Excerpts from CybErg 2005 discussion on preliminary guidelines for wise use of computers by children

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The following comments were posted to the bulletin board that discussed the keynote paper by Straker, Pollock and Burgess-Limerick on guidelines for wise use of computers by children (see this issue). A selection of six discussion threads are included in this paper: on the need for a shared conceptual model, cognitive development, task variety, reasonable postures during sedentary tasks, learning to touch type and responding to discomfort. The contributors' names and details have been removed.

Thread 1: a shared conceptual model

Contributor 1: posted 14 October 2005 17:06

Should there really be a shared conceptual model? Rather should not we come up with models that are specific to certain contexts/environments and ones that address the use of computers by children from these contexts. Concerning social protection as a guideline, as parents and educators try to monitor the exposure to aspects such as pornography, how possible is it really to protect children against such things? There are quite a lot of negligent parents, abusing parents, people who for instance do not take part in forums that introduce these guidelines. We also have parents who are not interested in computers, but get their children computers, then monitoring their use may not be a reality?

Contributor 2: posted 14 October 2005 17:41

The points made are certainly valid and make a case for standards or guidelines that apply to the system of internet and computer use. Manufacturers of software, hardware and providers of internet access and usage may be able to do more. The standards or guidelines do need to be evidence-based and capable of standing up in legal proceedings to support this.

Thread 2: Guideline 4 Facilitate cognitive development

Contributor 3: posted 13 September 2005 16:51

Of course, one of the problems of assistive cognitive development content is determining what exactly is appropriate for a child of a particular age. Certainly there is software (e.g. NetNanny) available that will block access to age inappropriate content (although websites have become quite savvy in bypassing this type of software). It is far more difficult for a teacher or parent to determine what is age appropriate for cognitive development. Perhaps there are some child or educational professionals out there who would assist in this endeavour?

Contributor 4: posted 15 September 2005 10:12

It is interesting that there has been recent media interest in the fact that IQ values have been going up in standardized testing around the world for decades. Without re-norming, today's 'average' children would have been rated as 'exceptional' 50 years ago. One of the reasons that has been put forward for this is that we live in such an information-rich age that it creates a more stimulating

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cognitive environment—and when you think of today's games, even compared with those of 20 years ago when Pac Man was the height of sophistication, you can see how they require people (children) to handle complex problems, ill-defined goals, etc.

Contributor 5: posted 15 September 2005 22:14

I would not think there is a big problem here, as children are very adaptable like all of us. When they get in to something they fail to grasp, they simply tune out and go onto something else. The problem of the Net is the inverse one—maintaining attention.

Age-appropriateness is a funny one to deal with. We can ban or block, but the bright will get around it. A better way is to inform and educate and dialogue with children. Let them read the 'banned' books, see the porno sites, etc. and then let us talk about it. It is just too easy to get around proscription and remain uninformed, unenlightened. So you think this course is too risky?

Contributor 6: posted 16 September 2005 00:56

Hi [contributor 4]—I agree that these games do have the capacity to develop some problem solving skills, however, the complex problems are often devoid of the rich reality that life develops e.g. many of the virtues like respect, responsibility (moral consequences of their actions) and the social/cooperative problem solving skills. Hi [contributor 5]—I do think it is too risky! I think that dialogue/informing children is paramount but believe this can be done without taking children out of the acceptable boundaries of what is 'reasonable' in any given family situation.

Contributor 4: posted 16 September 2005 11:24

I am not sure that maintaining attention is a problem with kids and computers—it seems to me the bigger problem is that they get so engaged (enter a 'flow' experience, if you like) that they fail to respond to other stimuli—like discomfort, whatever. [Contributor 6], I agree that on-line life will differ from real-life, although if there are children who are not fully engaged with real-life, then computer-life may be better than what they are doing. One of my Ph.D. students a few years ago (Lynne Roberts) looked into young adult's experiences of MOOS (sort of chatrooms where you take on a character which may or may not resemble your own 'real' character). She found that people who had maintained their use for more than 6 months, typically found the distinction between 'real-life' and 'online life' a false one. They argued that their experiences online were as real as anything they had off-line. This may not be the case for younger people though. What do you think?

Thread 3: Guideline 5.1.1 Encourage task variety

Contributor 7: posted 23 September 2005 05:00

What do participants think about the utility of this guideline—there is a potential problem about task variety not actually providing physical variety. I remember a cartoon from the 1980s RSI days which showed a room with dozens of identical workstations with data entry/typists working at each station. The picture showed the manager explaining to some health inspector "Oh yes, our girls have lots of job variation—they rotate desks every hour". So task/job variety may actually result in more of the same in posture/muscle activity terms.

Contributor 8: posted 11 October 2005 10:43

[Contributor 7], I think postural variety is critical. However, to get at postural variety your guidelines will need to extend beyond computer use and provide advice on other sedentary/repetitive tasks. This is an acute need in developed countries for starters think about the cumulative effect of these activities: video game time, television time, time seated in the classroom and music practice.

Contributor 7: posted 12 October 2005 0:36

Good point [Contributor 8], the increasing sedentary activity time by adults and children in affluent countries is a major health issue. These guidelines on computer use will not be sufficient to cover the other sedentary tasks as you rightly point out.

Contributor 9: posted 12 October 2005 16:54

This is a critical issue. But I think we do not even know enough about current practice yet. For example—what combination of activities are kids engaged in at computer/games? How does this affect their movement—which is I think what matters in terms of task variation? How often do they get up, turn, rock the chair, etc. in the course of a computer session. My son reads (online and hard copy) magazines, writes fan fiction and e-mails, eats and listens to music at the same time.

Thread 4: Guideline 5.2 Encourage reasonable postures during sedentary tasks

Contributor 7: posted 23 September 2005 05:12

Three sitting postures have been recommended for adults:

(1) upright, 90° at knees and elbows, arms floating posture,
(2) forward tilt trunk, extreme version of which is the one requiring knee support ala Balans, but otherwise with forearms resting on desk,
(3) backward tilt trunk, back supported on chair.

Any thoughts on the appropriateness of these for children?

Contributor 3: posted 23 September 2005 13:41

Hi [Contributor 7], Not really my area of speciality, but I would think that facilitating more dynamic or more active postures would be better for children's development (e.g. a seating arrangement that 'encourages' movement or that provides resistance to static postures). I would think that children should be in a physical building phase rather than a physical support phase.

Contributor 10: posted 23 September 2005 23:31

Hi [Contributor 7], As you very seldom see child sized anthropometrically appropriate 'ergonomic' chairs—i.e. those equipped with forward tilt, support in the right places or adjustability—I think anything that encourages them to be upright and not start slouching early is to be encouraged. My definition of slouching is an obvious 'C' of the spine. I also agree with [contributor 3] about seating that is designed with a view to be easily adjusted and encourage movement. It is hard enough to get adults to adjust their chairs—I had to develop a whole training module on decreasing the fear of adjusting chairs!

Contributor 11: posted 26 September 2005 23:49

[Contributor 7], As a practitioner I find the third option, i.e. tilt back is the preferred option in industry. It is enhanced by the use of a footrest for them to place their toes whilst their heels may be on the floor. This seems to give better stabilization for the back against the backrest. This applies for taller as well as shorter users. The latter may use the footrest for elevation of the feet as well. What have you found?

Contributor 12: posted 27 September 2005 07:18

I agree with [contributor 11], tilt back (foot support optional), easy relaxed lower limb posture—I know the standards are 90° hip, knee, etc., but I understood that there was some evidence that more like 110° back tilt provided for better back support, etc. Much of my working days, these days are seated at a desk, and I personally find that back tilted backrest, with relaxed lower limb postures, is my preference. As a practitioner, I suggest these postures to clients and feedback from them indicates decrease in symptoms, etc. I also usually recommend adoption of some kind of forearm support during keyboard/mouse tasks (encourages relaxed shoulder postures). With regards to relating these guidelines for children (not my area of expertise, except for having raised four of them), I would agree with [contributor 3] that facilitation of more dynamic postures would be the preference—I have noticed that my 17 year old daughter sits well back on her chair, uses the desk for forearm support whilst using the keyboard, and appears, well, 'relaxed' overall.

Contributor 13: posted 28 September 2005 13:32

[Contributor 12], I would not worry too much about what standards say about 90° (or much else really)—standards are typically compromise documents put together without too much regard to scientific evidence. To be fair, the authors of standards are understandably reluctant to say "we don't have a clue" and propose what they believe (or can collectively negotiate) to be the best guess. I do not believe there is any evidence to justify an upright posture, and what you describe sounds perfectly sensible to me—especially using the desk for forearm support. That in turn implies pushing the monitor back as far as possible and making sure that the image size is large enough. Back to the issue of standards—I really wish the authors of standards would provide references to justify their recommendations. When I think they have got it right I would still like to know how the position was arrived at. For example, AS3590.2-1990 [Australian Standards] provides a nice figure which proposes that the optimal viewing zone is from 15° to 45° below horizontal and a note to the figure suggests "The most comfortable viewing zone (neck muscles relatively relaxed) as a desk is the area 32–45° below the horizontal". Now I think that is pretty correct, but I would love to know how the position was arrived at. (And how, when that is what the relevant AS has said since 1990, we ended up with recommendations of horizontal eye height displays in literature bound for users is a mystery to me).

Contributor 14: posted 30 September 2005 15:53

I hate to lump children in one group when we compare them with adults. I tend to think of children in several categories—3 to 8 years (because of the development of the growth plates at the ends of the bones); 8 or 9 years to early adolescence and then the three phases of adolescence characterized by growth spurts where the bones are longer, then attain volume and then attain mass and start to take on what we think of as lumbar curves and fat deposits and so on. And I hate to lump all the different adult guidelines together. Of course, their feet should be supported—but the cervical spine issues are very different, their necks are much more flexible than with adults, many do not have cervical lordosis—and this is generally considered normal—for many years and their vision is different. And commonly recommended principles for adults do not apply in the same way. For example, the single most important reason (though not the only one of course) that adults need to move is that their spine requires passive transport through osmosis to nourish the spine and to eliminate waste products. Yet children's spines (before adolescence, although I am not sure exactly when the shift is) have active transport of nutrients and waste products.

Contributor 7: posted 04 October 2005 09:44

Welcome [contributor 14], and thanks for your comments [contributors 11, 12, 3, and 9]. Regarding three seating options again—there is evidence, as suggested by [contributor 12], that a backward tilt/supported trunk does decrease disc pressure and back extensor activity levels. In the past this has been interpreted as a positive. However, this may not be appropriate for adults now, and may be even more inappropriate for children—my reasoning is that a backrest is like a splint—it is used temporarily to support an impaired area until recovery of normal internal support mechanisms. This line of argument would, therefore, suggest that 'resting' the back in a backward tilt supported position should only be used as a variation/break—and not as a dominant work/task posture. What are your thoughts?

Contributor 14: posted 04 October 2005 18:43

Thanks, [contributor 7], I feel a bit uncomfortable in most discussions (and also here) in that we seem to be skipping back and forth between adults and children. Though I suppose that is because there is so much more information about adults. I realize that many of my assumptions about children are based on guesses, such as the implications of growth spurts or bone development or the developmental phases of the spine—and during adolescence particularly, fat deposits that affect curvatures. I keep circling around what are the design implications for children in their early years of development (when their bones are soft and growth plates seem to be particularly vulnerable) and during growth spurts (when their spine is lengthening before it attains volume or mass and before the muscular/tendon/ligaments are able to support the posture). I realize that much of what I think are based on what may or may not be intelligent guesses. We just do not know. Anyone who visits worksites (at least, in the US, not sure about other countries) sees that most employees do not adjust their seating, most work with their back unsupported, most tend to sit in postures that minimize muscle effort, rather than promote long-term well-being. So I wonder if the most important issue would be to learn to adjust their work area and to encourage a range of good postures. And I am guessing that postural support is particularly important during certain phases of childhood. And also, I am supposing that the rules for viewing angles and distances for adults do not apply at all to children. And that children need even lower sightlines than adults—even though these are almost universally higher. I appreciate [contributor 13]'s comment—and have seen the same in standards committees. The closer you look, the more you realize how much of our assumptions are based on guesses that were derived from specific situations that no longer apply.

Contributor 7: posted 05 October 2005 08:24

I agree with your concern about the risks of taking adult data and applying it to children. I also agree that there are age-related differences across childhood that may well be very important—the issue of spinal changes is a good example you raise. The studies by Burton et al. (1996) in the UK and Balague et al. (1988) in Europe show low back pain prevalence changes rapidly over early adolescence—from around 10% at 10 years of age to around 50% by 15 years of age. Skeletal maturation is likely to be one significant factor in these figures—and as an ergonomist I would also suggest that seat and workstation design are also likely to be important. We are in a study at the moment of 2000 adolescents trying to tease out some of these issues. I was also interested in your comment about display heights—and [contributor 13]'s earlier comment. [Contributor 13] and [contributor 4] and I are currently finalizing the results of a lab study on 12 year olds looking at display height effect on neck/shoulder posture and muscle activity—and have a follow-on study planned for next year to look at these issues in 5–6 year olds.

Contributor 14: posted 08 October 2005 09:52

Thanks, [contributor 7]. Obviously, children and vision involves a number of inter-related issues with respect to how their vision changes as they develop, the development of the spine, core muscles and tendons/ligaments. There is an interesting article (Dormans, 2002) on the second of these, how the cervical spine develops. Here is an example quote from the article: "Physiologic motion of the cervical vertebrae in children is greater than that in adults, and a normal pediatric cervical spine may appear to have a subluxation. When a subluxation is not present, the movement is termed a pseudosubluxation and does not need treatment. Pseudosubluxation of the second cervical vertebra on the third or of the third cervical vertebra on the fourth is common in children (Cattell and Filtzer, 1965; Swischuk, 1977; Pennecot et al., 1984; Sullivan, 1994; Loder, 1996). In one study, pseudosubluxation of the second cervical vertebra on the third was seen in 19% of children who were one to seven years old; pseudosubluxation of the third cervical vertebra on the fourth was seen less frequently (Swischuk, 1977). Another study showed that pseudosubluxation occurs in 40% of children under the age of eight years (Cattell and Filtzer, 1965)."

Contributor 14: posted 08 October 2005 10:20

What I was trying to say above is that from what I saw above and in other articles, children develop cervical curves with age and until they are somewhere around 10 or so, it is quite common for children not to have a cervical curve—and that this is generally considered normal. Further, their muscles, tendons and ligaments are playing catchup and they are less able to control their neck postures. I have a

limited knowledge of children and vision other than that their vision changes with age. But Knut Foservold and Dennis Ankrum's contribution to the child ergonomics book suggests that there may be a reason to be concerned that high viewing angles that children are commonly subjected to at computers may have long-term implications in how their visual system develops.

Contributor 15: posted 11 October 2005 01:43

These are interesting comments on physiological development in children and some of the major concerns with children and computer use. I am certainly not an expert in child development nor involved in research. The concerns I have are based on what I have seen in the classroom (computer labs, predominately) and with my own children at home (from early days of home computers) and in dorm rooms (laptops and some desktops), now that they are in University. Schools typically have funding issues. The various computer labs I have seen in Calgary, Canada from the elementary, junior high, and senior high levels have desks or tables for a work surface and most commonly, non-adjustable chairs. Where there are adjustable chairs they may be in poor repair and have limited adjustability. Due to a lack of work surface space and a reluctance to place the box on the floor or on a CPU stand, monitors can be placed on the computer box, often resulting in neck extension and an upward viewing angle. Students will often 'perch' on the chair edge, lean to one side, or 'slump' in the chair. Due to the width of the keyboard, with numeric keypad on the right, right-hand mouse use, in combination with anthropometric measurements, students are often using extreme reaches to use the mouse. The mouse may be placed on a higher surface, requiring an elevated reach as well. Classes here in Calgary vary in length, but a number of schools at the high school level, for example, have 90 min classes. It would not be uncommon for students to sit at their desk/table for the entire period using their computer (for those classes where they use a computer). My concern for ergonomics is a combination of poor furniture and equipment and computer use behaviour in the schools. At home, the diversity of computer 'work stations' would be tremendous. Most of the situations I have seen (a sampling of friends and our children's friends) have children working at the home computer with non-adjustable seating and keyboard height and slope. Work surface depth may be limited such that the screen distance is very close, particularly with larger cathode-ray tubes; and feet may be unsupported. Computer use could be for school use, computer games, and 'chatting'. In the university dormitory rooms I have seen at four or five different universities across Canada, the seating is poor, often with no adjustability. Desk/work surface depth may be narrow, cathode-ray tubes may be positioned off to one side, and work surfaces are too high, resulting in reaching up to the keyboard and mouse. With laptop use, there are similar issues to those faced by adult users, when keyboard

and screen are attached (no external keyboard and mouse). Students often spend long hours at their computers to surf the internet, write assignments, and 'chat'. Generally, I would summarize that our educational institutions and the general population have not advanced very much from an ergonomics perspective when it comes to the use of computers for our children. We certainly have seen more emphasis on ergonomics in the business world. Initially, it would be helpful to have some guidelines available based on the kind of research and reports that have been mentioned in this keynote and from the respondents to this topic. The promotion of these guidelines (and rationale for their use) through the IEA and other interest groups, to the level of decision making for schools and for the general public would be a lofty goal. In my consulting practice I often come across employees who have musculoskeletal injuries conditions that appear to have begun when they were students. Awareness and action at an earlier age could have positive carry-over to adult computer users.

Contributor 7: posted 11 October 2005 02:38

Thanks for your comments [contributors 14 and 15]. [Contributor 15], your experience of computer workstations in schools, homes and universities is similar to what I have seen—in Australia, Asia and Europe. These types of observations are some of the driving reasons behind our work on developing evidence-based guidelines. It was interesting to note your comments on home versus school use by children. We have data from a few studies now suggesting children commonly work for longer total durations and longer durations at one sitting at home than at school—so guidelines for home use may be more important (but harder to implement) than school use. [Contributor 14], I agree that the limited available evidence suggests children's musculoskeletal and visual system capacity and development may result in different needs at different stages. So far we have found 10–12 year olds respond very similarly to young adults in terms of posture and superficial neck/shoulder muscle activity when using computers at a desk. By mid next year we should know whether the same is true for 5–6 year olds.

Thread 5: Guideline 5.3.1 Learn to touch type

Contributor 16: posted 14 September 2005 17:51

I do not have research to support this, but many of the staff whose workstations I assess, especially people who are over 45–50, did not learn how to type and, therefore, must flex their neck to see the keys—and tend to 'peck' when they type. The lower you put the keyboard to encourage neutral positions for the elbows and wrists means that the neck has to flex even more. Our department will give typing tutorial software for them to use—but when I follow up with them, they usually have not used it enough to significantly decrease neck flexion. Therefore, because our

society is so dependent on using computers, schools need to teach children as early as possible how to touch type. It is difficult to get people to change their behaviour—especially when they are older.

Contributor 7: posted 19 September 2005 04:20

Hi [contributor 16], In terms of available evidence, I think it shows that non-touch typists do have more head flexion/movement—but do not necessarily have more musculoskeletal disorders. There may be a confounding factor in that touch typist do more typing. A graduate student of mine did a project looking at adults and touch typing and reported it at the last CybErg conference (Brandis and Straker, 2002).

Contributor 13: posted 19 September 2005 13:27

I do not doubt hunt and peckers have greater neck flexion (although they would not necessarily if everyone put their monitors lower, as I think they should). The issue comes down to how much neck flexion is too much—I believe we do not know. We certainly do need to get past the simplistic 'neck flexion is bad'.

Contributor 17: posted 21 September 2005 08:50

Just a suggestion, perhaps self-awareness is the key to avoiding unwanted outcomes. I am not a touch typist but do a heck a lot of work on a computer and try to use all 10 fingers. Keying is now part instinctive and part looking-as-I-go and a degree of checking later to correct mis-types; but I have positioned components so that I have minimal static neck flexion and am not consciously pecking. Some days are more tiring than others and I make movement adjustments to compensate. But generally I must be something of a fidget as I seldom now experience related stress and aches in neck or arms from long sessions (perhaps that is just old-fashioned physical conditioning). It is my eyesight that tends to blur after a prolonged day and evening session. So for children I would suggest inculcating good habits and body awareness from the outset and certainly I would encourage learning to touch type while the brain absorbs these things more easily. A bit like learning several languages at an early age is easier than later.

Contributor 16: posted 11 October 2005 00:26

Hi [contributor 7], thank you for your comments regarding non-touch typing and neck flexion. I look forward to reading your student's research. Perhaps my experience here has just been incidental—but the two office workers here with the greatest cervical and upper trapezius complaints are the 'hunt and peckers.' I agree that not all neck flexion is bad, but as you noted, [contributor 13], how much is too much? I suspect both of these employees had pre-existing cervical issues (both came from skilled trades

prior to moving up into management) and perhaps for them, the static neck flexion they are experiencing at their desks is too much. Obviously I agree that they need to either take more frequent micro breaks (or learn how to reduce looking down at their keys).

Contributor 7: posted 11 October 2005 02:47

All this discussion about touch typing had some personal consequences on the weekend—I realized by oldest son was turning 10 and I had not done anything about teaching him touch typing—so I bought a typing tutor program aimed at kids (by Eureka media) and he and his younger (8) brother both did their first lessons. An immediate observation was how easy it is for young people to learn things. Another was quite impressive—the program started with some basics on how to sit in good posture (stuff I had said to my children lots of times) but later that day the younger one prompted his older brother to sit in better posture (if only parents had the impact of new computer programs each day). Freeing the 'need' to look at fingers all the time to type must provide greater flexibility—but maybe increases monotony when just looking at screen. Perhaps being an ok but not too good touch typist would be the way to go—good enough so that the repetitive looking for most characters is not needed, but not so good so that you have to look down for the unusual characters—like "%" or numbers.

Thread 6: Guideline 5.3.2 Respond to discomfort immediately

Contributor 8: posted 11 October 2005 11:09

I was not able to locate the text you proposed for this section. However, I support the concept of providing advice on response to discomfort. My experience working with adults returning to work following injury shows me that a person's reaction to pain shapes their approach to returning to or avoiding returning to work. I think we should encourage children to approach pain from use of computers in a similar way to that of pain from sports injury. Children should be encouraged to remain active but to reduce the strain on the sore body part. Also recovery should be expected. In this way a positive approach to managing pain would be modelled from when young.

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