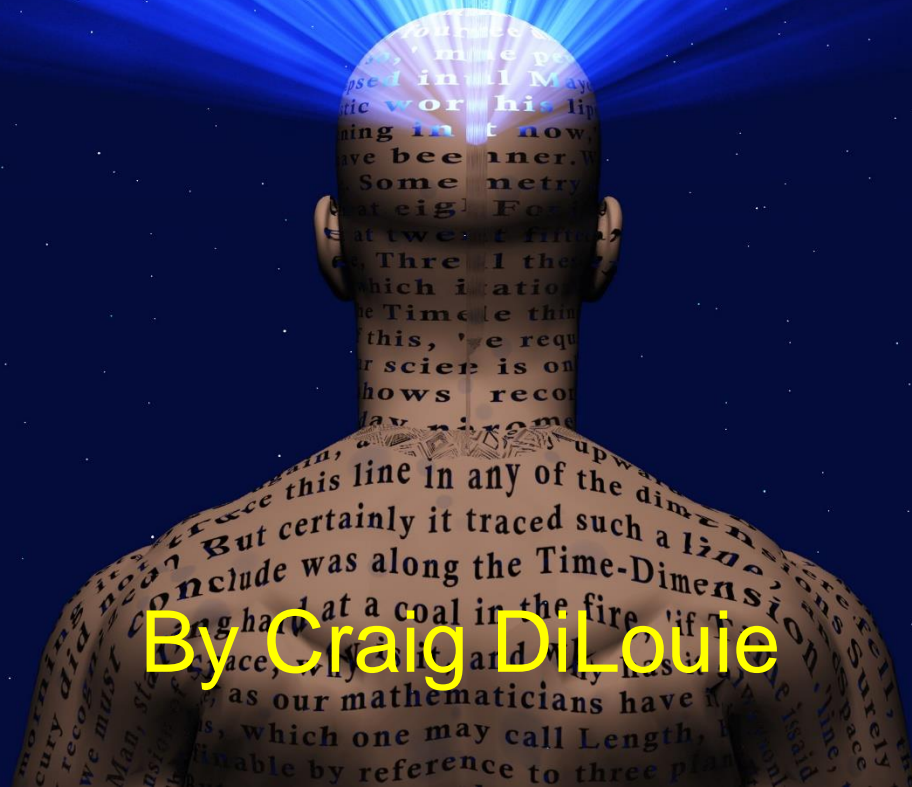


This Is Your Brain on Words



By Craig DiLouie

Genesis

A woman with long blonde hair, wearing a white long-sleeved shirt and a dark skirt, is floating in the air. She is holding a book in her right hand and looking at it. She is wearing high-heeled shoes. The background is a light-colored wall with vertical panels. There are several books floating in the air around her, and some books are stacked on the floor. The overall scene is surreal and dreamlike.

- Reading is magic
- Interest in underlying mechanisms of reading and creative writing
- Result: a meditation on the minds of the reader and writer

Part One



**READING AND
THE BRAIN**

Reading and the brain

At a basic level, reading involves decoding a string of abstract symbols and translating it into complex ideas.

In reality, a whole lot more is going on.

The baker had a kindly face.

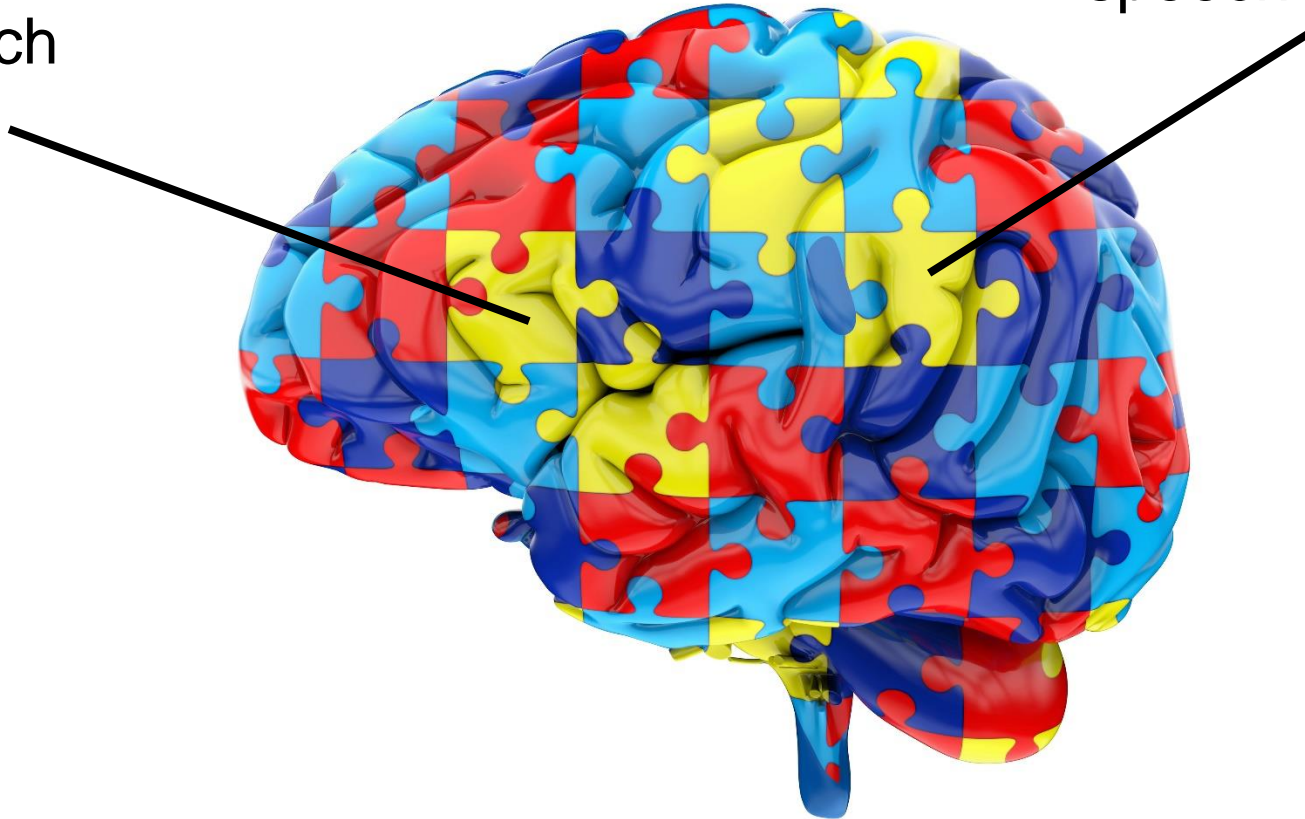
Reading and the brain

Broca's area

Production of
speech

Wernicke's area

Comprehension of
speech



**The baker had an open jar of
cinnamon under his nose.**

Reading and the brain

Broca's area

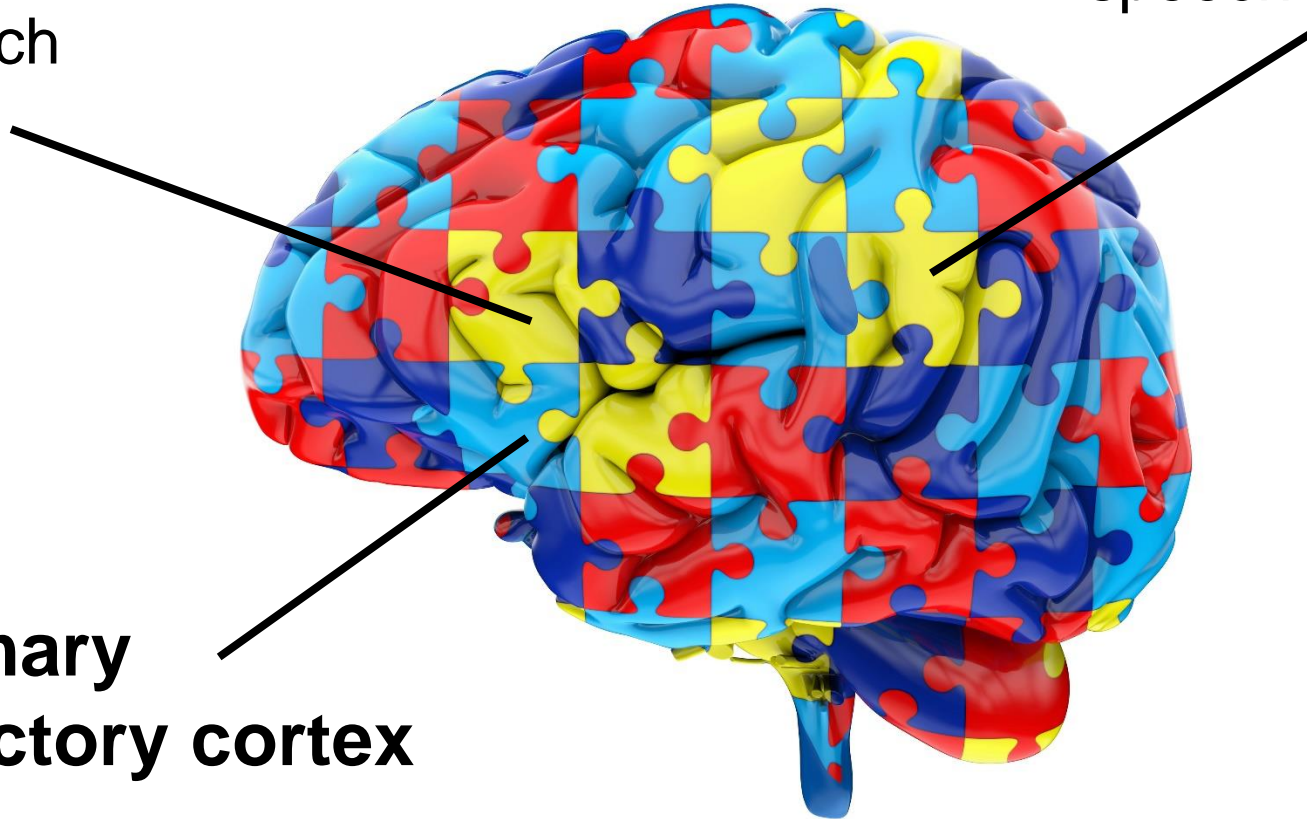
Production of
speech

Wernicke's area

Comprehension of
speech

Primary olfactory cortex

Detection of odors



2006 neurolinguistic study

- Conducted in Spain
- Researchers asked participants to read words and conducted fMRI scans of their brains
- Words either had strong odor association or were neutral
- When looking at odor-associated words like “cinnamon” and “coffee,” the subjects’ primary olfactory cortex lit up

**The baker held the jar in his
leathery hands.**

Reading and the brain

Broca's area

Production of
speech

Wernicke's area

Comprehension of
speech



Sensory cortex

Sensation of touch

Emory University study

- 2012 study evaluating brain activity and language
- Researchers asked participants to read sentences and conducted fMRI scans of their brains
- One area of study was metaphor
- Sensory metaphors like “velvet voice” and “leathery hands” stimulated the sensory cortex
- Cliché figures of speech like “a rough day” and general descriptions like “pleasing voice” and “strong hands” did not

Inspired by the baker, she ran home and hammered out a first draft on her keyboard.

Reading and the brain

Broca's area

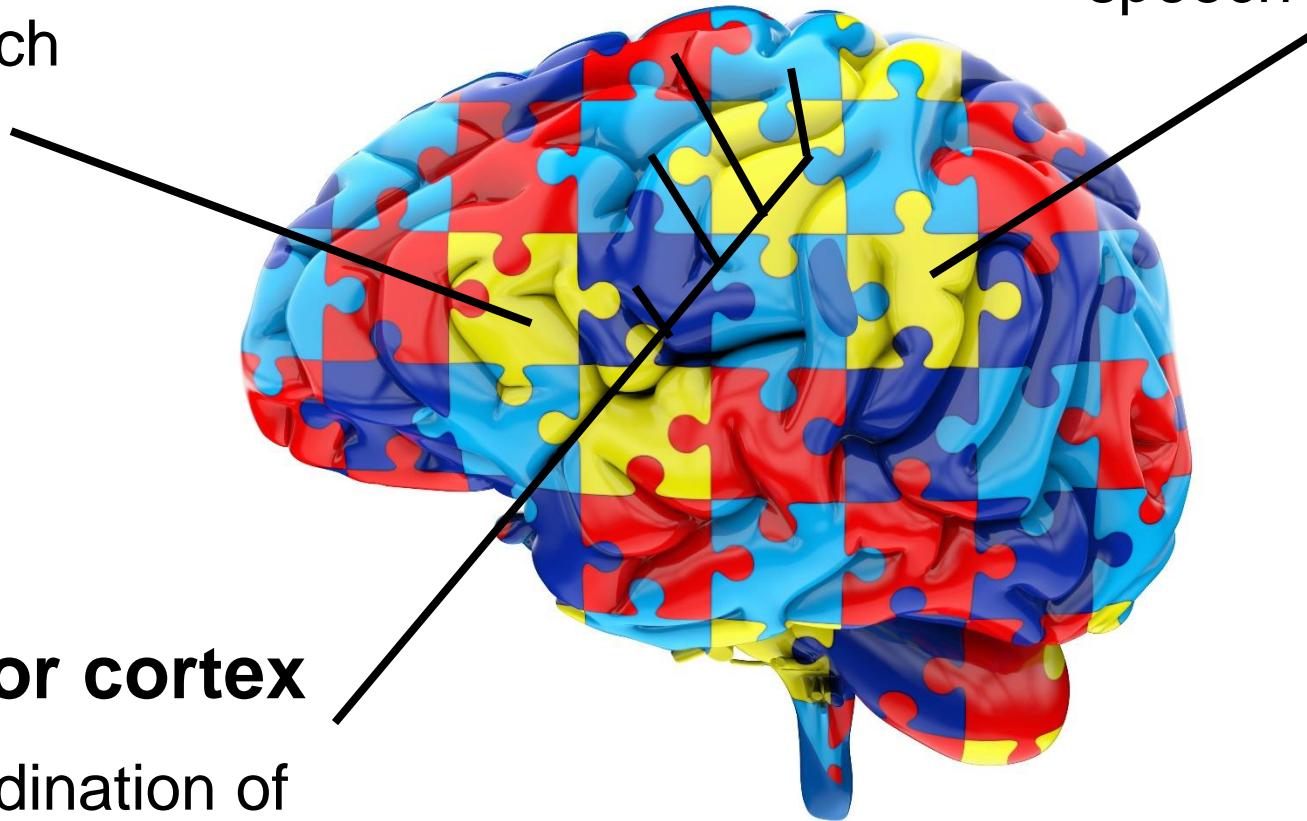
Production of
speech

Wernicke's area

Comprehension of
speech

Motor cortex

Coordination of
bodily motion



Laboratory of Language Dynamics study

- 2013 French study led by cognitive scientist Véronique Boulenger
- Researchers asked participants to read sentences and conducted fMRI scans of their brains
- Area of study was motor activity
- Scans showed brain activity in motor cortex when reading sentences like “Pablo kicked the ball”
- Activity specific to parts of cortex whether motion was related to specific body parts

**After she was done writing,
she looked around her empty
house and felt alone and
unloved. She knew what she
had to do. She would...**

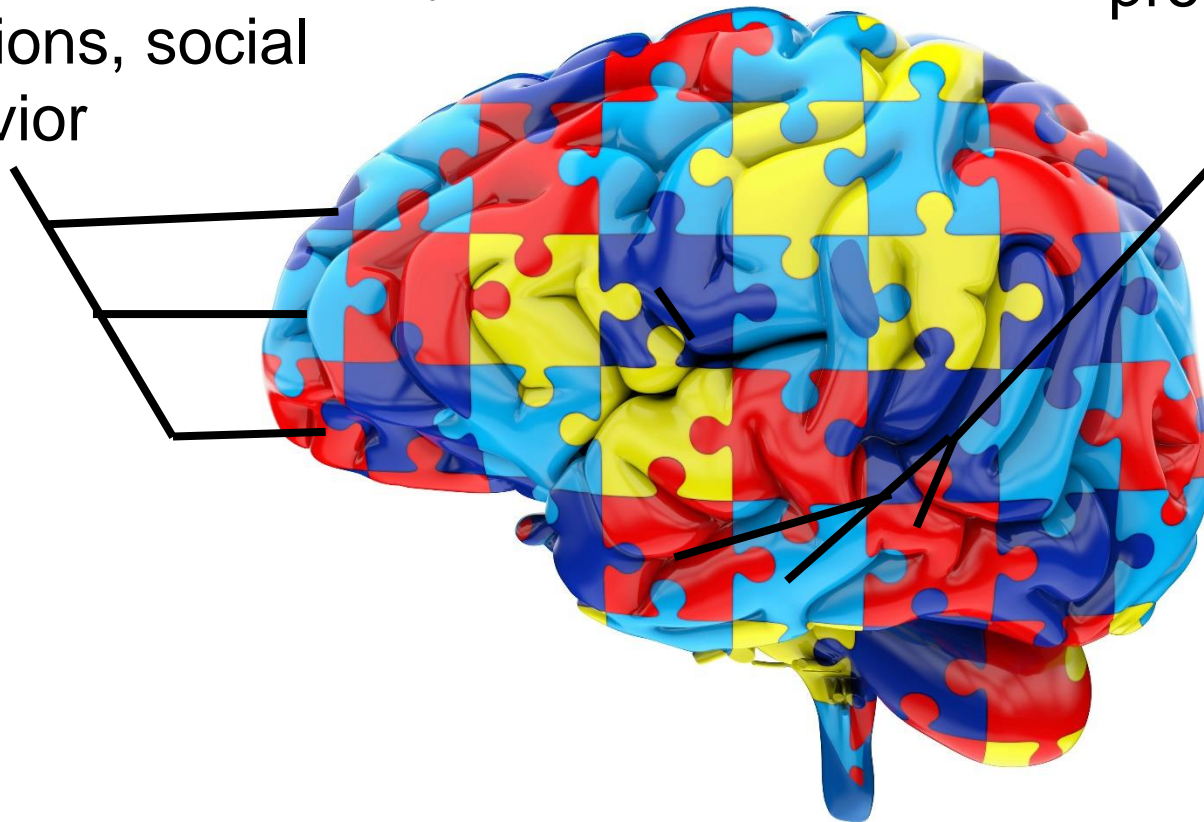
Reading and the brain

Prefrontal cortex

Cognition, personality,
decisions, social
behavior

Superior temporal sulcus

Multisensory
processing



Meta-analysis of fMRI studies

- 2011 analysis of 86 fMRI studies
- Raymond Mar, psychologist at York University in Canada
- Significant overlap in brain networks used to understand narratives and those used to interact with other people
- Especially interactions in which we try to detect the thoughts and feelings of other people
- This ability to make a map of other people's intentions is called "theory of mind"
- Stories exercise this capacity as we identify with character's feelings, figure out their motives, and track their interactions

Reading fiction is enjoyment.

“The neural changes that we found associated with physical sensation and movement systems suggest that reading a novel can **transport you into the body of the protagonists**. We already knew that good stories can put you in someone else’s shoes in a figurative sense. Now we’re seeing that **something may also be happening biologically.**”

Dr. Gregory Berns, Emory University

“Fiction is [a vivid reality]
simulation that runs on minds of readers just as computer simulations run on computers.”

Dr. Keith Oatley,
University of Toronto



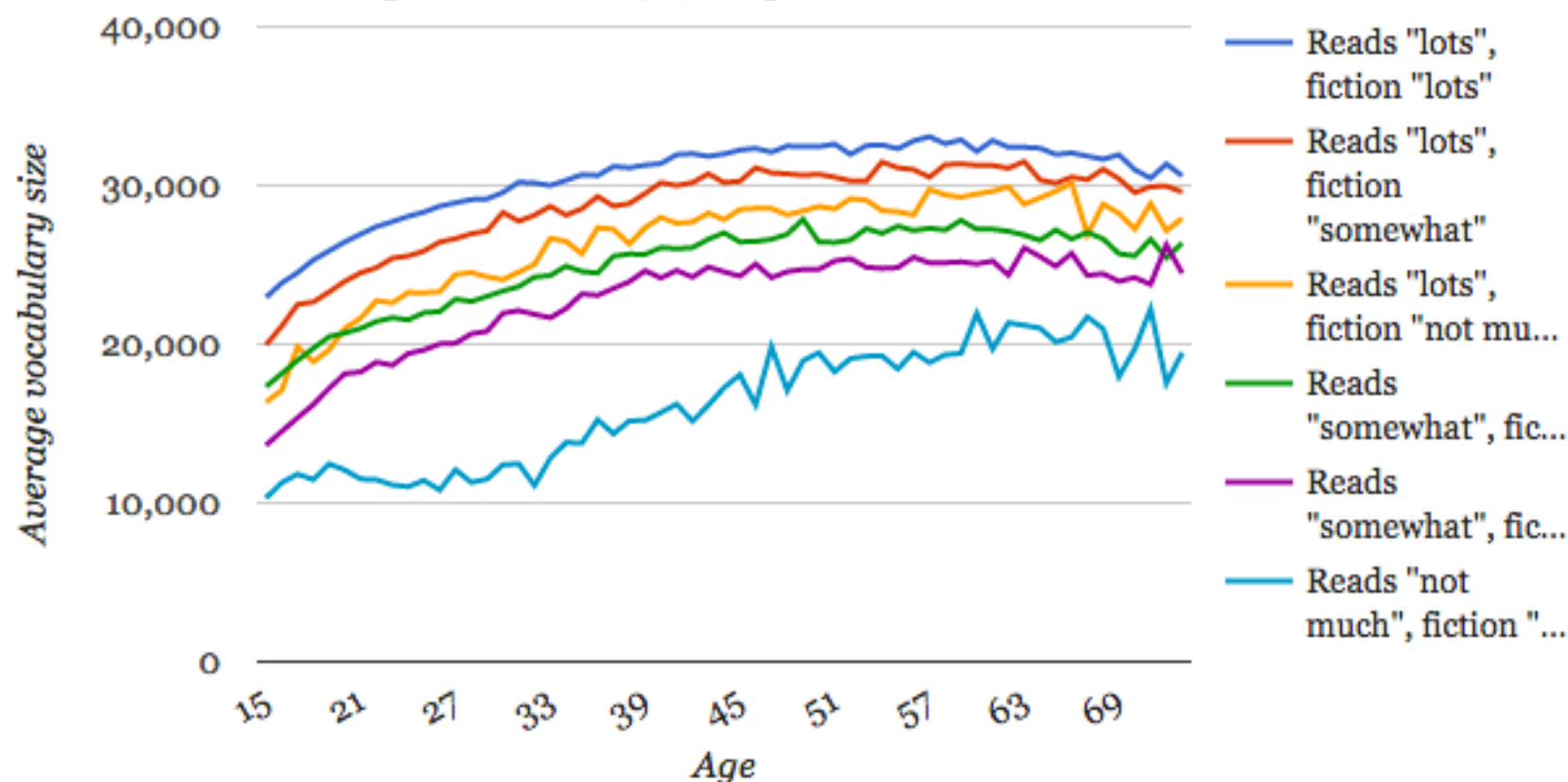
**Reading fiction is biologically
adaptive.**

“Fiction narratives supply us with a **mental catalog** of the fatal conundrums we might face someday and the **outcome of the strategies we could deploy in them.**”

Steven Pinker, Harvard University, author, *How the Mind Works*

**Reading fiction improves
vocabulary.**

Average English native speaker vocab by age and reading habits (287,314 responses)



Reading fiction may be healthy.

Reading for as little as 6 minutes can



reduce stress by 60%, slow heart beat, ease muscle tension and alter your state of mind

Reading reduces stress:

68%

100%

300%

600%

more than:



Listening
to music



Drinking a
cup of tea



Going for
a walk



Playing a
video game

**Reading fiction fosters empathy
and emotional intelligence.**

Empathy and social skills

- In 2018, University of Rochester psychologist David Dodell-Feder conducted meta-analysis of 53 effects in 14 studies
- Explored relationship between fiction reading and empathy
- Found a small but statistically significant improvement in social-cognitive performance compared to nonfiction reading and no reading

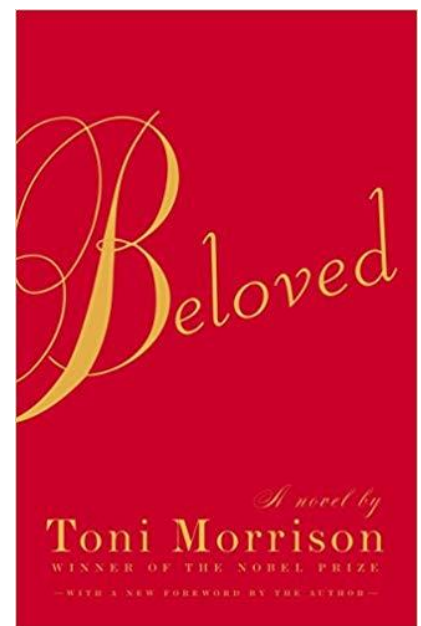
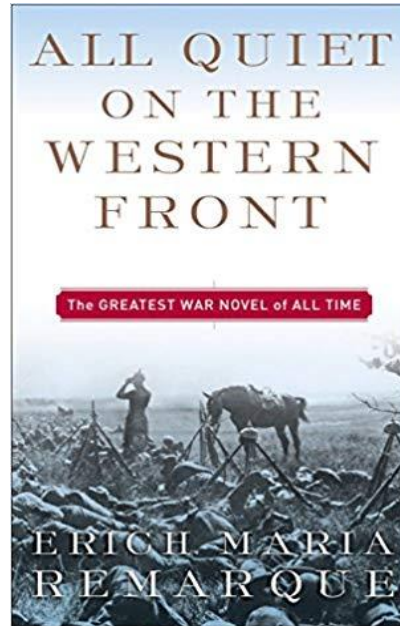
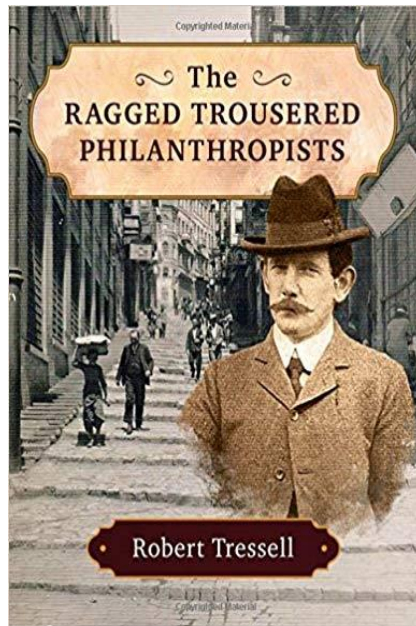
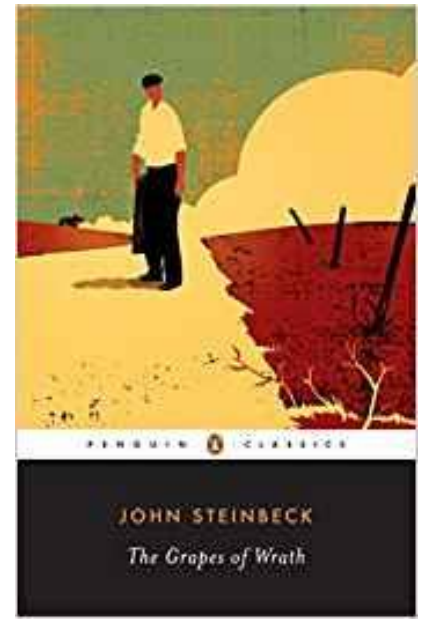
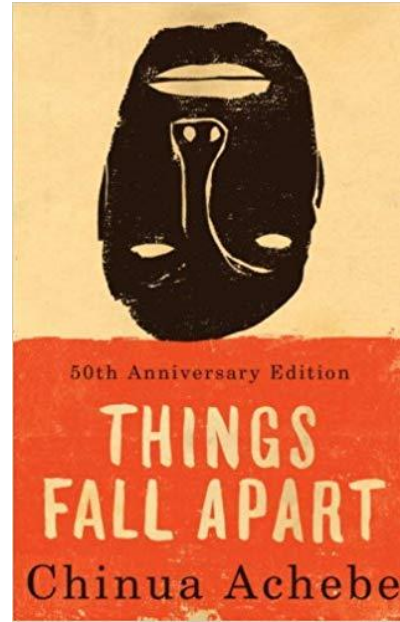
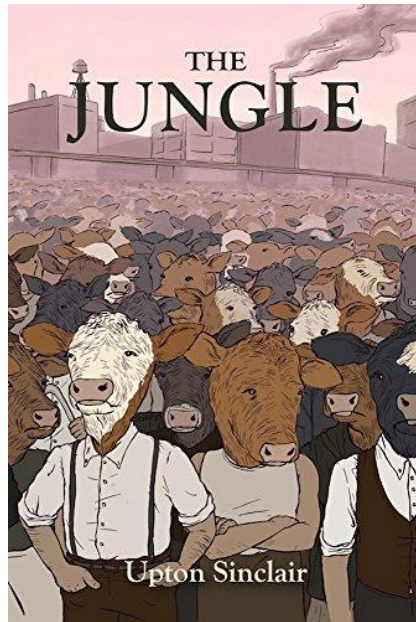
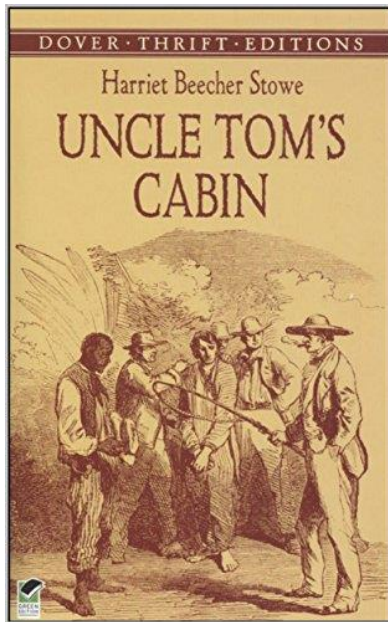


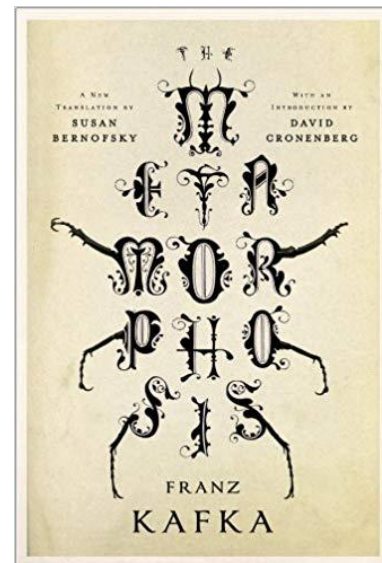
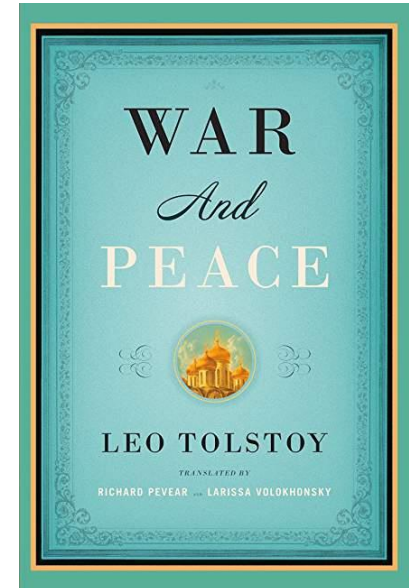
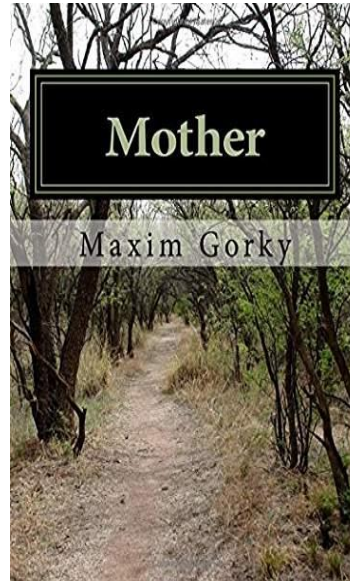
Reading fiction is therapeutic.

Bibliotherapy

- Prescribed reading of relevant material
- Based on identifying with others through literature
- Example: woman loses husband and is grieving, reads a story about a widow
- Personal identification, catharsis, insight into relevance of solution in the story
- Proven effective with long-lasting effects in treating depression

Reading fiction changes minds.





American Library Association most challenged/banned/burned books in 2018:

George by Alex Gino: transgender, sexual content

A Day in the Life of Marlon Bundo by Jill Twiss: LGBTQIA+, political and religious views

Captain Underpants series written and illustrated by Dav Pilkey: encourages disruptive behavior

The Hate U Give by Angie Thomas: “anti-cop,” profanity, drug use, sex

Drama by Raina Telgemeier: LGBTQIA+ characters and themes

Thirteen Reasons Why by Jay Asher: addresses teen suicide

This One Summer by Mariko Tamaki: profanity, sex

Skippyjon Jones series by Judy Schachner: Mexican stereotypes

The Absolutely True Diary of a Part-Time Indian by Sherman Alexie: sex, profanity, violence, underage drinking, religious views

This Day in June by Gayle E. Pitman: LGBTQIA+

Two Boys Kissing by David Levithan: LGBTQIA+

Conclusions

- Reading is a biological experience
- Reading exercises “theory of mind” regions
- Reading delivers enjoyment as well as potential for increased empathy, stress reduction, and other benefits
- Reading is an act of power and resistance

“For some of us, books are as important as almost anything else on earth. What a miracle it is that out of these small, flat, rigid squares of paper unfolds world after world after world, worlds that sing to you, comfort and quiet or excite you. Books **help us understand who we are and how we are to behave. They show us what community and friendship mean; they show us how to live and die.**”

Anne Lamott, author of *Bird by Bird: Some Instructions on Writing and Life*

Part Two



**WRITING AND
THE BRAIN**

“She read everything every spare moment. She was a junkie for the printed word. And lucky for me, **I manufactured her drug of choice.**”

Wonder Boys



Connecting with the reader

Jeff Gerke, author and writing instructor on “hacking the reader’s brain”:

- #1: get the reader’s attention by capitalizing on human interest in danger and surprise

In other words, hook the reader!

- #2: connect the reader with the protagonist

Build that connection as strongly as possible to trigger release of oxytocin, empathy chemical.

- #3: The story needs struggle (conflict)

Challenge the protagonist with obstacles to achieving his or her goal.



Struggle is compelling

“Three Keys To Telling Personal Stories That Move Hearts And Minds,” *Forbes*, May 2016:

#1: inciting incident

What happened that created adversity?

- #2: personal transformation

How did you arise to the challenge?

- #3: Life lesson

Connect that struggle and transformation to the broader world shared with the reader.

Connecting with the reader

Lisa Cron, author, *Story Genius* and *Wired for Story*, offers five steps to “hacking the reader’s brain”:

- #1: Know your hero’s flaw and need to change before writing
- #2: What does the hero want from the get-go?
- #3: What misbelief is keeping the hero from getting what he or she wants?
- #4: What external plot problem will force the hero on a path to change?
- #5: What is the hero’s a-ha moment—where misbelief becomes a new belief?



Summing it up

- What happens to get reader to pay attention?
- Who is the main character?
- Is the character relatable?
- What does the main character want?
- What is in the way of them getting it?
- What risk or sacrifice is needed to get it?
- How must the main character change to get it?
- How is the character or the world changed after the struggle?
- What does this teach the reader about life?

Writing and the brain

Prefrontal cortex

Cognition, personality,
decisions, social
behavior

Anterior cingulate cortex

Making associations
between unrelated
concepts

Posterior cingulate cortex

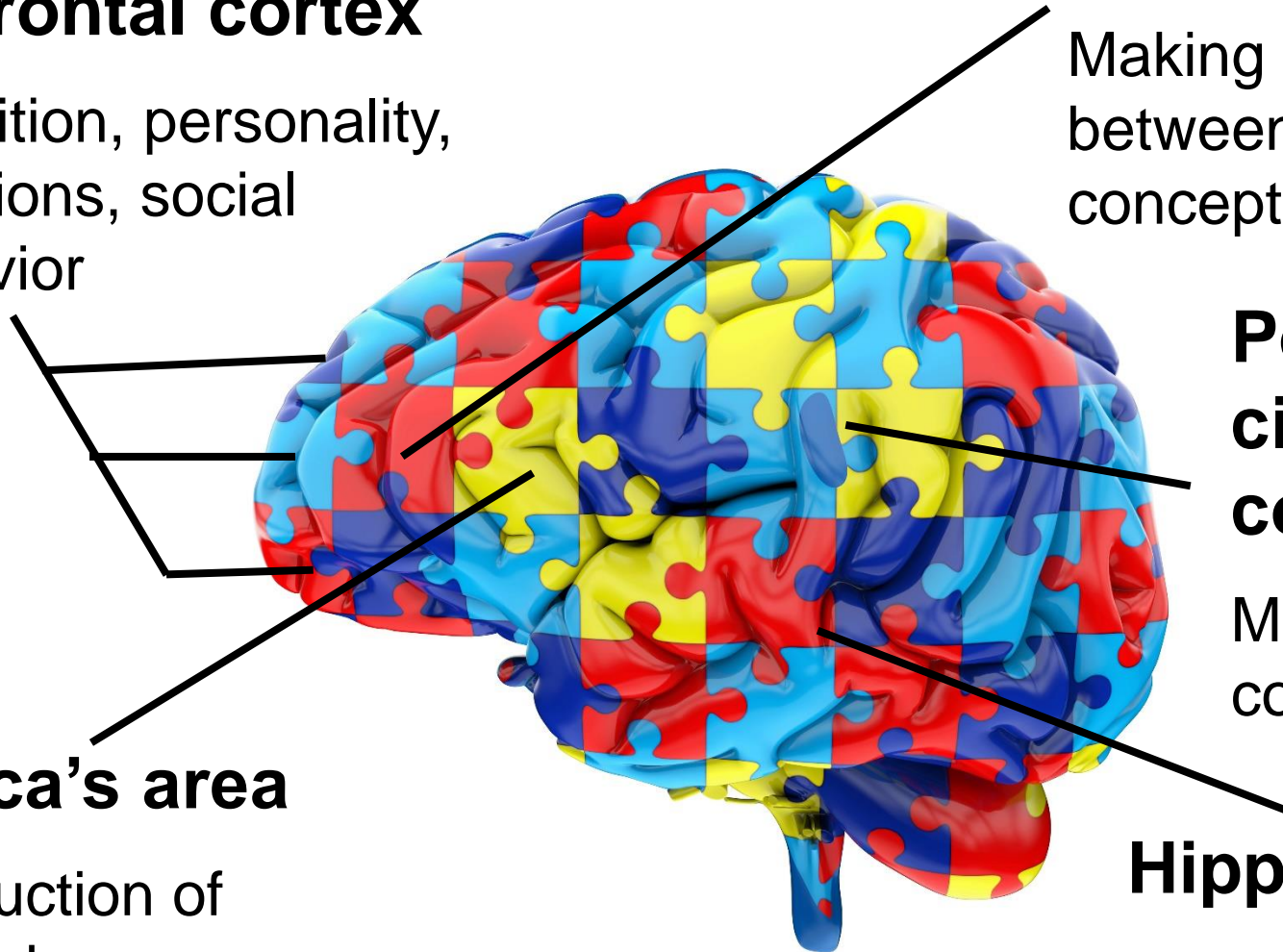
Memory and
control

Broca's area

Production of
speech

Hippocampus

Memory



Two studies

- 2005 study (Howard-Jones et al): participants given three words and asked to make a story during fMRI scan

Found activity not just in language region but also region for making associations between unrelated concepts

- 2013 study (Shah et al): participants given 30 words of a familiar text, asked to brainstorm continuation, and then given two minutes to write the continuation

Found activity in language region for both brainstorming and writing; for writing, additional areas related to memory and motor area related to physical writing; for brainstorming, additional area involved in planning and control

Writers are both born and made

MYTH	REALITY
Writers are born, it's a natural talent	If you're intelligent and have creative problem-solving skills, you can be a writer
Creativity can't be taught	Creative skills can be taught
Writers work best alone	Writers can benefit from constructive feedback and reading other authors
Writers work best without convention	Craft can improve one's game enormously
Inspiration arrives like lightning to produce perfect work	Many writers produce regular work, find writing hard work, and undergo a lot of revision
Writers are mere conduits for books to write themselves	Writers have a lot more control over their creativity than might be felt

Practice makes perfect

- A study by German researchers led by Martin Lotze
- Observed brain activity during writing process
- Brain activity different between novices and veterans
- Brain activity of professional writers was similar in some way to the brains of other skilled people like musicians or athletes, Lotze concluded
- Dr. Jim Daines in *Psychology Today*: “We have a lot of prejudices about what skills require practice”
- Like a violinist who has to make a lot of racket before getting good, be prepared to write relatively poorly on the way to becoming the writer you will become

Psychology of the writer

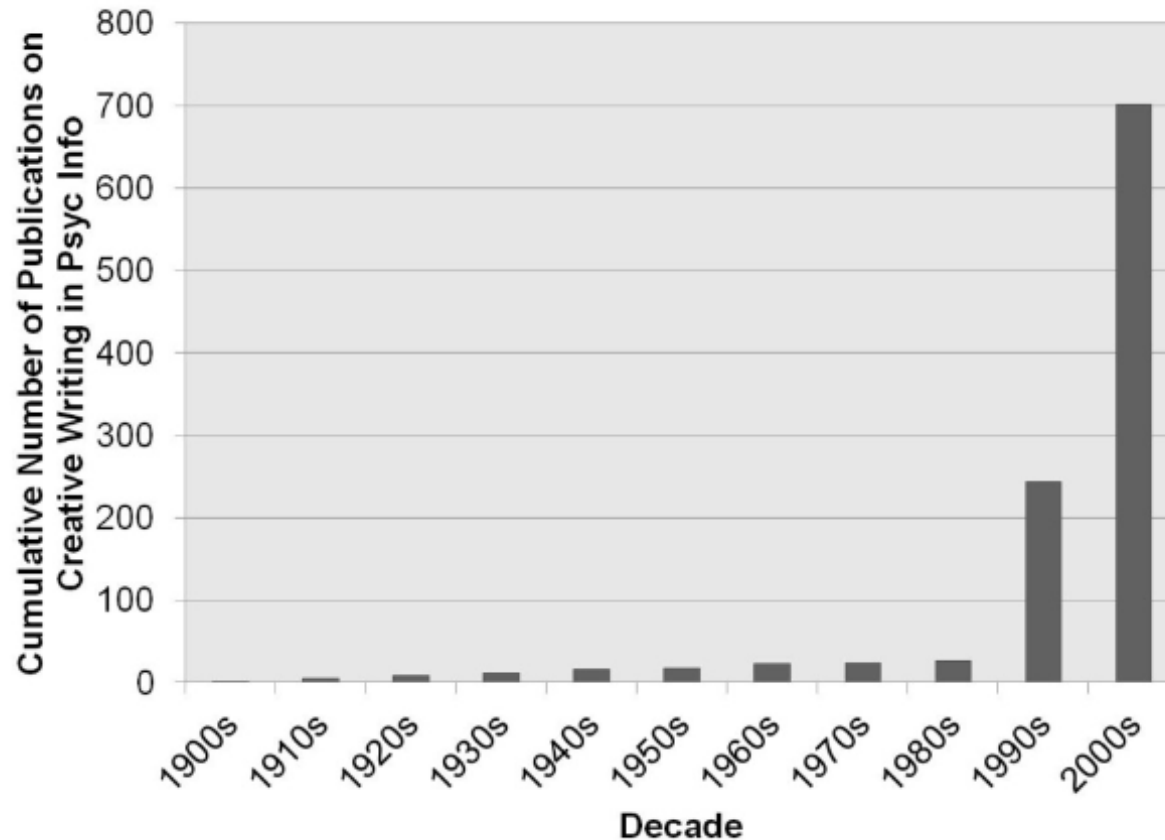


Figure 1. Cumulative number of publications on the subject of creative writing indexed in PsycInfo, by decade.

Psychology of the writer

The Institute of Personality Assessment and Research at University of California, Berkeley evaluated 30 distinguished writers over three days. They found 5 common traits:

- high intellectual capacity
- valued intellectual and cognitive matters
- valued independence
- had high verbal fluency and quality of expression
- enjoyed aesthetic impressions

Writers are awesome

Researcher Jane Piirto conducted qualitative study of writers listed in Directory of American Poets and Writers. She collected and analyzed interviews, memoirs, and biographies.

Distinguishing traits:

- high levels of ambition (and envy!)
- highly concerned with philosophical issues such as meaning of life
- high levels of frankness and risk-taking
- placing a high value on empathy
- keen sense of humor

Writers have issues

- Researcher A.M. Ludwig compared 59 female writers to 59 matched controls and found the writers suffered from higher levels of depression, mania, panic attacks, generalized anxiety, eating disorders, and drug abuse
- Members of artistic professions, he found in subsequent research, were twice as likely to suffer from two or more psychological disorders as people in other professions
- Yet productivity is a sign of resilience, health, and ego strength

Writing is therapeutic

- Writing is used as therapy to treat grief, desertion, trauma, abuse, and other ailments
- Premise is that writing one's feelings causes emotional trauma to fade and achieves self-awareness
- Allows anonymous revelation of private thoughts and anxieties
- Creativity releases dopamine

The creative process (Wallace, refined)

- Preparation: gather information
- Incubation: subconscious works on ideas
- Creative frustration: is this going anywhere?
- Illumination: make connection between ideas
- Implementation: ideas become reality via critical thinking

Getting into the flow

- M. Csikszentmihalyi conducted qualitative study of creative people including eminent writers
- Writers described experiencing “flow” during writing process

FLOW (DESCRIBED)	HOW TO GET IT (S.K. PERRY)
Psychological state High challenge and skill Intense concentration Merging action and awareness Sense of control over activity Hard but rewarding work	Be passionate about the work Get regular feedback Engage in prep rituals Minimize anxiety about outcome

Getting creativity flowing

- Cognitive stimulation via exposure to other's ideas an effective tool
- fMRI study involving 31 participants tasked to create alternate uses for everyday objects
- They performed task after time period in which they reflected on their ideas or in which they were shown stimulus-related ideas of others
- This cognitive stimulation was effective in improving originality and affiliated with increased neural network activity
- What can we learn? Read other authors, join writing groups, and find a constructive Ideal Reader

Writer's block

- A function of not being able to produce words or not being able to imagine what happens next?
- Because brainstorming is shared between language and planning and control areas, problem may be in the latter region for some writers
- We can't make the needed connections and plans to begin writing out of fear or lack of confidence (e.g., impostor syndrome)

“Writer's block is a highly treatable condition. A systematic approach can help to alleviate anxiety, build confidence, and give people the information they need to work productively.”

Dr. P. Huston, University of Ottawa Heart Institute

How to mitigate writer's block

Mild blockage

- Have realistic expectations
- Be allowed to be imperfect (write a draft)
- Sidestep whatever is blocking you
- Optimize your writing conditions

Moderate blockage

- Imagine you are someone you admire writing
- Talk through your work with a sympathetic ear
- Write stream of consciousness to prime the pump
- Take a break

Severe blockage

- Cognitive or behavioral therapy
- Negative consequences

Negative consequences

- In 1983, R. Boice et al conducted an experiment with two groups of 10 academicians
- All agreed to make a good writing environment, schedule writing time each week, produce a minimum output (pages), and graph their output over 22 weeks
- Agreement during “negative contingency” periods to give \$15 to an organization they hated for every day in which they missed their pre-commitment goal
- Of the 26 participants, 7 dropped out, the rest showed consistently improving productivity during negative contingencies compared to noncontingent periods

Commit to anything.
Add stakes as an incentive.



THE MOST DANGEROUS WRITING APP

03:26

You failed.

I wrote 120 words in 01:33 minutes - and then I
died using The Most Dangerous Writing App #MDWA

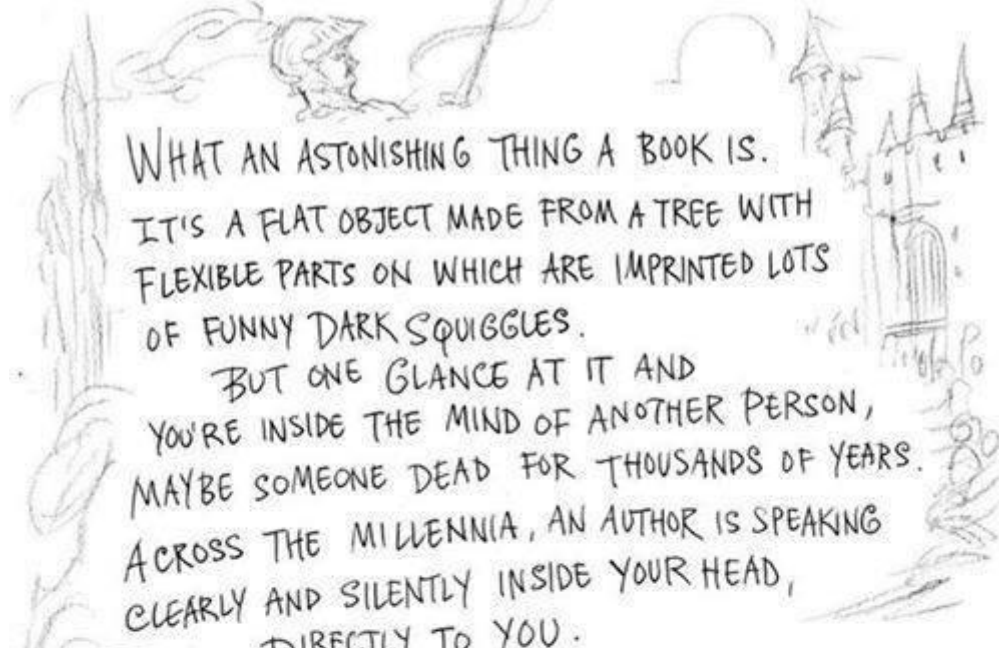


Retry

650c 120w 76wpm

Conclusions

- Character transformation and conflict are the key to compelling stories, theme doesn't hurt
- Writing engages multiple regions of brain
- Writers are both born and made; practice makes perfect
- Writers have a distinct psychology
- There are worthwhile techniques that foster “getting in the zone”
- Writer's block can be overcome



WHAT AN ASTONISHING THING A BOOK IS.

IT'S A FLAT OBJECT MADE FROM A TREE WITH
FLEXIBLE PARTS ON WHICH ARE IMPRINTED LOTS
OF FUNNY DARK SQUIGGLES.

BUT ONE GLANCE AT IT AND
YOU'RE INSIDE THE MIND OF ANOTHER PERSON,
MAYBE SOMEONE DEAD FOR THOUSANDS OF YEARS.
ACROSS THE MILLENNIA, AN AUTHOR IS SPEAKING
CLEARLY AND SILENTLY INSIDE YOUR HEAD,
DIRECTLY TO YOU.

WRITING IS PERHAPS THE GREATEST OF HUMAN INVENTIONS,
BINDING TOGETHER PEOPLE WHO NEVER KNEW EACH OTHER,
CITIZENS OF DISTANT EPOCHS.

BOOKS BREAK THE SHACKLES OF TIME.

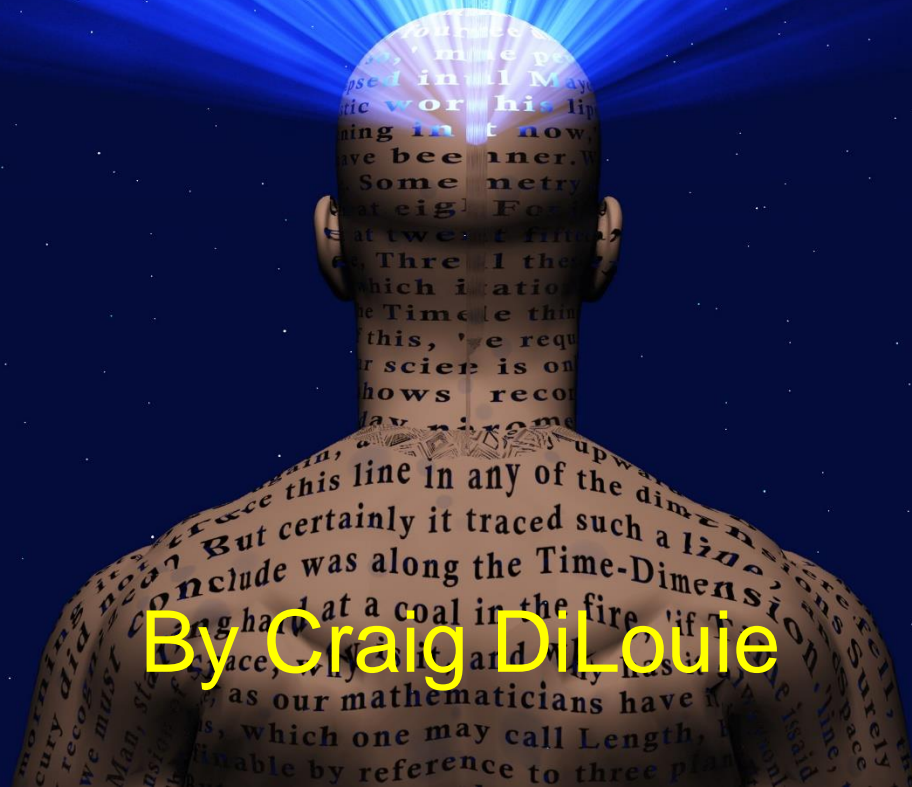
A BOOK IS PROOF THAT HUMANS ARE CAPABLE OF WORKING
MAGIC.

CARL SAGAN



CHRIS
RIDDELL

This Is Your Brain on Words



By Craig DiLouie

Get a copy of this presentation

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www.CraigDiLouie.com