

Appendices: Ergonomic Case Study of an Audiologist Performing Visual Reinforcement Audiometry

Appendix A

Fact Finding Questionnaire to Structure Interview

General Background Information

1. How long have you been an audiologist?
2. What does an audiologist do?
3. Who are your clients/patients?
4. What are some of the challenges you face in your work?
5. Do you experience any discomfort during your workday?
6. Do you have any injuries or conditions that might be affecting your work?
7. What aspects of your work would you change or improve?

Work Schedule

1. What is your work schedule?
2. How do your working hours break down over the course of a day, including breaks?
3. Is this breakdown the same each work day or does it vary?
4. How many patients (and families) do you typically see in 1 day?
5. How long is a typical visit with a patient (and family)?
6. Are there any patient visits that exceed the typical visit time? If so, how long would these appointments be?
7. Are you a display screen user?

According to the Health and Safety Executive (2003, p. 8),

It is generally appropriate to classify someone as a display screen user if he or she:

- uses display screen equipment for continuous or near-continuous spells of an hour or more at a time; and
- uses display screen equipment in this way more or less daily; and
- has to transfer information quickly to or from the display screen equipment; and
- also needs to apply high levels of attention and concentration; or is highly dependent on display screen equipment or have little choice about using it; or needs special training or skills to use the display screen equipment (2003, p. 8).

Work Environment

Questions are based on questions by Anderson et al. (Pheasant, 2006, p. 161).

- What are the paper-based tasks? Is there hard copy writing or reading?
- What are the screen-based tasks?
- Is there telephone work?
- Are there other kinds of manual work involved in your work process at a desk?
- Is there work done away from the desk?
- Are there other miscellaneous aspects of your work you would like to describe?
- Do you conduct meetings or have visitors?

Appendix B

Chart Based on Wilson's (2005) Onion Modeling Analysis

Issue	Result	Interacting Element
parent coaching required throughout test, child may not be cooperating for test, ear probes falling out of child's ears	additional workload for audiologist, increased time constraint on conducting test in time allotment	task
inappropriate equipment placement	excessive reach envelopes and bending, static loading and poor seating relationships	equipment
inappropriate seating	static loading and poor posture	personal work space
inappropriate work surface heights and placement	excessive reach and bending, static loading and poor seating relationships	personal work space
lack of storage and improper placement of existing storage	excessive bending, excessive reach envelopes and increased travel distances, work interruption	personal work space, wider work space
inadequate lighting and inappropriate natural lighting conditions	decreased visual acuity, glare, work process distractions, increased travel distances, and possible security issues	personal work space, wider work space, physical environment
lack of space, parent viewing area, meeting space, visibility, security, circuitous environment, ambient noise, dry air	distractions, irritations, frustrations, additional workload/stress for audiologist to manage	wider work space, physical environment
influence of other tasks or processes on work performance	other tasks, processes require further assessment to determine impact but preliminary interview reveals possible contribution to stress and musculoskeletal discomfort	work organization and job design

Appendix C

Seating

Researchers recommend the seat height be at or slightly below popliteal height to avoid under-thigh tissue pressure and the seat depth should be slightly below the buttock-popliteal length to engage the backrest (Pheasant, 2006, p. 131). An adjustable seat height between 419–511 mm would accommodate the audiologist’s popliteal height of 450 mm, and a medium seat depth would fit the buttock-popliteal length of approximately 460-490 mm. If armrests are desirable, they should be padded and not exceed 350 mm from the backrest in order to clear the desk, and a seat width of 500 mm will accommodate the largest female user’s hip breadth with clothing (Pheasant, 2006, p. 132, 134). Lumbar support protruding 40 mm from the main plane of the backrest at its maximum point will support “lordosis,” but further evaluation would be required due to variations among individuals (Pheasant, 2006, p. 132). A medium height backrest (independent of the seat) of 500 mm would support the upper back and shoulder regions for rest periods (Pheasant, 2006, p. 132), and Canadian Standards Association International recommends an adjustable seat angle with a minimum 3° forward tilt and 4° rearward (2000, p. 174).

Equipment and Workstation

The zones of convenient reach in a horizontal plane are calculated using the distance “d” below the shoulders and the user’s shoulder (biacromial) breadth (Pheasant, 2006, p. 98). Using photographs to roughly determine these dimensions (dimensions would need to be further validated), with $d = 500\text{-}600$ mm and biacromial breadth = 360-380 mm, the corresponding radius for the audiologist’s “normal working area” should be approximately 380 mm (Pheasant, 2006, p. 98). The 5th percentile female radii (350 mm for normal working area and 550 mm for maximum working area) used by Grandjean were applied to this study to accommodate women of less than average height and thus possible changes in the workforce (Pheasant, 2006, p. 98). Electrical wires trail on the floor and electrical outlets are positioned 460 mm above floor level, requiring unnecessary bending.

Toy Storage

A different sized or shaped table could increase clearances around the table to allow for a small mobile guest seat or task seat on castors where the audiologist could sit while speaking with the parent(s), inserting ear probes, and monitoring the DPOAE laptop.

Having built-in toys or activities (as in children's exhibits) rather than loose toys that fall on the floor might reduce the amount of bending the audiologist must do both during and after each appointment. Presumably, loose toys would still be used even if an activity table was designed for the space; thus, wall-mounted toy storage and storage for testing accessories at standing height would be preferable.

Lighting

According to C. Corbet, a lighting designer with HH Angus Engineers, the ambient lighting comes from K12 lenses which are general diffuse lenses that kick light everywhere, meaning there is little control over where the light goes (personal communication, December 20, 2012).

C. Corbet also notes that,

Observers want to darken room environments to study their subjects but also require lighting for security, safety, or to complete tasks while observing. So the best strategy to achieve this is by implementing zone control through the use of 3-way switches with a dimmer located within easy reach at the desk area but also at the entrance of the office suite. This reduces the amount of travel distance required by the user to adjust the lighting. Zone control would allow the front entrance area to still be lit while allowing the desk area to be dark. This creates a safely lit entranceway for other staff, but also gives the subject added security in that she can see potentially unwanted visitors entering her space (personal communication, December 20, 2012).

C. Corbet also comments at length on strategies to light the desk area and the audiology booth. To summarize his thoughts on the desk area,

A two-by-two indirect basket lighting fixture on dimmers would produce a softer light within the space and should be placed to the left or right of any screen-based task to avoid glare issues. A 460 mm flexible LED gooseneck task lamp in the cooler whites (visual acuity is better in the blue spectrum) attached to the work surface would allow the subject to direct the light over her clipboard as she charts results in the darkened space. Wall sconces could be provided to allow the audiologist to better control the level of light and location of light relative to the screen-based tasks (personal communication, December 20, 2012).

C. Corbet comments on the lighting in the audiology booth:

The lights in the booth are opal lenses, which are bright but produce glare and refract light through the space, not lighting the floor. To improve the lighting conditions, one could use open compact fluorescent down lights with a 55° beam spread on dimmers, which produce a more controlled beam of light. The light should be placed on either side of the parent and child to illuminate the sides of their faces (light fills face on either side) through the observation window, as opposed to down lighting above their faces, which can produce harsh shadows. In this strategy, the reinforcement puppets would be in the darker areas and would thus have a more dramatic effect when activated. To give the audiologist depth of field on the patient, the back wall behind the patient should be lit, which could be achieved by cove lighting washing the wall with soft light. The lights should be placed to either side of any screen-based equipment to avoid glare if the user happens to look upward from her screen. Again, a gooseneck task light could be provided (personal communication, December 20, 2012).