

***Transforming TechnoStress
into TechnoHealth
It is not just angles and equipment***

Erik Peper, Ph.D

**Institute for Holistic Health Studies
San Francisco State University**

and

BiofeedbackHealth

epeper@sfsu.edu

www.peperperspective.com

Intro

- Form groups of 4-5 (include the people behind and in front of you)
- Assign a spokes person who can report back to the group
- Introduce yourself and share the best thing that happened to you this week
- Describe what you want to learn in the workshop

Take pictures of the audience

- When practice is finished asked participants to freeze and observe themselves.
- Who moved themselves?
- Who changed the environment?

What was the purpose of this practice?

- Positive memory changes mood
- Lack of somatic awareness since we focus on task performance.
- Who was aware that they twisted their body and that it was uncomfortable?
 - Who rotated their body
 - Who rotated the chair
- What does it take to become aware and act on the awareness?

Observations

- Those who change the environment take control

Rated treatments for Lower Back Pain

out of 45 treatments



Crowd sourcing data from 64,520 patients' reports

Reproduced with permission from: <https://www.healthoutcome.org>

Peper, E., Krüger, B., & Gokhale, E. (in press). Comparing Muscle Activity and Spine Shape in Various Sitting Position. *Biofeedback*.

Exploring Stack Sitting

“Stacksitting has been shockingly effective in resolving a nagging sciatic pain that was resistant to cortisone shots and medication. The effects and the underlying logic are deeply moving to me and keep me wanting to research and explore further.”

- -Julie Southern, President, Spiralinks Corporation

Gokhale, E. (2013). *8 Steps to a Pain-Free Back*. Pendo Press.

How to sit stacked

- Scoot your bottom far back in the chair while hinging forward at the hip.
- Gently straighten your spine by thinking of the back of the head reaching upward to the ceiling.
- Keep the head level as you make yourself tall and avoid tilting your head back, which lifts the eyes and compresses the neck.
- Roll your shoulders a little forward, a little up, and back.
- Feel your spine lengthening during inhalation (without the chest lifting) and feel the spine settling or stacking during exhalation.
- Periodically perform an internal 'proprioceptive body scan' of your back, shoulders and body for any unnecessary muscle tension.
- Change position frequently to reduce inter-disk pressure and covert static muscle tension.
- Use SEMG feedback to monitor muscle tension.

What way to sit

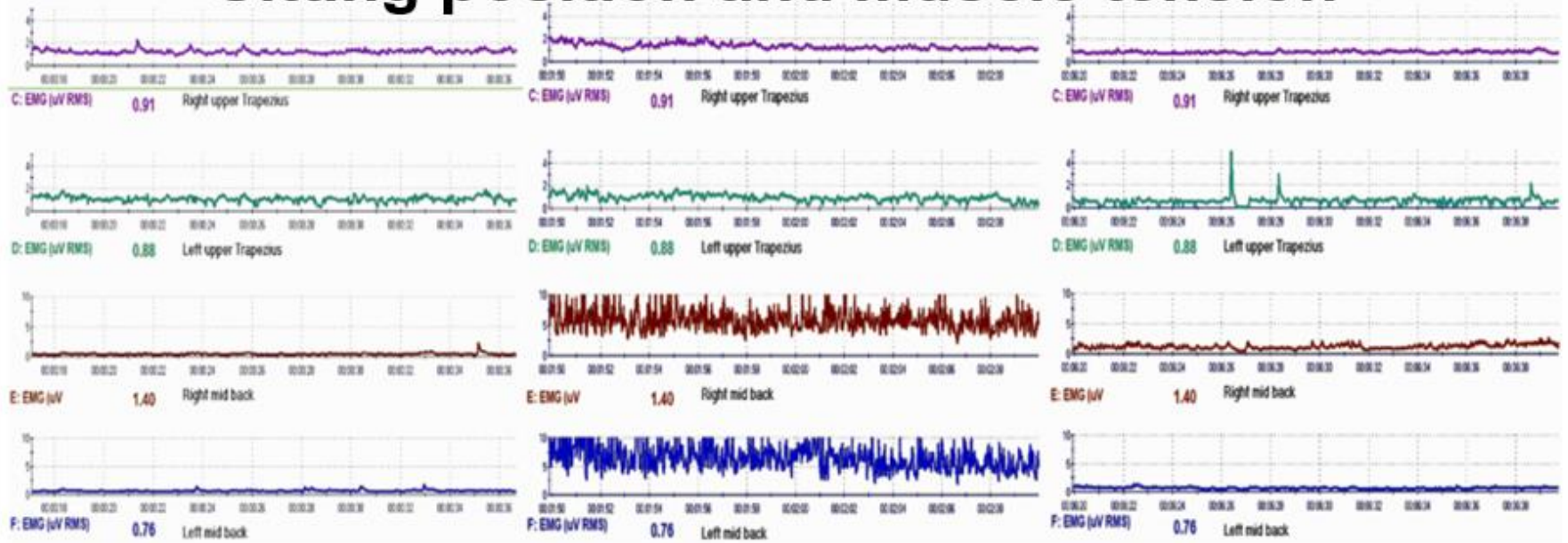


SpineTracker (Stollenwerk et al, 2018) consists of five sensor units, attached to the subject's back and captures the angle of each sensor on the spine.

The sensors were placed on the back with even spacing, with the lowest sensor on the sacrum at a fixed distance of 0.5" above the intergluteal cleft.

The dynamic spine shape is displayed on a digital screen.

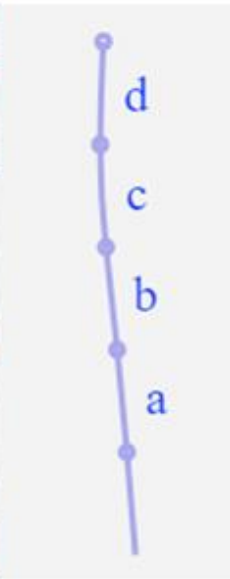
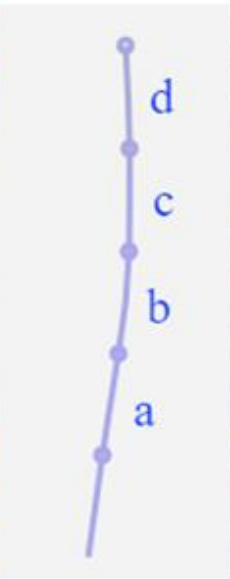
Sitting position and muscle tension



Slouch

Straight

Stacked



Problems with TechnoStress

- Employees get injured from working at the computer/laptop/cellphone
- **Ergonomic changes alone are not resolving the problem**
- Lack of somatic awareness until discomfort occurs
- Budget constraints for teaching health habits and prevention
- Reduced productivity
- Medications often make it worse (opioids, statins, sleeping medication)
- Most interventions occur after people are injured (*an ounce of prevention is worth a pound of cure*)
- High work and self workload/pressure

Purpose of Presentation

- Ergonomics is often insufficient to promote and maintain health
- Digital media impacts health
- Biofeedback makes the invisible visible to demonstrate how body/mind and environment affect each other
- Biofeedback can enhance ergonomic impact and enhance self-participation with the use of wearables

TechnoHealth Certification Program

Biofeedback for Ergonomists

- 1 day workshop
 - The use electromyography (EMG) and posture biofeedback
 - Assessment
 - Intervention protocols
- Follow-up session necessary for certification
 - Case report presentation
 - Challenges and how to resolve them
 - Exam
- Contact: Erik Peper, PhD epeper@sfsu.edu
Richard Harvey, PhD rharvey@sfsu.edu

Physical workload

- Lift and carry
- Push and pull
- Work postures
- Repetitive movements

What makes it difficult for the body

- Weight
- Frequency
- Distance to the body
- Reach height
- Distance vertical
- Spinal twist
- To hold the weight for a long period
- Walking with the weight.

'Extreme' postures

- Above the head
- Twisted spine
- reaching
- Kneeling

Now a new generation









Changing What It Means to Be Human



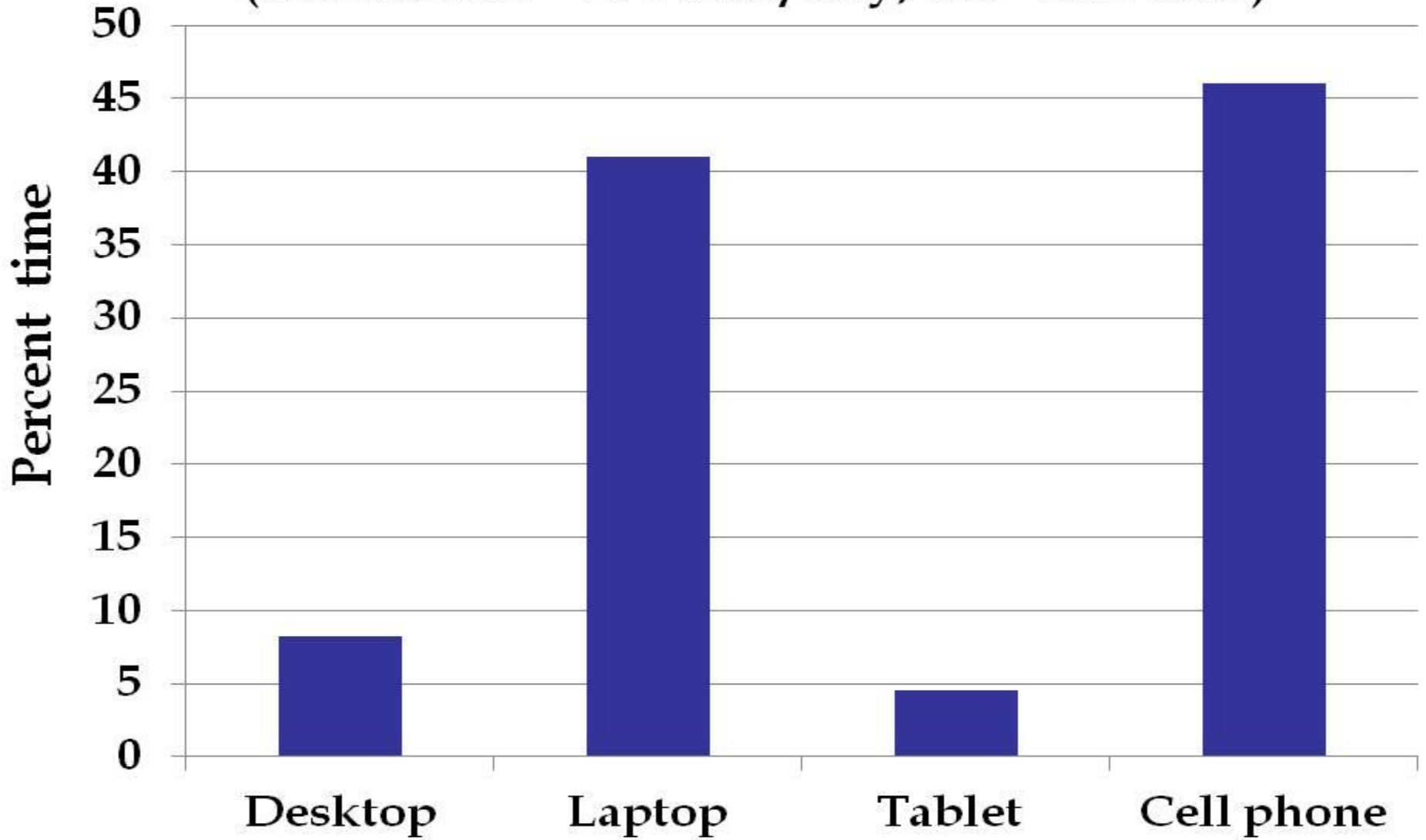
More than four hours per day of watching video games (with violent), children are no longer able to recognize basic emotions on human faces.

Challenges with elearning/screen learning

- Led blue light emission (insomnia, macular degeneration)
- Near visual stress (myopia, increase sympathetic arousal, shallow breathing)
- Immobility
- Head forward/collapsed position
 -  eye, neck, back, shoulders, headache symptoms
 -  pedestrian deaths (captured by the screen)
 -  energy
 -  depression

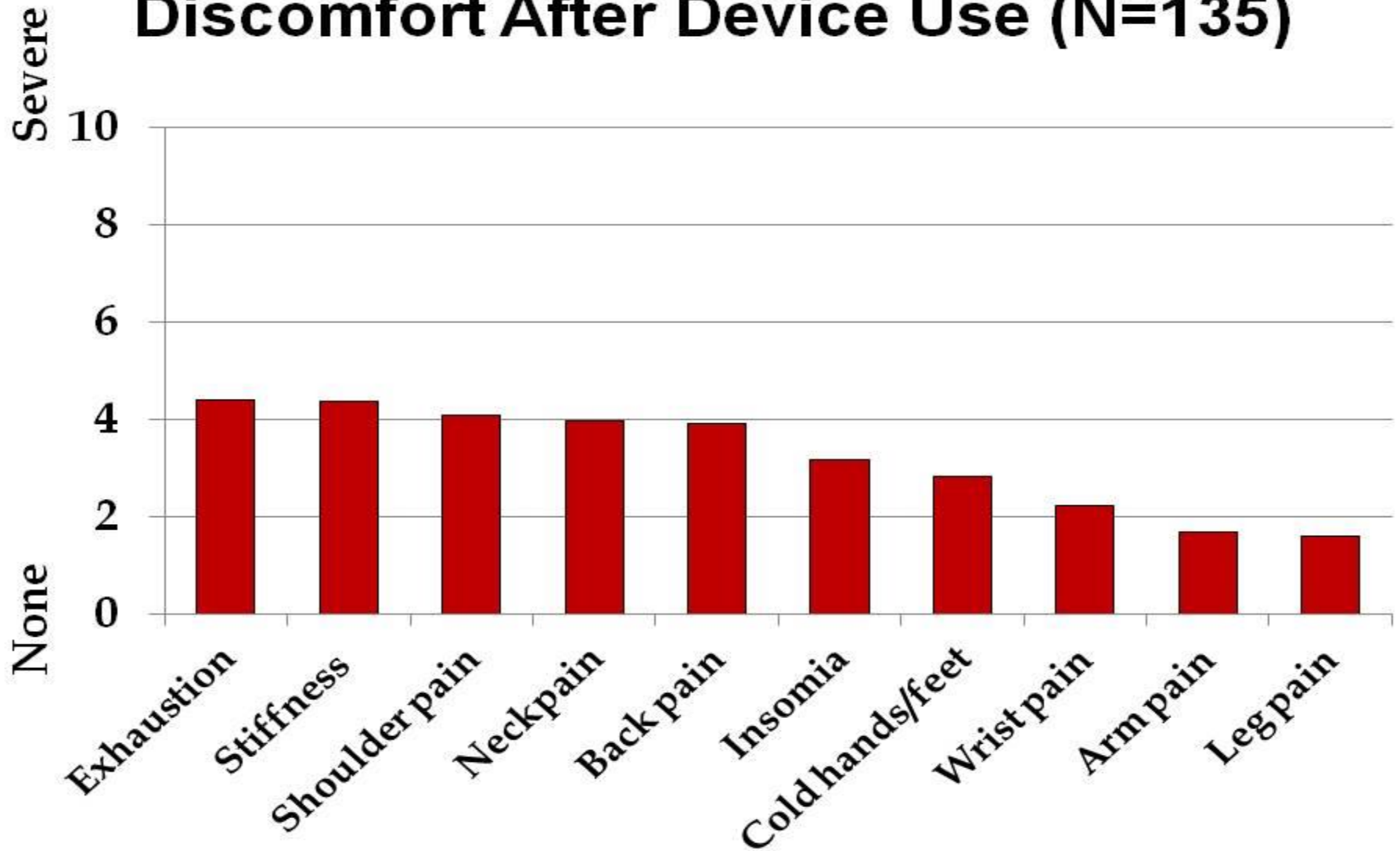
Percent time devices are used per day (N=135)

(Total time= 271 min/day; SD=185 min)



Peper, E. et al, (2013), Multitasking and how students use computers, laptops, tablets and smartphone-effects on health.(in preparation).

Discomfort After Device Use (N=135)



Peper, E. et al, (2013), Multitasking and how students use computers, laptops, tablets and smartphone-effects on health.(in preparation).

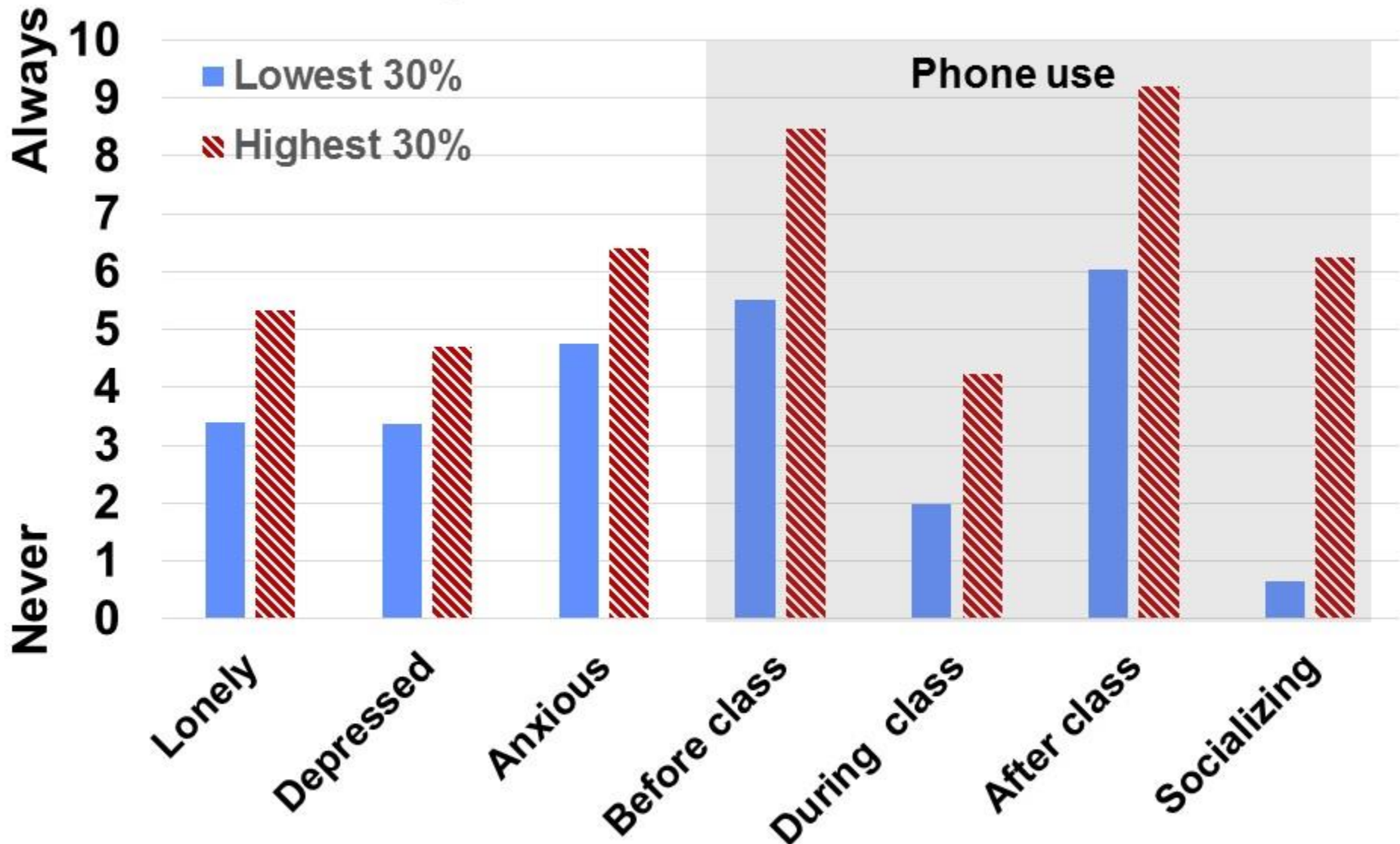
Symptoms	Eyes	Neck	Shoulders
Smartphone	51% straining 49% dryness 27% burning	66% tightness 48% aching 47% soreness	69% tightness 53% soreness 34% aching
iPad/tablet	57 % aching, burning, dullness	86% soreness 71% tightness 57% aching	71% cramping, tightness 43% aching, soreness

Percentages of most commonly reported symptoms in the eyes, neck, and shoulders of device users along with their accompanying intensity ranking on a scale between 1-10, 1=slightly uncomfortable, 10=unbearable.

Peper, E., Waderich, K., Harvey, R., & Sara Sutter. (2013). The psychophysiology of contemporary information technologies-Tablets and smart phones can be a pain in the neck. Presented at the 44th Annual Meeting of the Association for Applied Psychophysiology and Biofeedback. Portland, OR.

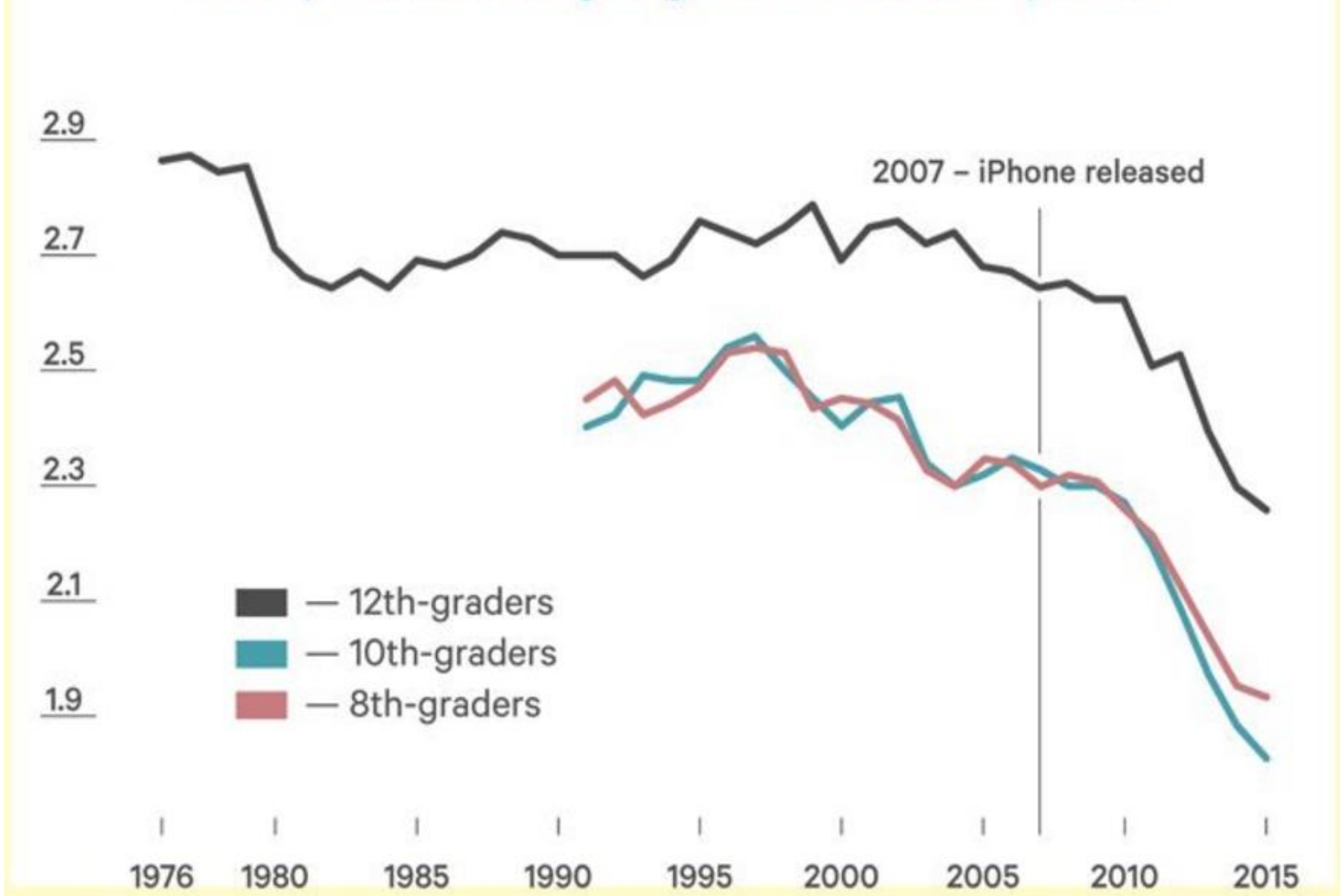
Phone use while socializing

Highest and lowest 30%



Not Hanging Out With Friends

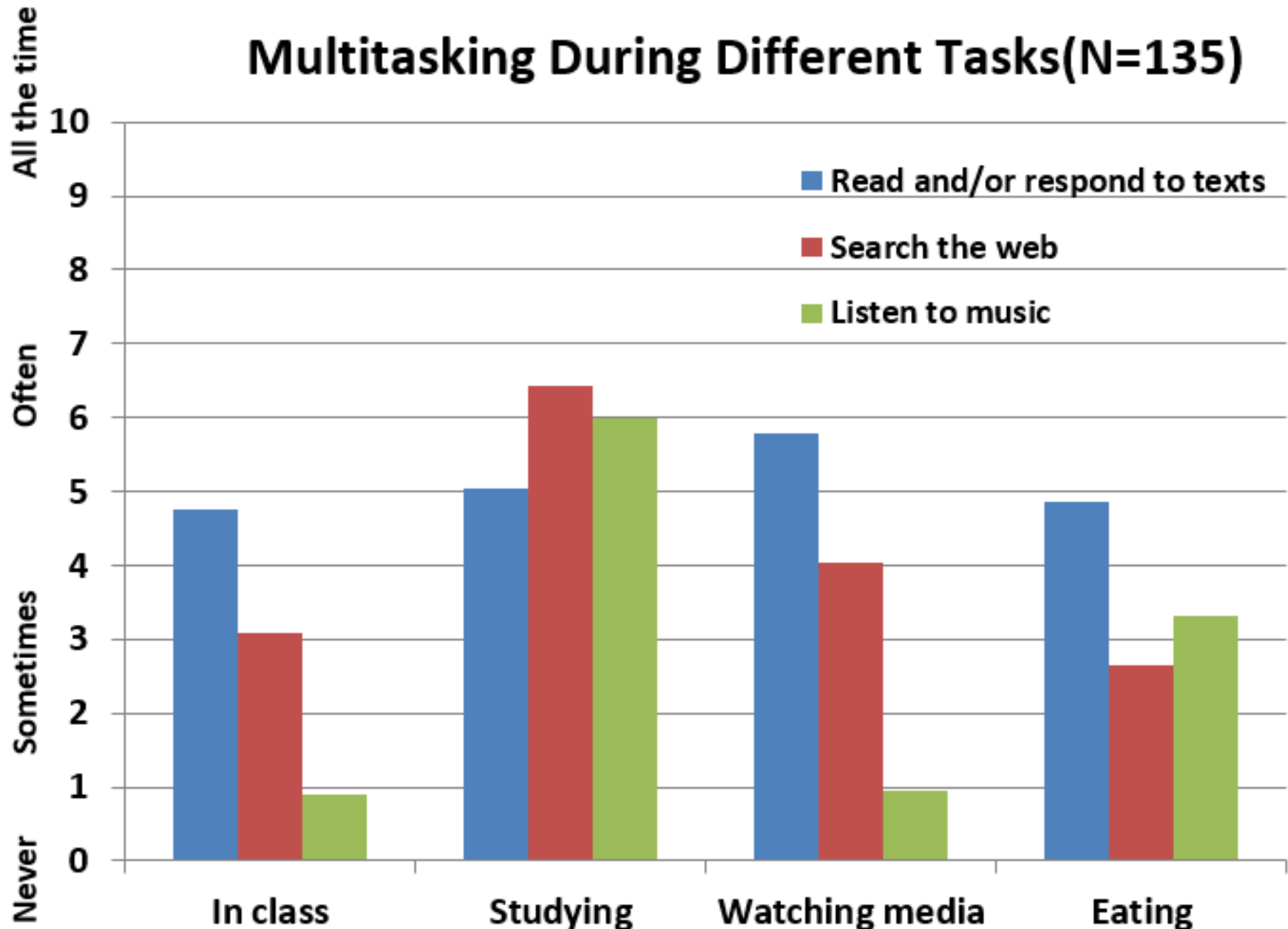
Times per week teenagers go out without their parents



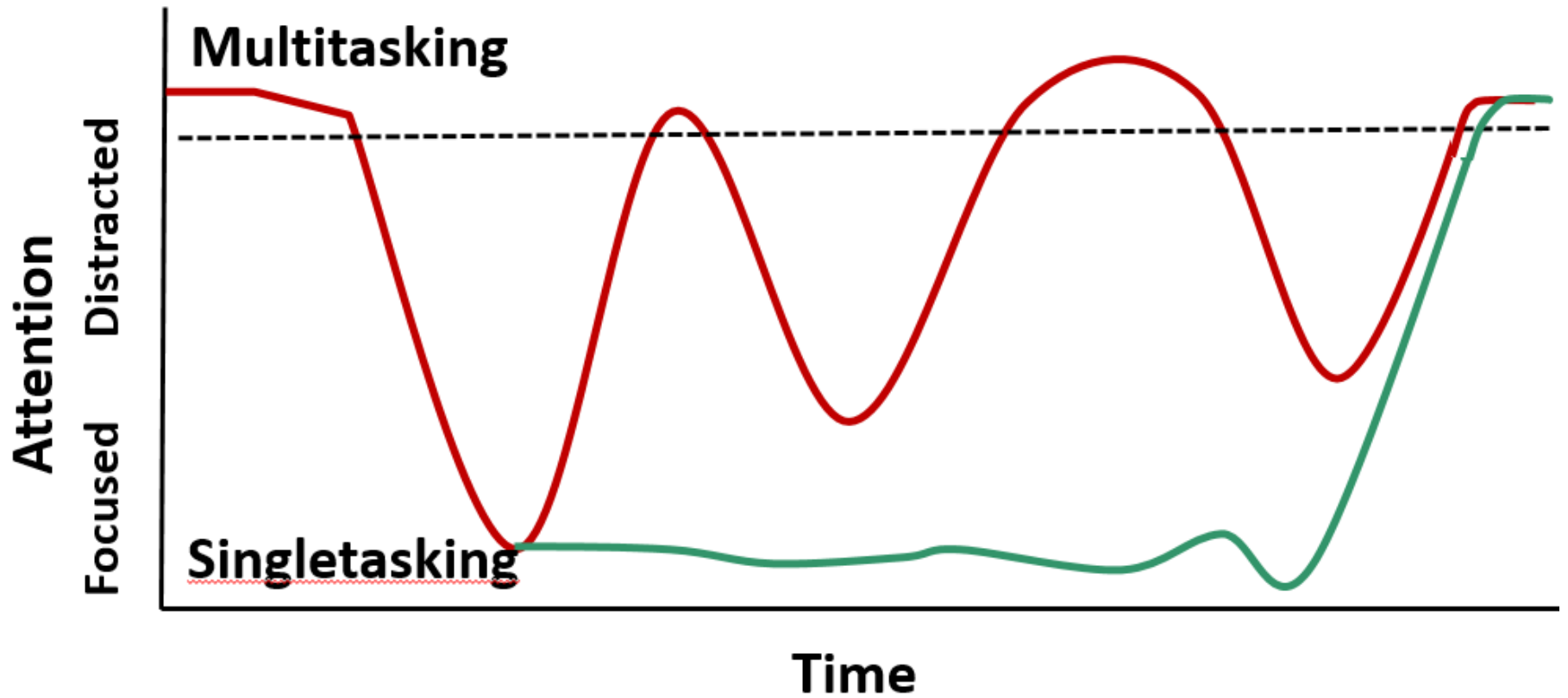
Twenge, J. (2017). Have smartphones destroyed a generation. *The Atlantic*. September issue.

https://www.theatlantic.com/magazine/archive/2017/09/has-the-smartphone-destroyed-a-generation/534198/?utm_source=twbp

Multitasking During Different Tasks(N=135)

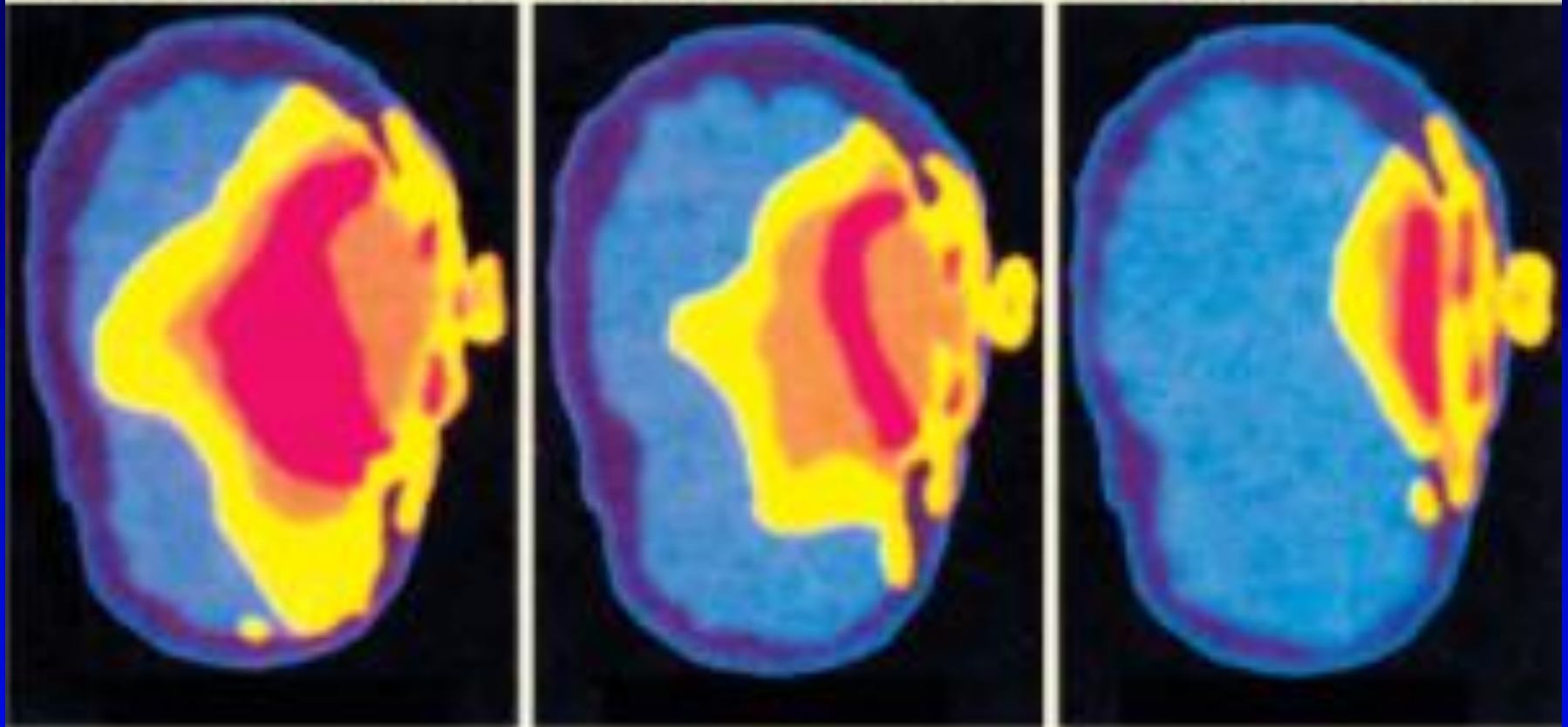


Diving analogy: The effect of multitasking on task performance



Microwave Cellphone Effects

Absorption in the Brain According to Age



5 Year Old

10 Year Old

Adult

Courtesy of Dr. Om Gandhi, University of Utah, 1996, IEEE Publication

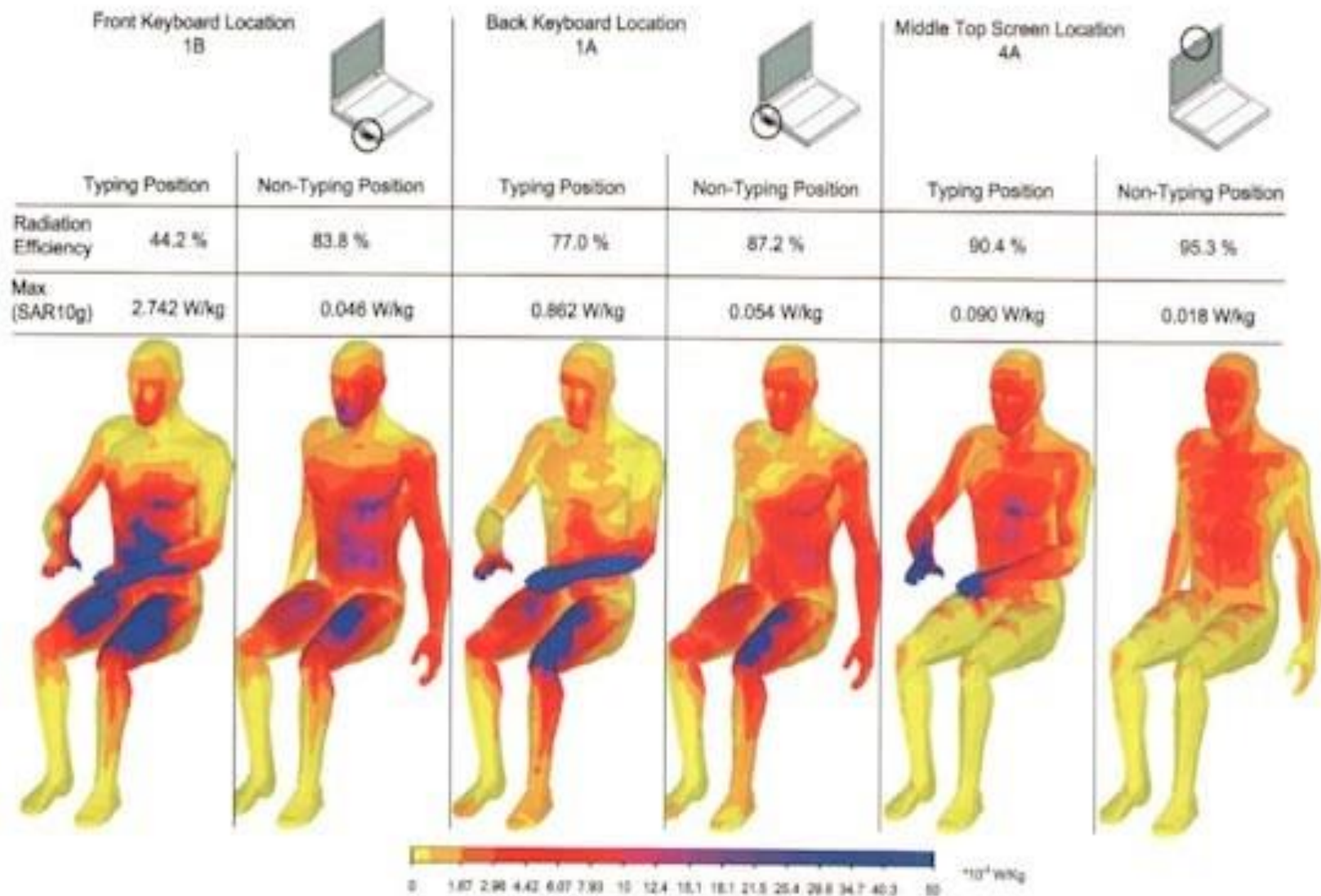


Figure 22. The absorption of electromagnetic energy in human tissue: the resulting antenna radiation efficiencies and SARs in the operator's body at 2.44 GHz for different inverted-F antenna (IFA) element locations.

From: <http://media.portland.indymedia.org/images/2012/03/414397.jpg>

Recommendation

- Keep cell phone and any EMI emitting device away from human tissue.
 - Men do not clip it on your belt-it may increase testicular cancer and do not put your laptop on your lap as the heat decreases sperm count and may increase testicular cancer.
 - Women do not put in bra
- Use speaker phone or earphones

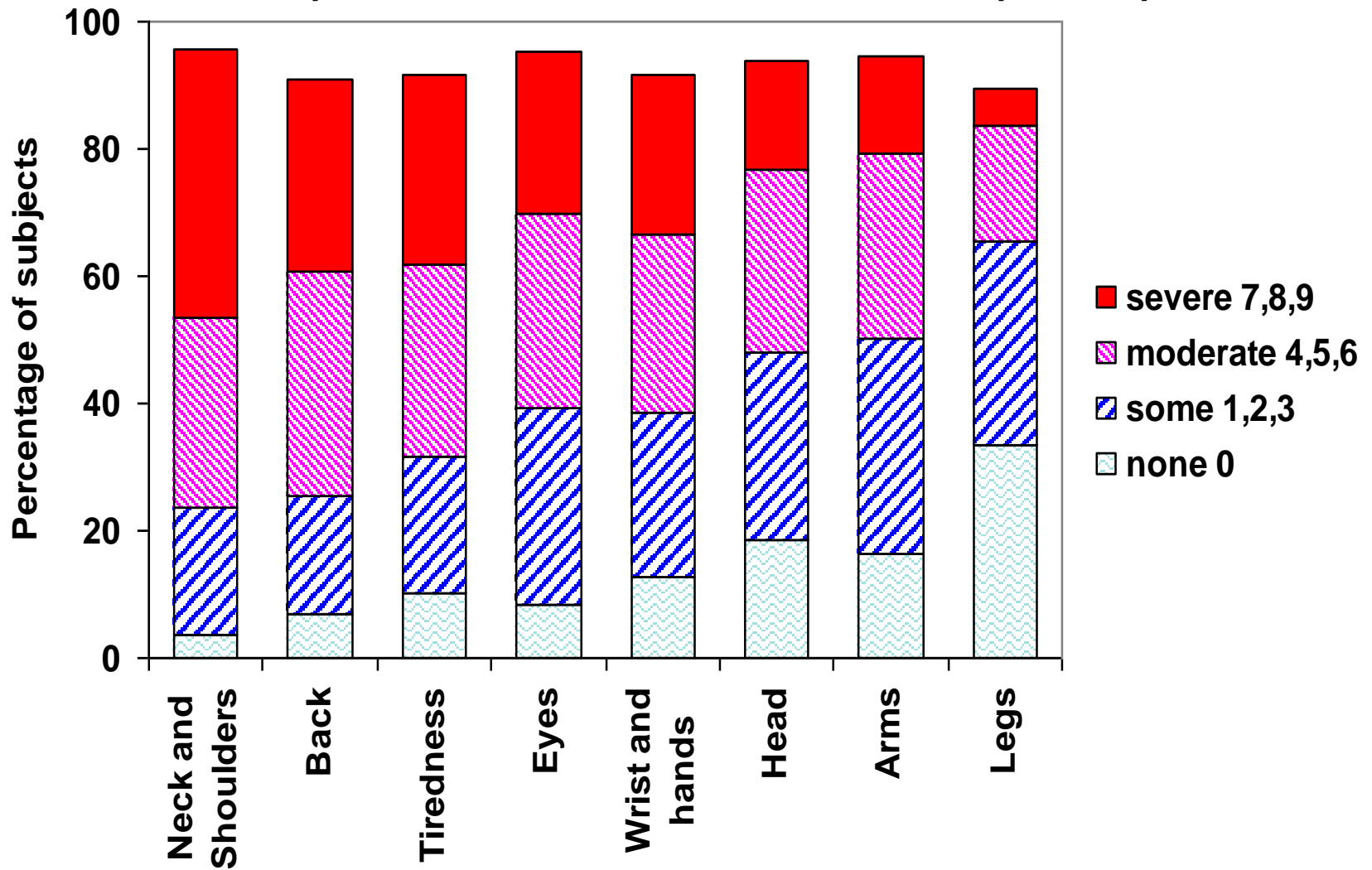
Epidemiological Findings

- Increase in cancers of the head, parotid gland (salivary gland), eye and testicles on the side of the body you hold cell phone
- Increase in ADD/ADHD* (~10% in USA) and Autism spectrum disorders such as Asperger's syndrome (1 in 88 children)
- Increase in obesity, metabolic syndrome/type 2 diabetes
- Increase in sleep disturbance
- Increase of exhaustion, neck and shoulder pain
- Increase is depression

*http://en.wikipedia.org/wiki/Attention_deficit_disorder#cite_note-what-is-add-15

**Estimates from CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network, <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5101a1.htm?cid=ww5101a1>

DISCOMFORT INTENSITY RATING (LOW, MEDIUM, HIGH) FOR EACH BODY LOCATION (N=189)



Common causes of work-related stress

Which, if any, of the following do you think are the most common causes of work-related stress nowadays? (%)



Universe: Workers aged 18+

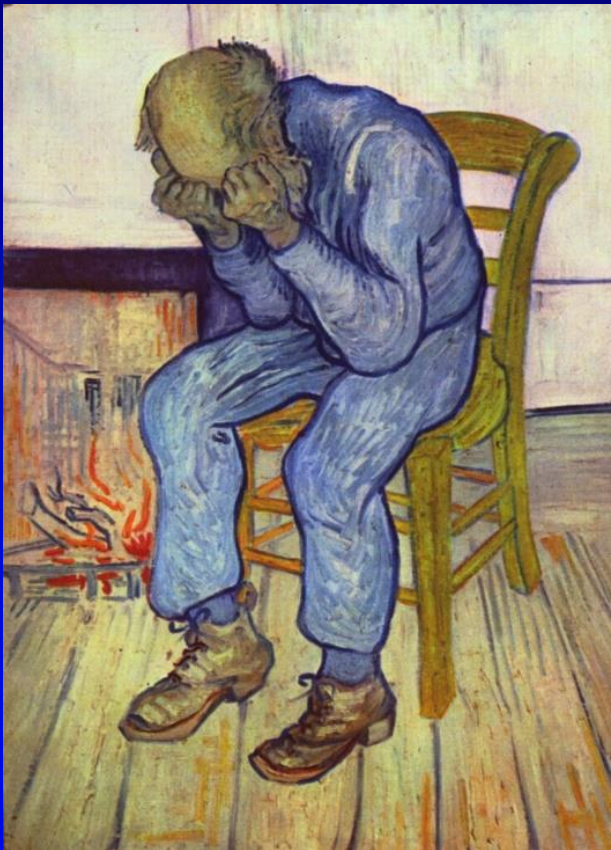
Worksite complaints	Percent	
Room temperature	41.7	Ergonomist
Tired	29.2	Physician/ psychologist
Burning eyes	29.2	Optician
Fuzzy vision	12.5	
Sneezing	12.5	Physician
Headache	20.8	Physician/ Physical
Neck pain	20.8	therapist/ Ergonomist
Back pain	16.7	
Noise	16.7	Ergonomist

Components of TechnoHealth



How did you feel this morning?

How many of you felt totally happy and were looking forward to the day when you woke up--just like when you are in love?



Practice: Energy gain/Energy Drain

- Identify a drain and gain
- Develop an specific behavioral strategy to change it. Be very specific: When, where, how, with whom, at what time, what get in the way
- Do not discuss why; discuss how you will do it
- Share the new strategy with your partner
- Send email/telephone to the partner that you have performed the task
- See pages 9-10

Common Approaches

- Ergonomic corrections
- Physical therapy and/or physical exercises
- Task variation/breaks
- Corrective supports
- Medications and/or surgery
- Vision correction

IMPORTANT:

Most interventions are done post-injury!

Components of TechnoStress

- Normal work related stress and injuries *
 - High workload
 - High responsibility
 - Lack of control
 - Lack of social support
- Injuries unique to computer/laptop/phone work environments
 - **Ergonomics is the foundation and insufficient since people still get injured after intervention**
 - **Lack of awareness**
 - **Lack of training in TechnoHealth**

*Kompier, M. and Levi, L. (1994). *Stress at Work: Causes, Effects and Prevention*. Dublin: European Foundation for the Improvement of Living and Working Conditions.

Missing Components for Prevention

- Systems approach
- Somatic and mind/body awareness
- Workstyle: Work/rest cycle, micro- and macrobreaks
- Stress management/regeneration
- Training in psychophysiological control
- Strengthening/flexibility
- Social support
- Individual and corporate responsibility

He is unaware until it is too late!

Neck pain
(static low muscle
tension)

Headaches
(cervical
compression and
static low muscle
tension)

Back pain
(Kyphosis and
immobility)



Problems in ergonomic knowledge, awareness, work &
self stress, empowerment and functional fixedness

How do you know

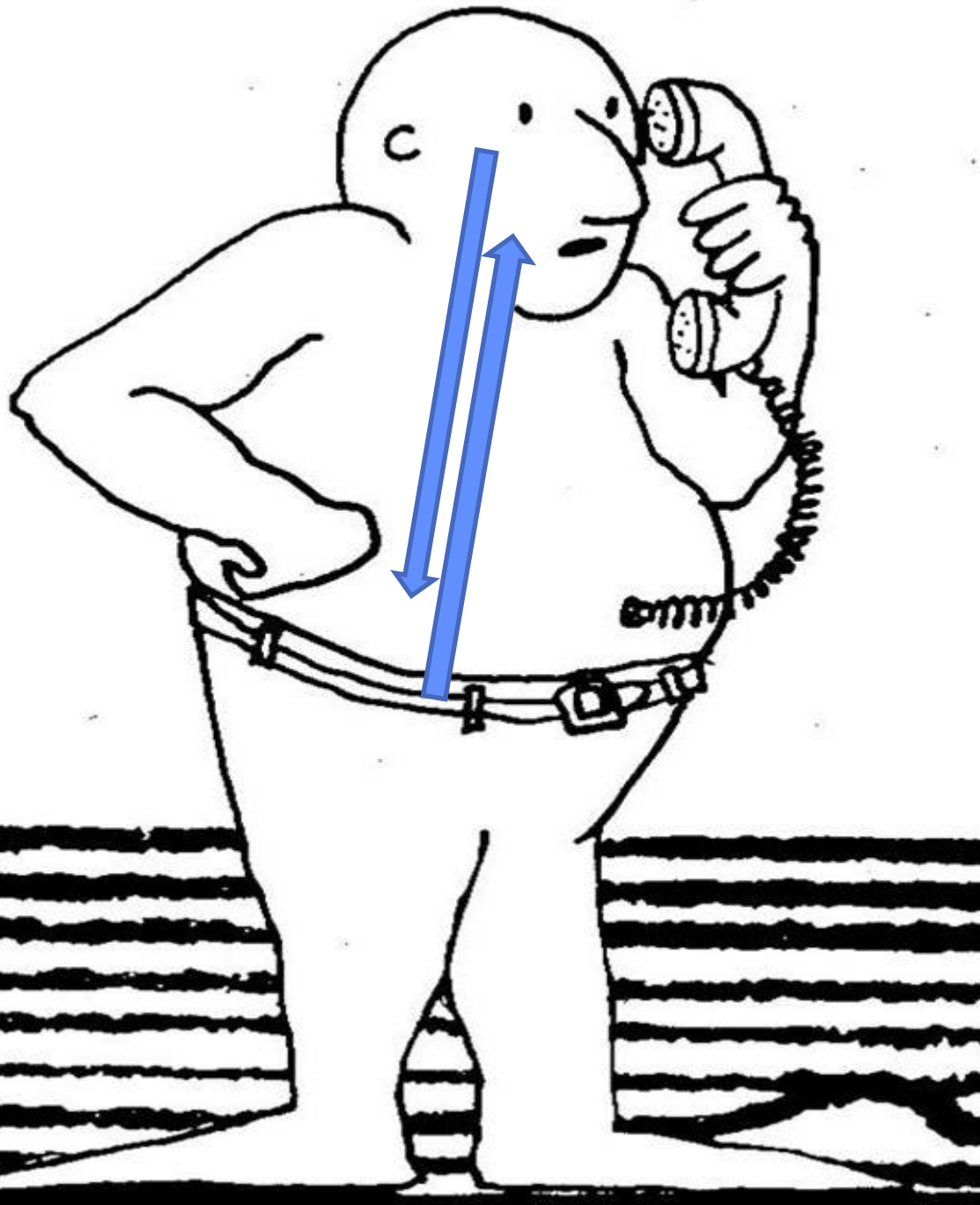
- If the muscle are relaxing after ergonomic adjustment?
- Knows if and when muscle are tightening?
- If breathing quickens?

Exercise: Mousing Simulation

- Hold a mouse to the side of the keyboard
- Write your street address backward and right click when you finish each letter.
- Make the height of the letter about $\frac{1}{2}$ inch
- Write as quickly as possible

What Did You Observe?

- Tension in your neck and shoulders?
- Breath holding and rapid/shallow breathing?
- Stiffness in your trunk
- Dry eyes?
- How long can you work like this?



Biofeedback
demonstration

Awareness

Covert muscle
tension

Ergonomic
assessment

Regeneration
training

Psychophysiology Demonstration

- EMG anterior deltoid and trap
- Respiration
- SCL

Biofeedback Makes

- the undocumented documented
- the unfelt felt
- the invisible visible
- Confirms whether the ergonomic setup or the person is performing the task correctly

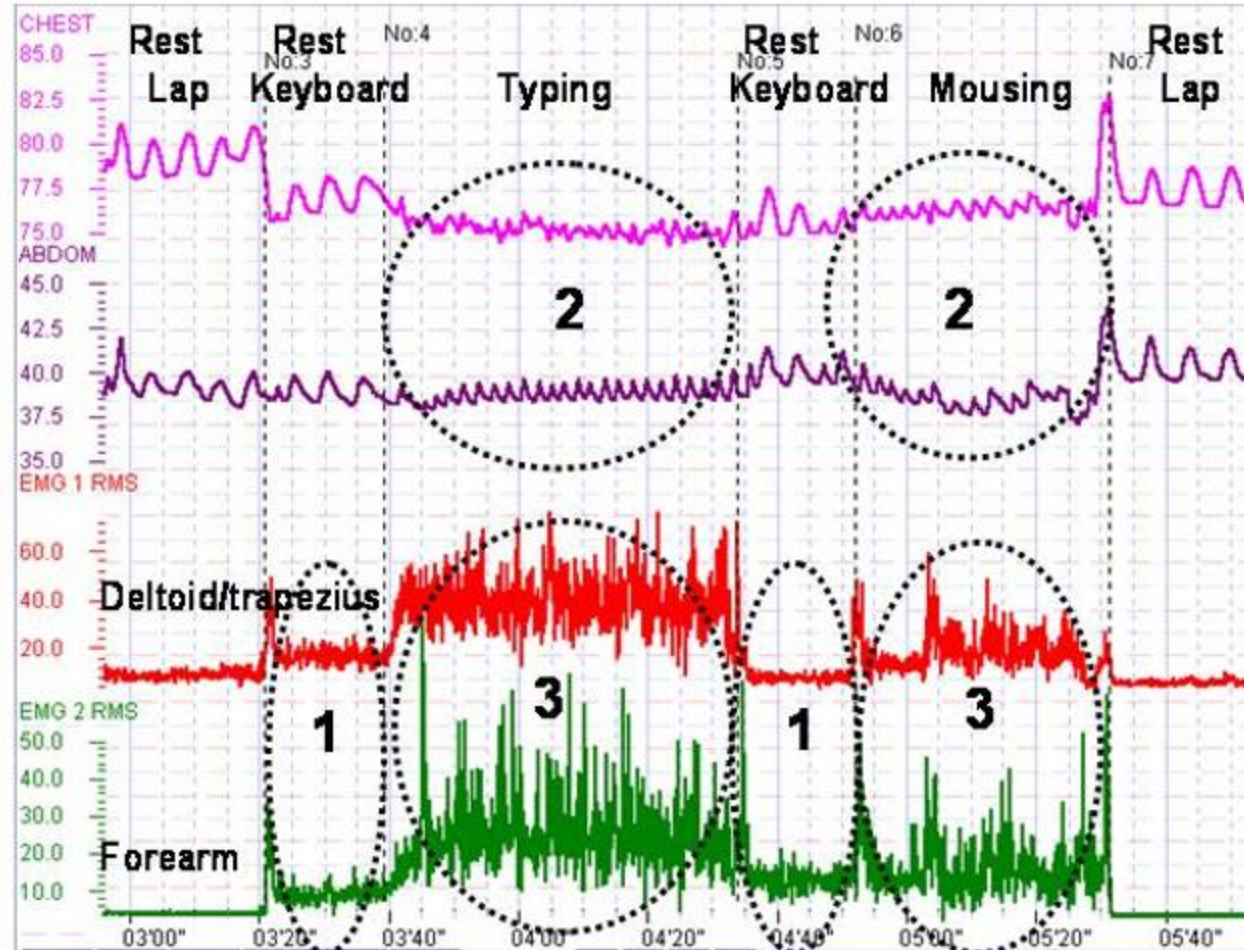
Worksite assessment with biofeedback

- Working at the computer
- Texting
- Ergonomics
- Physiology
- Analysis of work and personal stress

Use of biofeedback

- Assessment
- Training microbreaks
- Breathing at work
- Ergonomic assessment
- Chair, keyboard, environment

Psychophysiological risk factors (1-2)



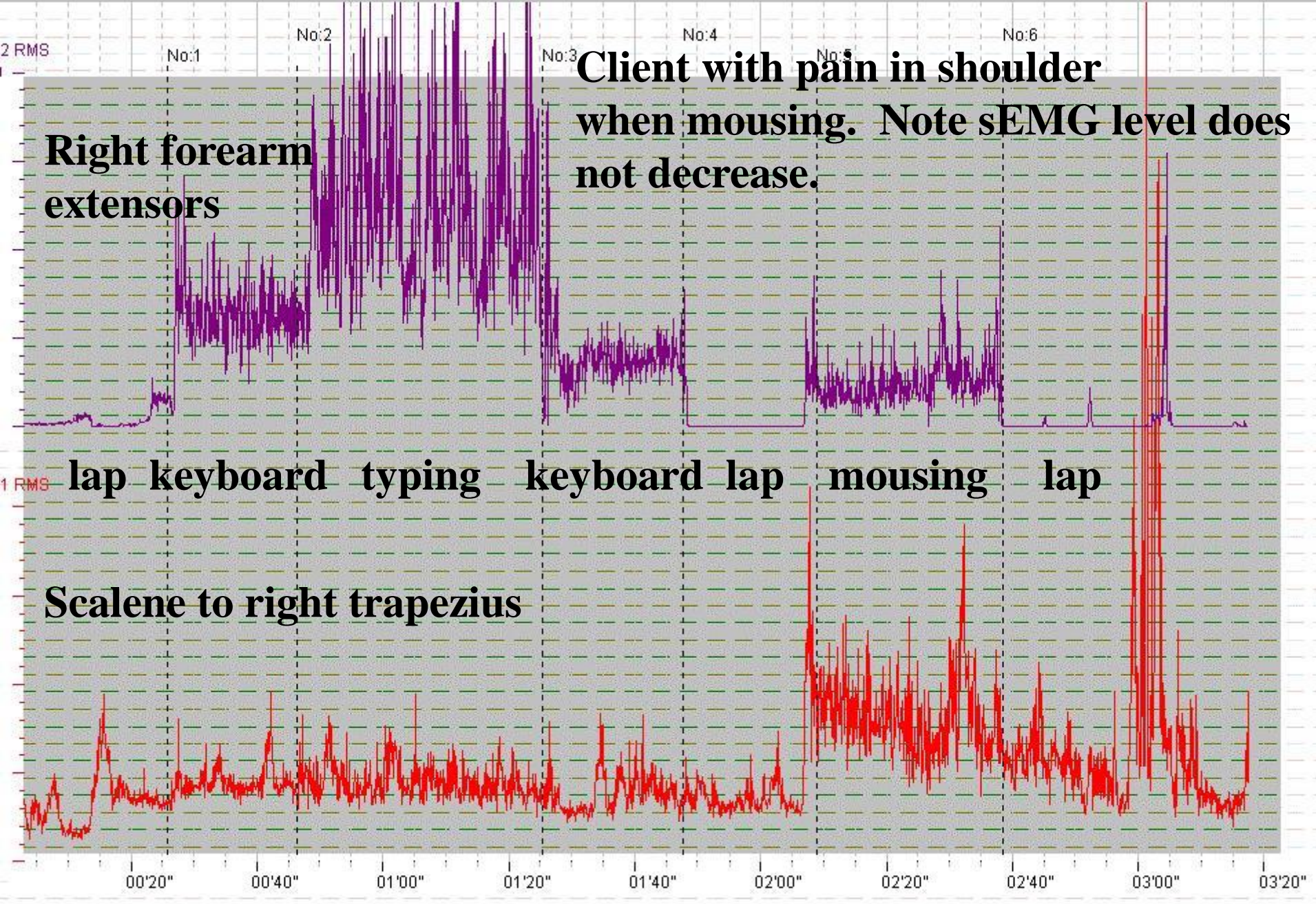
Peper, E. & Harvey, R. (2008). From technostress to technohealth. *Japanese Journal of Biofeedback Research*, 35(2), 107-114.

Psychophysiological risk factors

1. Forearm and shoulder (deltoid/trapezius) muscle tension increased when the person rests her hands on the keyboard without typing
2. Respiration rate increased during typing and mousing
3. Shoulder muscle tension increased during typing and mousing
4. Absence of rest periods in the shoulder muscles as long as the fingers are resting, typing, or mousing.

Peper, E. (2007). Stay Healthy at the Computer: Lessons Learned from Research. *Physical Therapy Products*. April.





Client with pain in shoulder when mousing. Note sEMG level does not decrease.

Right forearm extensors

lap keyboard typing keyboard lap mousing lap

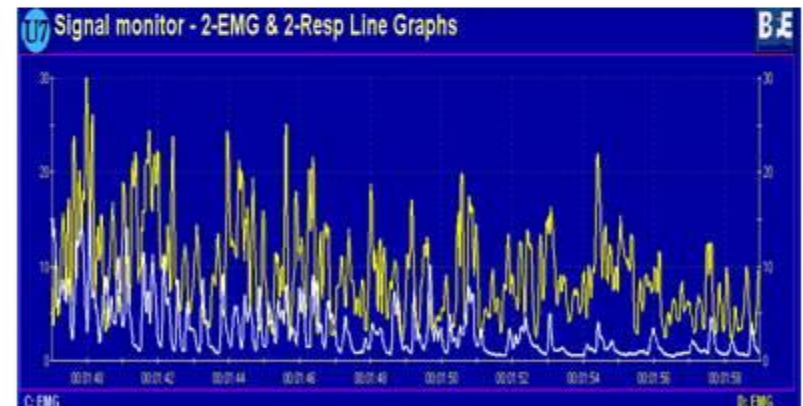
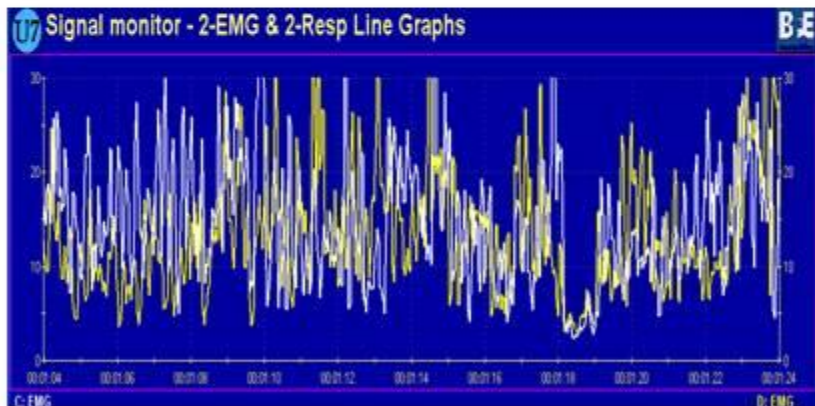
Scalene to right trapezius

Traditional mouse



Yellow: R. anterior deltoid trapezius
White: R. forearm extensors

Handshoe Mouse



Mean SEMG

Yellow: 14.8 μ V

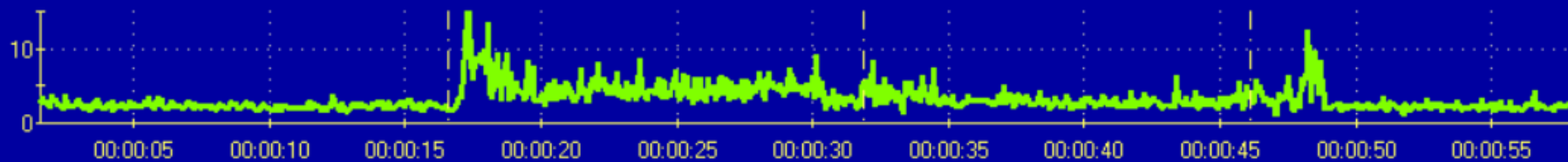
White: 13.5 μ V

9.4 μ V

3.1 μ V

4 EMG

Without seat and back correction chair



C: EMG (uV RMS)

7.33

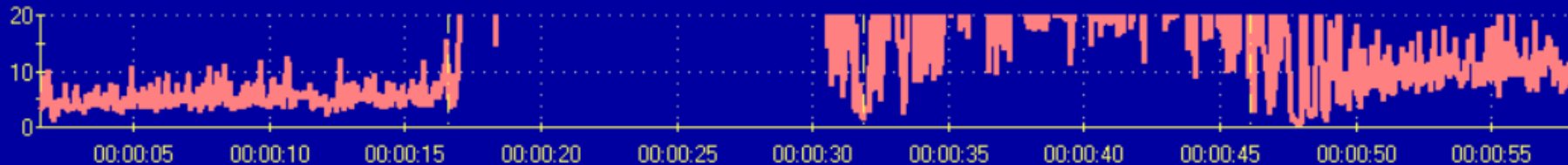
Cervical neck

Rest

Work position

Corrected

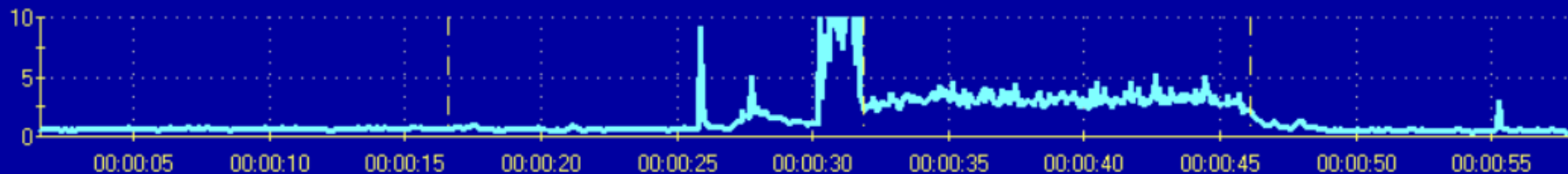
Rest



D: EMG (uV RMS)

22.46

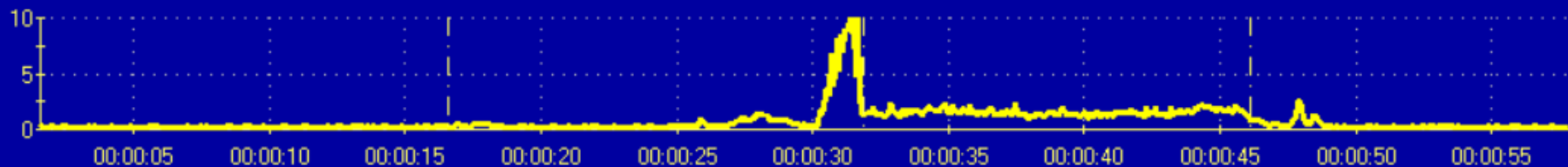
Right Trapezius



E: EMG (uV)

0.70

Right low back

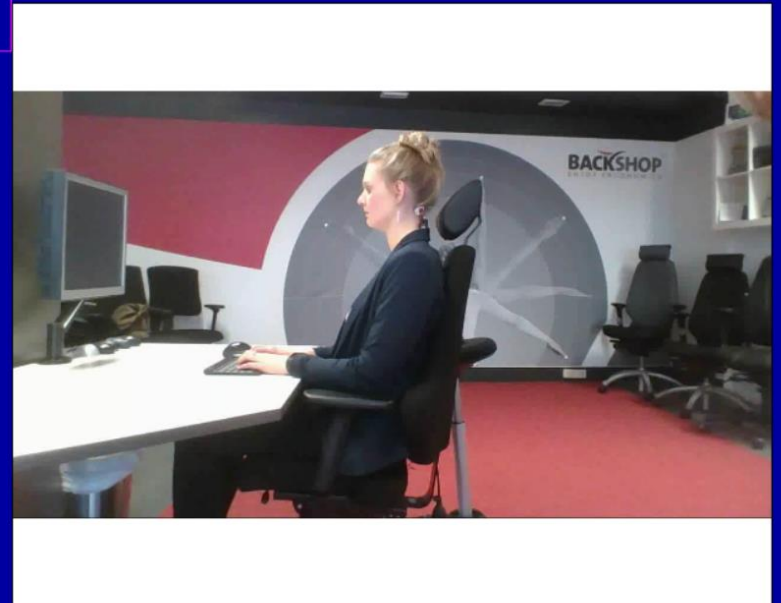


F: EMG (uV RMS)

0.30

Left low back

If you notice the presence of EKG (heart beat) artifact, make sure to set the bandpass filter on the MyoScan-Pro sensor to 400N



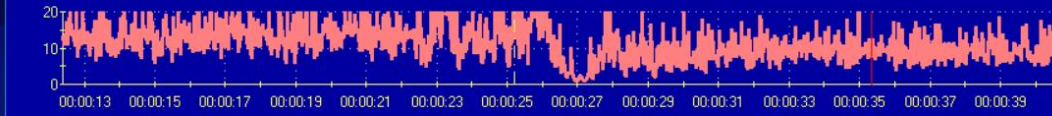
C: Deep row (abdominal)

4 EMG

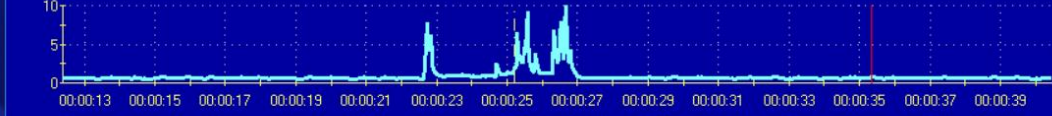
Seat pan horizontal Seat pan adjust



C: EMG (uV RMS) **2.36** Cervical neck



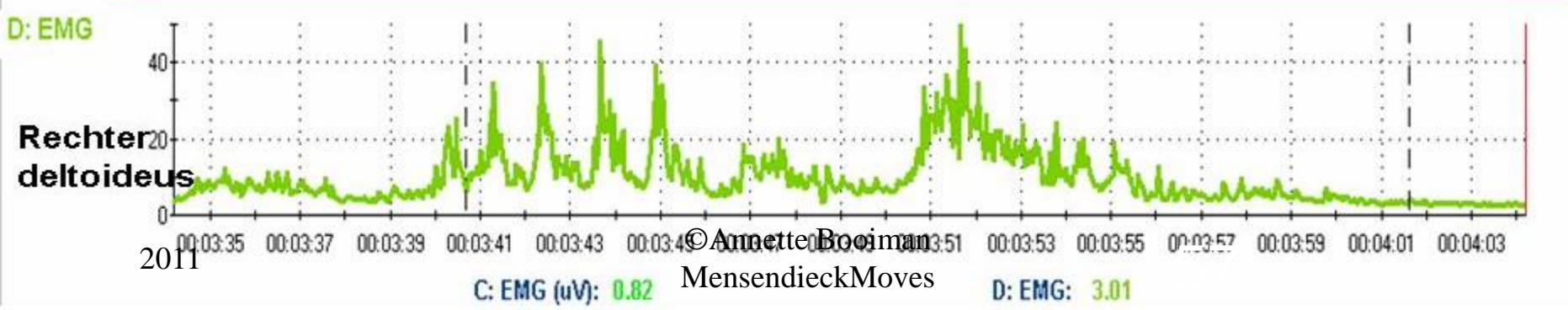
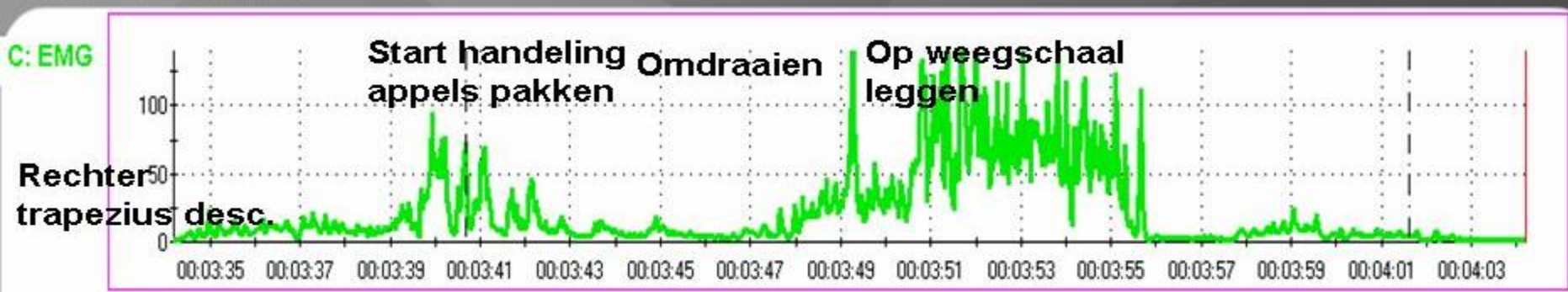
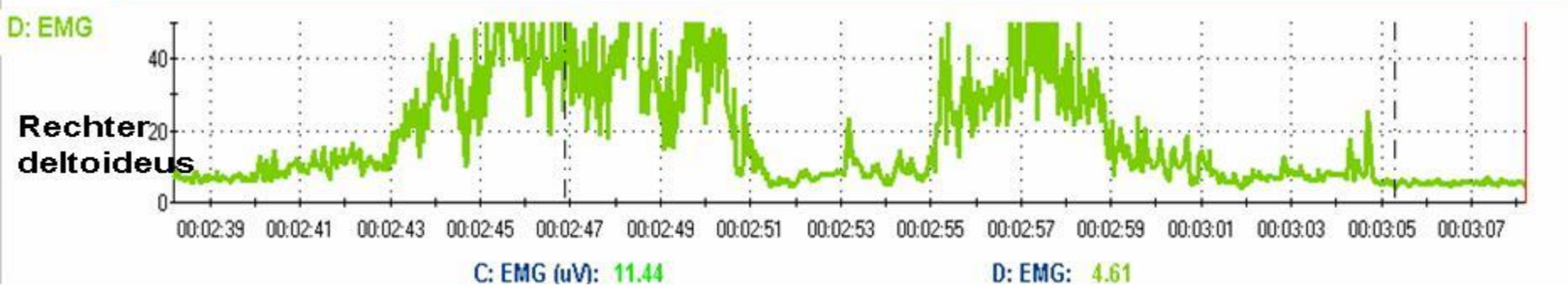
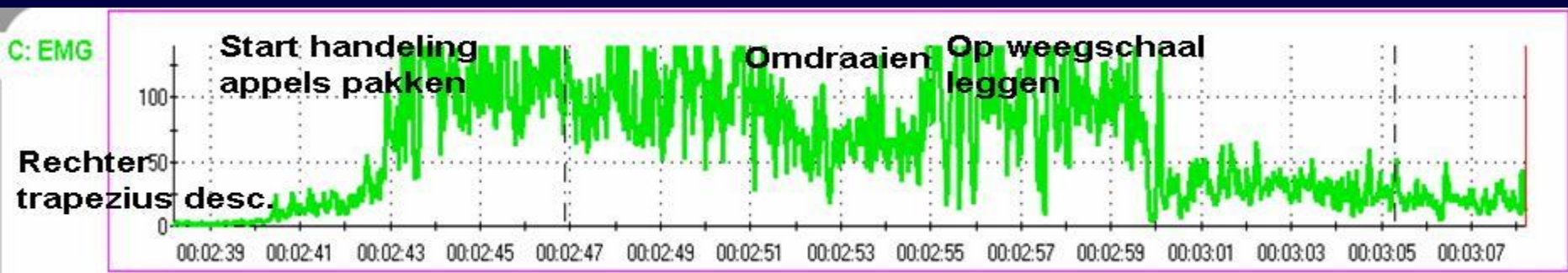
D: EMG (uV RMS) **9.15** Right Trapezius



E: EMG (uV) **0.65** Right low back



F: EMG (uV RMS) **0.30** Left low back



“Without kinesthetic awareness and without the skills to reduce tension, ergonomic adjustments with intermittent rest periods are **NOT** sufficient to reduce risk for injury.”

Peper, E., Wilson, V.S., Taylor, W., Pierce, A., Bender, K., and Tibbets, V., (1994). Repetitive Strain Injury. Physical Therapy Products.5(5),pps.

Effect of posture

- Changes muscle tension patterns
- Effects blood flow to the head
- Effects breathing
- Impacts cognition
- Impacts mood
- Impacts felt sense of power/powerlessness

Increased cervical spine stress



Stress on the cervical spine 10-12 lbs when the head is in its upright position; 60lbs when looking down.

From: Hansraj, K. K. (2014). Assessment of stresses in the cervical spine caused by posture and position of the head. *Surgical technology international*, 25, 277-279

Tight Upper
Trapezius
& Levator
Scapula

Inhibited
Rhomboids
& Serratus
Anterior

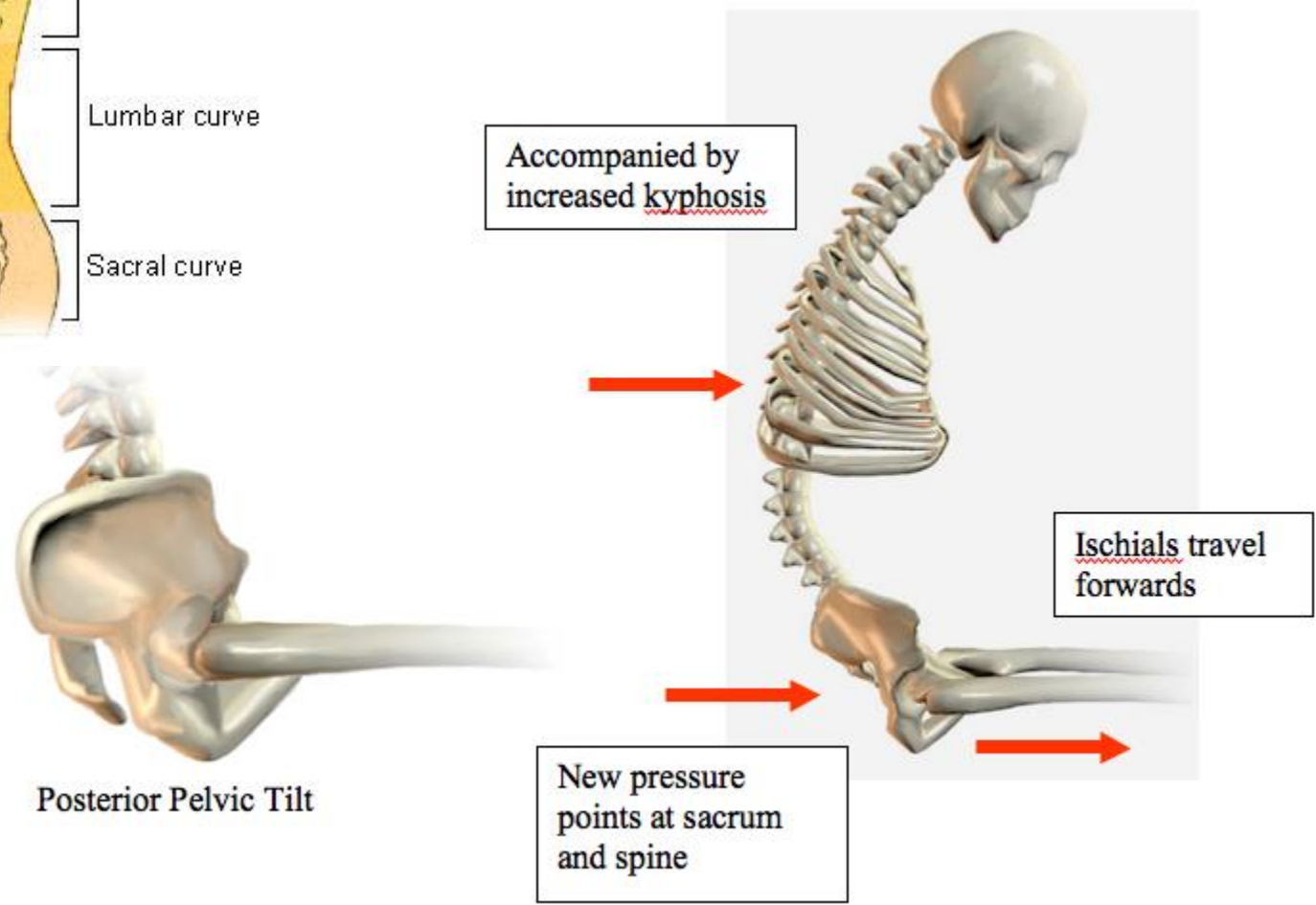
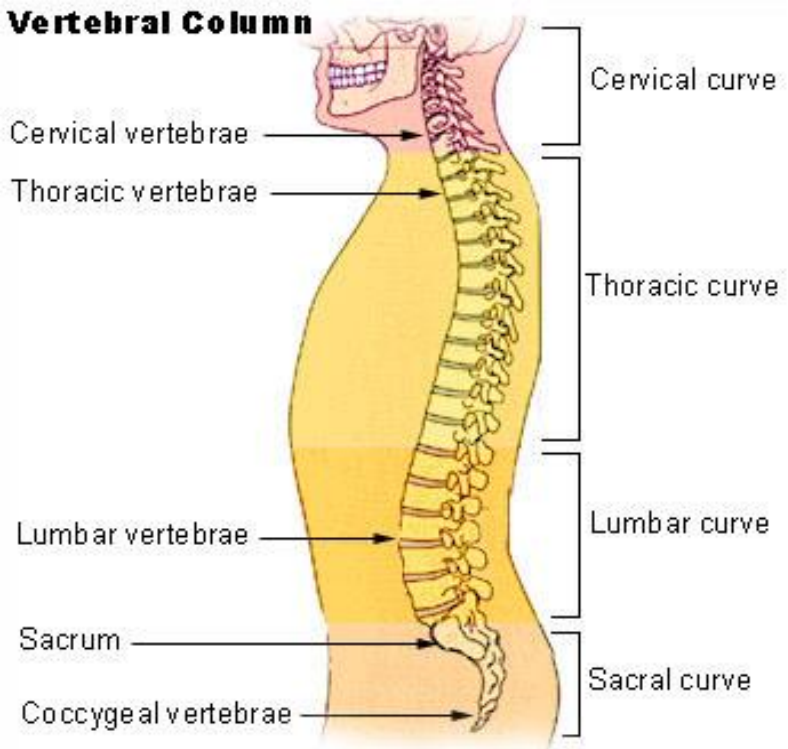


Inhibited
Neck
Flexors

Tight
Pectorals

Upper Crossed Syndrome

Vertebral Column



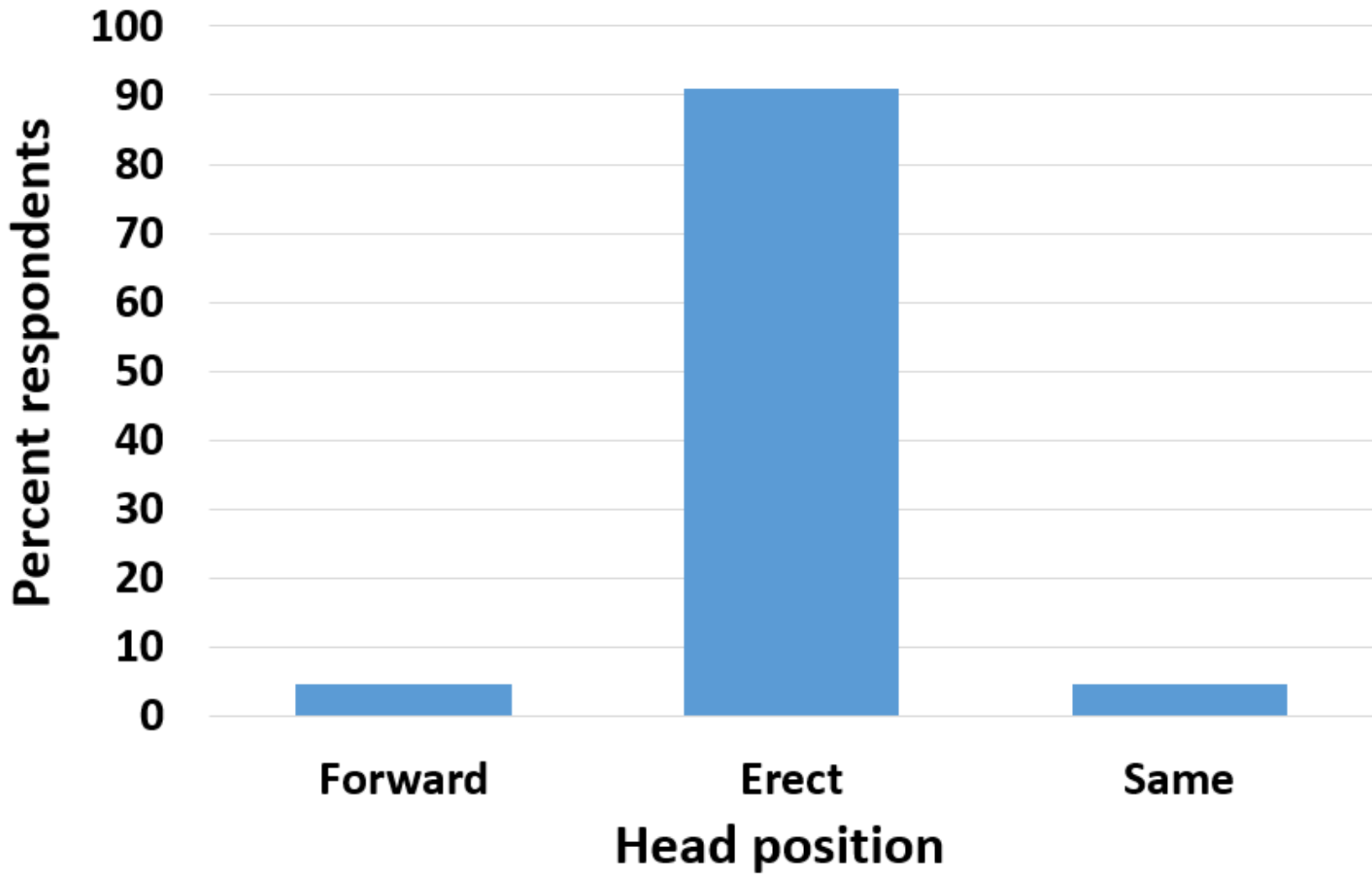
Slouching/startle posture induced symptoms

- Increased tiredness/exhaustion
- Increased vision difficulty
- Physical symptoms: neck, shoulder, back pain
- Increase depression, anxiety and irritability
- Reduced social/spacial awareness
- Increased pedestrian deaths

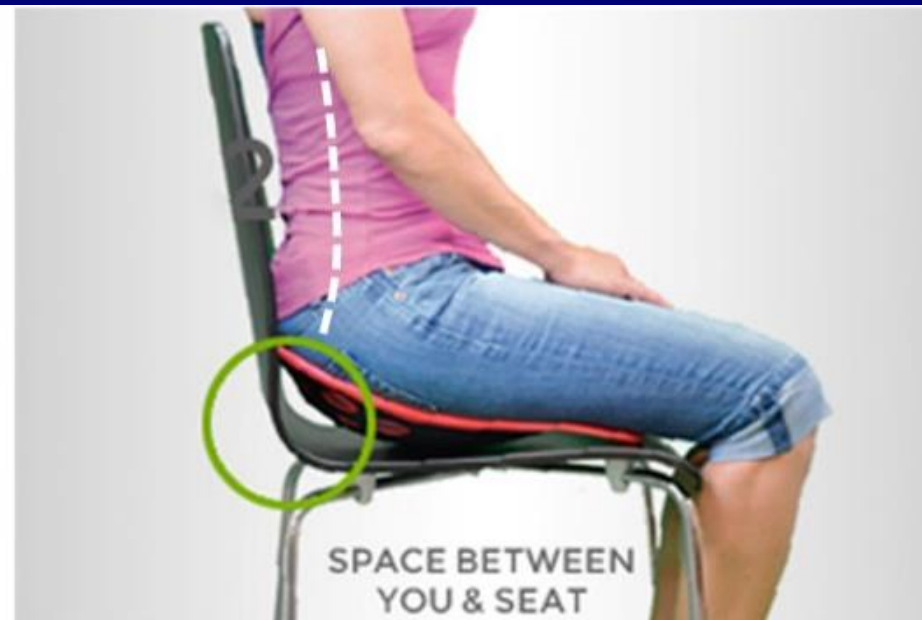
Practice: Posture and head rotation

- Crane head forward and look and rotate head to the left and right
- Be tall and erect and look and rotate head to the left and right
- **What did you experience?** In which position could you rotate

Ease of head rotation



Effect of BackJoy® seat insert.



Reproduced from: <http://www.backjoy.com/sit/>

Peper, E., Lin, I-M, & Harvey, R. (2017). Posture and mood: Implications and applications to therapy. *Biofeedback*.35(2) 42-48.

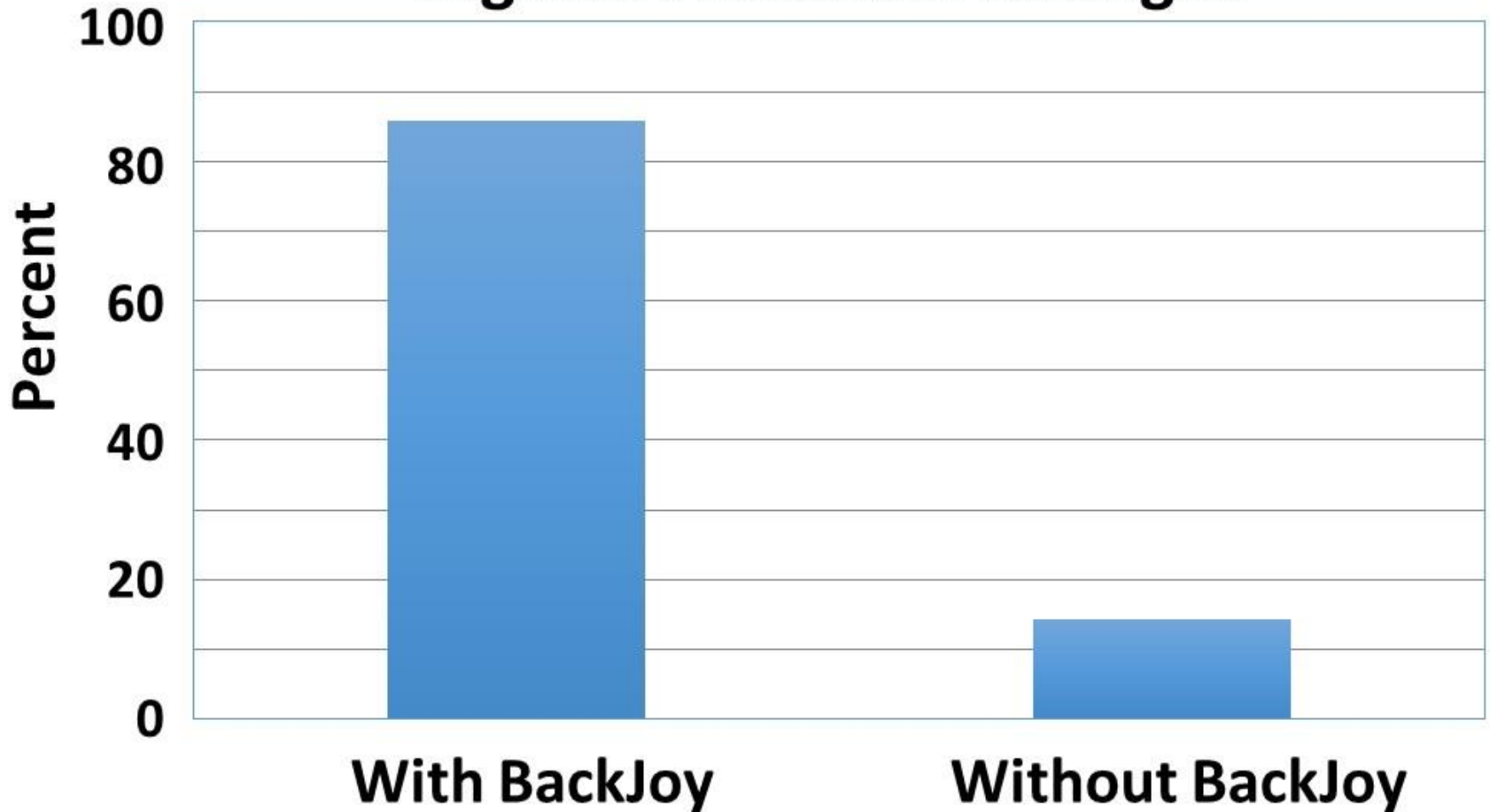


Peper, E., Lin, I-M, & Harvey, R. (2017). Posture and mood: Implications and applications to therapy. *Biofeedback*.35(2) 42-48.

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www.biofeedbackhealth.org

Participants' Position of Highest Perceived Strength



Peper, E., Booiman, A., Lin, I.M., & Harvey, R. (2016). Increase strength and mood with posture. *Biofeedback*. 44(2), 66–72.

Idiomatic phrases describe the posture ↔ mood relationship

Positive and empowering

- *My world is looking up*
- *Walking tall*
- *Standing proud*
- *Upstanding citizen*
- *Has a good head on her shoulders*
- *Expand*

Negative and powerless

- *What a downer*
- *In a slump*
- *Collapsed*
- *Ducked out of his responsibility*
- *All curled up*
- *Constrict*

Practice: Body Posture

- Collapse, eyes down—think happy thoughts
- Erect, eyes up, hands turned open—think negative thoughts

Possible impact in education:

Children sit for hours in a collapsed position at their desks or computers. Are we training for depression?

Effect of erect or collapsed posture on access to empowered or powerless, helpless, hopeless and defeated memories

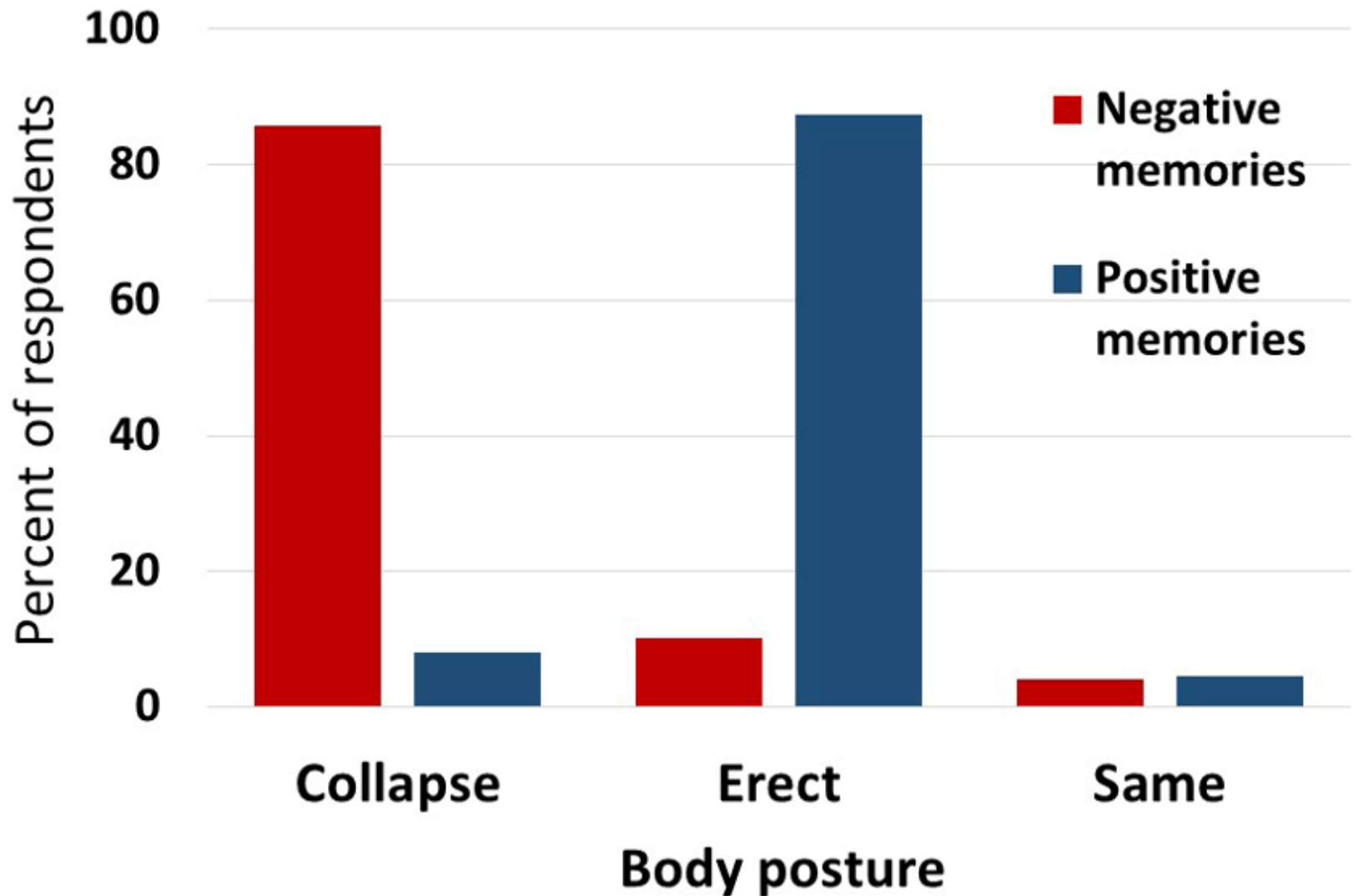


Collapsed



Erect

Emotional recall and body posture



The Biofeedback Posture Trainer

UpRight Go



- Attaches to back or neck on spine
- Provides vibratory feedback when user slouches
- Records data on smart phone
- Participants can use at home
- To start sign up needs to connect to WiFi

UpRight Go

UPRIGHT GO™
TRAIN / TRACK
TO IMPROVE YOUR POSTURE

UPRIGHT GO
UpRight Technologies Ltd.
Everyone

UNINSTALL UPDATE

10 THOUSAND Downloads
3.1 160 Health & Fitness
Similar

Train & track to improve your posture with this tiny habit-forming wearable.

WHAT'S NEW
- Long slouch notification - we're now actively watching your back when you're in

Ringtone

CALIBRATION
VIBRATION

06:09
SESSION 1 of 2

SWITCH TO TRACKING

DAY 7		FULL STATS
GOAL	TRAINING	TRACKING
2x10min	4min	0min

TRAINING

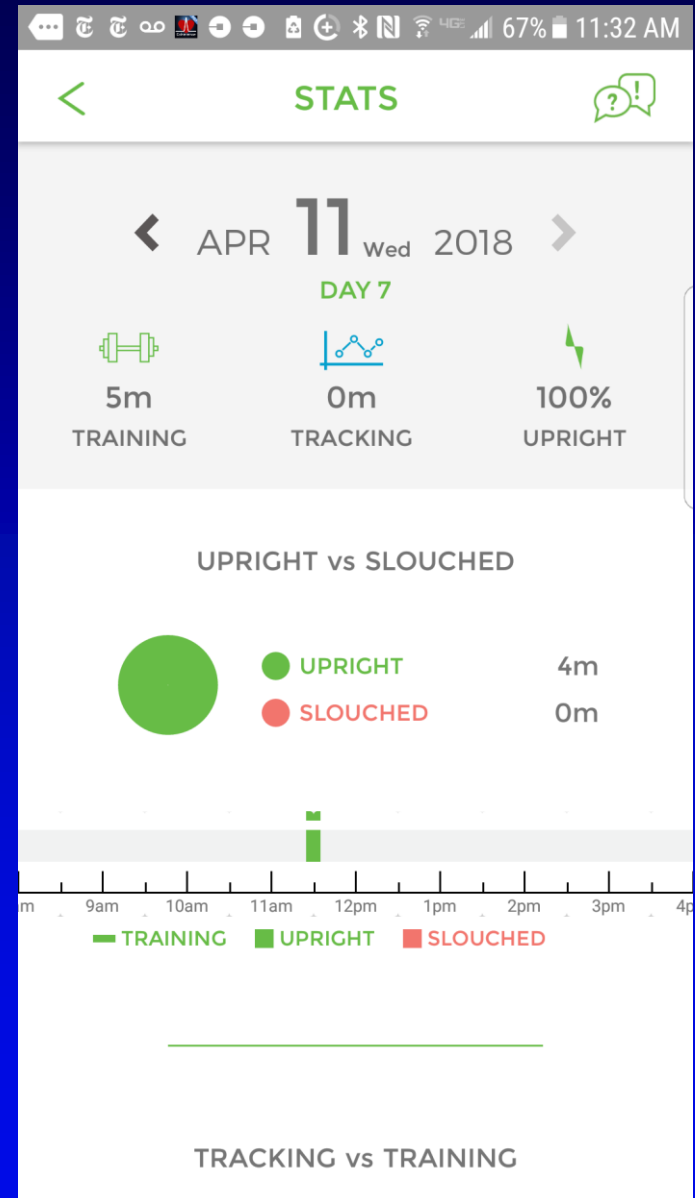
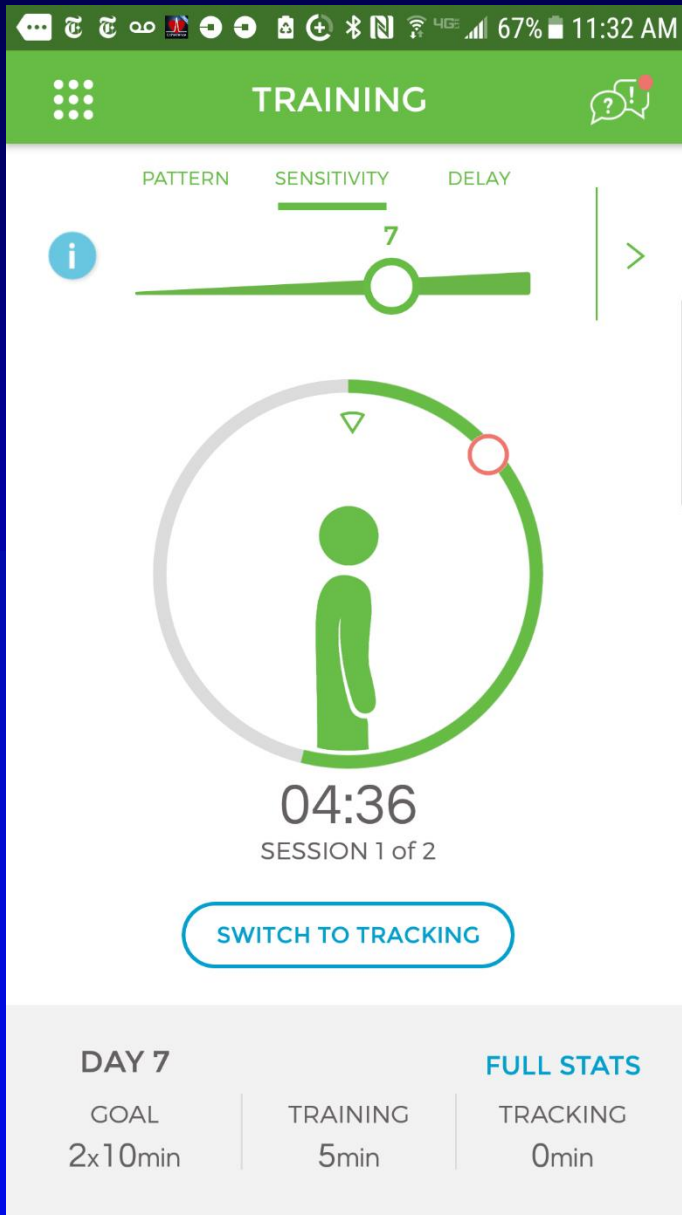
CALIBRATION
VIBRATION

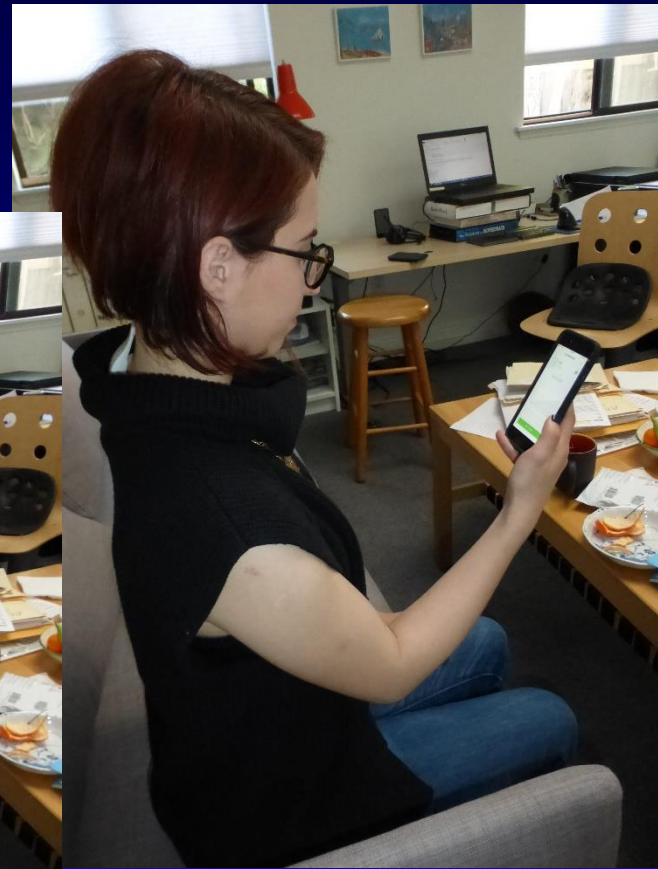
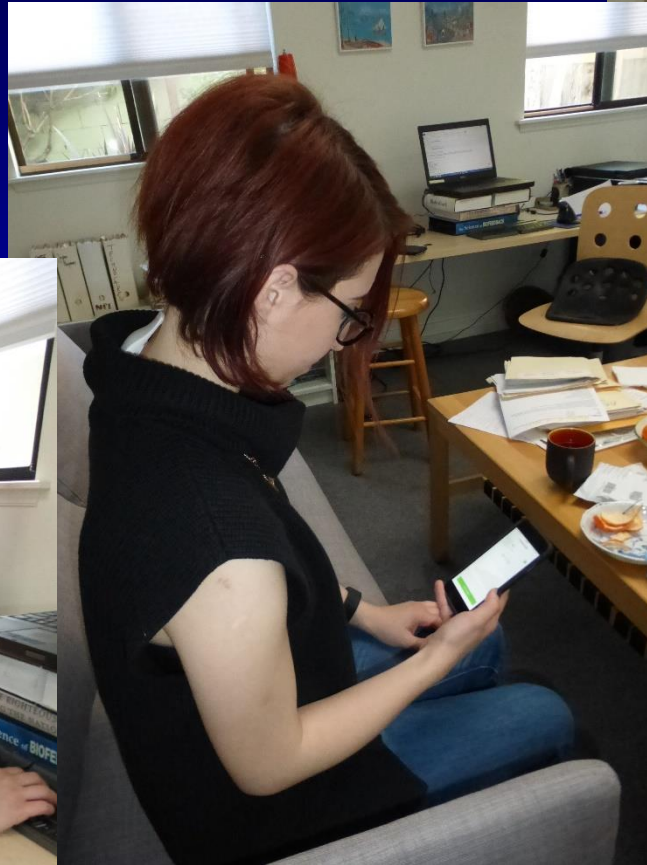
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SESSION 1 of 2

SWITCH TO TRACKING

DAY 7		FULL STATS
GOAL	TRAINING	TRACKING
2x10min	4min	0min

UpRight Go





Studies

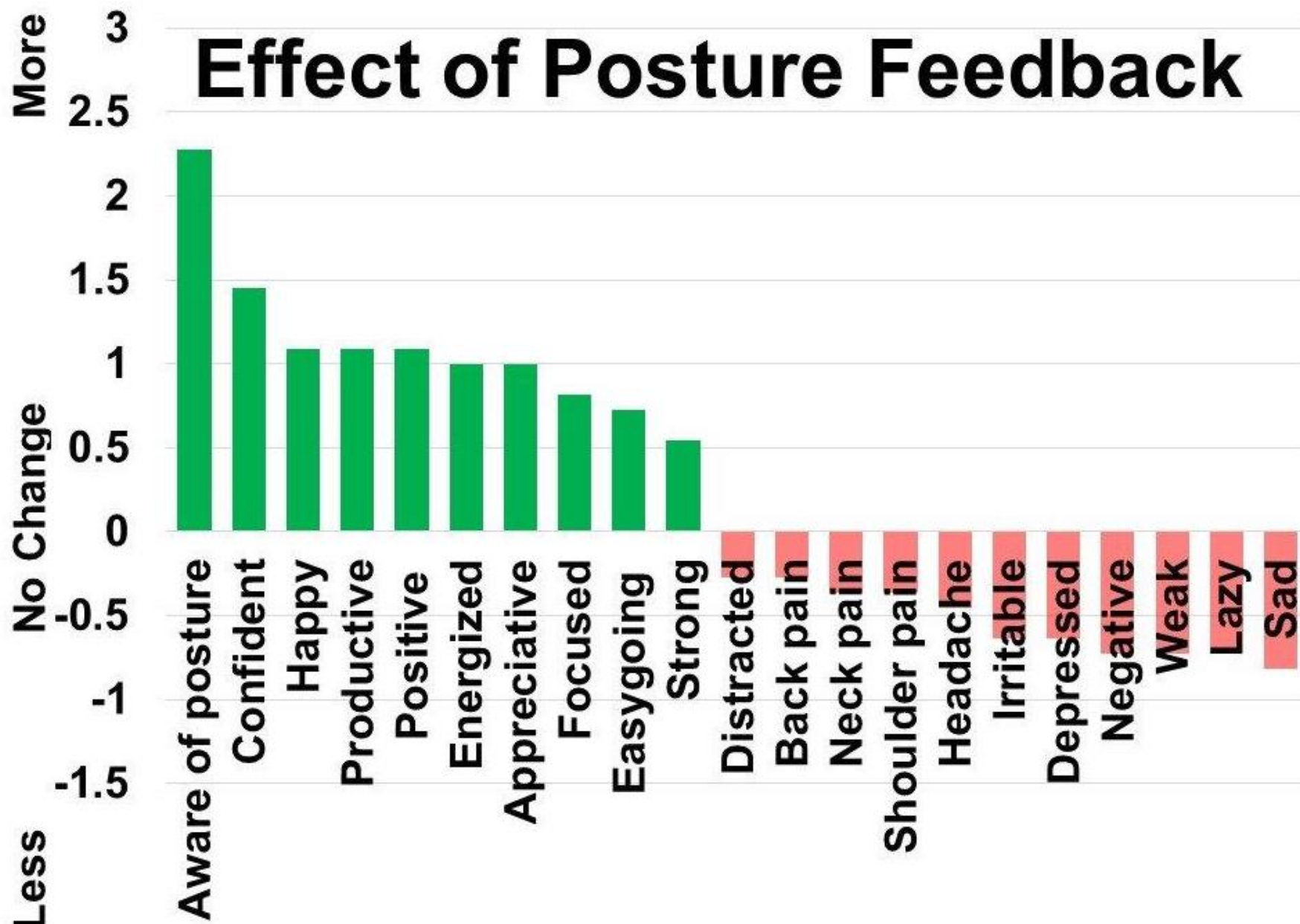
- Preliminary explorations what participants associate with slouching (vibratory feedback)
- SFSU employees used them at the worksite to reduce neck and shoulder discomfort and exhaustion
- Pilot study with students
- Controlled UpRight study

Interrupt automatic slouching

- When aware of situation that would trigger slouching or you catch yourself slouching
 - Change ergonomics
 - Sit/stand up in power position
 - Look up
 - Breathe lower (Exhale slowly and imagine that the breath expands beyond you/down your feet)
 - Transform powerless and self-critical thought to an empower thought
 - Smile
 - If tired take a break and walk

Observations

- Most participants were surprised when they slouched
 - Sitting and crossing one leg over the other looking at the computer screen,
 - Thinking about the work that has to be done, feeling defeated or intimidated).
- The feedback reminded them to change
 - Move/wiggle to interrupt “sitting disease”
 - Change powerless thoughts and emotional stressors
 - Sit erect in power posture



Colombo, S., Joy, M., Mason, L., Peper, E., Harvey, R., & Booiman, A. Posture Change Feedback Training and its Effect on Health. Poster presented at the 48th Annual Meeting of the Association for Applied Psychophysiology and Biofeedback, Chicago, IL March, 2017.

RAND 36-Item Health Survey

- physical functioning
- bodily pain
- role limitations due to physical health problems
- role limitations due to personal or emotional problems
- emotional well-being, social functioning
- energy/fatigue
- general health perceptions.

Effect of Posture Biofeedback on Combined Rand Score



Note: 23% increase in health scores occurred even though the post measure was taken just before final exams.

Harvey, R., Mason, L., Peper, E., & Joy, M. (in press). Effect of Posture Feedback Training on Health, *Applied Psychophysiology and Biofeedback*.

Summary of findings

- More awareness of posture
- Reduced back and neck pain
- Increase positive mood
- More mobility

Participant Reports

- “In the erect position, I had good thoughts about my myself, my life, and the world. When collapsed, my thoughts became dramatically more negative.
- “It felt like more work to sit collapsed. It was harder to breathe and open up my stomach. I didn’t have much awareness of my breath. In the erect position, it seemed easier and smoother to breathe. I felt more air in my stomach.”

Using Power Posture: 54 year Old Woman with Social Phobia

- I have been diligently practicing some of these Power Postures over the past few days. I was in a training for Divorce Mediation, which felt a little over my head professionally. I used it throughout the training whenever I went to the restroom or out for a break. I'd come back, and notice people treating me with more respect, asking me to accompany them for lunch, perceiving me as more competent than before, and by the end of one day, feeling energized, happy, empowered, more intelligent, and more socially connected.*

Application of posture: Case report

- At the moment I am trying to be aware of the situation in front of me rather than reacting to it.
- For example, yesterday my son who is 10 had a bad mood and I did not know what had happened, and he at first refused to tell me. Because I was aware of the posture information I could help him open up by making him change his posture without knowing.
- He became more open and told me what had happened earlier and I could help him move forward.

-Emy Maduro

TechnoHealth Certification Program

Biofeedback for Ergonomists

- 1 day workshop
 - The use electromyography (EMG) and posture biofeedback
 - Assessment
 - Intervention protocols
- Follow-up session necessary for certification
 - Case report presentation
 - Challenges and how to resolve them
 - Exam
- Contact: Erik Peper, PhD epeper@sfsu.edu
Richard Harvey, PhD rharvey@sfsu.edu

Erik Peper, Ph.D

Institute for Holistic Health Studies

San Francisco State University

and

BiofeedbackHealth

epeper@sfsu.edu

www.peperperspective.com