Towards a framework for international research collaboration to address research gaps on ergonomics issues of mobile touch screen device use

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1. Mobile touch screen devices are rapidly becoming widely used

Mobile touch screen devices (MTSD) include standard sized tablet computers (e.g. Apple iPad, Microsoft Surface), small tablet computers (Samsung Galaxy Tab) and smart phones (e.g. Apple iPhone, Samsung Galaxy). They are characterised by their mobility (light, portable), intuitive interface (touch screen, graphic user interface) and range of functions (internet access, email, video conferencing, social media, viewing movie/TV content, games, data entry, document editing etc.). MTSD are thus used for educational, occupational, rehabilitation, entertainment and social purposes. Occupational purposes include crime scene investigation, sports tactics analysis, restaurant order taking, delivery confirmation and patient records. MTSD are also used across the age spectrum - from young children (McManis et al., 2012), through school children and adolescents (Banister, 2010), adults (Kumin et al., 2012), to the elderly (Alviseke et al., 2012).

Since the introduction of Apple’s iPhone in June 2007 and iPad in April 2010 accessibility to MTSD has increased rapidly. Worldwide in 2012 sales of MTSD surpassed desktop computers for the first time (Singh, 2014). The increased accessibility appears to be translating to increased use. For example, in Australia, industry figures show that 46% people use a tablet and 68% use a smart phone (Fadaghi 2014 a and b). Children and adults can now be observed using MTSD in many aspects of daily lives.

2. Mobile touch screen device use is likely to impact on physical, mental and social outcomes

Given the apparent frequent and substantial MTSD use by many people, this human-technology interaction is likely to have important physical, mental and social impacts. Evidence from prior information and communication technologies such as television, desktop and laptop computers suggest impacts are likely to include:

- Physical impacts such as displacement of physical activity, prolonged sedentary time, sustained awkward postures, repetitive movements, increased close-focus vision (Czepita, 2014; Straker et al., 2008)
- Mental impacts such as increased mental pressure and distraction from multi-tasking, stress relief from increased social engagement or game play, cognitive productivity and learning (Banister, 2010), decreased critical thinking (Barr et al., 2015)
- Social Impacts such as displacement of real-world human interaction, increased audio and video communication with friends and family (Madianou et al., 2011; Przybylski et al., 2013)
- Other impacts such as sleep loss and disruption (Cajochen et al., 2011)

3. Mobile touch screen device use is an emerging ergonomics issue

Given the rapid increase in availability of MTSD and potential impacts it is important for ergonomics researchers to develop an understanding of the amount and patterns of use, the consequences of use and the potential mechanisms linking use and consequences.

As MTSD devices have rapidly penetrated many communities over the last 8 years and research is lagging, an international collaborative approach to identifying the research gaps and addressing these is warranted.
4. Potential mobile touch screen device use research gaps

4.1 Amount and patterns of use
Research is needed to provide an understanding of the amount and patterns of MTSD use including:
• who is using MTSD?
• how much are MTSD being used?
• when are MTSD being used?
• where are MTSD being used?
• why are MTSD being used?
Understanding these issues will help inform who is likely to be at risk from negative impacts and also help tailor interventions to at risk groups and situations.

4.2 Consequences of use
Research is needed to provide a better description of the positive and negative consequences of MTSD use including:
• what are the MTSD use musculoskeletal disorder consequences?
• what are the MTSD use cardiometabolic disorder consequences related to increased sedentariness?
• what are the MTSD use myopia consequences related to increased close-focus vision tasks?
• what are the MTSD use thinking and learning consequences from increased information processing?
• what are the MTSD use consequences on social connectedness?
• what are the MTSD use consequences on sleep quantity and quality?
Understanding these issues will help identify the consequences and thus the issues of priority concern in terms of outcomes.

4.3 Mechanisms linking MTSD use and outcome consequences
Research is also needed to provide a better understanding of the mechanisms linking MTSD use with consequences. Potentially important mechanisms to be explored include:
• how do posture, movement and muscle activity exposures of MTSD use lead to pain?
• how does sedentariness change sugar and fat metabolism and cardiometabolic disease processes?
• how does close-focus electronic screen exposure change visual system structure and function?
• how does MTSD use change thinking processes and capability?
• how does MTSD use mediate or alter social interactions?
• how does MTSD screen exposure mechanics (e.g. light frequencies) and content alter sleep?
Understanding the mechanisms will help identify ways to minimise negative outcome consequences.

5. Potential for international collaboration to address research gaps
Given the rapid international penetration of the use of MTSD, an international research collaboration may be an effective way of efficiently directing available research resources to provide the evidence needed to inform wise use of MTSD. Whether an international collaboration is useful will depend on questions such as:
• can research groups minimise redundancy in research?
• can research groups acquire necessary resources to conduct needed research?
• can research keep up with changes in technology?
• can research findings be quickly translated to industry and users?
A framework for international collaboration to address research gaps could be established based on a shared vision and a mechanism for facilitating collaboration. A web hub for ergonomics research on MTSD use may be a productive first step.

6. Conclusion
MTSD use appears to be growing rapidly across a broad spectrum of people. Understanding this new wave of technology and its potential consequences is essential to informing individuals how to gain the benefits from this technology whilst minimising the risks. A collaborative international approach to identifying research gaps and addressing these will support more timely provision of critical information.
References


