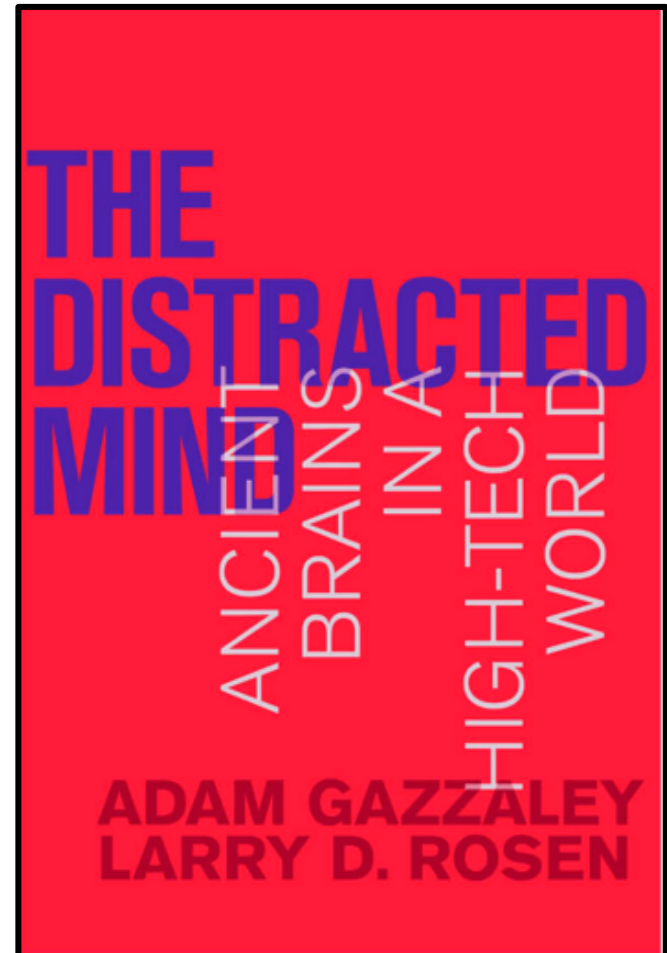


THE DISTRACTED MIND:

Ancient Brains in a High-Tech World

Larry D. Rosen, Ph.D.
CSU Dominguez Hills

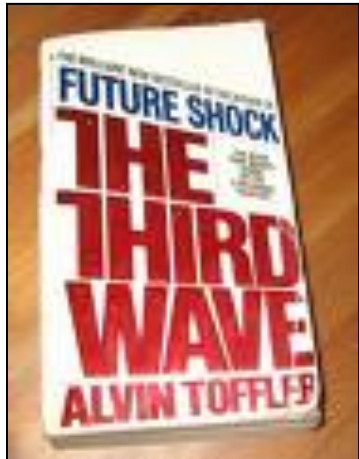
The Alberta Teachers'
Association
May 27, 2016



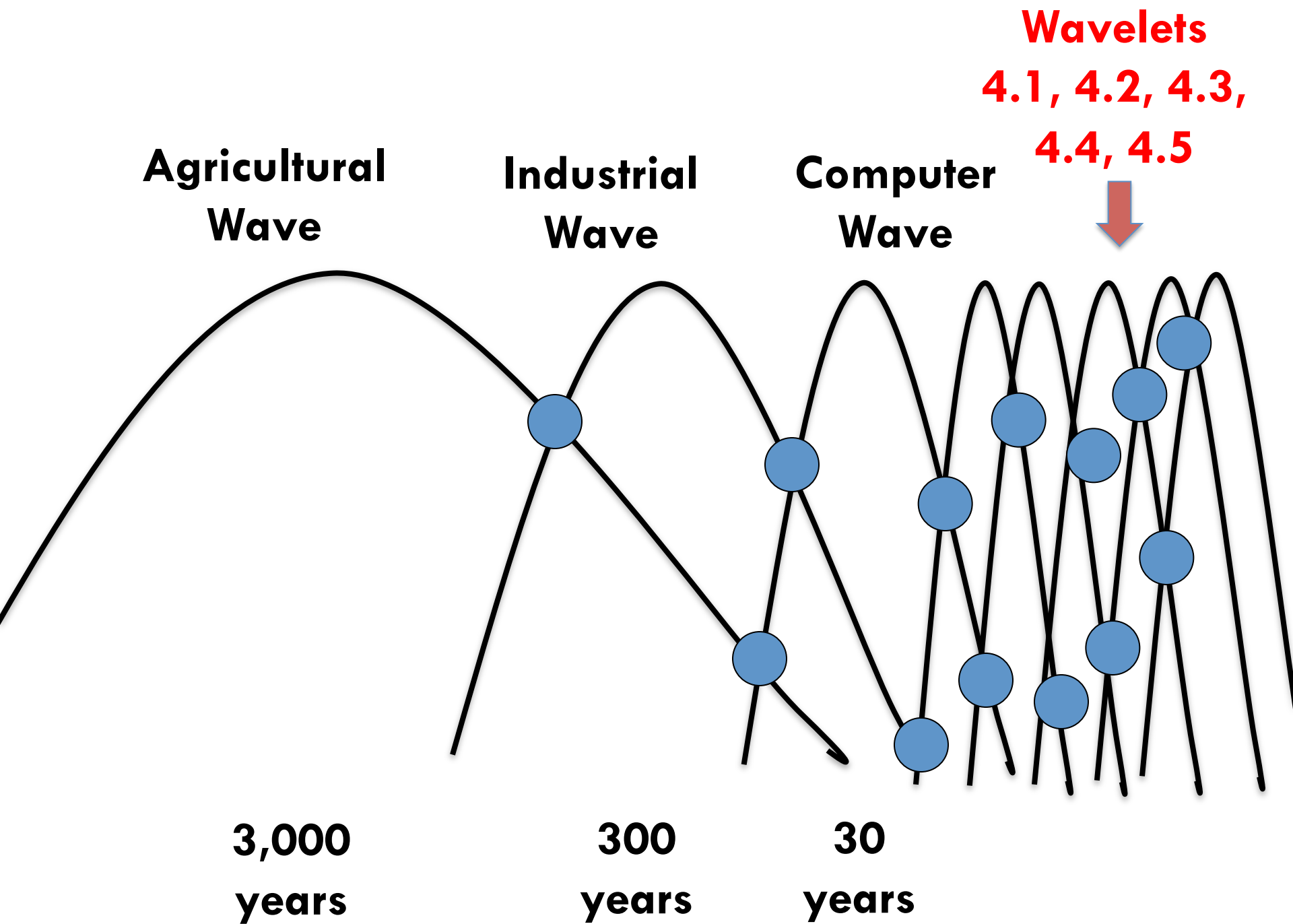
TODAY'S PLAN

- Our Current Technology Obsession
- Overview of Our Brain and How It Works
“Under the Influence of Technology”
- A Model of Why We Get So Distracted
- Dealing With Everyday Distractions
- Understanding Classroom/Studying Distractions
- Prescriptive Advice and Strategies
- Burning Questions

HOW DID WE GET THIS WAY?



WAVES	TECHNOLOGY	YEARS
FIRST	Agricultural Wave	3,000
SECOND	Industrial Wave	300
THIRD	Computer Wave	30
4.1	Information Wavelet	?
4.2	Communication Wavelet (Email)	?
4.3	Mobile Wavelet	?
4.4	Social Communication Wavelet	?
4.5	Smartphone Wavelet	?
4.6 ??	Biological Technology Wavelet	?



WHAT'S DRIVING THE WAVES?

Technology Penetration Rate



Technology Game
Changers



PENETRATION RATE

Radio took 38 years

The Telephone took 20 years

Television took 13 years

Cell Phones took 12 years

The WWW took 4 years

iPods took 3 years

Blogs took 3 years

MySpace took 2.5 years

Facebook took 2 years

YouTube took 1 year



Angry Birds
Took Just 35
Days!

THREE GAME CHANGERS MADE WAVELETS

- **WORLD WIDE WEB** (promoted several wavelets)
 - ✓ Anytime Information
 - ✓ E-Mail
 - ✓ Anywhere Mobile Computing
- **SOCIAL MEDIA**
 - ✓ One-to-Many Communication
 - ✓ Self-Expression
- **SMARTPHONES** “*changed everything*” — Steve Jobs
 - ✓ Everything in One Device
 - ✓ Whatever, Wherever, Whenever

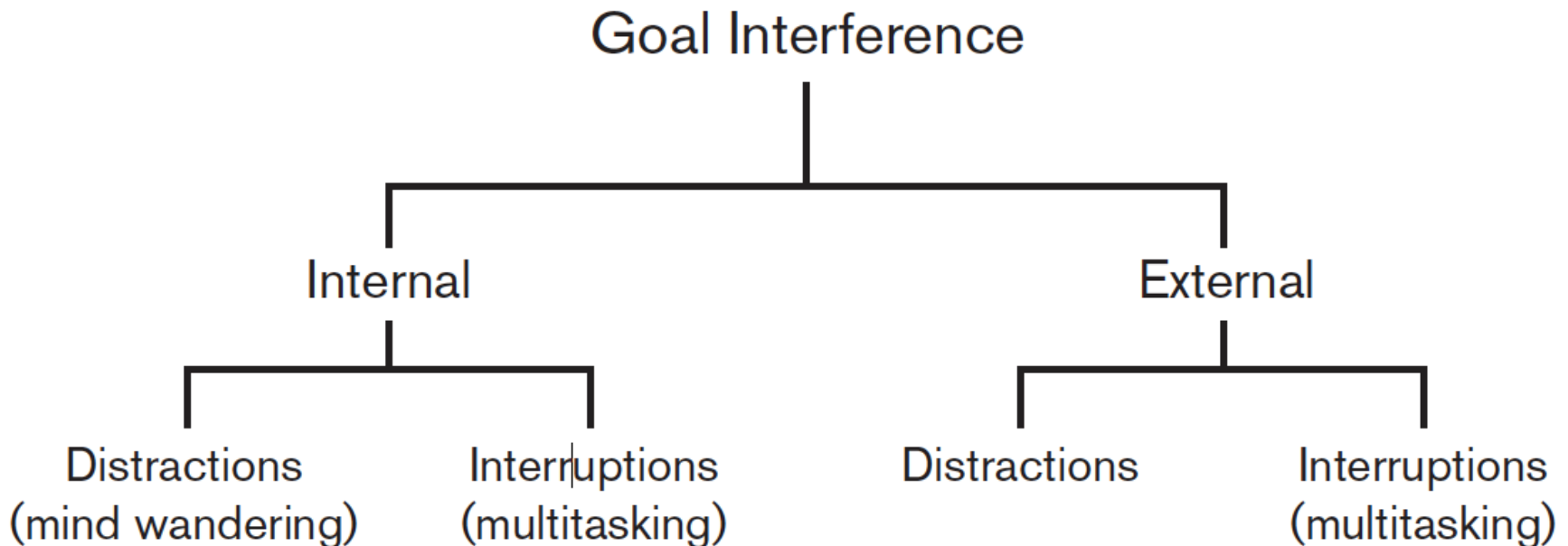
TECHNOLOGY LEADS TO [GOAL] INTERFERENCE

- DISTRACTIONS

- ✓ From the Environment
- ✓ From Our Brain

- INTERRUPTIONS

- ✓ From the Environment
- ✓ From Our Brain



EXAMPLE OF INTERFERENCE TYPES

A STUDENT IS TRYING TO LISTEN TO THE TEACHER

- Checking His Phone After a Vibration from Text Message → **External Interruption**
- Trying to Listen BUT ALSO Watching Johnny Doodle on His Paper → **External Distraction**
- Thinking About What He is Doing After School → **Internal Distraction**
- Thinking About How Cute That Girl is in the Second Row (and trying to listen) → **Internal Interruption**

IT'S GETTING WORSE

Whatever, Whenever, Wherever

- Proliferation of Smartphones
- Omnipresent Access
- Invasive Alerts and Notifications
- Enticements from Websites – Windows, Tabs, Apps, Videos, etc.
- Media Multitasking Increasing [More Later]
- Constant Checking [More on This One Later, Too]

HOW WE SET GOALS

- **EXECUTIVE FUNCTIONS TO SET GOALS**
 - ✓ Evaluation
 - ✓ Decision Making
 - ✓ Planning
 - ✓ Organization
- **COGNITIVE CONTROL PROCESSES TO ENACT GOALS**
 - ✓ Attention
 - ✓ Working Memory
 - ✓ Goal Management

COGNITIVE CONTROL

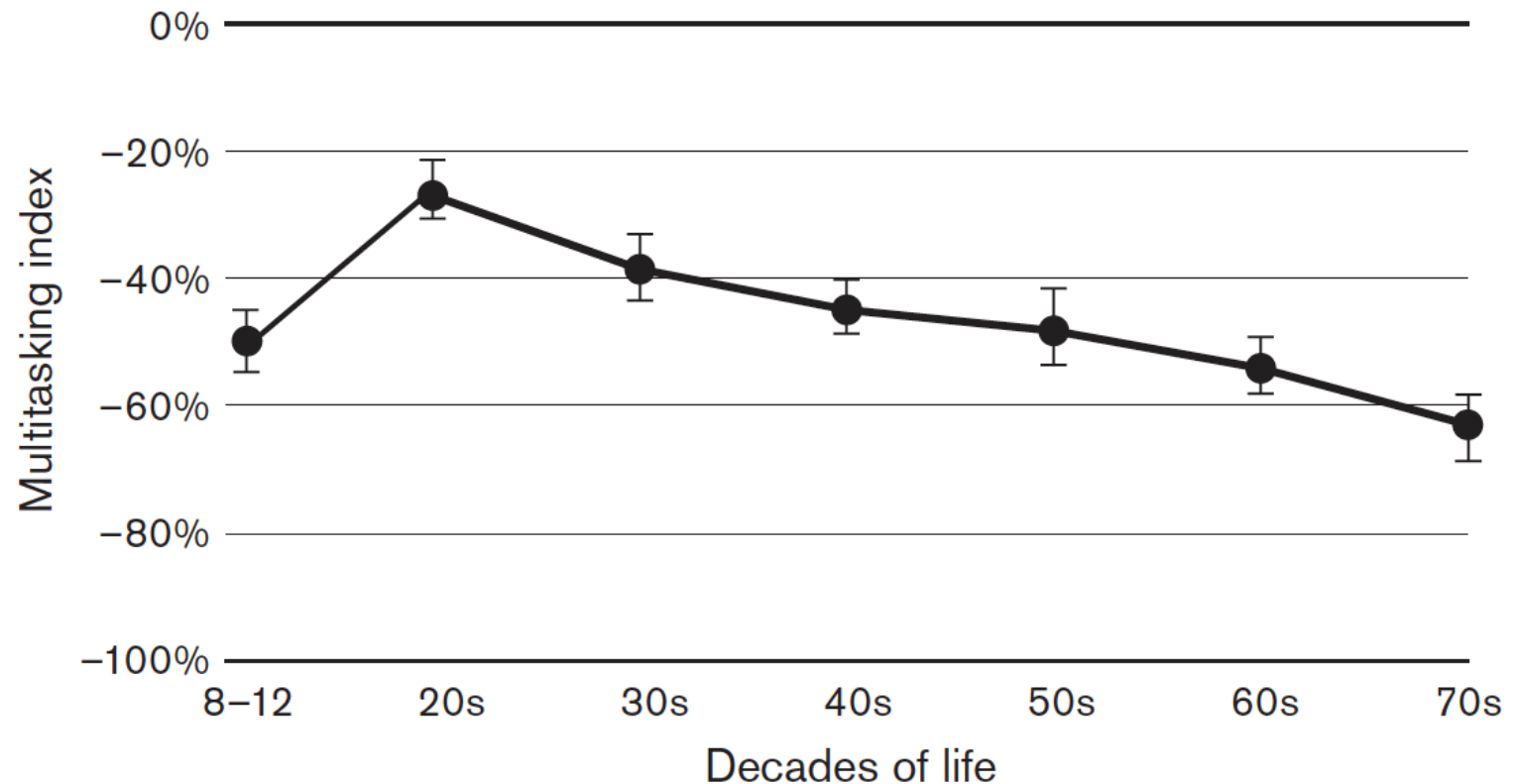
- Top Down vs. Bottom Up
- Attention Distribution Limitations – We are NOT parallel processing computers
- We Cannot Process at Light Speed
- Age Limitations
- Capacity Limitations

COGNITIVE CONTROL PROCESSES

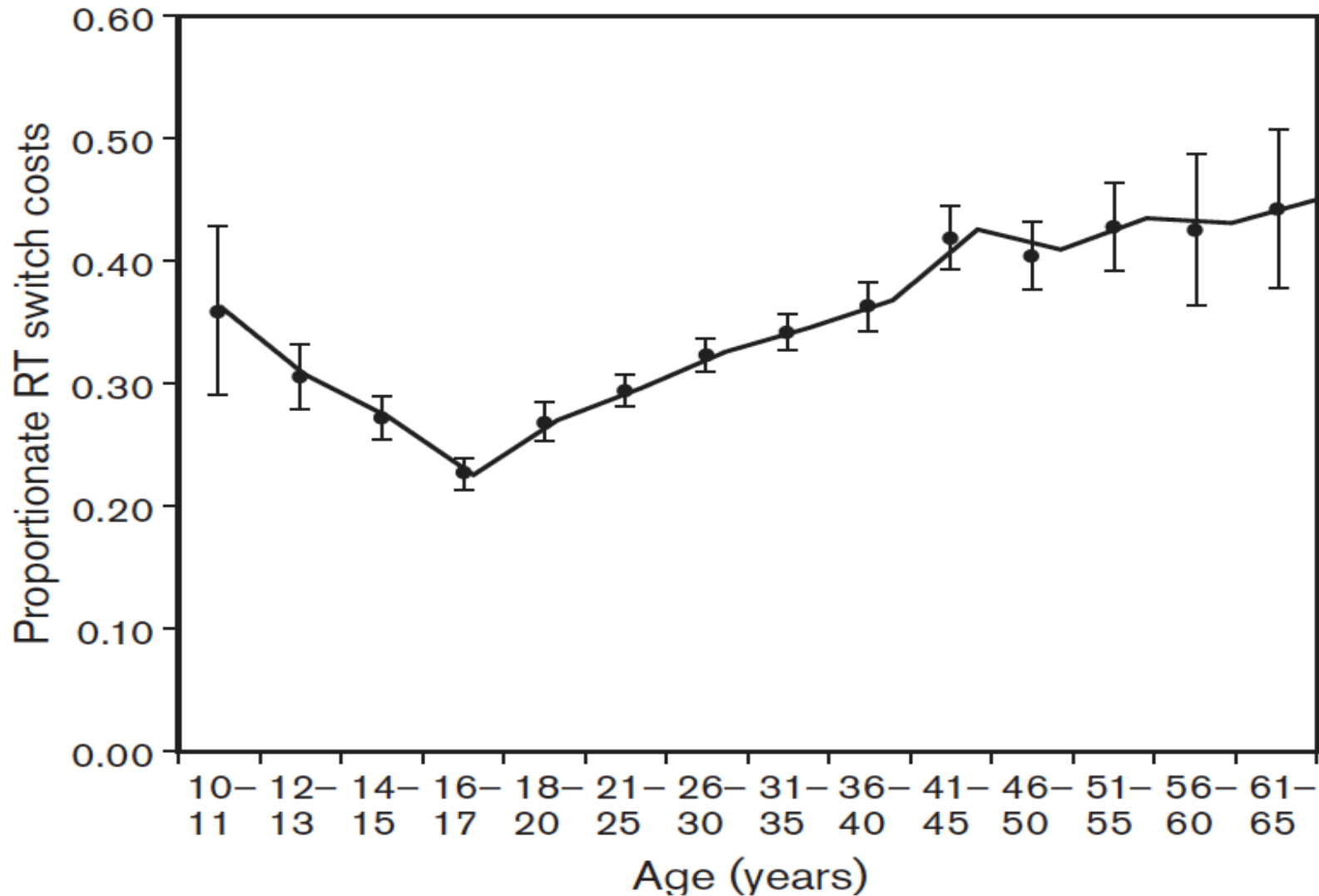
ATTENTION

- Selectivity: What to Attend to or Enhance
 - ✓ Sensory Information
 - ✓ Temporal Information
 - ✓ Location Information
- Selectivity: What to Ignore or Suppress
 - ✓ Irrelevant or Contradictory Information
- Persistence: Keeping Vigilant
 - ✓ Sustaining Attention (A tough one for students!)

ATTENTION ACROSS THE LIFESPAN



ATTENTION ACROSS THE LIFESPAN



MORE COGNITIVE CONTROL PROCESSES

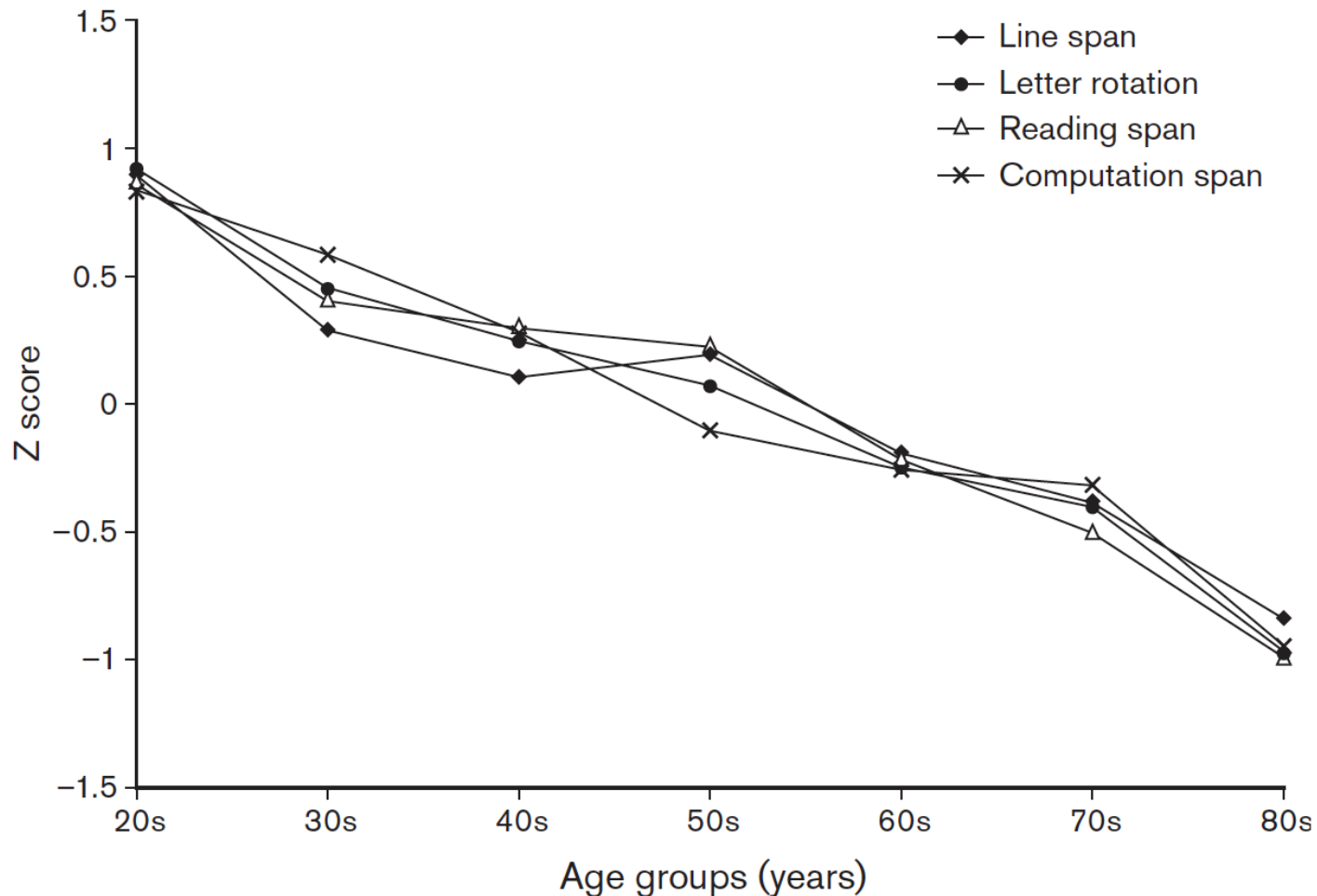
WORKING MEMORY

- ✓ Holding Information in Mind
- ✓ Active Process
- ✓ Time Limited
- ✓ Capacity Limited
- ✓ Quality (Fidelity) Limited
- ✓ Age Limited

GOAL MANAGEMENT

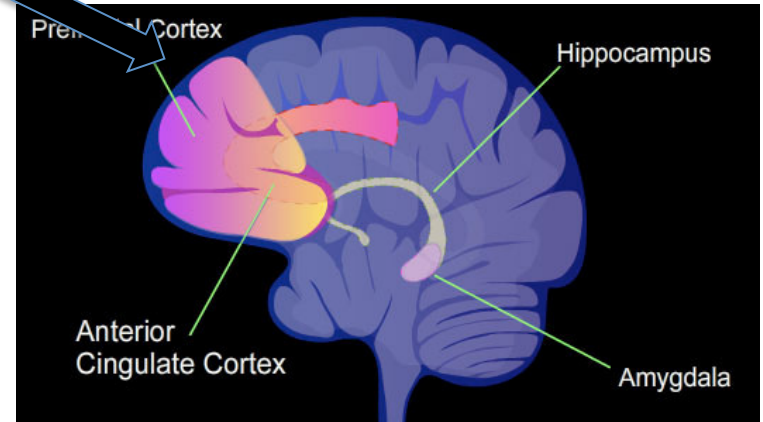
- ✓ Multiple Goals
- ✓ Mental Traffic Controller
- ✓ Task Switching Required

WORKING MEMORY ACROSS THE LIFESPAN



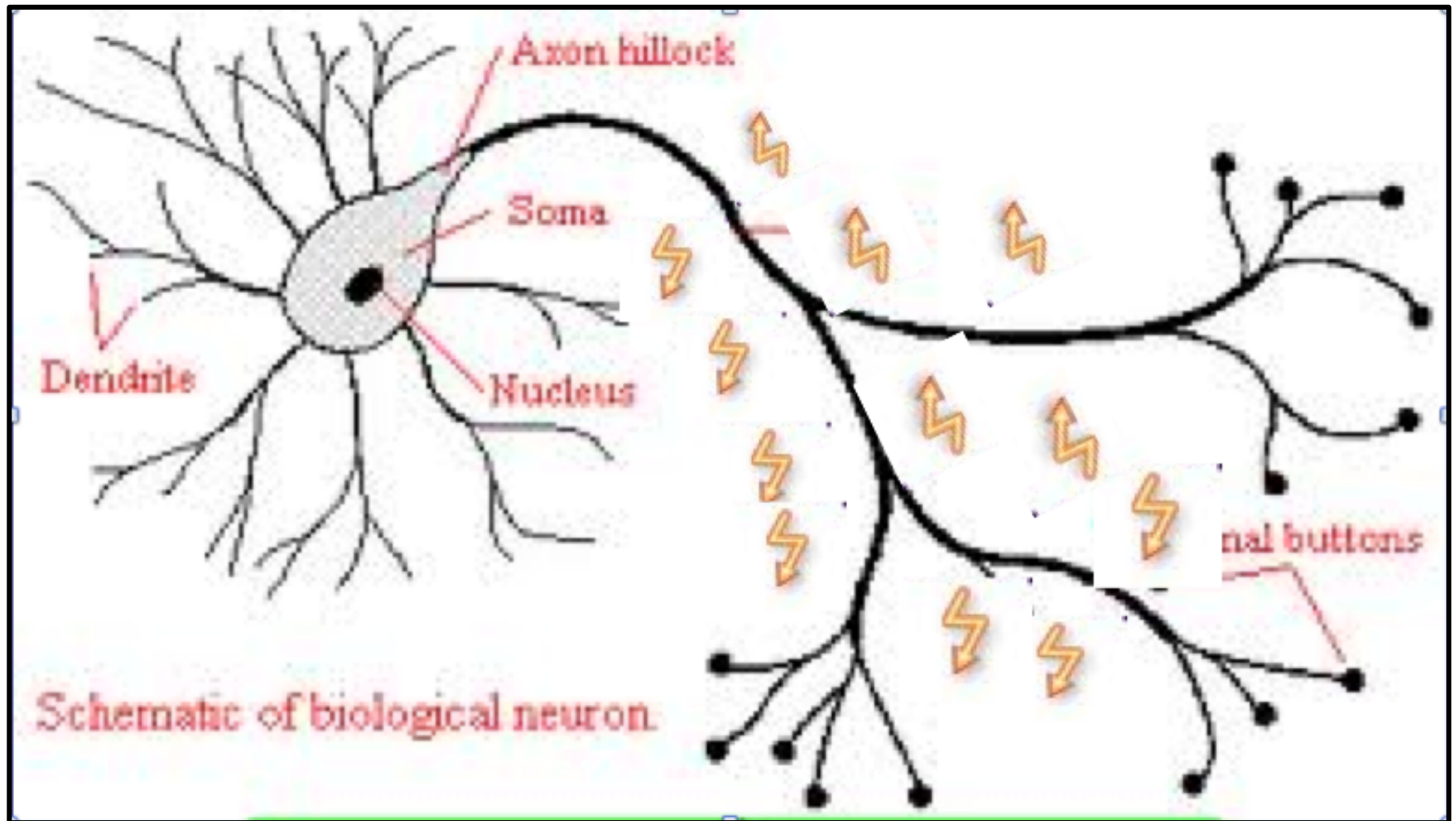
THE BRAIN: THE IMPORTANT PARTS!

- Prefrontal Cortex
 - ✓ Houses All Executive and Cognitive Control Functions
 - ✓ Develops Over Time
- Neural Network
 - ✓ Interconnections of Multiple Brain Areas
 - ✓ Sensory Systems
 - ✓ Internal States – Emotions
 - ✓ Memory
 - ✓ Motor Control

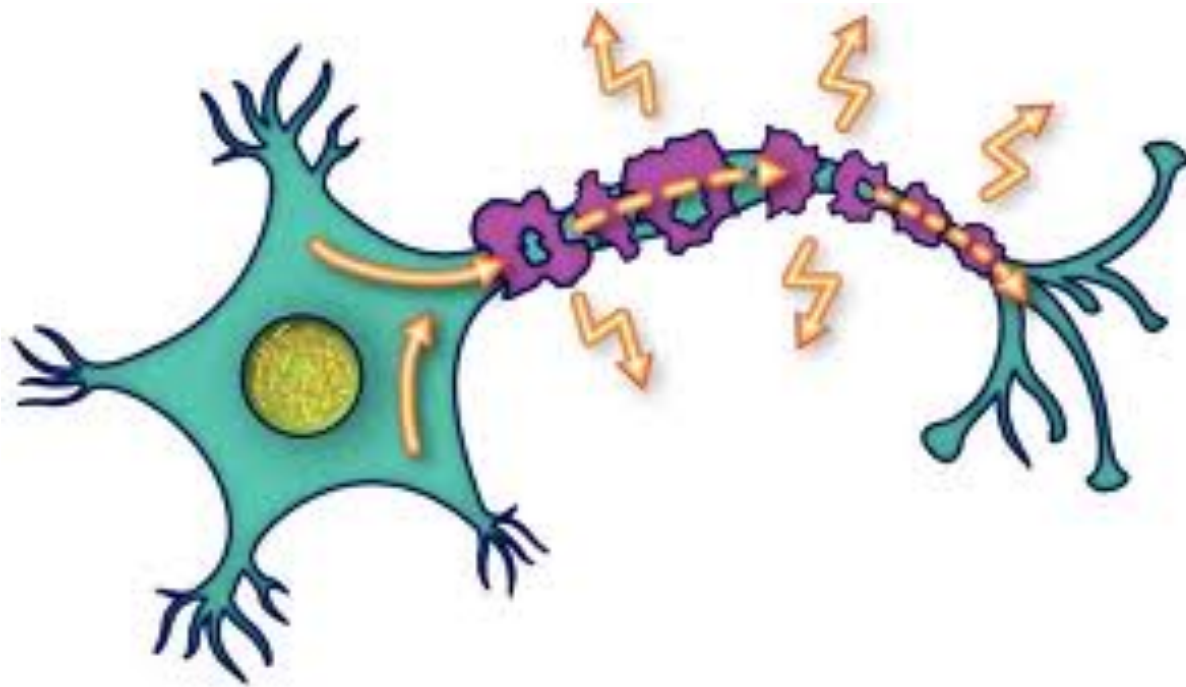


**NERVE CELLS IN THE
PREFRONTAL CORTEX DO NOT
FUNCTION WELL FROM BIRTH
AND DO NOT COMPLETELY
DEVELOP UNTIL THE MID-TO-
LATE 20S**

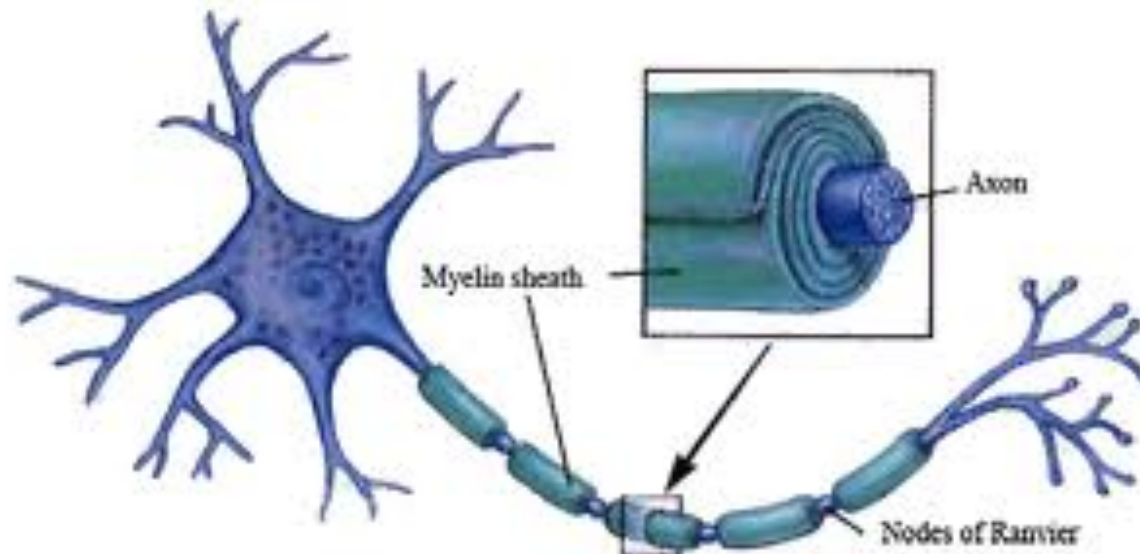
INFANT NEURONS START WITHOUT A “COATING” CALLED MYELIN



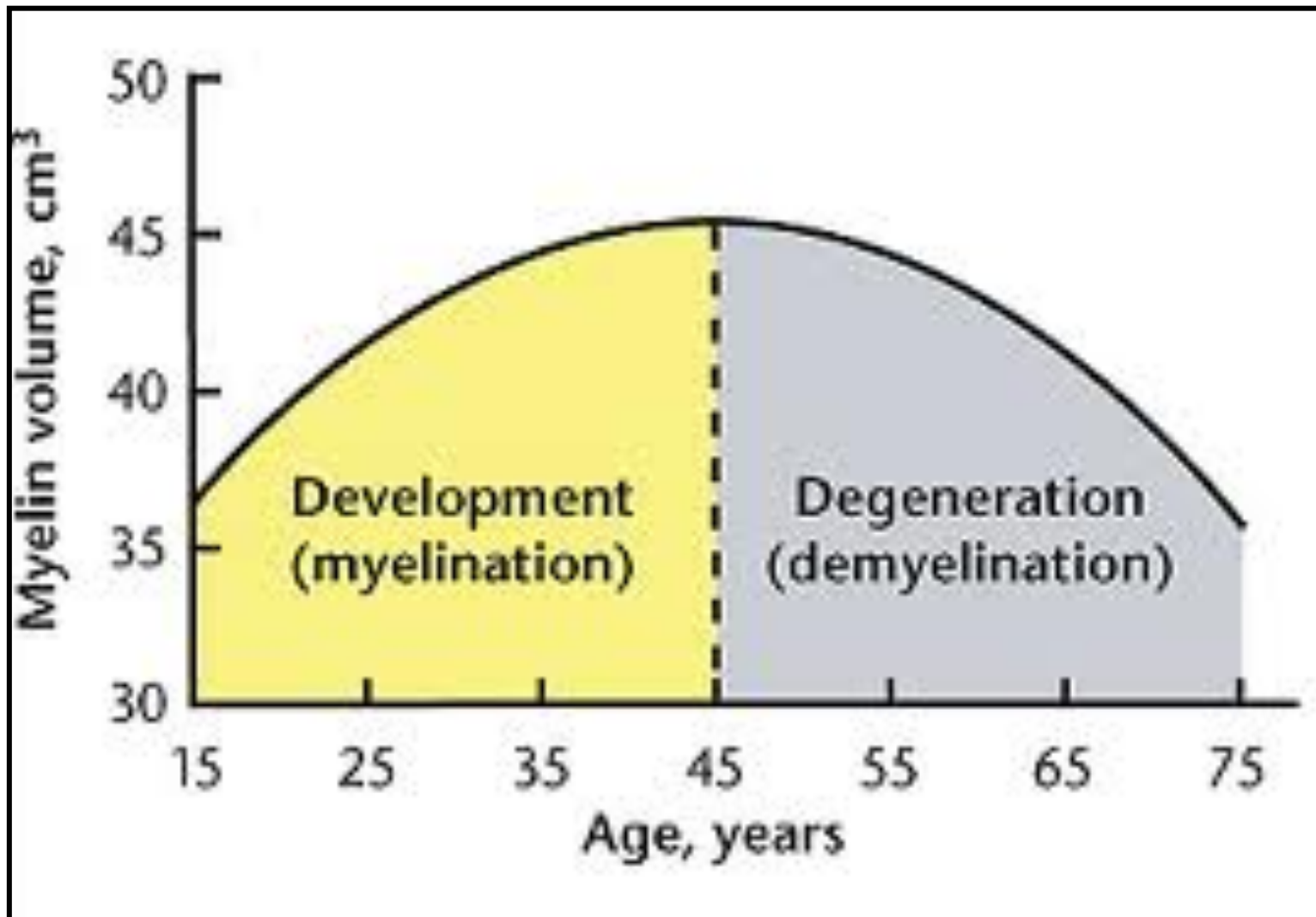
AS CHILDREN GROW NEURONS START TO MYELINATE BUT SOME SIGNALS STILL ESCAPE



EVENTUALLY ALL NEURONS ARE MYELINATED BUT THE LAST AREA IS THE PREFRONTAL CORTEX

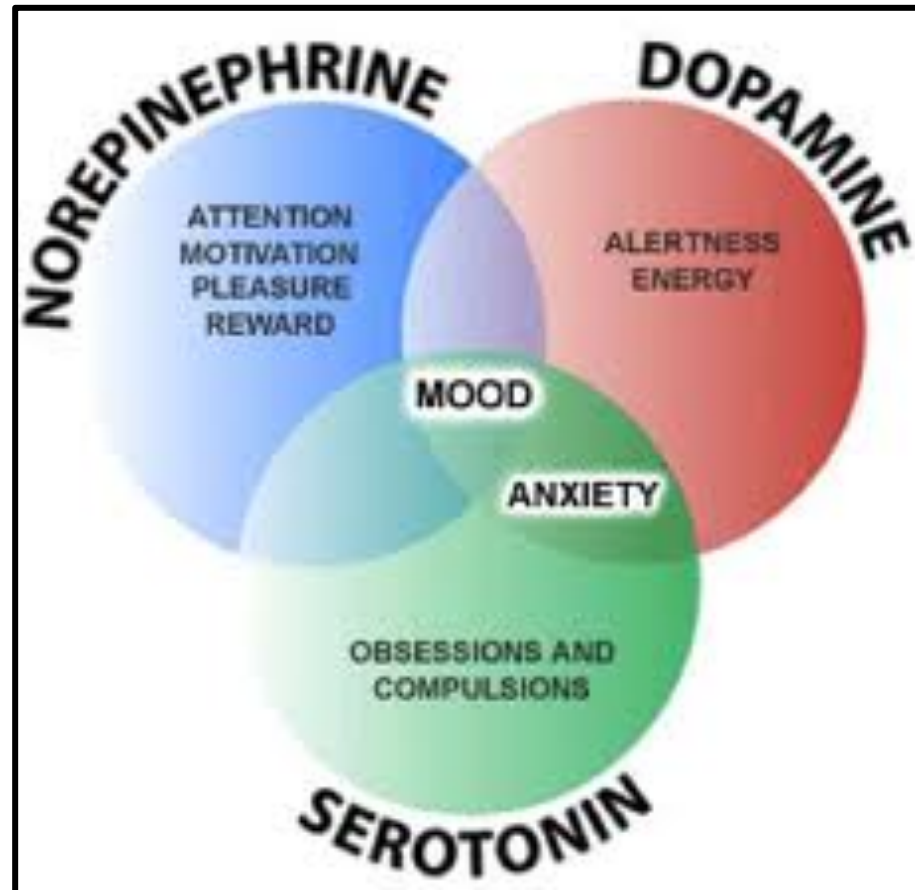
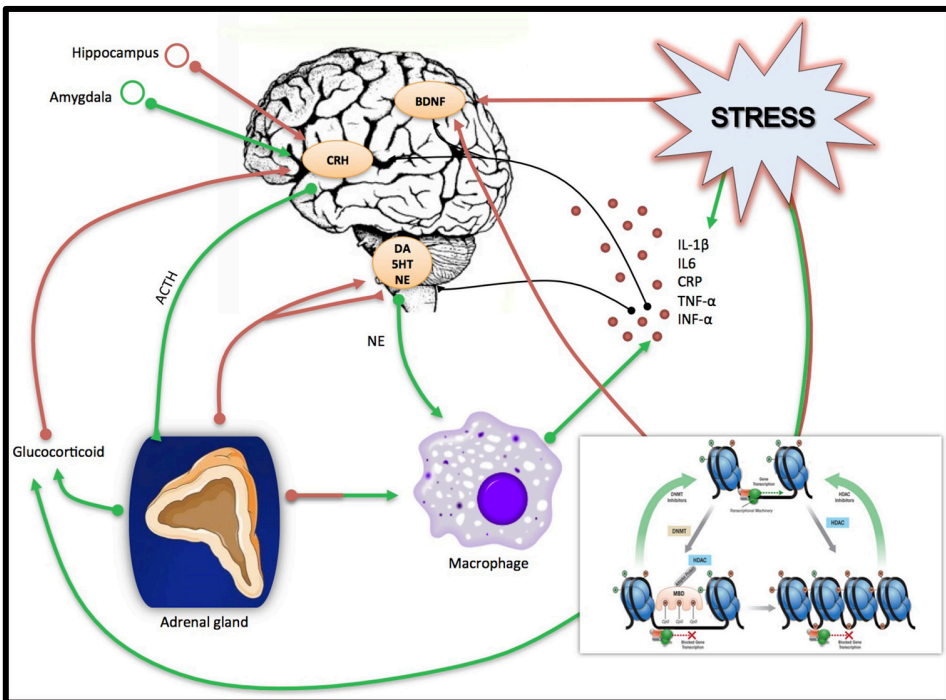


**... AND THAT IS NOT COMPLETE
UNTIL MID-TO-LATE 20s OR LATER**



IT'S NOT ONLY ABOUT BRAIN STRUCTURE

IT'S ALSO ABOUT BRAIN CHEMISTRY



ANXIETY IS A FUNCTION OF BRAIN CHEMISTRY

- 67% Of Teens And Young Adults Check Their Phones Every 15 Minutes Or Less
- If They Can't Check In That Often, 50% Get Moderately-to-Highly Anxious
- What Are They Checking?
 - ✓ Text Messages
 - ✓ Social Media – Facebook, Twitter, Instagram, etc.

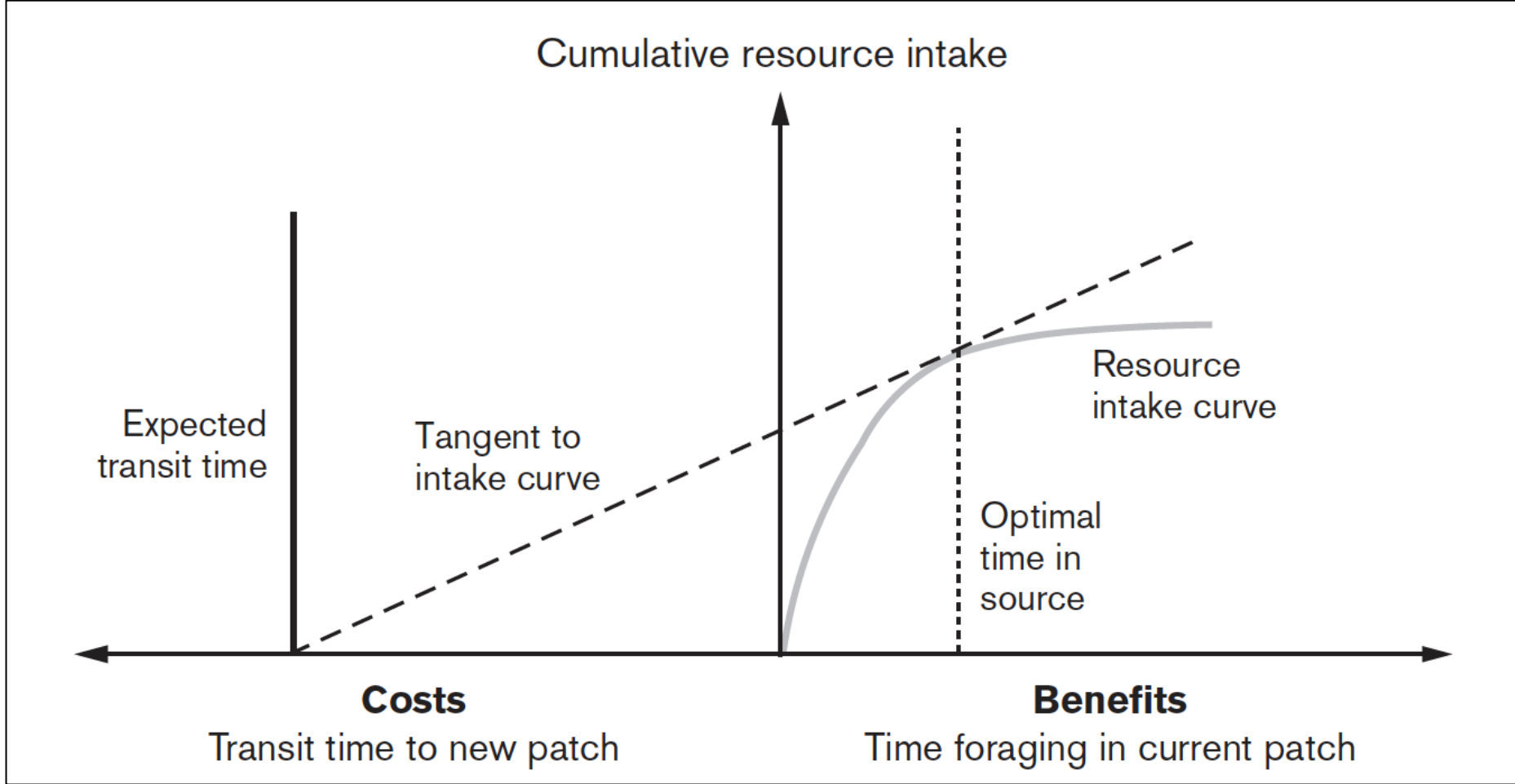
THIS CAN LEAD TO →

PHANTOM POCKET VIBRATION SYNDROME



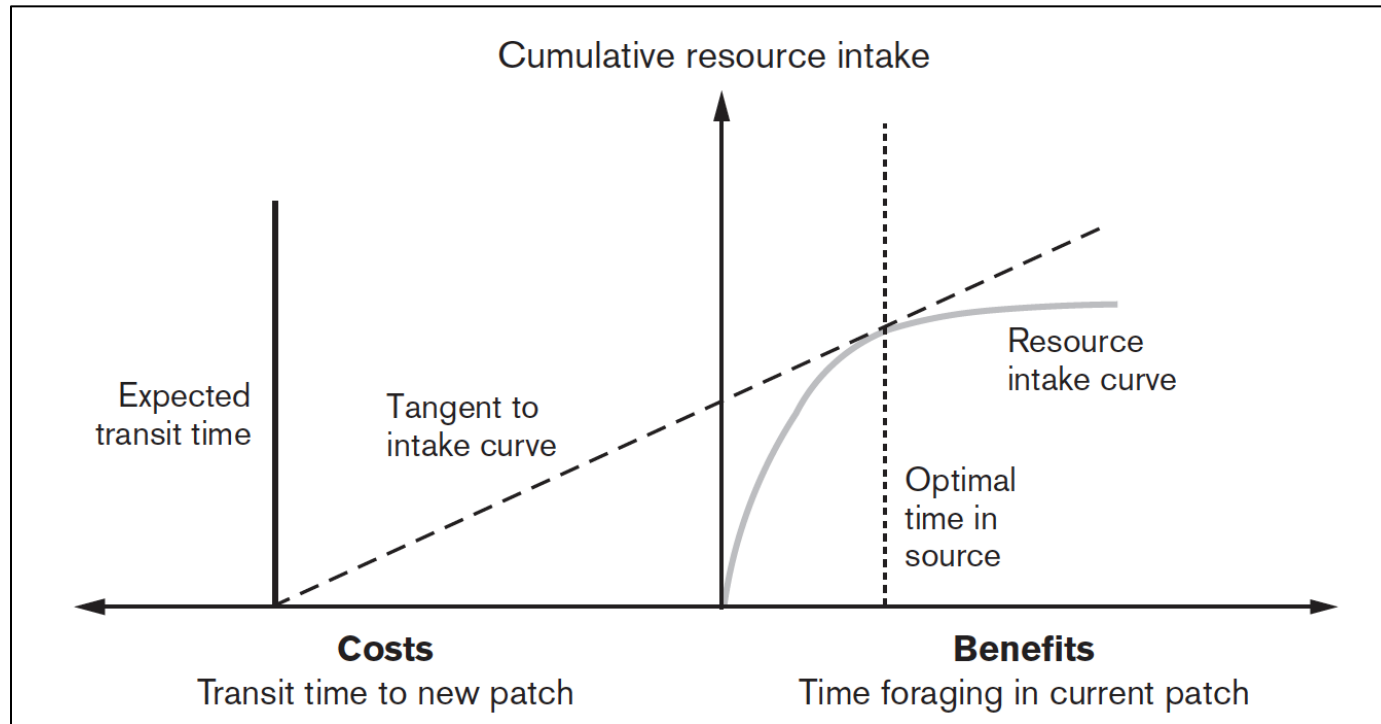
A MODEL OF “INFORMATION” FORAGING

- Based on Optimal Foraging Theories from Animal Behaviors
- Animal Behaviors are not Random → Drive to Survive
- How Animals Forage in “Patchy” Environments
- When to Stay and When to Move
- Marginal Value Theorem (MVT) Tested Accuracy of Model



- Animal attempts to maximize intake (food) with diminishing returns
- Decision to Move Depends on:
 - ✓ How Far the Animal Needs to Go to Find the Next Patch
 - ✓ How Much Food is Left in the Current Patch

NOW ... WHAT DRIVES “INFORMATION” FORAGING?



- ✓ METACOGNITION
- ✓ ACCESSIBILITY

- ✓ METACOGNITION
- ✓ BOREDOM
- ✓ ANXIETY

MEDIA MULTITASKING

- Is it REALLY Multitasking?
 - ✓ Task Switching
 - ✓ Continuous Partial Attention
- Prevalence Among Younger People and Older, too!



GENERATIONS ARE DIFFERENT IN VALUES, BELIEFS, ATTITUDES AND USE OF TECH!

(Rosen & Lara-Ruiz, 2015)

Silent/Traditional Generation (1925 – 1945)

Baby Boomers (1946 – 1964)

Generation X (1965 – 1979)

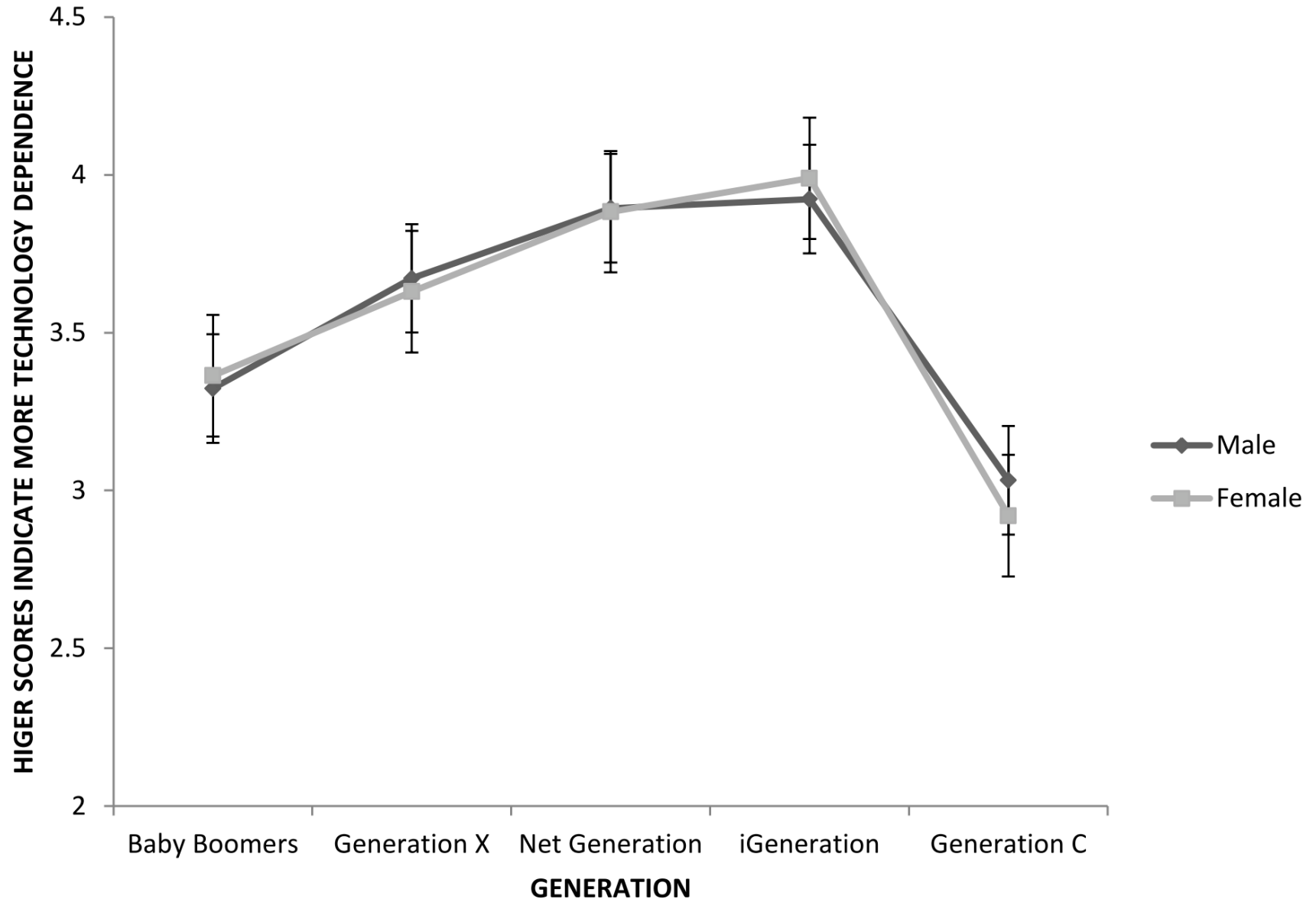
Net Generation (1980 – 1989)

iGeneration (1990 – 1999)

Generation C “Connected” (2000+)

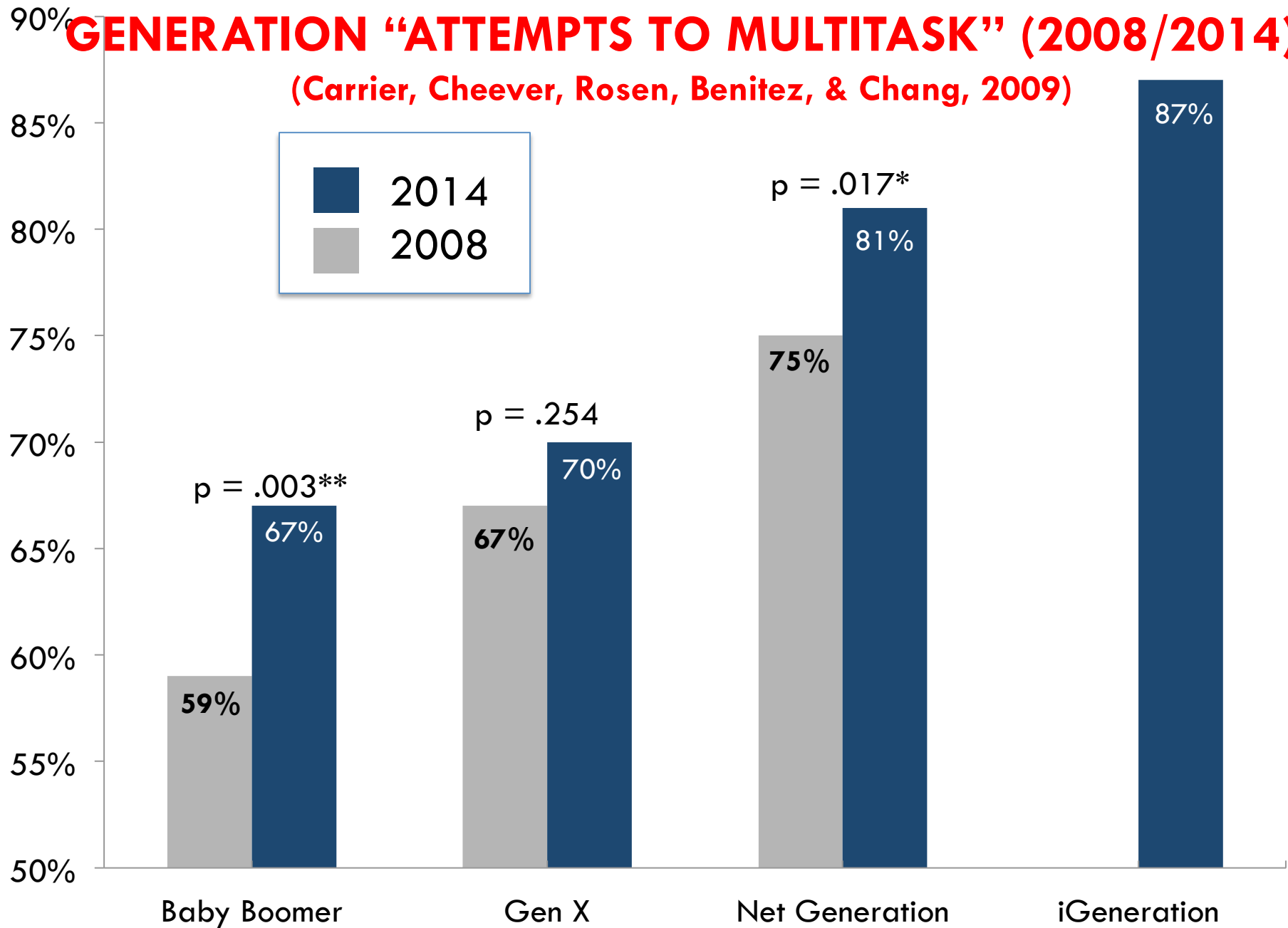
AN EXAMPLE

FIGURE 3.15: TECHNOLOGY DEPENDENCE



PERCENTAGE OF PAIRED ACTIVITIES EACH GENERATION “ATTEMPTS TO MULTITASK” (2008/2014)

(Carrier, Cheever, Rosen, Benitez, & Chang, 2009)



ISSUES FOR PARENTS AND EDUCATORS

Everyday Multitasking
Health Ramifications



Classroom Multitasking
Studying Multitasking



EVERYDAY MULTITASKING

- Biometric Belt Eye Camera Study (all activities)
 - ✓ 300 Hours of Leisure Time
 - ✓ Younger Adults Switch 27 Times Per Hour (2 minutes)
 - ✓ Older Adults Switch 17 Times Per Hour (3-4 minutes)
- Instant App Study
 - ✓ Used an Unobtrusive Smartphone App for 8 weeks
 - ✓ Daily Unlocks = 56
 - ✓ Daily Minutes = 220
 - ✓ Daily Minutes Per Unlock = 3.93



MORE EVERYDAY MULTITASKING

- Sleeping With Technology
 - ✓ 9 In 10 Americans Use Technology Device In Hour Before Bedtime (Blue Light Impacts Melatonin)
 - ✓ Half (Or More) Teens And Adults Leave Phone On Vibrate Or Ring
 - ✓ Half Check Their Phone At Least Once A Night (And Not For The Time)
- Everyday Reading
 - ✓ We Do Not Read “Screen” Text From Left To Right
 - ✓ We Use An “F” Pattern

MORE EVERYDAY MULTITASKING

- Impatience With “Slow” Technology
 - ✓ 23 Million Observations Of Server Data (Buffering)
 - ✓ Average Viewer Starts To Abandon In 2 Seconds
 - ✓ 6% More Abandon Every Second
 - ✓ 10 Second Delay → Two-Thirds Are GONE
 - ✓ Average Online Shopper → 4 Second Rule
- Television Watching
 - ✓ 81% Of The Time Using A “Second Screen”
 - ✓ Reduces Memory For Both
 - ✓ Unaware Of The Frequency Of Attention Shifts (12%)

EVEN MORE EVERYDAY MULTITASKING

ATTENTIONAL BLINDNESS

- Clown Study
- Patterned After Gorilla Study
- Showed Only 8% Of Cell Phone Users Saw The Clown



EVEN MORE EVERYDAY MULTITASKING

- Walking Across Busy Intersections
 - ✓ 3,700 Street Crossers In Manhattan (Also Seattle)
 - ✓ More Than Half Looking At Or Using Phone
 - ✓ Took Longer To Cross
 - ✓ At Least One “Unsafe” Crossing Behavior (4x More Likely If Using Cell Phone)



(Credit: Peter Haskell/WCBS 880)

EVEN MORE EVERYDAY MULTITASKING

- Relationships
 - ✓ “Only Sips Of Connection – Not Communication”
 - ✓ University Of Essex Study:
 - Random Phone Present During One-on-One Conversation
 - Reduced Closeness, Trust, Empathy And Understanding
 - ✓ iPhone Effect
 - Own Mobile Device On The Table Or In The Hand
 - Conversations Less Satisfying
 - Feel Less Empathic Toward Other

PRETEEN SOCIAL SKILLS DEVELOPMENT

- 5-Day 6th Grade Outdoor Camp Without Technology (Plus Wait-List Control Group)
- Before The Camp: Identify Emotions From Photos And Video
- After The Camp: Try To Identify Again
- Results:
 - ✓ Improved Facial Emotion Recognition After Removing Technology Use For Just Five Days!

THE MOST SERIOUS EVERYDAY MULTITASKING

- Driving
 - ✓ Cell Phone User And Drunk Driver Have Equal Chance Of Traffic Accident
 - Handsfree Conversations Do Not Help!
 - It's Not About the Device. It's About the Brain!
 - ✓ 69% Of Adults Speak On Phone While Driving
 - ✓ 31% Text While Driving
 - ✓ Half Of High School Students Talk Or Text
 - ✓ No Impact Of Talking To A Passenger

TECHNOLOGY USE AND STUDENTS



DISTRACTED STUDENTS

- 90% Use Classroom Devices For Nonacademic Reasons
- Computer Session Logs: On Task Only 2.3 Minutes Before Switching
- Study Session In Lab (3 Hours) → Biggest Interrupter Was Smartphone
- Students KNOW That Texting And Social Media While Studying “Interferes” With Life

MORE DISTRACTED STUDENT STUDIES

- Doing Something Else While In Class Or Studying → **Less Boredom**
- Texting And Social Media Use During Class → **Worse Lecture Notes**
- Using Interruptive Technology During Class (Social Media, Texting, Emailing, IM'ing) → **Worse On Test**
- Cell Phone Use During Class → **More Anxiety, Lower GPA**
- More Technology Use In Class → **More High-Risk Behaviors**

DISTRACTIONS WHILE READING

Bowman, Levine, Waite, & Gendron (2010)

CONTROL GROUP



Read



Take Test

INTERRUPTION GROUP 1



IM



Read



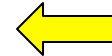
Take Test

INTERRUPTION GROUP 2

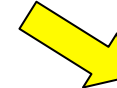


Read

**MULTIPLE
INTERRUPTIONS**



IM



Continue to Read



Take Test

- 1. Who Took Longer to Finish the Chapter and the Test?**
- 2. Who Performed Better on the Test?**
- 3. Who Showed More Stress?**

OBSERVATIONS OF DISTRACTED STUDENTS STUDYING

(Rosen, Carrier, & Cheever, 2013)

RESEARCH METHODOLOGY

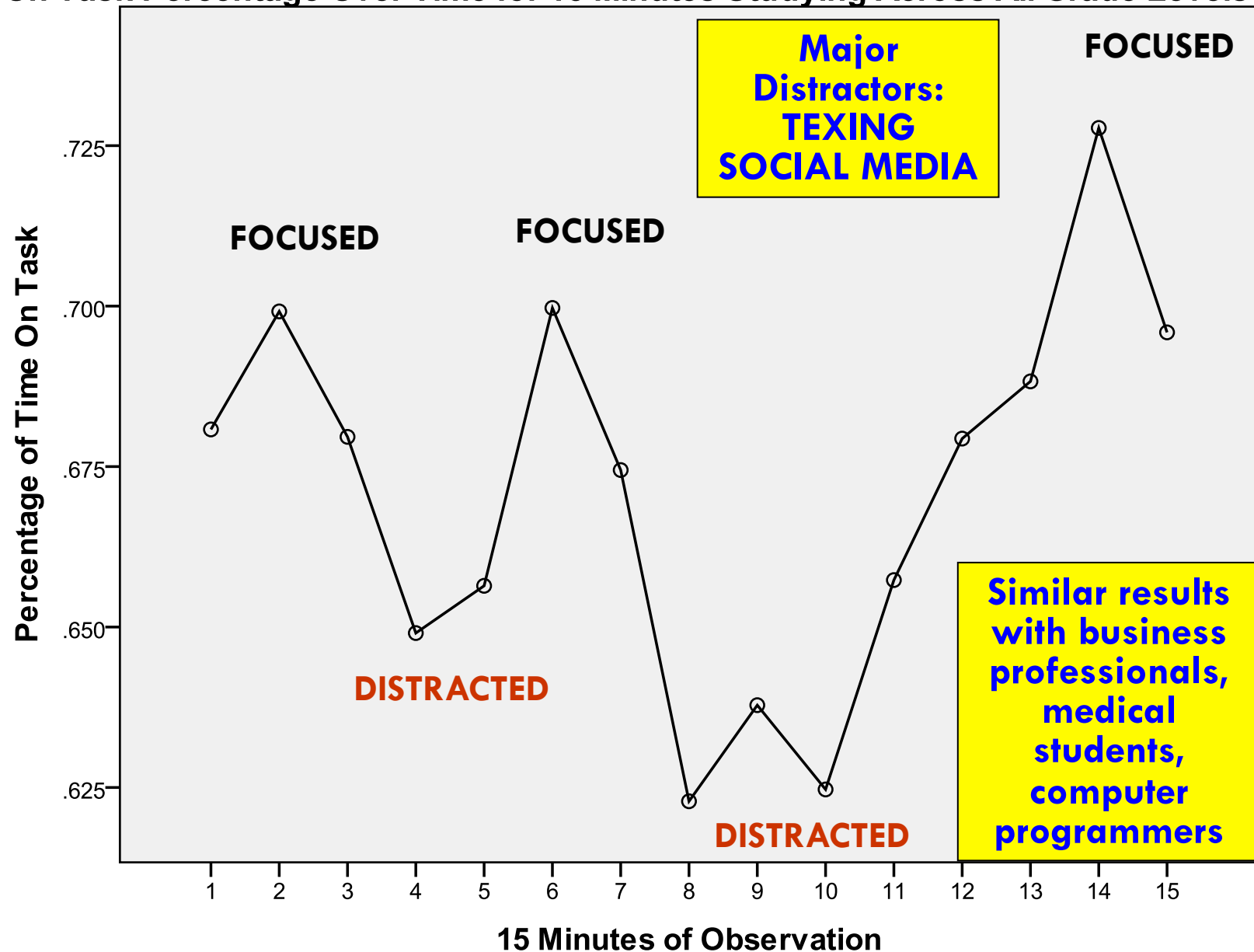
- 279 Middle School, High School And University Students
- Observations Every Minute For 15 Minutes
- Variables: On/Off Task, School Performance, Available Technology (Windows Open)

RESEARCH QUESTIONS

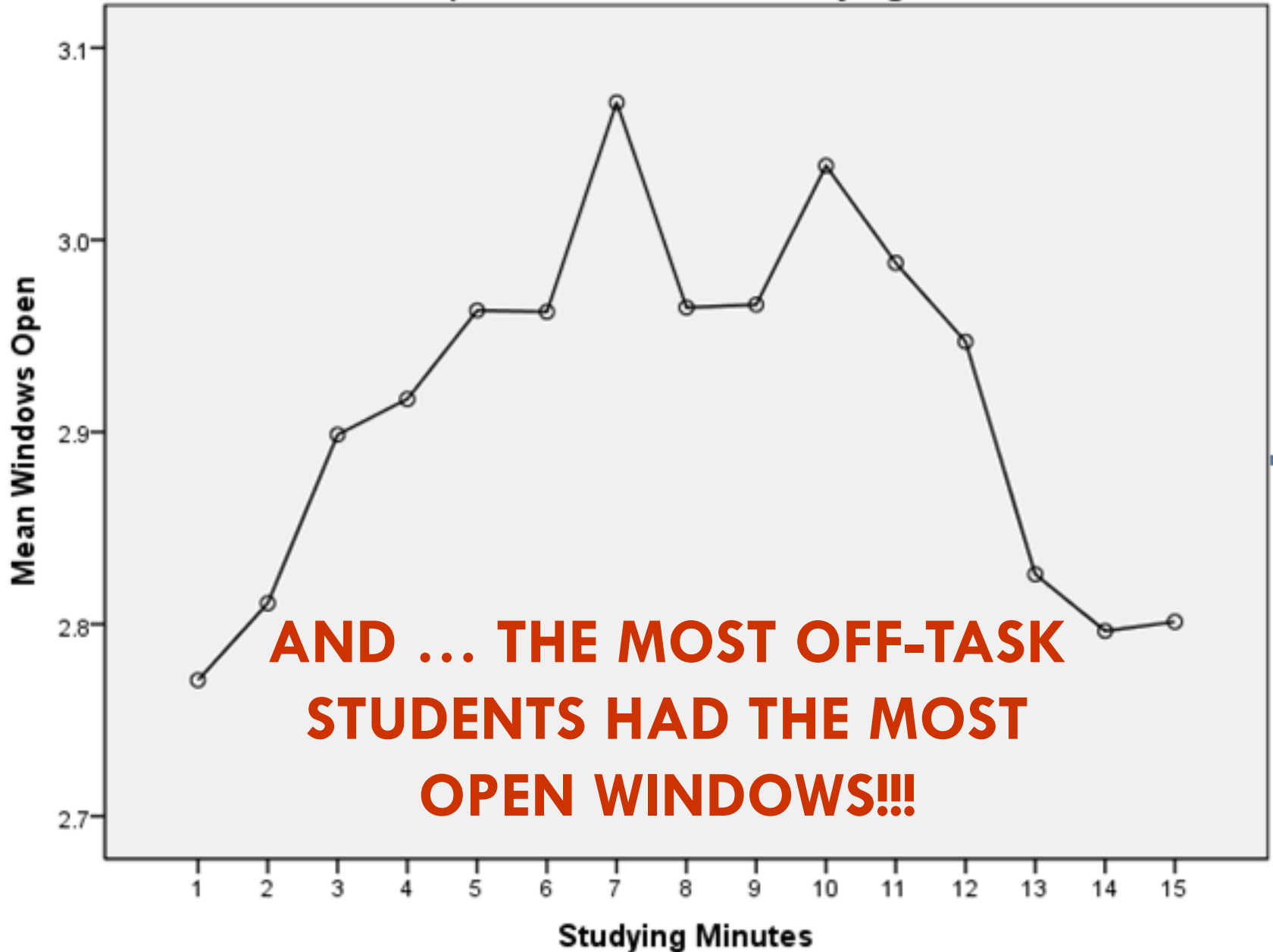
1. Are Students Able To Focus Amidst Technological Distractions?
2. What Predicts School Performance?

OBSERVATIONS OF DISTRACTED STUDENTS STUDYING

(Rosen, Carrier, & Cheever, 2013)



Windows Open Over 15 Minute Studying Time



WHAT PREDICTS SCHOOL PERFORMANCE (GRADES)?

How Much They Stay “On Task” (GOOD!)

If They Have Strategies For Studying (GOOD!)

Preference For Task Switching (BAD ☹️)

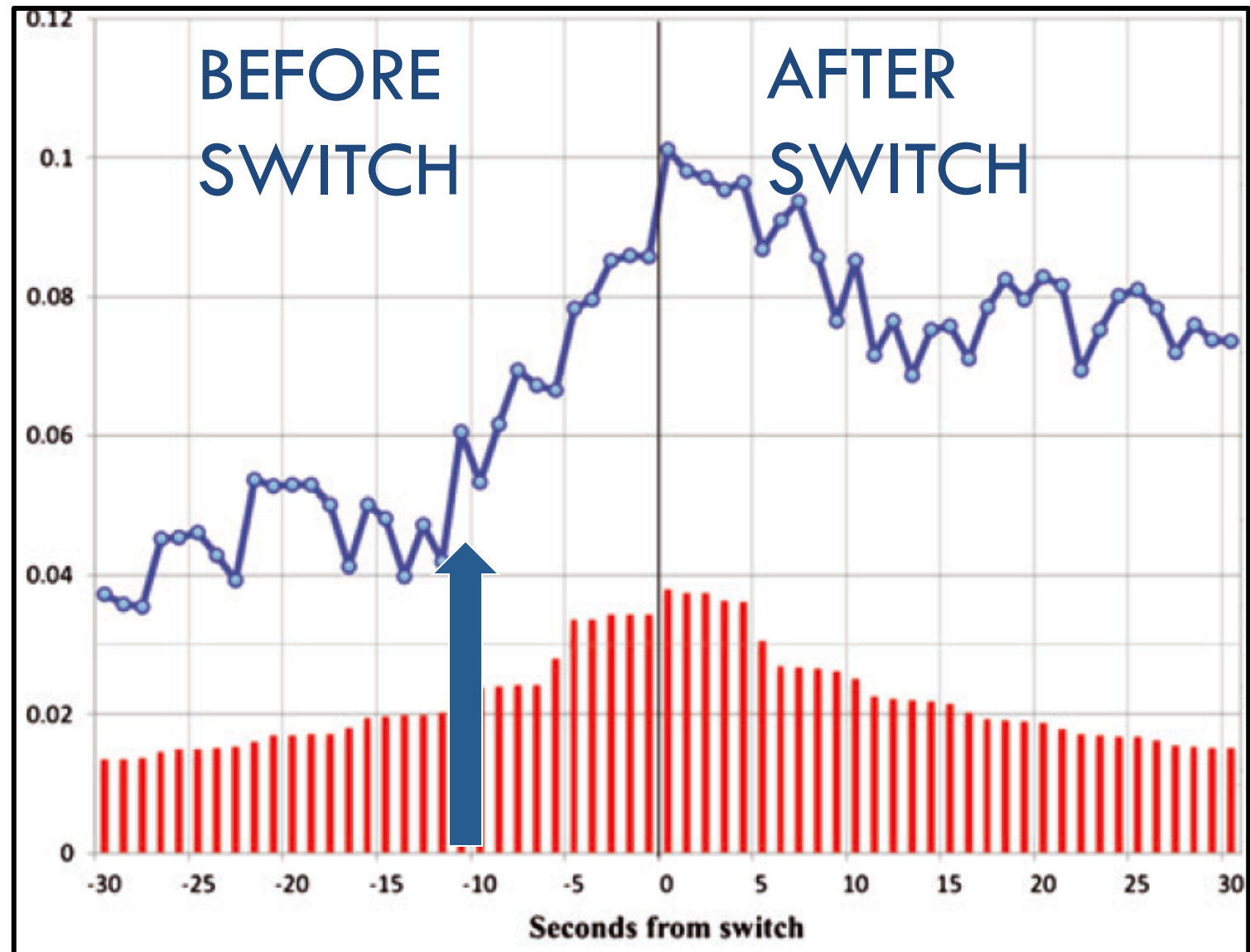
Daily Media Consumption (BAD ☹️)

Whether They Checked Facebook ONCE During 15 Minutes (AWFUL!)

WHAT HAPPENS “BIOCHEMICALLY” WHEN PEOPLE TASK SWITCH?

- Recent Stanford University Study (Yeykelis Et Al., 2014)
- Watched Task Switches On Computer Screen
- Also Measured “Arousal”
- Switched From One Screen To Another Every 19 Seconds
- Most Common (1 In 4 Switches):
 - ✓ E-mail (40 Seconds Per Visit)
 - ✓ Facebook (78 Seconds Per Visit)

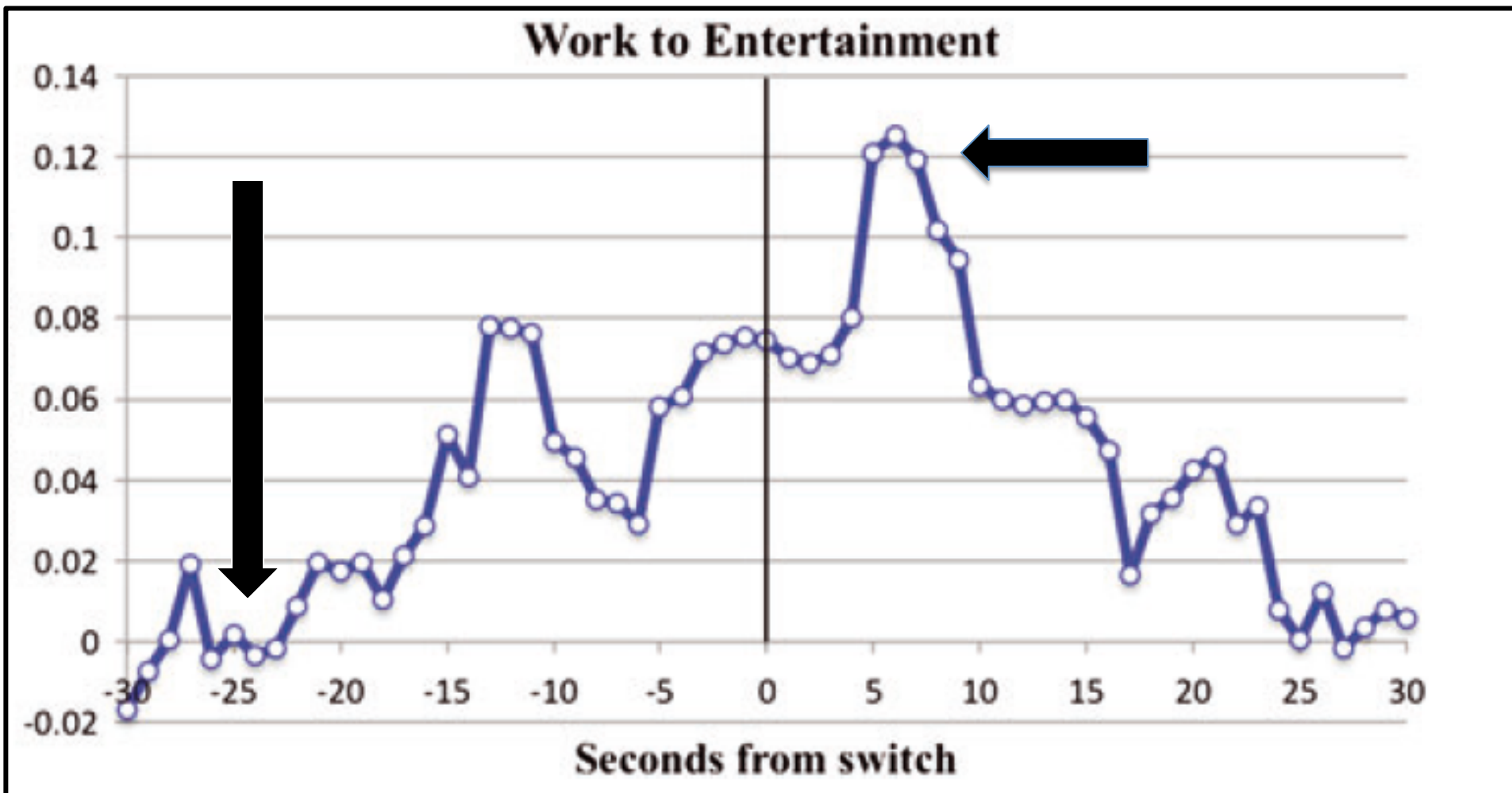
WHAT HAPPENED TO AROUSAL LEVELS?



IS THIS THE SAME FOR ALL TYPES OF SWITCHES?

- Divided Into “Work” And “Entertainment” Websites
- Looked At Switches From Work → Entertainment And Entertainment → Work

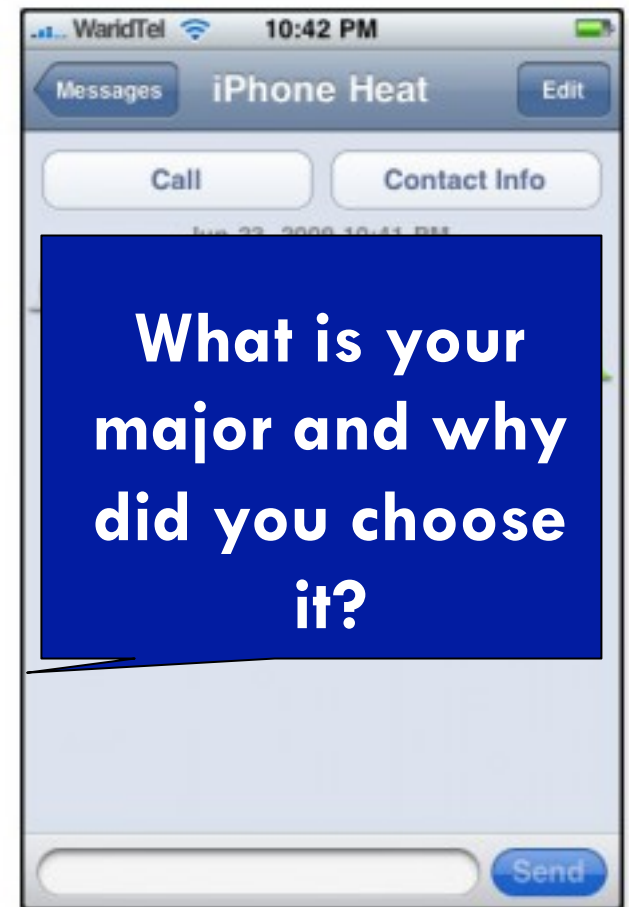
ONLY INCREASED AROUSAL SWITCHING FROM WORK TO “ENTERTAINMENT” (FACEBOOK, VIDEOS AND GAMES)



THE IMPACT OF TEXT MESSAGE INTERRUPTIONS DURING LECTURE

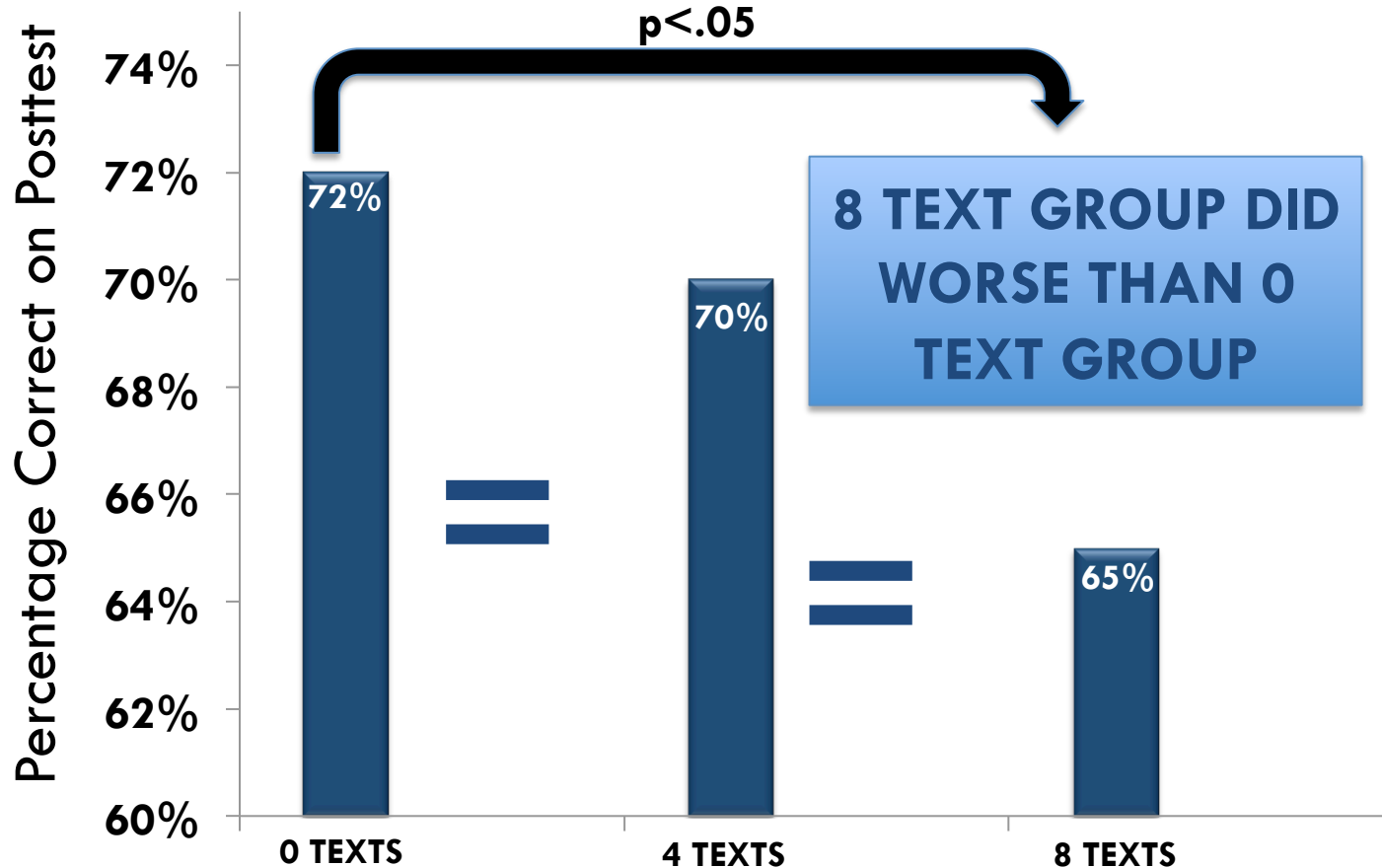
(Rosen, Lim, Carrier, & Cheever, 2011)

- **4 University Classes;
N=175**
- **30 Minutes Video Lecture**
- **Interruptions**
 - ✓ **0 Texts**
 - ✓ **4 Texts**
 - ✓ **8 Texts**
- **Tested Immediately After
Video Lecture**



THE IMPACT OF TEXT MESSAGE INTERRUPTIONS DURING LECTURE

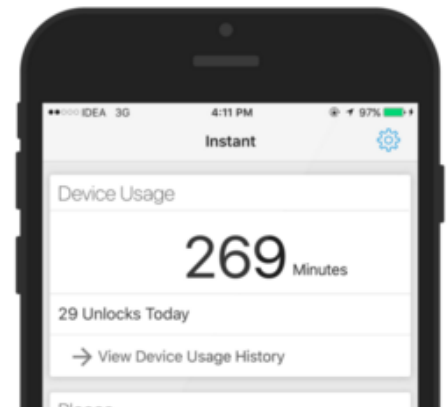
(Rosen, Lim, Carrier, & Cheever, 2011)

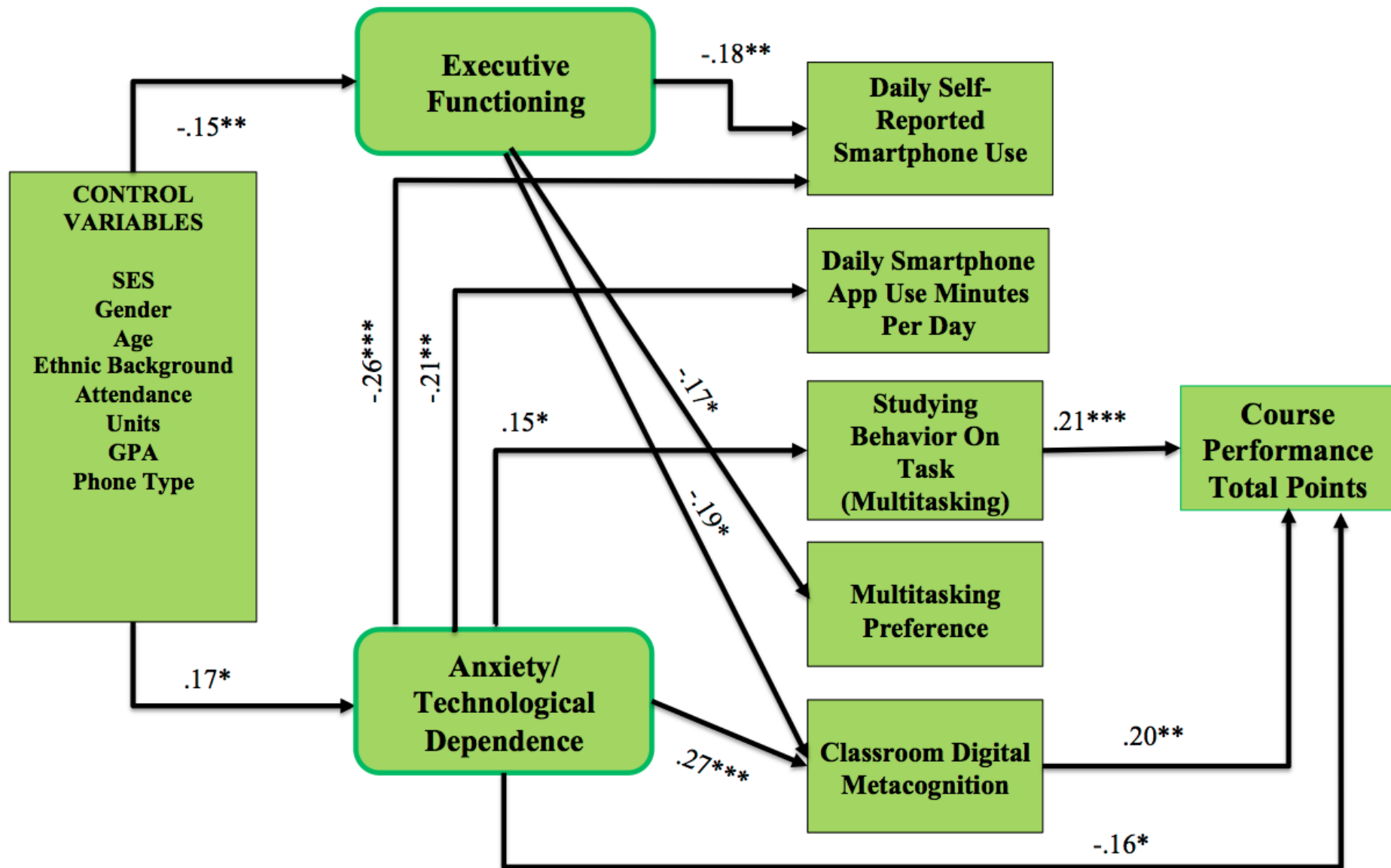


- Those Who Responded IMMEDIATELY To A Text Message Got A “C”
- Those Who Waited For A Few Minutes To Respond Got An “A”!

TECHNOLOGY USE AND CLASSROOM PERFORMANCE

- 216 College Students
- Battery of Self-Report Measurement Instruments
 - ✓ Daily Smartphone Use
 - ✓ Executive Functioning
 - ✓ Anxiety About Missing Out (FOMO)
 - ✓ Digital Metacognition (Knowing What To Do With Tech In The Classroom)
- Self-Reported Studying Behavior
- Instant App





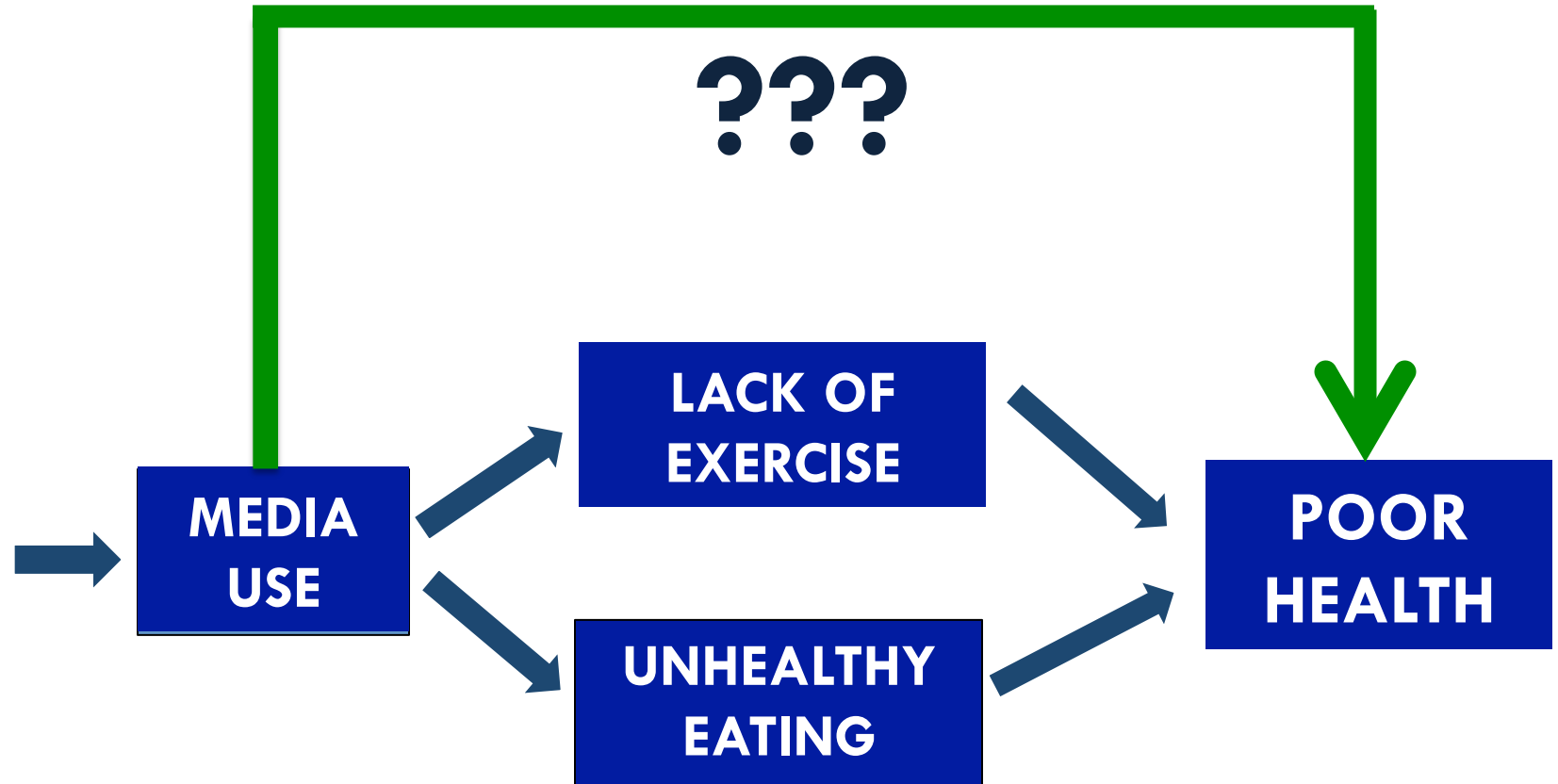
TECHNOLOGY USE AND HEALTH



TECHNOLOGY AND HEALTH: CHILDREN, PRETEENS AND TEENS

(Rosen, Lim, Felt, Carrier, Cheever, Lara-Ruiz, Mendoza, & Rokkum, 2014)

Parent/Child Demographics



TECHNOLOGY AND HEALTH: CHILDREN, PRETEENS AND TEENS

(Rosen, Lim, Felt, Carrier, Cheever, Lara-Ruiz, Mendoza, & Rokkum, 2014)

PREDICTORS OF POORER HEALTH:

- Children:
 - ✓ Too Much Technology
- Preteens:
 - ✓ Too Much Technology
 - ✓ Too Much Video Gaming
- Teenagers:
 - ✓ Too Much Technology
 - ✓ Too Much Video Gaming
 - ✓ Too Much Online Time

TECHNOLOGY AND MENTAL HEALTH: TEENS & ADULTS

(Rosen, Whaling Rab, Carrier, & Cheever 2013)

- METHODOLOGY: MCMI, Tech Use, Facebook Use
- Dysthymia (mild depression)
 - ✓ More Facebook Friends → **Fewer** Symptoms
 - ✓ More Time On Telephone → **Fewer** Symptoms
- Major Depression
 - ✓ More Time On Telephone → **Fewer** Symptoms
 - ✓ More Facebook Friends → **Fewer** Symptoms
 - ✓ More Time Online → **More** Symptoms
- Mania
 - ✓ Any Facebook Activity → **More** Symptoms
 - ✓ Listening to More Music → **More** Symptoms

TECHNOLOGY AND MENTAL HEALTH: TEENS & ADULTS

(Rosen, Whaling Rab, Carrier, & Cheever 2013)

- Narcissistic Personality Disorder
 - ✓ ANY Facebook Activity → **More** Symptoms
- Histrionic Personality Disorder
 - ✓ ANY Facebook Activity → **More** Symptoms
- Antisocial Personality Disorder
 - ✓ More Facebook Friends → **Fewer** Symptoms
 - ✓ More Time On Telephone → **Fewer** Symptoms
 - ✓ More Time Online → **More** Symptoms

TECHNOLOGY USE AND ANXIETY

FO·MO

/ˈfōmō/

noun informal

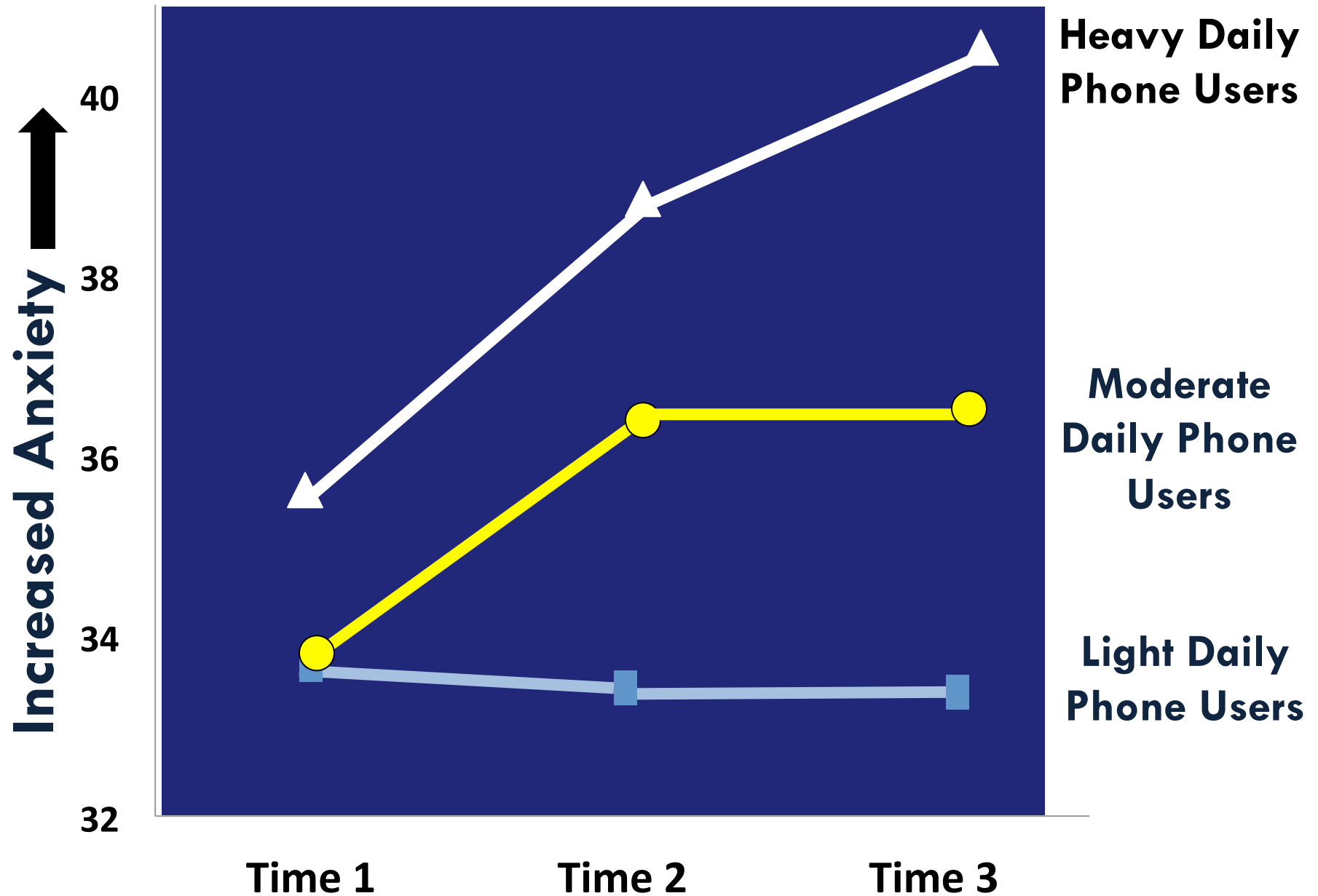
Anxiety that an exciting or interesting event may currently be happening elsewhere, often aroused by posts seen on a social media website.

OUT OF SIGHT IS NOT OUT OF MIND: ANXIETY ABOUT NOT HAVING YOUR PHONE (NOMOPHOBIA)

(Cheever, Rosen, Carrier, & Chavez, 2014)

- 163 College Students
- Half Allowed To Keep/Use Smartphones
- Half Had Smartphones Removed
- **THE TASK? JUST SIT THERE AND DO NOTHING – NO TALKING, NO SCHOOL WORK - NOTHING**
- Measured Anxiety Three Times: 10, 30, 60 Minutes After Losing Access To The Phone
- Used Self-report Measure (STAI)

OUT OF SIGHT IS NOT OUT OF MIND

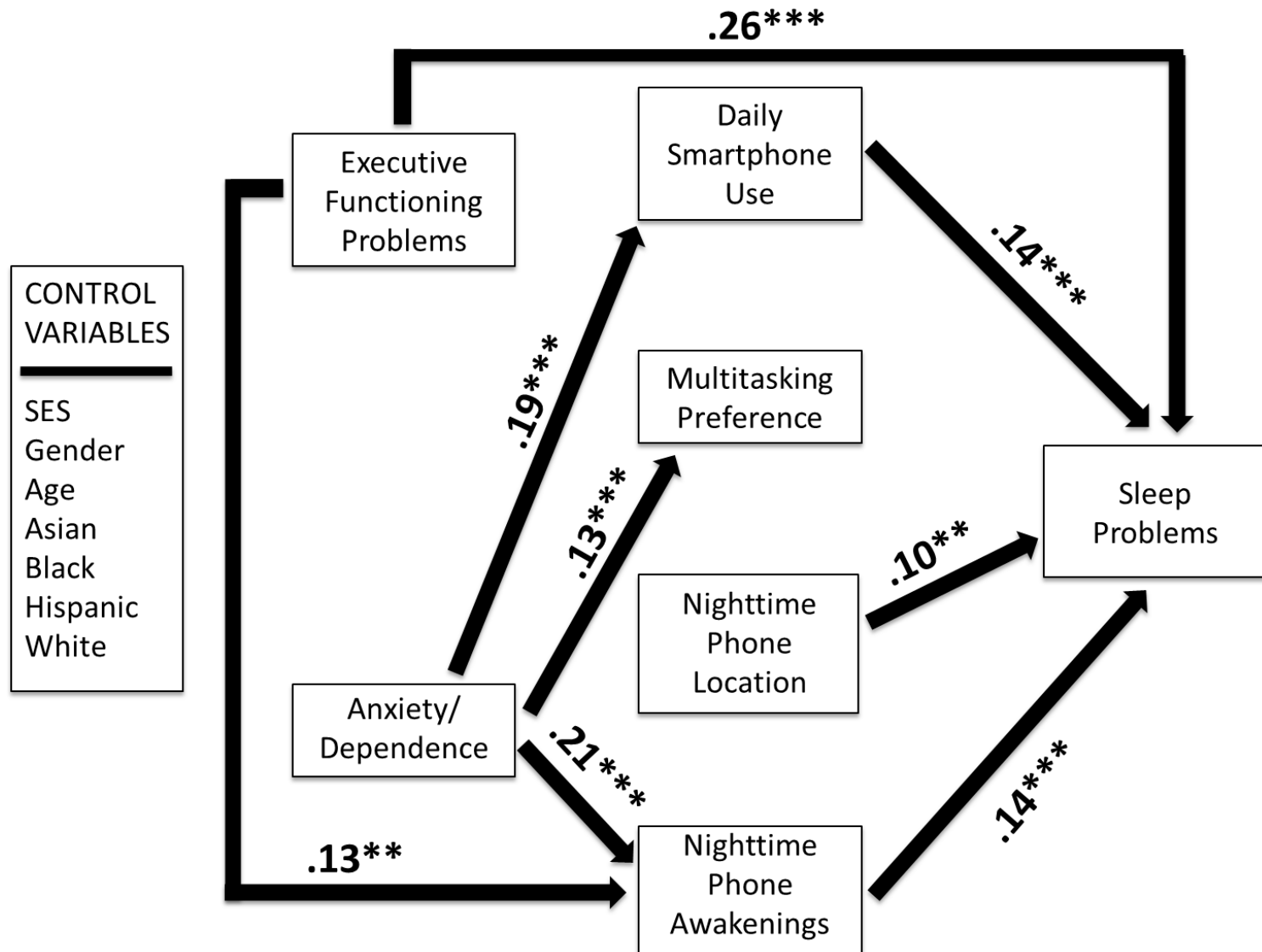


TECHNOLOGY USE AND SLEEP

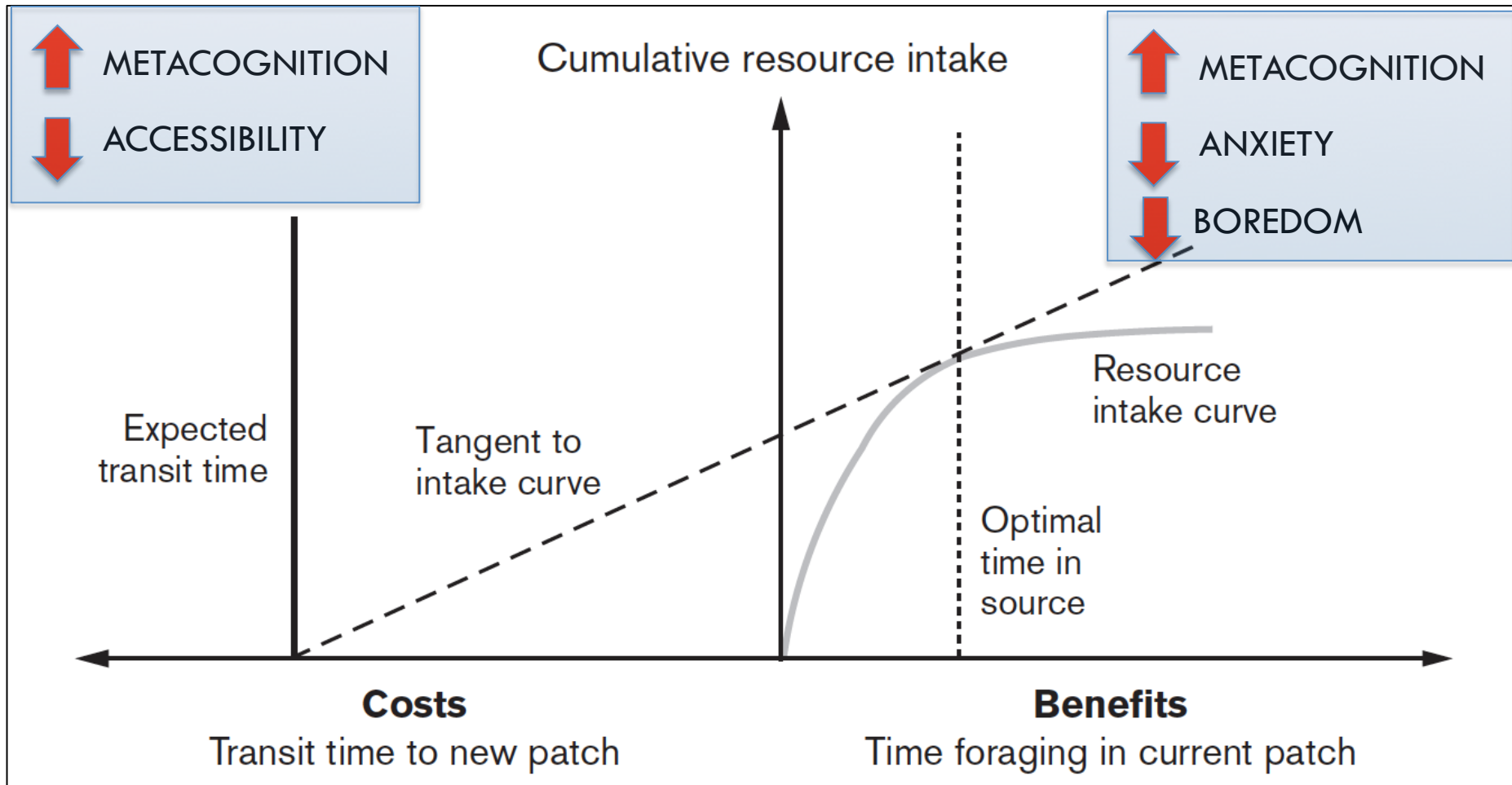
- 700+ College Students
- Online Survey Measurement Battery:
 - ✓ Daily Technology Use, Multitasking Preferences
 - ✓ Executive Functioning
 - ✓ Anxiety (FOMO)
 - ✓ Nighttime Phone Use/Location
- Predictive Model
 - ✓ Executive Dysfunction and Anxiety/Technological Dependence Predict Technology Usage
 - ✓ Technology Usage Predicts Sleep Problems

SLEEPING WITH TECHNOLOGY: WHAT PREDICTS A POOR NIGHT'S SLEEP?

Rosen, Carrier, Miller, Rokkum, & Lara-Ruiz, 2016)



BACK TO THE FORAGING MODEL



STRATEGIES FOR OUR STUDENTS

IMPROVE METACOGNITION

- ✓ Understanding the Costs of Task Switching
 - Decreased Learning
 - Increased Time
 - Increased Stress
 - Example: CNN & Crawl
- ✓ Monitoring Your Time With Technology (apps)
- ✓ Strategy: Technology Breaks

POSSIBLE METACOGNITIVE QUESTIONS FOR STUDENTS

- **The best room for me to study in at home is _____ because _____.**
- **Some ways that I can avoid distractions while studying at home are _____.**
- **A good place for me to put my phone before a class or before studying is _____.**
- **If I use technology in class, some ways that I can make sure I don't get distracted are _____.**

STRATEGIES FOR OUR STUDENTS

DECREASE ACCESSIBILITY

- ✓ Quiet Study Area
- ✓ Single Screen
- ✓ Close [NOT MINIMIZE] Windows, Apps, Tabs
- ✓ Close E-mail – Check On A Schedule
- ✓ TECH BREAKS: Phone Away Or Upside Down – Alerts Silenced
- ✓ Consider Apps That Help Control Environment (SelfControl, FocusMe, KeepMeOut)

STRATEGIES FOR OUR STUDENTS

DECREASE ANXIETY

- ✓ DO NOT BE PAVLOV'S DOG
- ✓ Set Expectations for Others
- ✓ Use Automatic E-Mail Replies/Social Media Posts
- ✓ Use Apps to Auto Reply to Calls, Texts
- ✓ Allow Calls From People With Potential Emergencies
- ✓ Practice Meditation and Mindfulness
- ✓ Physical Exercise Reduces anxiety

STRATEGIES FOR OUR STUDENTS

DECREASE BOREDOM

- ✓ Program in Breaks to “Reset Your Brain”
 - Nature, Exercise
 - Short Naps
 - Talk to a Human Being
 - Read Joke Book, Grab a Snack, Listen to Music
- ✓ Standing instead of sitting increases blood to brain
- ✓ Play “familiar” music in the background
- ✓ Use Tech Breaks to Increase Time on Task

STRATEGIES FOR OUR STUDENTS

VALUE AND GET A GOOD NIGHT'S SLEEP

- ✓ Learn About the Impact of Poor Sleep on Learning and Memory
- ✓ Monitor Sleep Activities
- ✓ Remove All Portable Devices One Hour Before Bedtime
- ✓ Gradually Reduce the Light in the Bedroom
- ✓ Provide Your Brain With “Predictable Content”: Music, Books, TV
- ✓ Avoid FOMO: Alert Others of Your Unavailability
- ✓ Do Not Grab The Phone the Instant You Awaken

BURNING QUESTIONS TO PONDER

- What Can We Do As Parents and Educators to Eliminate Distraction and Enhance Student Focus and Attention?
- What Student-Obsessed Technologies Can We Harness in the Classroom and at Home?
- Are We On A Downhill Slide In Our Obsession With Technology With No Point of Return or Can ANYONE See a Light at the End of the Tunnel?