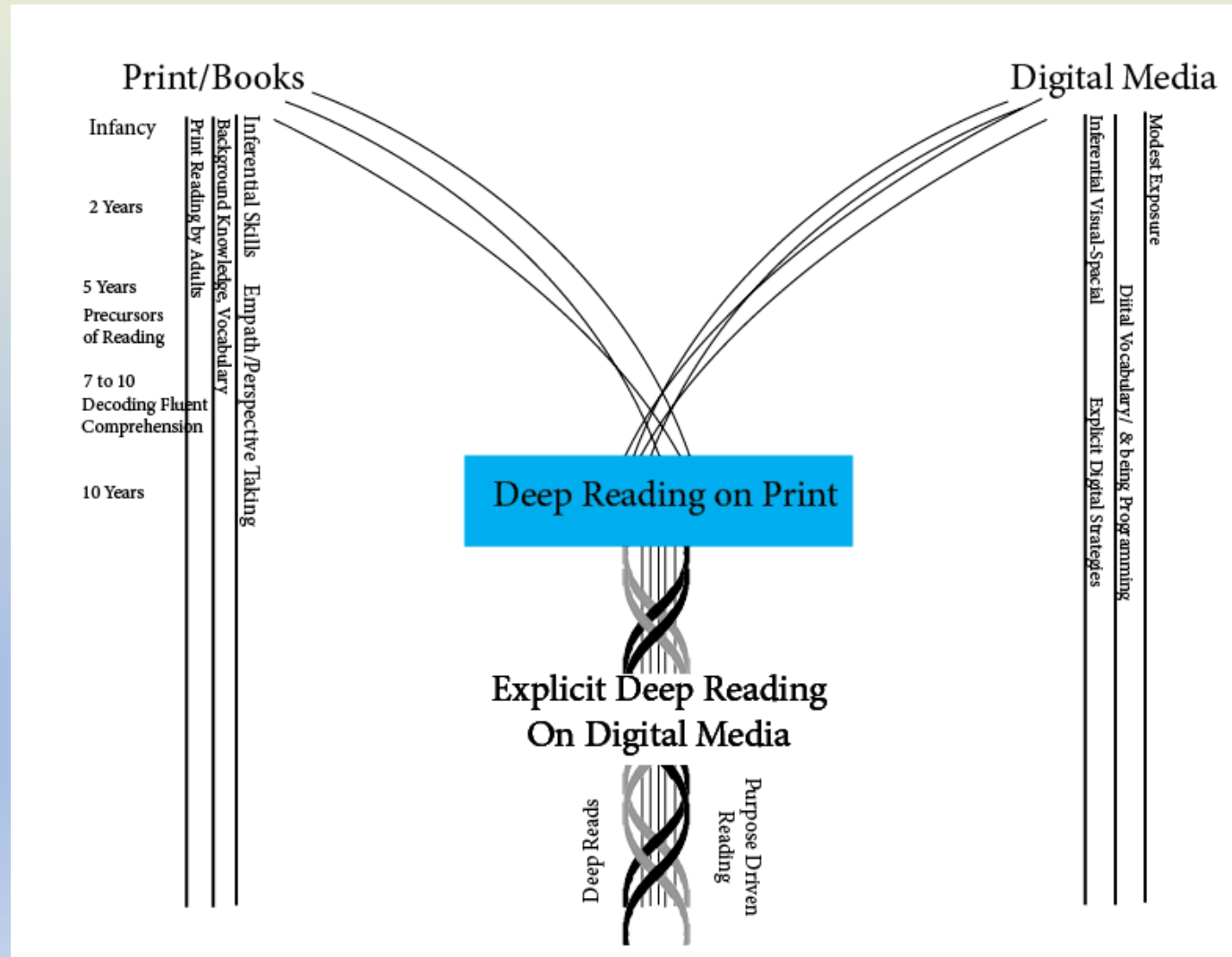
# Proposal for a 'Biliterate Brain'

- Parallel Paths for Print and Digital Modes
- Early Childhood Emphases on Print for Reading
- Early Emphases on Digital Mediums for Coding and Programming
- Development of Deep Reading Skills with Print
- Explicit Teaching of Deep Reading Skills with Screens

# Vygotsky's Model of Thought and Language



# Biliterate Brain



# GOAL: Deep Reading across Mediums

Ensuring the formation of deep reading across *any medium* is our best LEGACY AND INOCULATION against false information, demagoguery, and indifference to “other”.





WHO IS THE 'GOOD READER' TODAY?



“A culture can be judged by how it pursues three lives: the life of **activity** and **productivity**, the life of **enjoyment**, the life of **contemplation**.”



# So Too...THE 'GOOD READER'



“Among the three lives...we have a life of action and a life of enjoyment, but for the most part we are lacking a life of contemplation...there are dire consequences of this.”

John S. Dunne (2012)



# The Third Life of the Good Reader

“To read, we need a certain kind of silence...that seems increasingly elusive in our over-networked society...and it is not contemplation we desire but an odd sort of distraction...masquerading as being in the know. In such a landscape, knowledge can't help but fall prey to illusion...that *speed can lead us to illumination*, that it is more important to react than to think deeply.

Reading is an act of contemplation...an act of resistance in a landscape of distraction. It returns us to *a reckoning with time.*”

David Ulin



# ‘Reckoning with Time’ in the Future of Reading

The discernment of truth...and wisdom...  
depends on the **allocation of time** we give  
to the processes underlying them in our reading brain.

“Use it or Lose it” must in our Hinge Moment  
be changed to “**Choose it**”.



# Stewards of the Next Generation

“It would be catastrophic to become a nation of technically competent people who have lost the ability to think critically, to examine themselves, and to respect the humanity and diversity of others. And unless we support these endeavors, it is in such a nation that we may well live. It is therefore urgent now to support curricular efforts aimed at producing citizens who can take charge of the own reasoning, who can see the different and foreign not as a threat to be resisted but as an invitation to...expand their own minds and capacity for citizenship.”

Martha Nussbaum

The background of the slide is a vibrant, multi-colored cosmic web. It features a dense field of small, bright yellow and white stars. Overlaid on this are intricate, filamentary structures in shades of deep red, magenta, and bright blue, resembling the large-scale structure of the universe. The overall effect is a rich, textured space scene.

# Future of the Reader

This time...this hinge moment...let us  
choose with all our intelligence.