Seven Practical Human Factors and Ergonomics (HF/E) Tips for Teleworking/Home-learning using Tablet/Smartphone Devices

1

ED-148 Desktop Stool
The Ergonomic Good Practice awarded by the Japan Human Factors and Ergonomics Society.
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Foreword

It has been a while since digitization penetrated deeply into our life. Pros and cons of digitization have been discussed from the very beginning of its introduction. The discussions have been evolving as Information and Communication Technologies (ICT) and humans are becoming more an inseparable whole. It is a normal process of technological evolution, but this brings about complex systems which are oftentimes associated with side effects. Usually the mechanisms and behaviors of complex systems are hard to understand which in turn imposes a variety of problems on humans. It is especially true in the case of ICT because of their untransparent nature. It is the reality of our lives, which people have to live with. Human Factors and Ergonomics (HF/E) provides a powerful means of coping with the challenges of ICT.

The International Labour Organization (ILO) launched its Future of Work Initiative based on an understanding that work styles would change significantly as a result of new technologies, especially digital technologies. It was also envisaged that industries, markets and job opportunities would be restructured significantly by the shift of technologies. For instance, ILO foresees that remote working will become a dominant work style, which is expected to improve work-life balance for both men and women. How to realize this potential benefit is an important question to be answered by sciences and technologies. HF/E is recognized as a discipline that can make a significant contribution to this end.

This booklet is conceived during the time people are struggling with the COVID-19 pandemic. Infectious diseases are known to be major threats to human lives, society, and even the entire civilization. COVID-19 has evidenced that people cannot be fully prepared for a state of pandemic, despite all the lessons learnt and despite all the scientific safeguards. Unfortunately, COVID-19 is said to be long-lasting and there will be lots more sources of infection that may attack us in the future. It is believed that COVID-19 has added a huge social momentum that will drive people into new ICT-based lifestyles both at home and at the workplace, irreversibly. This foreseeable shift coincides with the ongoing surge of ICT mentioned above. No doubt, remote working and remote learning will play a major role and become a common practice for many workers and students.

Remote working and remote learning are no longer merely a trendy choice. It is hard to say that the market is matured, but at least it is flooded with many products – both hardware and software. Obviously, these technologies are in the midst of fierce competition. They are expected to give us safer, more efficient, and more balanced lifestyles as ILO hopes. How to realize this while

minimizing negative side effects is a meaningful question to be asked. It is essential that HF/E considerations are properly incorporated in every phase of product design. Apart from product design, there are various HF/E issues related to physical, cognitive, and organizational aspects of the interaction between humans and technology products. This booklet titled "*Seven Practical Human Factors and Ergonomics (HF/E) Tips for Teleworking/Home-learning using Tablet/Smartphone Devices*" focuses on several important issues that are commonly found in home work/learning environments that include interactions with digital devices. These issues have multiple causes. Influential factors include the inattentiveness of people at home, extent of time control, handiness of devices, nonideal layout, quality of lighting, appropriateness of furniture, and diverse cultural backgrounds, just to mention a few. To alleviate these issues, it is fundamentally important for people to understand how devices can be used correctly and how people can behave properly in given home work/learning environments. It is hoped that the seven tips presented in this booklet will help people understand the fundamentals and will transform the understanding into correct behaviors that will enhance their performance and preserve their health and wellbeing.

Dr. Yushi Fujita, CPE, CPEJ
Past President
International Ergonomics Association

Preface

The World Health Organization (WHO) declared the new coronavirus disease (COVID-19) as a pandemic on 11 March 2020. As a result, several employees have been forced to work from home and students have no option but to engage in virtual learning sessions. The Human Factors and Ergonomics (HF/E) community can help in not only mitigating social anxiety under the chemical, biological, radiological, nuclear and explosive (CBRNE) disaster events through risk communication but also provide multifaceted solutions with regard to applying HF/E methodologies, approach, knowledge and perspective during such pandemic situation.
At HF/E, we work on theories, principles, data, and methods that can help optimize human well-being and overall system performance. Thus, the HF/E community strives to provide practical ways to balance and optimize public health measures and assess the economic / social impact of long-lasting social activities during the COVID-19 pandemic.
Public health emergencies, in general, require an interdisciplinary and a comprehensive systems approach. Thus, in collaboration with stakeholders, the Japan Human Factors and Ergonomics Society (JES) has started working with our council members, society members, and stakeholders on initiatives for tackling this issue.

To begin with, the JES conducted an online survey including the full members of JES who are working at educational institutions, to collect information on their response status during the COVID-19 crisis (see IEA website: https://iea.cc/jes-survey-on-covid-19/). The results revealed that less than 40% of the respondents were aware of the appropriate human factors and ergonomics to be followed when teleworking or attending online meetings and about ways to improve the indoor working environment.

Hence, an expert panel consisting of the JES council members put forward a few action-oriented tips for individuals who are teleworking/home-learning using tablet/smartphone devices, based on the format of the Ergonomic Checkpoints prepared by the ILO/IEA. This document outlines practical HF/E tips that can be put into practice immediately by employees and students who are teleworking/home-learning using a tablet/smartphone device, at a low cost or without any cost.

Main council members of the JES have contributed to confirming the seven tips proposed in this document and gave fruitful advice on them. Special thanks to the following Contributors; Yoshihiro SHIMOMURA, Ph.D. (Chiba University), Kazuo AOKI, Ph.D., CPEJ(Nihon University), Kentaro KOTANI, Ph.D.(Kansai University), Takashi TORIIZUKA, Ph.D., CPEJ(Nihon University), Motonori ISHIBASHI, Ph.D., CPEJ(Nihon University),Miwa NAKANISHI, Ph.D.(Keio University),

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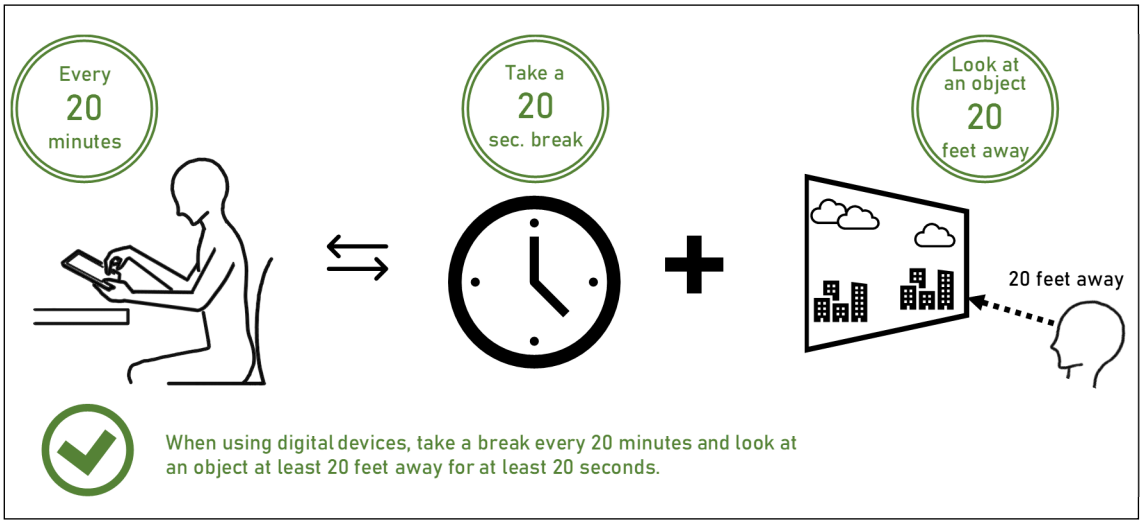
HF/E tip 1

Practice the 20-20-20 rule when using digital devices for teleworking/home-learning.



WHY

Looking at screens for longer periods may cause various health issues, such as eye strain or musculoskeletal discomfort caused by constrained postures.

RISKS / SYMPTOMS

- eye strain
- musculoskeletal disorders (MSD; particularly in the neck)
- inefficiency in work
- excessive fatigue

HOW

- Set an alarm for every 20 minutes while using digital devices, as a reminder to take a break.
- When you are hosting a webinar or an online lecture, insert a slide urging a short break or ask questions once every 20 minutes.
- Change your position from sitting to standing and look at something 20 feet away for 20 seconds. In addition to the 20-20-20 rule, switching between sitting and standing position alternatively is also an effective way of preventing general health problems.

SOME MORE HINTS

- The 20-20-20 rule was designed by a Californian optometrist Jeffrey Anshel as an easy reminder to take breaks and prevent eye strain.[1)2)]
- Alternately, a person can benefit from closing their eyes for 20 seconds every 20 minutes. Also, remembering to blink frequently can prevent dry eye by increasing tear production.[3)]
- Assign diversified tasks intentionally to avoid staring continuously at your screen all day. For example, make it a practice to use a writing instrument instead of typing on the keyboard or tablet to take notes when watching webinars.

References

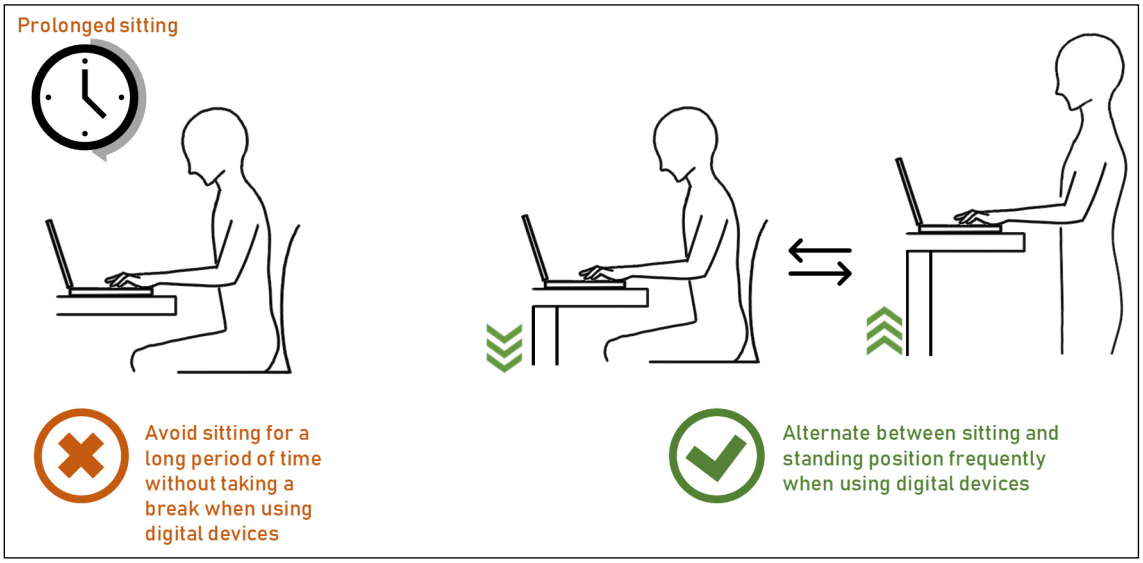
1) Anshel JR. (2007) Visual ergonomics in the workplace. AAOHN J. 55(10):414-20; quiz 421-2.

2) American Optometric Association. Computer Vision Syndrome. Available at: https://www.aoa.org/patients-and-public/caring-for-your-vision/protecting-your-vision/computer-vision-syndrome?sso=y.

3) Does the 20-20-20 rule prevent eye strain? https://www.medicalnewstoday.com/articles/321536#how-to-use-the-20-20-20-rule

HF/E tip 2

Alternate between sitting and standing position when using digital devices such as a tablet and/or laptop



WHY

Alternating between standing and sitting position while using digital devices is much better than remaining in the same posture for a long period of time. Recent studies suggest that being sedentary for a long time increases the risk of noncommunicable disease.[1)] The key here is to alternate your position as needed, and to reduce the total amount of sitting time in a day.

RISKS / SYMPTOMS

- MSDs
- noncommunicable diseases such as type 2 diabetes, cardiovascular disease, and cancer
- inefficiency in work
- excessive fatigue

HOW

- Introducing a height adjustable sit-stand workstation is one of the better ways to ensure flexible postures.
- A combination of 10-min of sitting, and 5-min of standing is a better way to maintain workers' arousal level and work performance.[2)]
- Adjust the height of the table at your elbow level or slightly below it when both sitting and standing.

SOME MORE HINTS

- Interrupt your sitting time with a short period of low-intensity walking. Introducing a 2-min active break after every 20 min of sitting time can lower your postprandial glucose and insulin levels.[3)] This means that avoiding prolonged sitting can be an effective way of preventing or reducing risks of acquiring type 2 diabetes.
- According to the World Health Organization (WHO), physical inactivity has been estimated to account for 5.5% of all the death-causing risk factors across the world.[4)]
- You can not only find many sit-stand related products but also find tips on using them appropriately on the Internet. You can conduct a search on the Internet using the key words "standing desk" or "sit-stand".

References

1) Yamamoto K, Matsuda F, et al. (2020) Identifying characteristics of indicators of sedentary behavior using objective measurements, Journal of Occupational Health, 62:e12089. https://doi.org/10.1002/1348-9585.12089

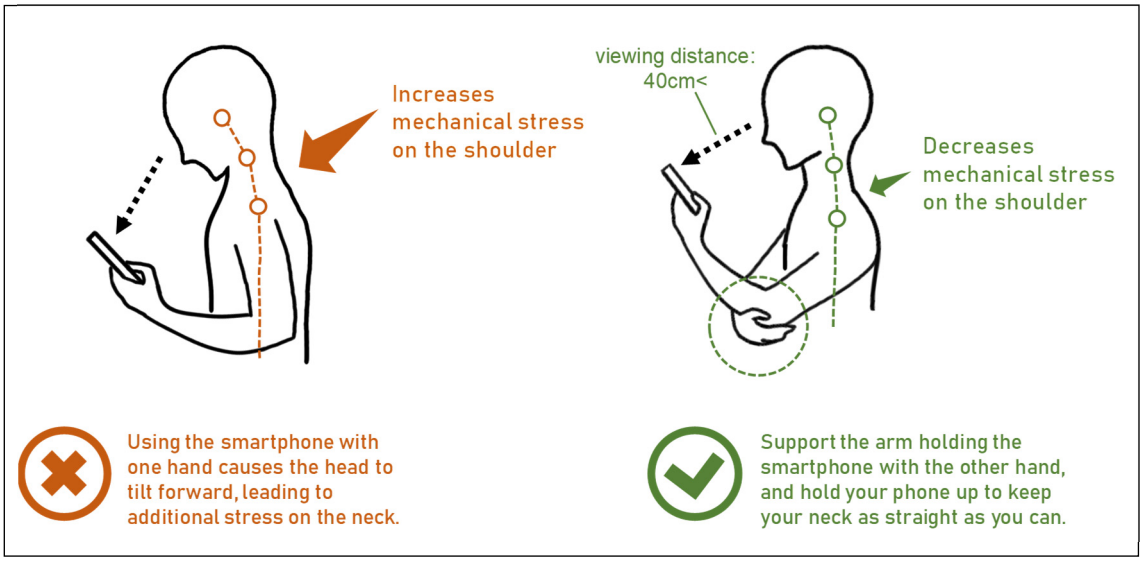
2) Ebara T, Kubo T, et al.(2008) Effects of adjustable sit-stand VDT workstations on workers' musculoskeletal discomfort, alertness and performance, Ind Health. 46(5):497-505. https://doi.org/10.2486/indhealth.46.497

3) Dunstan DW, et al. (2012) Breaking up prolonged sitting reduces postprandial glucose and insulin responses, Diabetes Care, 35(5):976-83. https://doi.org/10.2337/dc11-1931

4) WHO (2009) GLOBAL HEALTH RISKS - Mortality and burden of disease attributable to selected major risks, https://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf

HF/E tip 3

Support the arm holding the smartphone with the other hand, and hold your phone up to keep your neck as straight as you can



WHY

While using smartphones, users often adopt a forward head posture as they hold the device close to their body to reduce muscular fatigue on the arm. Looking down at your phone leads to greater stress on the cervical spine and shoulder. To reduce prolonged static forward head posture, it is important to make a habit of supporting the arm holding the smartphone with the other hand and holding the phone up to keep your neck as straight as possible.

RISKS / SYMPTOMS

- non-specific neck MSDs / neck pain
- text neck syndrome
- headache

HOW

- Almost universally, text messaging using the mobile device leads to a flexed neck, and a non-neutral typing-side wrist.[1] Furthermore, predominantly handling the smartphone with one hand leads to higher mechanical stress on one side of the neck and shoulder/upper extremities. This could be avoided by frequently switching the hand holding the smartphone.
- Maintain a comfortable viewing distance between your eyes and the device you are holding; typically, more than 40cm.

SOME MORE HINTS

- A review demonstrated that neck complaints have the highest prevalence rates, ranging from 17.3% to 67.8% worldwide.[2] This study also found that neck flexion due to phone calls, texting, and gaming is related to musculoskeletal complaints among mobile device users.
- Cervical flexion angles during smartphone texting are associated with neck pain.[2][3]
- Head flexion angle was significantly larger for text messaging than for other tasks and while sitting than while standing.[4]

References

1) Gold JE, Driban JB, et al. (2012) Postures, typing strategies, and gender differences in mobile device usage: an observational study, Appl Ergon. 43(2):408-12. https://doi.org/10.1016/j.apergo.2011.06.015

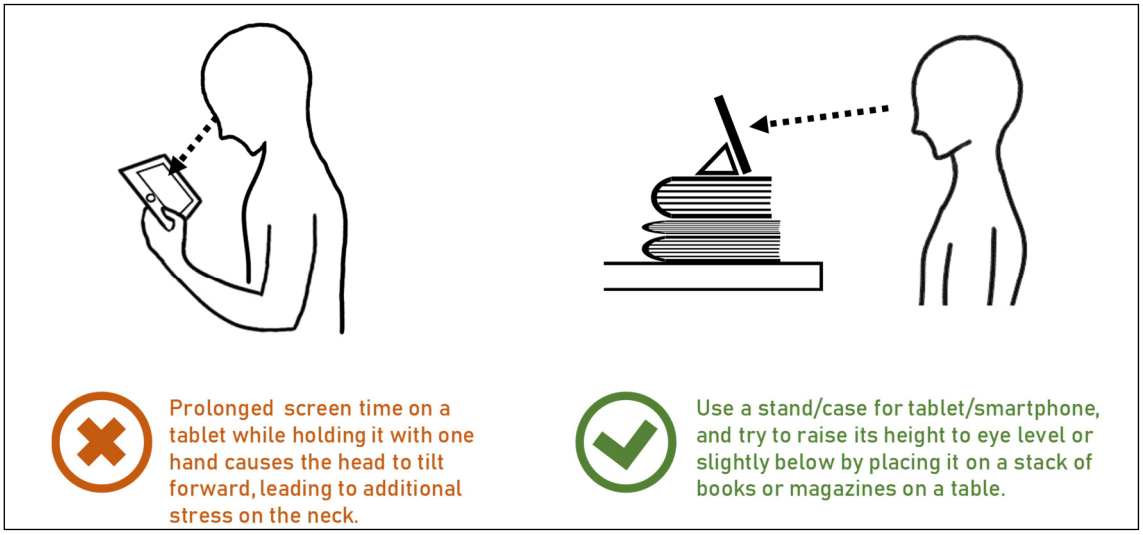
2) Xie Y, Szeto G, Dai J. (2017) Prevalence and risk factors associated with musculoskeletal complaints among users of mobile handheld devices: A systematic review., Appl Ergon. 59(Pt A):132-142. https://doi.org/10.1016/j.apergo.2016.08.020

3) Kim M.S. (2015) Influence of neck pain on cervical movement in the sagittal plane during smartphone use, J. Phys. Ther. Sci., 27 (1) :15-17. https://doi.org/10.1589/jpts.27.15

4) Lee S, Kang H, Shin G. (2015) Head flexion angle while using a smartphone. Ergonomics, 58(2):220-6. https://doi.org/10.1080/00140139.2014.967311

HF/E tip 4

Use a stand/case for tablet/smartphone and try to raise its height to eye level or slightly below by placing the device on a stack of books or magazines



WHY

Mobile handheld devices have an advantage owing to their small size, as they can be held and operated with one hand. However, the use of such devices leads to head forward flexion. The more your head is bent forward, the greater the pressure on the neck and shoulder, thus leading to upper limb MSDs, text neck, and non-specific neck MSDs. Therefore, when watching a screen for a certain time (approx. more than 15 minutes), use the stand/case for tablet/smartphone, without holding the smartphone in your hand, and try to raise its height to eye level or slightly below by placing the stand on a stack of books or magazines on a table.

RISKS / SYMPTOMS

- non-specific neck MSDs / neck pain
- text neck syndrome
- headache

HOW

- The screen should be placed directly in front of you to avoid twisting or awkward postures when looking at the screen.
- Keeping an appropriate viewing distance is also important to avoid eye strain and head/neck flexion. Keeping the screen too far away can result in forward-bent posture, which can cause text neck. At the same time, holding it too close, and keeping the screen brightness on high can cause eye problems. A remarkably simple way of keeping an appropriate distance is to simply place the device at a length equal to that of your fully extended arm.
- Adjust the screen's viewing angle. The device should be placed at eye level or slightly below it. Use a stand/case for tablet/ smartphone to easily adjust the tilt. It is also important to take measures to prevent direct/indirect glare. Adjust the work desk layout or light source to avoid light falling directly on the screen. Keep the screen's glare low by adjusting the screen position.

SOME MORE HINTS

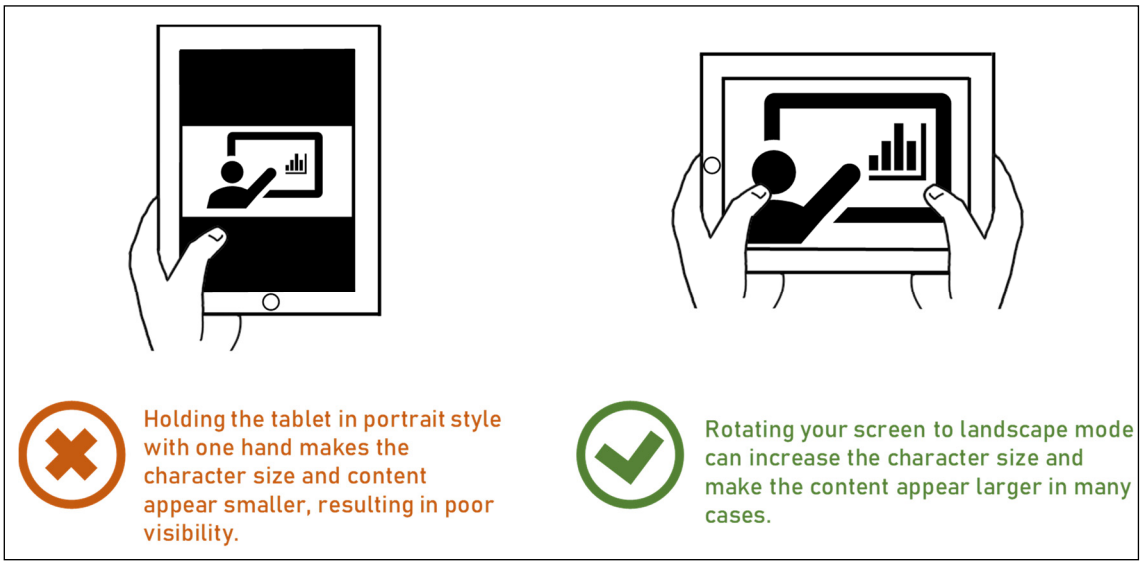
- Tablet use is similar to paper use, however with less neutral spinal posture, more elevated scapular posture and greater upper trapezius and cervical erector spinae activity. This is offset by greater variability in posture and muscle activity. Tablet computer use clearly results in different musculoskeletal stresses than desktop computer use.[1)]
- If your screen is brighter than your surroundings, adjust your screen brightness to the level of your ambient light. Now, latest tablets/smartphones have an illuminance sensor that automatically adjusts the brightness if the adjustment function is switched on. Ensure suitable and sufficient ambient brightness in your room when using digital devices.

References

1) Straker LM, Coleman J, et al. (2008) A comparison of posture and muscle activity during tablet computer, desktop computer and paper use by young children, Ergonomics, 51(4):540-55. https://doi.org/10.1080/00140130701711000

HF/E tip 5

Use landscape orientation as standard when browsing or watching content on the digital devices.



WHY

If you have to use the tablet/smartphone temporarily for texting, browsing, or watching content, hold it with both hands. Larger, heavier tablets are found to have significantly worse usability and biomechanics, and their use with one hand should be limited.[1)] Furthermore, holding the tablet/smartphone in portrait mode with one hand makes the character size and the content appear smaller, resulting in poor visibility.

RISKS / SYMPTOMS

- upper limb/neck MSDs
- low usability, poor visibility
- eye strain
- inefficiency in work

HOW

- Rotating your screen to landscape orientation can increase character size in many cases.
- Placing the tablet flat on the desk in landscape mode expands the keyboard on the screen. Make sure to expand the keyboard as much as possible when you have to input text using on-screen keyboard.
- Key pitch (center-to-center distance between keys) is one of the factors that affects typing speed, resulting in errors and dissatisfaction in usability.
- Remember that although placing the tablet flat on the desk is appropriate for typing or writing when using a stylus or Bluetooth pen, it will result in high neck flexion.

SOME MORE HINTS

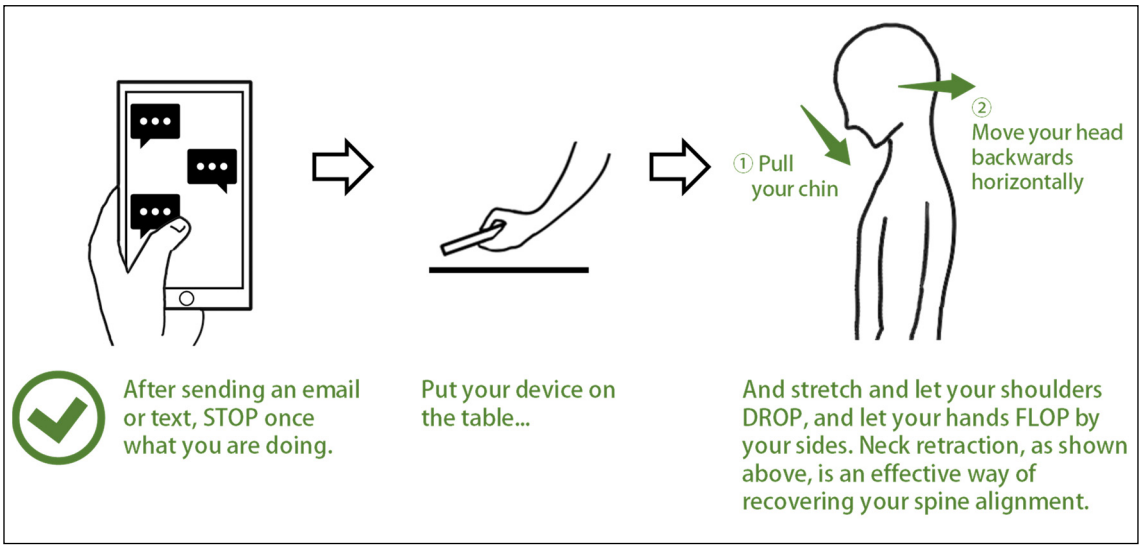
- Holding even a low weight tablet in a fixed posture for long periods of time without any support can cause musculoskeletal problems in neck, wrists, and arms.
- Make sure to select and use a tablet case easy to grip with both hands in case you have to temporarily hold it.
- When watching the screen for a certain time, use a stand/case for tilting the tablet or elevating its height, and use a stand for a laptop, as is shown on the cover page of this document.

References

1) Pereira A, Miller T, Huang YM et al. (2013) Holding a tablet computer with one hand: effect of tablet design features on biomechanics and subjective usability among users with small hands, Ergonomics, 56(9):1363-75. https://doi.org/10.1080/00140139.2013.820844

HF/E tip 6

Stop-Drop-Flop! [1)]
Try to adopt this simple way as a habit for taking micro pauses



WHY

"Stop, Drop, and Roll" is a well-known fire safety slogan taught to children, emergency service personnel, and industrial workers to be implemented if their clothing catches fire. As in this slogan, the Similarly, the imitative slogan "Stop-Drop-Flop" is useful for maintaining your health when using digital devices for frequent texting. Try to make Stop-Drop-Flop a habit and a cue for taking micro pauses.

RISKS / SYMPTOMS

- repetitive strain injuries (RSI)
- neck MSDs
- upper limb /wrist MSDs

HOW

- Stop-Drop-Flop – take micro pauses. For e.g., at the end of an email or text, stop what you are doing, stretch, and let your shoulders drop, and let your hands flop by your sides.[1)]
- Keep in mind to practice the neck retraction exercise, shown in the figure above, as a stretch. The neck retraction movements are a commonly prescribed physical therapy technique for treating patients with neck pain and dysfunction.[2)]

SOME MORE HINTS

- A common advice to prevent upper limb MSDs such as repetitive strain injuries (RSI) is indulging in brief exercises while taking frequent micro pauses.
- The more your head is bent forward, the greater the force on the neck and shoulder. With the average human head weighing around 5kg, this means that looking at your phone at a 45-degree angle of neck flexion could put up to 22kg of stress on your neck.[3)]
- The Global Burden of Disease Study 2015 indicates that MSDs such as lower back pain and neck pain were the leading cause of disability-adjusted life years (DALYs) in most countries.[4)]

References

1) Mobile Office Ltd., Ergonomics guidance for mobile workers – quick reference sheets, https://www.mobileoffice.guru/site_files/5706/upload_files/MobileOfficeAllGuidancedocv1.pdf?dl=1

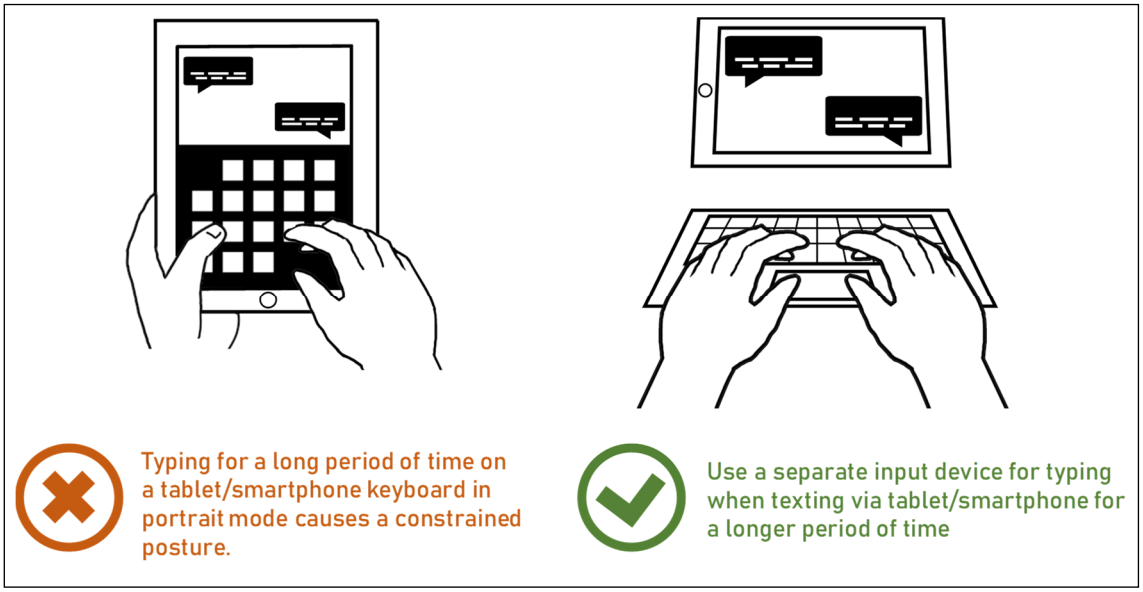
2) Pearson ND, Walmsley RP (1995) Trial into the effects of repeated neck retractions in normal subjects, Spine, 20(11):1245-50

3) Hansraj KK. (2014) Assessment of stresses in the cervical spine caused by posture and position of the head, Surg Technol Int. 25:277-9.

4) GBD 2015 Disease and Injury Incidence and Prevalence Collaborators (2016) Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015, Lancet, 388(10053):1545-1602. https://doi.org/10.1016/S0140-6736(16)31678-6

HF/E tip 7

Use an external HF/E keyboard when texting via tablet / smartphone for a long time



WHY

If you have to enter characters using a tablet or smartphone for extended periods of time, make sure to use an external HF/E keyboard instead of the on-screen keyboard. Entering characters using an on-screen keyboard results in many typos because of narrow key pitch, especially under the portrait orientation. Furthermore, typing for a long period of time on a tablet/smartphone keyboard in portrait mode causes constrained posture.

RISKS / SYMPTOMS

- inefficiency in work
- upper limb/neck MSDs
- low usability

HOW

- Use an external Bluetooth keyboard if your work demands a significant amount of text entry.[1)]
- Key pitch (center-to-center distance between keys) is one of the factors that affects typing speed, leading to errors and dissatisfaction in usability. Select an HF/E keyboard with a standard key pitch (19 mm).
- Separating the keyboard and screen has many benefits. Since the proper viewing distance for the monitor is different from the operating distance for a keyboard, they need to be placed independently.
- If a keyboard is used frequently, it should be close enough to your body, at a distance that does not require straightening of your elbows. The recommended human reach envelope (primary zone) is within a radius of 40 cm, directly in front of you.

SOME MORE HINTS

- Wireless keyboards are compatible with most tablets/smartphones with Bluetooth connectivity. Try to search the terms "Bluetooth keyboard" or "wireless keyboard tablet" on the Internet.
- When the key pitch is small, ulnar displacement, in particular, becomes even more severe, and the posture tends to become constricted. So, be careful and avoid a strained posture.[2)]

References

1) Mobile Office Ltd., Ergonomics guidance for mobile workers – quick reference sheets, https://www.mobileoffice.guru/site_files/5706/upload_files/MobileOfficeAllGuidancedocv1.pdf?dl=1

2) Saito S, Piccoli B et al. (2000) Ergonomic Guidelines for Using Notebook Personal Computers, Industrial Health, 38:4421-434. https://www.jstage.jst.go.jp/article/indhealth1963/38/4/38_4_421/_article/-char/en

General Human Factors and Ergonomics Guidelines for Teleworking/Home-learning

- Chartered Institute of Ergonomics & Human Factors, Three golden rules for home working, 2020, https://www.ergonomics.org.uk/Public/News_Events/News_Items/Three-golden-rules-for-home-working.aspx
- Japan Human Factors and Ergonomics Society, Ergonomic guidelines for laptop use, 2010 (in Japanese), https://www.ergonomics.jp/official/page-docs/product/guideline/notePC-guideline-2010.pdf
- Susumu SAITO, Bruno PICCOLI, Michael J. SMITH, Midori SOTOYAMA, Glenn SWEITZER, Maria Beatriz G. VILLANUEVA, Ryoji YOSHITAKE, Ergonomic Guidelines for Using Notebook Personal Computers, Industrial Health, 2000, 38:4421-434. https://www.jstage.jst.go.jp/article/indhealth1963/38/4/38_4_421/_article/-char/en
- Mobile Office Ltd., Ergonomics guidance for mobile workers – quick reference sheets, https://www.mobileoffice.guru/site_files/5706/upload_files/MobileOfficeAllGuidancedocv1.pdf?dl=1
- Stanford University, Environmental Health & Safety, Telecommuting & Mobile Ergonomics, https://ehs.stanford.edu/subtopic/telecommuting-mobile-ergonomics
- Canadian Centre for Occupational Health and Safety(CCOHS), OSH Answers Fact Sheets: Telework / Telecommuting, https://www.ccohs.ca/oshanswers/hsprograms/telework.html
- Washington State University, ENVIRONMENTAL HEALTH & SAFETY Ergonomic Resources for Teleworkers, https://ehs.wsu.edu/workplace-safety/ergonomics/ergonomic-evaluation/
- U.S. Office of Personnel Management, Telework Employees Safety Checklist, https://www.telework.gov/federal-community/telework-employees/safety-checklist/
- Federal Emergency Management Agency, USA, 7 Essential Tips for Safe and Healthy Teleworking, https://www.fema.gov/7-essential-tips-safe-and-healthy-teleworking
- ILO Encyclopaedia, Telework, https://www.iloencyclopaedia.org/part-xvii-65263/office-and-retail-trades/item/648-telework
- International Ergonomics Association(IEA) and International Commission on Occupational Health(ICOH), ERGONOMICS GUIDELINES FOR OCCUPATIONAL HEALTH PRACTICE IN INDUSTRIALLY DEVELOPING COUNTRIES, 2010, http://www.icohweb.org/site_new/multimedia/news/pdf/ERGONOMICS%20GUIDELINES%20Low%20res%20Final%20April%202010.pdf

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