4-21-2011 12:00 AM

Development and Testing of a Low Vision Product Selection Instrument (LV-PSI): A Mixed-Methods Approach

Daniel Fok
The University of Western Ontario

Supervisor
Dr. Janice Miller Polgar
The University of Western Ontario

Graduate Program in Health and Rehabilitation Sciences
A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy

DEVELOPMENT AND TESTING OF A LOW VISION PRODUCT SELECTION INSTRUMENT (LV-PSI): A MIXED-METHODS APPROACH

(Spine title: Development and Testing of a Low Vision Product Selection Instrument)

(Thesis format: Integrated-Article)

by

Daniel Fok

Graduate Program in Health & Rehabilitation Sciences

A thesis submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

The School of Graduate and Postdoctoral Studies
The University of Western Ontario
London, Ontario, Canada

THE UNIVERSITY OF WESTERN ONTARIO
School of Graduate and Postdoctoral Studies

CERTIFICATE OF EXAMINATION

Supervisors

Dr. Janice Miller Polgar

Dr. Lynn Shaw

Supervisory Committee

Dr. Jeffrey Jutai

Dr. Craig Hall

Examiners

Dr. Craig Hall

Dr. Anthony Vandervoort

Dr. Jim Dickey

Dr. Jim Lenker

The thesis by

Daniel Fok

entitled:

Development and Testing of a Low Vision Product Selection Instrument (LV-PSI): A Mixed-methods Approach

is accepted in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

Date

Chair of the Thesis Examination Board

Abstract

Products including assistive technology devices (ATD) may aid persons with low vision (LV) in the performance of everyday meaningful activities (or occupations). Some examples of products and ATDs that may be used by persons with LV include: telephones with large buttons and display, large computer displays, white canes, handheld magnifiers, closed-circuit televisions and electronic magnifiers. Studies have shown that the use of products by persons with LV may mitigate serious consequences of occupational deprivation. Unfortunately, approximately 30% of all ATDs that may be used by persons with disabilities are abandoned. In Canada, it is conservatively estimated that $46 million is lost per annum from LV ATDs abandonment alone. The proper matching of the person and the technology during the selection process has been theorized as necessary to mitigate inappropriate device abandonment. In this dissertation, a mixed-methods approach with qualitative and quantitative study components was used to develop and test a LV product selection instrument (LV-PSI) that may help with the matching process.

The qualitative inquiry began with gaining initial insight on ATDs usage and their perceived importance from a sample of 17 participants with LV. Two qualitative research sessions with LV participants (N=10) then followed. Each session was made up of two data collection modes of a modified nominal group technique and focus group discussions. The two modes were used to elicit voice and perspectives of the participants on product selection. Content analysis and a grounded theory approach were used to analyze the respective data obtained. Three major themes that may inform product selection emerged and they included: (1) product attribute, (2) personal compatibility, and (3) meaning.

Along with findings from a scoping review of the literature, the themes that emerged and the data collected from the qualitative research sessions were used to generate items and content for the LV-PSI. A testing of the internal consistency (Cronbach's coefficient alpha) and factor structure of the instrument (principal component analysis), with scores obtained from LV participants (N=152), occurred. Prior to these quantitative analyses,

the instrument was reviewed by a panel of experts (N=11) and pilot tested by study participants (N=20). A four component solution was selected based on the Scree plot and a desire for parsimony which resulted in a 21-item LV-PSI. The four components were theorized as congruent with the factors of: Product (visual) attribute, meaning, independence, and personal compatibility. The alpha values were 0.77, 0.63, 0.63 and 0.59, respectively. Future research to further examine the LV-PSI's content and construct validity, score interpretations, format and predictive value was proposed.

Keywords: Low vision, product selection, assistive technology devices, mixed methods

Co-Authorship Statement

Chapter 3 of this dissertation has been accepted for publication. At least two other chapters will be submitted for publication. Drs. Janice Miller Polgar and Lynn Shaw will be co-authors for these forthcoming publications as they have significantly contributed to the design, data collection and or the peer review process to ensure that the interpretation of the findings was appropriate. Others may be invited to participate as co-authors depending upon publication rules and review processes, as well as, incremental work in the future.

Acknowledgments

I would like to take this opportunity to thank the following individuals for their support during my doctoral career:

Thu-Thuy, my wife, for firstly trading in her cool sounding last name that flowed well with her first name (Thu-Thuy Tang) for one that is hard-to-pronounce; but more importantly, for supporting my personal aspiration and challenge to pursue a doctoral degree. I shall forever be grateful for your love, understanding and willingness to put up with me throughout the years.

Chloe, my daughter, for being our 'funny bunny' who is blessed with the ability to cheer us up at any time; and for being attentive as I read her my journal publication drafts in lieu of bedtime stories.

Tin Chu and Pauline, my parents, for making the tough decision to emigrate from Hong Kong to Canada at the prime of their careers so that (my [sometimes] wonderful sister) Bo See and I have can have the opportunity to pursue higher education and flourish.

Dr. Janice Miller Polgar and Dr. Lynn Shaw, my doctoral supervisors, for tirelessly challenging me, and providing me with opportunities to grow throughout my studies.

Dr. Craig Hall and Dr. Jeffrey Jutai for serving on my thesis advisory committee. I would also like to thank Dr. Graham Strong, Dr. Alex Mao and their staff for volunteering their time to help me with participant recruitment.

Social Sciences and Humanities Research Council of Canada, Ontario Graduate Scholarship and Lawson Health Research Institute for their generous funding support.

Last, but not least, to the 189 participants and the 11 professionals from the expert panel that took part in the studies, for their effort and time. This work would not have been possible without your valued perspectives and feedback.

Table of Contents

List of Tables

List of Figures

List of Appendices

Chapter 1

1 Introduction

The World Health Organization (WHO, 2010) estimated that 650 Million people or approximately 10% of the world's population have some form of disability. This number is increasing due to factors such as population growth, ageing and medical advances to prolong life (WHO, 2010). In Canada, the Participation and Activity Limitation Survey (PALS), based on postcensal data, estimated that 12.4% of Canadians have one or more disabilities (Statistics Canada, 2006). Overall, persons with disabilities were disproportionably represented by those above the age of 65 at 41%, while 10% of working age adults 15 to 64 have one or more disabilities (Statistics Canada, 2006). The PALS also reported that 2.5% of the Canadian population has some form of seeing disability (Statistics Canada, 2006). This figure was a rough aggregate estimate given that there have been no major population-based studies which would reliably determine the epidemiological and demographic data on low vision and other vision loss disabilities in Canada (Jutai et al., 2007). Based on eight population-based studies worldwide, which was applied to the U.S. 2000 census, The Eye Diseases Prevalence Research Group (2004) estimated that of Americans of age 40 or over, 2.4 million (2.0%) were low vision and 937,000 (0.8%) were blind. Interestingly, Vitale, Cotch, and Sperduto (2006) estimated that of the 14 million people in the U.S. that were visually impaired, only 3 million had visual impairment that cannot be corrected with assistive technology devices (ATD) such as lenses, while the vision of the remaining 11 million people may be corrected with lenses good enough to qualify them for diver's license in most states. The authors further suggested that the provision of corrective lenses was a matter of public health with implications for safety and quality of life (Vitale, Cotch, & Sperduto, 2006). Given the factors of an aging population in the foreseeable future, and that most people with a seeing disability in Canada are 65 years of age or older, it may be expected that there will be an increase in the number of persons with vision loss (Statistics Canada, 2006; Jutai et al., 2007). The prevalence of vision loss in Canada was projected to increase from 2.5% of the population in 2007 to 4.0% in 2032 (Access Economics, 2009). With an increase in the number of persons with vision loss, demands for the services to

organizations like the Canadian National Institute for the Blind (CNIB) will likely continue to increase (Jutai et al., 2007).

To meet the challenges of service provision to persons with vision loss, CNIB and the Canadian Ophthalmological Society commissioned Access Economics (a consulting firm) to conduct a report on the cost and impact of vision loss in Canada. The report estimated the cost of vision loss to be $15.8 billion or 1.19% of Canada's GDP. The direct (health system related) cost of vision loss was estimated to be $8.6 billion. The economic impact of vision loss on the performance of occupations, or what people need, want or are obliged to do throughout the day (Wilcock, 2006), can be estimated at 7.2 billion dollars. From the report, the impact of vision loss on occupational performance was observed in the indirect costs of lost productivity, tax reduction and disability support programs, and care and rehabilitation (e.g., lost productivity of caregivers, and specialized library services)

The cost of assistive technology devices (ATDs) for people with vision loss, such as canes, talking watches, handheld magnifiers, closed-circuit televisions, electronic magnifiers, and electronic screen readers, was grouped into indirect costs to vision loss and was estimated to be at $303.9 million dollars (Access Economics, 2009). Note that the estimated cost of ATDs for vision loss did not include mass market commercial products and that they were based on actual costs of ATDs. From the published analysis in the report, the cost was allocated between "individuals, family and friends, government, employment and society/ other insurance entities" (p. 86). Though the cost of products such as ATDs and commercial products to stakeholders are in and of themselves significant, their potential and actual enablement of occupations in the contemporary setting is substantial and merits further investigation. A cursory search in the literature revealed that the provision of ATDs is a cornerstone of low vision rehabilitation programs (Watson, 2001; Rosenberg & Sperazza, 2008; Girdler, Packer & Boldy, 2008; Harper, Doorduyn, Reeves, & Slater, 1999; Hooper, Jutai, Strong, & Russell-Minda, 2008). There was also an interest in the use of mainstream commercial products such as smartphones, computers, and the internet to enable occupational performance by persons with vision loss (Crudden, 2002; Gerber, 2003; Wagner,

Vanderheiden, & Sesto, 2006). When selected, accepted and used appropriately, ATDs and related products have the potential to facilitate occupations that may increase productivity, independence, self-confidence, and overall quality-of-life and health of persons with vision loss (Day, Jutai, Woolrich, & Strong, 2001; Goodrich, 2003; Inge, 2006; Sperazza, 2001; Stelmack, Rosenbloom, Brenneman, & Stelmack, 2003).

In this dissertation, I focused on the *selection* aspect which may contribute to the success of product use and integration in the lives of persons with low vision. As suggested in the second chapter, though there have been a number of published works which indirectly point to considerations that persons with low vision have as they are selecting or using ATDs and related products, there is a gap in the literature when it comes to the examination of selection factors in a comprehensive fashion. Thus, for the remainder of this introductory chapter and for part of the next chapter, I will draw on research from the general ATD literature. The next sections will present a more formal definition of ATD, raise the issue of ATD abandonment, and provide the purpose of my dissertation along with an overview of its organization by the mixed-methods technique.

1.1 The problem: Assistive technology devices (ATD) and ATD abandonment

An ATD may be defined as "any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain or improve functional capabilities of individuals with disabilities" (Assistive Technology Act, 2004). Over the past 20 years, the number of ATDs, normally used by individuals with a disability to engage and participate in occupations, have quintupled to approximately 30,000 in the U.S, and this trend will likely continue (National Institute on Disability and Rehabilitation Research, 2006; Cornman, Freedman, & Agree, 2005). However, the number of ATDs used was a gross underestimate if we revisit the definition of ATD. Based on the broad definition above, any tangible object(s) that enable a person with a disability to perform an occupation better than without the object(s) is an ATD. Accordingly, a permanent marker, a large screen television, a hearing aid or a modified vehicle for wheelchair access, are all considered examples of ATDs. For the purpose of this dissertation, I make a slight distinction in that ATDs are objects that are designed for

people with disabilities, whereas commercial products are objects that are not necessarily designed for people with disabilities but may nevertheless be used by them in the performance of occupations. The word *product* was used to encompass both ATD and commercial product.

Despite the high prevalence of ATDs, as well as, their popularity among vendors, health practitioners, researchers and critics of technologies alike, the literature showed that many ATDs are abandoned shortly after they are obtained, often within four months of purchase (Strong, Jutai, Bevers, Hartley, and Plotkin, 2003). The abandonment of commercial products by persons with disabilities is less clear. Regardless, product abandonment is a serious issue given that they could be the last means by which a person may be able to perform meaningful occupations or be deprived of them. To further elaborate, there are associated social and human costs such as reduced functioning, reduced participation in meaningful and social activities, as well as the reduced choices and opportunities to engage in social, productive work, leisure and everyday occupations. These losses may lead to greater alienation, marginalization and perception of self as disabled which can erode a person's self-esteem and identity (Hocking, 1999).

In a commonly cited survey study of 227 adults with disabilities, Phillips and Zhao (1993) found that 29.3% (507 of 1732) of all ATDs were abandoned. Many of these devices were used for mobility as the sample contained mostly of persons with mobility impairments, although other major types of disabilities were represented as well, with the exception those with communicative disorders. These authors took a conservative definition of abandonment in that switching of brands, even if a person is dissatisfied with a particular ATD brand, was not considered abandonment. Further, logistic regression analysis suggested four predictors of abandonment and they included: A lack of consideration of user opinion in selection, easy device procurement, poor device performance and change in user needs or priorities.

In another survey study of 115 persons with disabilities that included persons with cognitive disorders (though most participants had mobility impairments), Riemer-Reiss and Wacker (2000) found similar ATD abandonment rates of 32.4%. Furthermore, 6.4%

of the devices were never even used. Of importance to note was that the authors looked at the significance of abandonment factors derived from Roger's theory of diffusion (1995) and existing literature. The 'relative advantage' of continuing to use a device over abandoning it was found to be strongest predictor of ATD usage. Similar to Phillips and Zhao's (1993) study, Riemer-Reiss and Wacker (2000) found that a lack of consumer involvement "in deciding upon the device" (p. 46) was a predictor for abandonment. One of the key recommendations from the study was that "consumers must be involved in the selection of their assistive technology" (p. 49).

Mann, Goodall, Justiss and Tomita's (2002) study provided more data to show that different nonuse rates were found with different ATDs, as well as with commercial products (e.g., 32.4% canes, 26.5% magnifiers, and 12.1% handheld showers were abandoned). Furthermore, they presented categorized list of reasons for nonuse or dissatisfaction of ATDs such as hearing aids, magnifiers and wheelchairs from 1056 frail elders. For example, the top five reasons for participants to stop using magnifiers included: "magnification not strong enough", "device is too small", "does not help", "vision has deteriorated too much" and "print appears to be blurry".

While there is a lack of economic analysis available to estimate the direct and indirect costs associated with ATD abandonment (Jutai, Strong, Ariizumi, & Plotkin, 2006), the magnitude of the problem may be in the tens of millions of dollars per annum in Canada. The Ontario Ministry of Health and Long-Term Care (2003) reported that $214 million was spent by taxpayers on ATDs in 2002-2003. This funding does not account for the purchase of ATDs by other governmental programs or, by consumers themselves, through their employers and/or insurance. Therefore, a conservative estimate (i.e., 15%) equates to a loss in excess of $32 million due to ATD abandonment in Ontario alone (Polgar, 2006). Further, by applying the same conservative abandonment cost estimate (15%) to the cost of ATDs spent by those with vision loss and relevant stakeholders previously mentioned ($303.9 M), a loss of approximately $46 million is realized. Note that additional costs with the abandonment of mass market products that were not funded by the government (e.g., ADP program) were not considered. The abandonment of such products would impact the person with vision loss the most if he has to bear the bulk of

the cost given that many are unemployed, underemployed or on fixed incomes (Fok & Sutarno, 2003).

In summary, from both a social and economic costing standpoint, it is important that we are aware of the magnitude of the ATD abandonment problem as well the cascading effect on daily life of persons with vision loss. The initial process of device selection, which focuses on the matching of the person and the technology, is paramount. A failure to successfully achieve this process was theorized as the first step towards abandonment (Scherer, Sax, Vanbiervliet, Cushman, & Scherer, 2005). As mentioned by several authors, the person with the disability who will be using the product should be given primary control in the selection process (Mann, et al., 2002; Riemer-Reiss & Wacker, 2000; Phillips & Zhao, 1993; Wessels, 2004; Polgar, 2006). Their involvement right from the beginning in the process cannot be overstated (Gray, Quatrano, & Lieberman, 1998; Law et al., 1998). As such, this dissertation primarily focused on the involvement of persons with low vision to explore product selection considerations.

1.2 Dissertation purpose and overview of design

As a program of study, I was and remain, interested in advancing the understanding of the considerations persons with disabilities have when they are selecting a device. In the confines of this dissertation, the purpose of the overall study was the development and initial testing of an instrument to assist persons with *low vision* to select an ATD or a product for use in daily occupations. The National Eye Institute (2007) suggested low vision to mean "that even with regular glasses, contact lenses, and medicine or surgery, people find everyday tasks difficult to do. Reading the mail, shopping, cooking, seeing the TV, and writing can seem challenging." PALS defined a seeing disability as having difficulty seeing newspaper print or clearly seeing the face of someone from 4m or 12 feet away (Statistics Canada, 2006). More precisely, Colenbrander (2002) suggested that the low vision classification from the International Council of Ophthalmology (ICO) and International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) of "mild", "moderate" and "severe" may be translated to visual acuities (in the better eye) of between 20/32 to 20/63, 20/80 to 20/160 and 20/200 to 20/400 respectively. For simplicity, the instrument presented in this dissertation will be referred to as the *low*

vision product selection instrument or *LV-PSI*. This instrument was the first of its kind with the stated focus.

A mixed-methods approach was used to develop and initially test the LV-PSI. More specifically, the *sequential exploratory mixed-methods study design* was adopted (Creswell & Plano Clark, 2007). This study design consisted of both qualitative and quantitative research components. The purpose of the qualitative and the quantitative parts of the study will be discussed in the next section.

1.2.1 Mixed-Methods

The mixed-methods approach, which was used in this dissertation, orients its worldview towards pragmatism. Pragmatism focuses on "what works", and takes advantage of multiple ways of understanding and data collection, for the primary purpose of addressing the research question(s) (Creswell & Plano Clark, 2007) To elaborate using Tashakkori & Teddlie's (1998) description of pragmatism: i) both quantitative and qualitative methods were used, ii) both objective and subjective points of view (epistemology[1]) were used, and iii) values played a large role in interpreting, especially, the qualitative results (axiology[2]).

Despite the use of pragmatism as a research paradigm for over 50 years (Creswell & Plano Clark, 2007), it was omitted from Guba and Lincoln's (2005) classification of paradigms. According to Guba and Lincoln (1994), a paradigm is a set of basic believes (or metaphysics) which defines a person's worldview and conduct or research. The authors advocate for the use of a metaphysical approach to classifying paradigms, which consists of an explication of the "logical (if not necessary) primacy" between ontological, epistemological and methodological assumptions (Guba & Lincoln, 1994, p. 108). The

---

[1] Epistemology refers to an understanding of how a researcher gains knowledge of what he knows; and as well, the relationship between the researcher and that being researched (Creswell & Plano Clark, 2007).

[2] Axiology refers to the role of values in the conduct of the research (Creswell & Plano Clark, 2007). The decision to focus on low vision device selection from a personal location reasoning point of view (Schwandt, 1994; Hesse-Biber, 2004) is provided in Appendix F.

question that is asked at the ontological level is "what is the form and nature of reality and, therefore, what is there that can be known about it?" (Guba & Lincoln, 1994, p.108). Does the researcher believe in a 'singular reality' or 'multiple realities' (Creswell & Plano Clark, 2007)? The conceptualization of ontology and its implications on epistemology and methodology has been a source of debate and controversy. In the first issue of Journal of Mixed-methods Research, Morgan (2007) challenged Guba and Lincoln's omission of pragmatism as a research paradigm. He criticized the arbitrariness of what Guba and Lincoln defined as a paradigm, and suggested that ontological assumptions have little effect on the conduct of research. Rather, Morgan (2007) inferred that the claim by Guba and Lincoln of paradigms being incommensurate with each other may actually discourage practical and interdisciplinary work between researchers. Morgan would like to shift the focus to discussing the connection between methodological and epistemological concerns, as well as, methodological and methods concerns: "The pragmatic approach that I am advocating would concentrate on methodology as an area that connects issues at the abstract level of epistemology and the mechanical level of actual methods" (p68).

While I do not go as far as Morgan (2007) who seemed to suggest the replacement of the metaphysical approach (ontology to epistemology to methodology), methodological issues were especially important here given the purpose of this dissertation to generate instrument content through qualitative means and test it through quantitative means. In particular, the work of DePoy and Gitlin (1998) was relevant to inform my work given their use of mixed-methods in research relating to disability and assistive technology. DePoy and Gitlin (1998) provided several rationales for the importance of considering a mixing or integration of qualitative and quantitative methods in health and human service inquires. One key rationale suggested was that "the increasing emphasis placed on the empirical demonstration of the need for outcomes of health and human services has led naturalistic researchers to consider using replicable strategies" (p. 31). Interestingly DePoy and Gitlin (1998) gave no rationale and made very little reference to the influence of ontology on research strategies. Instead they compared the research paradigms based on epistemology, approach to reasoning, theoretical aim and context. Depoy and Gitlin (1998) provided several ways in which they believe the research methods can be

integrated. A diagrammatic representation of one way of integration described by the authors, which was employed in the current research, can be found in Figure 1-1.

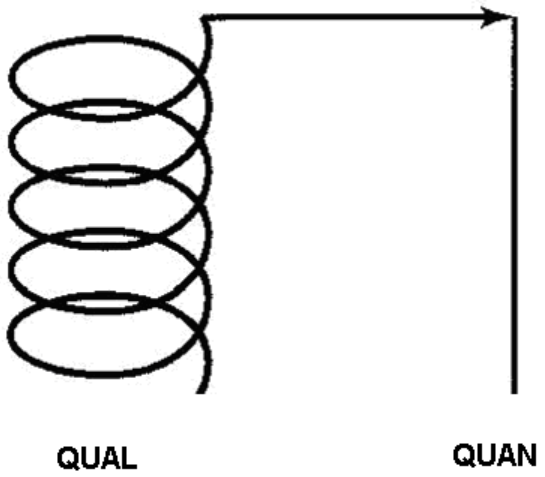

Figure 1-1: Mixed-Methods – Sequential exploratory design (adopted from DePoy and Gitlin, 1998).

In the currently study, the spiral on the left represented the qualitative study to gain a better understanding of product selection considerations by persons with low vision. The qualitative aspects were used to inform the development of the instrument (DePoy & Gitlin, 1998). The quantitative parts of the study are represented by the straight line on the right side of the figure. The reader is also referred to Figure 1-2 for a diagrammatic representation of the mixed-method study flow. Figure 1-2 is essentially a more detailed representation of Figure 1-1 where the left side is the qualitative part of the study (spirals in Figure 1-1) that feeds into the right side which is the quantitative part of the study (straight line in Figure 1-1).

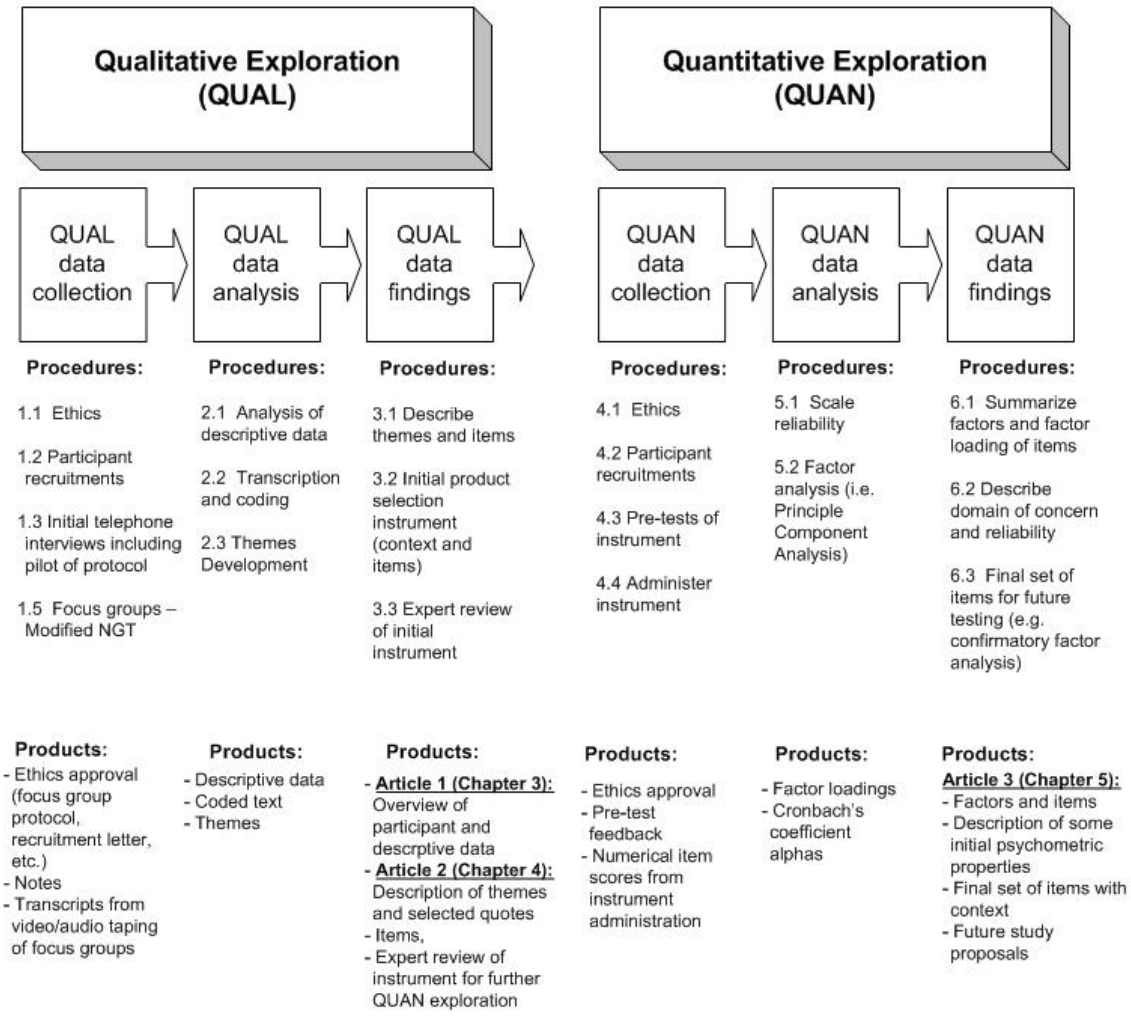

Figure 1-2: Overview of Mixed-Methods study processes in the dissertation (adopted from Creswell & Plano Clark, 2007)

There were three main purposes for the initial collection of the qualitative data in the study: 1) to gain breadth and contextual understanding of ATD and product selection considerations, some of which have been identified in the literature; 2) to gain from participants their lived experience perspective and reflection on selecting ATDs and products; and 3) to use the results along with the relevant literature to generate content and 'items' for instrument development and testing (see Chapter 5). The process of using qualitative data for the purpose of instrument development was indicative of a sequential exploratory design (DeVellis, 1991). Quantitative methods were used to perform initial testing of some of the instrument's basic psychometric properties. Internal consistency

was tested using Cronbach's coefficient alpha. Examination of how well the tool represents the domains of concern was completed using Principal Component Analysis (PCA). The aim of the instrument is to enable persons with low vision, and service providers, to consider selection criteria which are deemed as important in the successful selection of a product. Moreover, it is envisioned that the LV-PSI may be used by persons with low vision with service providers (along with other instrument or assessment processes), but also independently by persons with low vision to select products where no service providers are available.

1.2.2 Organization of the dissertation

This dissertation is organized in an integrated-article format. Chapter 2 provides foundational elements to the subsequent chapters to explore the product selection considerations by persons with LV through mixed-methods. More specifically, the next chapter will present: (1) Theoretical impetus for conducting the research, (2) a review of selected conceptual frameworks that may be useful for LV product selection, and (3) a scoping review of the data collected from LV participants in the literature that may be related to product selection, usage and/ or abandonment.

As indicated in Figure 1-2, three articles are included in this dissertation. The first two articles were generated from the qualitative study and the last article was from the quantitative study. The focus of the first article (Chapter 3) was to obtain initial insights on the perceived relative importance of products that LV participants use (N=17) on a daily basis. Descriptive demographic data from LV participants were also collected and analyzed. The information obtained from this article was then used to generate and refine the protocol used in the two qualitative data collection sessions that followed in the second article (Chapter 4). Ten of the 17 participants whose data are reported in the first article participated in the sessions. Each session consisted of two data collection modes which included the use of a modified nominal group technique and focus group discussions to explore the selection of different classification of products. The qualitative data were used to generate content and items for the LV-PSI. This part of the study was followed by the testing of the LV-PSI's structure and internal consistency following administration of the instrument with a sample of 152 LV participants. Finally, in

Chapter 6, I will present the integrated knowledge gained, and an evaluated of the use of the mixed-methods approach in the overall study. Future work to improve the development and testing of the instrument, as well as, to allow for its use in practice, will also be discussed.

1.3 References

Access Economics Pty Limited. (2009). The cost of vision loss in Canada: Full report for Canadian National Institute for the Blind and Canadian Opthalmological Society. Retrieved June 30, 2009, from www.cnib.ca/en/research/pages/covl.aspx

Assistive Technology Act of 1998, as amended. Pub.L. No.108-364. §3, 118 Stat. 1707 2004.

Colenbrander A. (2002). *Visual standards: Aspects and ranges of vision loss.* Report prepared for the International Council of Ophthalmology at the 29th International Congress of Ophthalmology, Sydney, Australia.

Cornman, J.C., Freedman, V.A., & Agree, E.M. (2005). Measurement of assistive device use: Implications for estimates of device use and disability in late life. *The Gerontologist, 45*(3), 347-358.

Creswell, J. & Plano Clark, V. (2007). *Designing and conducting mixed-methods research.* Thousand Oaks, CA: Sage Publications, Inc.

Crudden, A. (2002). Employment after Vision Loss: Results of a Collective Case. *Journal of Visual Impairment & Blindness*, 96, 615-622.

Day, H., Jutai, J.W., Woolrich, W. & Strong, G. (2001). The stability of impact of assistive devices. *Disability and Rehabilitation, 23*(9), 400-403.

DePoy, E. & Gitlin, L. (1998). *Introduction to research: Understanding and applying multiple strategies (2nd edition).* St. Louis, MO: Mosby.

DeVellis, R. (1991). *Scale development: Theory and application.* Newbury Park, CA: Sage Publications, Inc.

Fok, D. & Sutarno, C. (2003). Overcoming barriers: Workplace accommodations for people with vision impairment, in: *Proceedings of the 34th Annual Conference of the Association of Canadian Ergonomist*, London, ON.

Gerber, E. (2003). The benefits of and barriers to computer use for individuals who are visually impaired. *Journal of Visual Impairment & Blindness, 97*(9), 536-550.

Goodrich, G.L. (2003). Available and emerging technologies for people with visual impairment. *Generations (spring edition),* 64-70.

Girdler, S., Packer, T. L., & Boldy, D. (2008). The impact of age-related vision loss. *OTJR: Occupation, Participation & Health, 28*(3), 110-120.

Gray, D., Quatrano, L., & Lieberman, M. (1998). *Designing and Using Assistive Technology: The Human Perspective.* Baltimore, MD: Paul H. Brooks.

Guba, E., & Lincoln,Y. (1994). Competing paradigms in qualitative research. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-177). Thousand Oaks, CA: Sage.

Guba, E., & Lincoln,Y. (2005). Paradigmatic controversies, contradictions, and emerging confluences. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (3rd ed., pp. 191-215). Thousand Oaks, CA: Sage.

Harper, R., Doorduyn, K., Reeves, B., & Slater, L. (1999). Evaluating the outcomes of low vision rehabilitation. *Ophthalmic & Physiological Optics : The Journal of the British College of Ophthalmic Opticians (Optometrists), 19*(1), 3-11.

Hesse-Biber, S.N., & Leavy, P. (Eds.) (2004). *Approaches to qualitative research*. New York, NY: Oxford University Press.

Hocking, C. (1999). Function or feelings: Factors in abandonment of assistive devices. *Technology and Disability, 11*, 3-11.

Hooper, P., Jutai, J. W., Strong, G., & Russell-Minda, E. (2008). Age-related macular degeneration and low-vision rehabilitation: A systematic review. Canadian *Journal of Ophthalmology, 43*(2), 180-187.

Inge, K.J. (2006). Assistive technology as a workplace support. *Journal of Vocational Rehabilitation, 24*(2), 67-71.

Jutai, J., Hooper, P., Strong, G., Russell-Minda, E., Cooper, L., Hutnik, C., Sheidow, T., & Tingey, D. (2007). *Vision rehabilitation evidence-based review: Module 1: Terminology, demography, and epidemiology of low vision.* Unpublished manuscript, The University of Western Ontario, The Lawson Health Research Institute, and CNIB.

Jutai J.W., Strong J.G., Ariizumi H., Plotkin A. (2006). Feasibility of dynamic modeling of outcomes for low vision devices. In J.S., H.D. & Rubin G (Eds.), Proceedings of the Vision 2005 International Congress on Low Vision Research. Amsterdam: Elsevier.

Law, M., Baptiste, S., Carswell, A., McColl, M. A., Polatajko, H., & Pollock, N. (1998). *Canadian Occupational Performance Measure (3rd ed.)*. Ottawa, Ontario: CAOT Publications.

Mann, W.C., Goodall, S., Jutiss, M.D., and Tomita, M. (2002). Dissatisfaction and nonuse of assistive devices among frail elders. *Assistive Technology, 14* (2): 130-139.

Morgan, D. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed-methods Research, 1*(1), 48-76.

National Eye Institute. (2007). What you should know about low vision. Retrieved July 29, 2009, from www.nei.nih.gov/health/lowvision/LowVisPatBro2.pdf.

National Institute on Disability and Rehabilitation Research. (2006). Notice of final long-range plan for fiscal years 2005-2009. *Federal Register, 71*(31), 8165-8200.

Ontario Ministry of Health and Long-Term Care. (2003). Assistive devices and home oxygen program report. Toronto, ON.

Phillips, B., & Zhao, H. (1993). Predictors of assistive technology abandonment. *Assistive Technology, 5*(1), 36-45.

Polgar, J. (2006). Assistive technology as an enabler to occupation: what's old is new again (Muriel Driver Lecture). *Canadian Journal of Occupational Therapy, 73*(4), 199-205.

Reimer-Reiss, M. & Wacker, R. (2000). Factors associated with assistive technology discontinuance among individuals with disabilities. *Journal of Rehabilitation, 66*(3), 44-49.

Rogers, E.M. (1995). *Diffusion of innovations (4th edition)*. The Free Press. New York.

Rosenberg, E. A., & Sperazza, L. C. (2008). The visually impaired patient. *American Family Physician, 77*(10), 1431-1436.

Scherer, M., Sax, C., Vanbiervliet, A., Cushman, L., & Scherer, J. (2005). Predictors of assistive technology use: The importance of personal psychosocial factors. *Disability and Rehabilitation, 27*(21), 1321-1331.

Schwandt, T.A. (1994). Constructivist, interpretivist approaches to human inquiry. In N.K. Denzin & Y.S. Lincoln (Eds.), *Handbook of qualitative research*. Thousand Oaks, CA: Sage Publications.

Sperazza, L.C. (2001). Rehabilitation options for patients with low vision. *Rehabilitation Nursing, 26*(4), 148-151.

Statistics Canada. (2006). Participation and Activity Limitation Survey. Retrieved July 29, 2009, from www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3251&lang=en&db=imdb&adm=8&dis=2

Stelmack, J.A., Rosenbloom, A.A., Brenneman, C.S. & Stelmack, T.R. (2003). Patients' perceptions of the need for low vision devices. *Journal of Visual Impairment & Blindness, 97*(9), 521-535.

Strong, G., Jutai, J., Bevers, P., Hartley, M. & Plotkin, A. (2003). The psychosocial impact of closed-circuit television low vision aids. *Visual Impairment Research, 5*(3), 179-190.

Tashakkori, A. & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches.* Thousand Oaks, CA: Sage Publications, Inc.

The Eye Diseases Prevalence Research Group. (2004). Causes and prevalence of visual impairment among adults in the United States. *Archives of Ophthalmology, 122*, 477-485.

Vitale, S., Cotch, M.F. & Sperduto, R.D. (2006). Prevalence of Visual Impairment in the United States. *JAMA, 295*, 2158-2163.

Wagner, J., Vanderheiden, G. C., & Sesto, M. E. (2006). Improving the usability of a mainstream cell phone for individuals with low vision. *Journal of Visual Impairment and Blindness, 100*(11), 687-692.

Watson, G. R. (2001). Low vision in the geriatric population: Rehabilitation and management. *Journal of the American Geriatrics Society, 49*(3), 317-330

Wessels, R. (2004). *Ask the user. User perspective in the assessment of assistive technology. Thesis.* Maastricht University.

Wilcock, A.A. (Ed.). (2006). *An occupational perspective of health* (2nd ed.). New Jersey: Slack Incorporated.

World Health Organization (WHO). (2010). World report on disability: Concept note. Retrieved December 20, 2010, from www.who.int/disabilities/publications/concept_note_2010.pdf

Chapter 2

2 Theoretical background and review of literature

The theoretical background of the dissertation is presented in this chapter. The terms occupation and occupational deprivation are defined. This chapter emphasizes the importance of occupation in the lives of people with disabilities, and how products (i.e., assistive technology device (ATD) or mass market commercial products) may help to reduce occupational deprivation. This discussion is followed by a review of several relevant frameworks available in the ATD and consumer literature that may inform product selection by persons with low vision (LV). A scoping review was conducted on published works to gain perspective on what persons with LV deemed to be important during product section. This perspective, obtained from the literature, informed and provided directions to the subsequent qualitative and quantitative research studies reported in this dissertation.

2.1 Occupation and deprivation

There are a plethora of products available to persons with or without a disability that may be used throughout the day. Though some of us may feel inundated by the amount of technology around us (Wilcock, 2006) or be distracted by their promised capabilities, we must not lose sight of the fact that one of their purposes is to assist us in the performance of activities or *occupations.* Many occupational scientists believe that the engagement in meaningful occupations is as elemental as food and water for our survival (Wilcock, 1993; Wilcock, 2006). One of the earliest definitions of occupation from occupational science came from Yerxa et al. (1989) who referred to occupation as "chunks" of *activities* "named in the lexicon of the culture" (p.5). Clark et al. (1991) added to this version and suggested the often cited definition of occupation as "chunks of culturally and personally meaningful activity in which humans engage that can be named in the lexicon of culture" (p. 301). For example, preparing a meal, surfing the internet or riding a bike are all considered occupations under this definition. Nelson and Jepson-Thomas (2003) provided further specificity by articulating two rules, which may be applied

separately, or in concert, for determining when an occupation starts and stops and when an occupation is considered a sub-occupation of another.

> *First, one can use the perspective of the individual engaged in the occupation. Does he or she see the occupation as starting at the point of gathering the clothes, or does she or he see it starting with the loading of the washer? Does he or she see doing the laundry as part of something called "doing Saturday occupations?" Second, one can use sociocultural norms... How would most people in a culture or at a particular social level judge these matters? (p. 129)*

Though such self or culturally defined occupations or activities may seem mundane, being deprived of doing them may have dire consequences to our health, well-being and quality of life. Wilcock (2006) cited the example of children being developmentally delayed when deprived of occupations and given nothing more than water, food and a place to sleep; and in jails, prison riots and suicides have also been linked to a deprivation of occupations. In a less extreme example, working age adults who are not performing productive occupations to their potential (unemployed or underemployed) may experience poverty and depression (Wilcock, 2006). Formally, occupational deprivation may be defined as "a state of prolonged preclusion from engagement in occupations of necessity or meaning due to factors outside the control of an individual" (Christiansen & Townsend, 2004, p. 278). One large segment of our population that has been identified in the occupational science literature as being especially vulnerable to occupational deprivation is persons with disabilities (Whiteford, 2004).

2.1.1 Theorized determinants of occupation deprivation for persons with disabilities

Given the established importance of occupations, it is beneficial to highlight two determinants theorized to deepen occupational deprivation for persons with disabilities. Whiteford (2004) suggested that persons with disabilities may be deprived of the most basic taken-for-granted occupations as a result of external (non-human) environment and social attitudes. A poorly designed built environment is one that has not considered the needs of persons with disabilities, thus depriving them of the performance of daily occupations (Whiteford, 2004). For example, a curb cut which provides little tactile feedback for a blind white cane user, to indicate to him that he is entering oncoming traffic from the sidewalk, may exclude the individual from being able to safely navigate

in the community. Negative social attitudes from one person or a group of people towards persons with disabilities may also present barriers for occupational performance and participation. These attitudinal barriers may include but are not limited to "stereotyped perceptions, limited expectations, and subtle marginalization" (p. 236). For example, Roulstone (1998) provided an excerpt from a semi-structured interview with Clive, a part-time database and spreadsheet worker with cerebral palsy (CP), which suggested that attitudinal barriers may have contributed to his underemployment. Clive said:

> *Employers are prejudiced against those with CP, and also against those in wheelchairs... They also assume that because my speech is impaired I'm mentally handicapped... Employers seem amazed that I would even have the nerve to go for a job with my disabilities… They have already got this mental picture of what I am capable of. You could say you were a world expert on database construction, but it wouldn't make a bit of difference (p. 110).*

Changing attitudes and designing better environments are important components to consider in the mitigation of occupational deprivation experienced by persons with disabilities. The contexts or milieu becomes very important to participation and are part of the complexities toward underscoring the lived experience of a person with a disability as he performs an occupation (Cook & Polgar, 2008; Scherer, 1998).

2.1.2 The importance of ATDs and products to mitigate occupation deprivation for persons with disabilities

Despite the best efforts to foster hospitable settings and optimal built environments for people with disabilities, they may still be precluded from the performance of occupations as no design of environments or planned contexts can be truly universal and accommodate everyone (Trachtman, 1998, p.2). As such, the use of ATDs and related products are essential to the performance of everyday meaningful occupations by persons with disabilities (Vanderheiden, 1988; Whiteford, 2004; Polgar & Landry, 2004). Several studies in the low vision disability literature support this assertion.

In a retrospective, descriptive, cross-sectional population study among 85 year-old participants with and without vision loss (n = 617), Dabhlin, Ivanoff, and Sonn (2005) found that a majority of device users were independent of human assistance in activities of daily living. Participants with age related macular degeneration (ARMD) and other

ocular conditions used mobility devices to get around more than the participants in the normal vision group. The use of vision devices was not measured but the authors suggested that assistive mobility devices were needed for person with ARMD to remain independent.

In a longitudinal study (n = 438) that used multivariate analysis, the question concerning the relationship between optical and adaptive aides on change in depression and disability was assessed. Comparing data from time 1 (pre-service) and time 2 (6 months after), the authors findings significantly "support the efficacy of optical device use for declines in IADL disability and depression" (Horowitz, Brennan, Reinhardt, & MacMillan, 2006, p. S278).

Strong, Jutai, Bevers, Hartley, and Plotkin (2003) used the Psychosocial Impact of Assistive Devices Scale (PIADS) to look at the psychosocial impact of the use of closed circuit televisions (CCTV) on a cohort of participants with low vision (n = 36) annually for three years after adoption. Their finding suggests substantial psychosocial benefits were experienced by the cohort especially in the first two years after CCTV adoption. The authors suggest that the relatively lower PIADS scores in the third year may be due to a "response shift", where the effectiveness of the CCTV was not necessarily lessened but the meaning behind the participants' self-evaluation of the psychosocial constructs may have shifted.

Finally, in a similar study involving 68 CCTV users, Huber, Jutai, Strong, and Plotkin (2008) also found that participants experienced significant psychosocial benefits from the initial adoption of CCTV. Furthermore, while the PIADs scores peaked at one-month and waned over a six month period, the functional status of the participants remained the same as measured by the National Eye Institute Visual Function Questionnaire (NEI VFQ-25). This finding provided validation for Strong et al.'s (2003) assertion that the effectiveness of CCTV does not necessarily diminish even though the perceived psychosocial impact may be lowered over the same time period (Huber et al., 2008). The authors suggested that more studies should be done to see whether different assessment, training and counseling protocols may yield different results.

As demonstrated above, different ATDs or products may curb occupational deprivation in different ways by facilitating the performance of occupations. Though the important linkage between occupational performance and products was shown in the four aforementioned studies, this linkage may sometimes be taken-for-granted by clinicians or clients in the evaluation of device outcomes. The relation between occupational performance and ATDs is so inexorably linked or assumed that many rehabilitation outcome measurement instruments do not make the distinction between occupational performance with or without the use of products in their measures or items. Some examples include the Canadian Occupational Performance Measure (Law, et al., 1998), Impact on Participation and Autonomy (Cardol et al., 1999) and The Life Space Questionnaire (Stalvey, Owsley, Sloane, & Ball, 1999). Certainly, depending on the intended use of the instrument, the distinction between occupational performance with or without the use of an ATD may not be as relevant. For the purpose of the current work to produce a product selection instrument however, the ATD or product needed to be explicitly identified and examined. As Hocking (1997) advocated in the Person-Object Interaction model, it is important to examine the 'object', or in this case the product, which is often overlooked when discussing occupation or occupational performance within the occupational science literature. As such, several frameworks from the general ATD and consumer product literature that take into account the 'object' were included for the purpose of grounding the current LV product selection research.

2.2 Product selection framework

Lenker and Paquet (2003) reviewed several conceptual models from within and outside of the ATD literature that may be used for ATD outcomes research and practice. Four of these models are relevant to the current work. They include: Matching Person and Technology (MPT) (Scherer, 1998), The Human Activity Assistive Technology (HAAT) model (Cook & Polgar, 2008), Gitlin's "Career" model (Gitlin, 1998), and A Model of the Innovation-Decision Process (Rogers, 1995; Rogers, 2003). Even though these models are not necessarily specific to low vision research, they may be used to consider the complex relation and interaction of the person with a disability *and* the product during the selection process. The first three models reviewed are found in the ATD literature,

and the use of the Rogers' model (2003) may be found in the consumer literature. The relevance of these models to the current dissertation is also discussed.

2.2.1 ATD Frameworks

Dr. Marcia Scherer and colleagues have made significant contributions in the area of ATD selection through research and practice with the Matching Person and Technology (MPT) model. The MPT model suggested that considerations of the person, the milieu and the technology are necessary for a best "match" during the selection process. These three focused areas originally emerged from a grounded theory study with 10 adults with physical disabilities (five participants with spinal cord injury and five with cerebral palsy) (Lenker & Paquet, 2003). Of significance is that the MPT system of instruments (Scherer, 1998; Scherer & Craddock, 2002) have advanced and focused our understanding of the *pre-dispositions* to matching a person and the technology and these are mentioned shortly. A summary of the MPT assessment process and instruments may be found in Scherer et al. (2005, p. 1322, Table I). An example of one MPT instrument is the Assistive Technology Device Predisposition Assessment - Consumer form (ATDPA – C). It provides a section which asks the consumer to rate 10 general, non-disability specific items relating to "how do you feel about using the device?" (Scherer, 1998).

Although Scherer's approach has been heavily promoted, there has been limited published evidence that using the MPT makes a measurable difference in outcomes from device selection. Overall, there have been a dearth of well-controlled studies on the effectiveness of selection frameworks. Recently, Scherer, Jutai, Fuhrer, Demers, and DeRuyter (2007) proposed a framework for modeling the selection of ATDs (Figure 2-1).

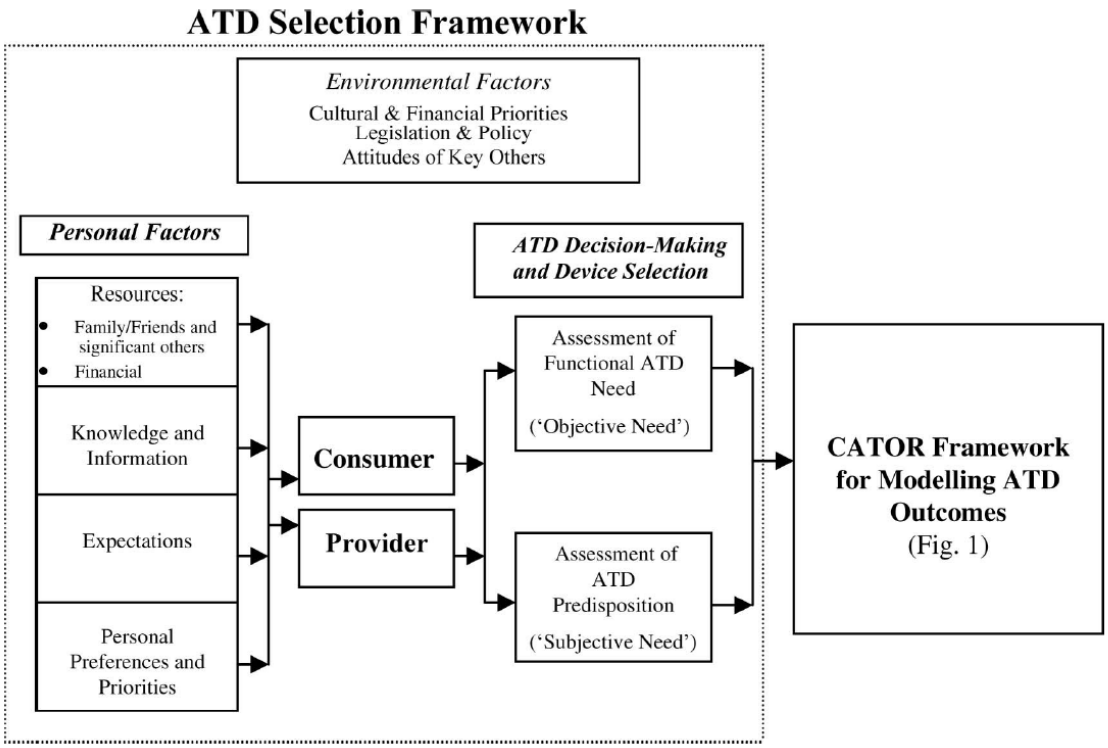

Figure 2-1: Framework for modeling the selection of ATDs (Scherer et al., 2007).

The two sets of pre-disposition factors expressed in this framework include environmental (cultural and financial priorities, legislation and policy, attitudes of key others) and personal factors of the consumer and the provider (resources, knowledge and information, expectations, personal preferences and priorities). "Together, these environmental and personal factors create the context in which ATD decision-making and device selection for a given individual occurs" (Scherer et al., 2007, p. 4). Objective needs (e.g., walk 50 feet on a smooth surface) are normally determined by the provider, whereas subjective needs (e.g., desire to move independently) are decided by the consumer (Scherer et al., 2007). The authors posit that the selection framework feed into an additional framework (not included here) which may be useful for modeling short and longer term ATD outcomes (Fuhrer, Jutai, Scherer, & DeRuyter, 2003). Together the MPT and the framework provided a comprehensive modeling of the selection of ATDs. They also created an excellent backdrop in situating the area of focus for the current dissertation. That is, the development of a low vision product selection instrument based on what persons with low vision deem as important considerations for product selection

and use, because they ultimately decide whether to use a product or not on a daily basis for occupational performance. In other words, the goal of the current work was not to replace the MPT but rather, to gain a better understanding of LV participants' perspectives (e.g., personal factors) that may influence product selection. These factors can then be operationalized as LV domain specific items that may supplement more generic items found in the MPT.

In terms of utility, Lenker and Paquet (2003) suggested that the MPT is a useful heuristic tool for ATD provision given its broad applicability, much like the HAAT model. The HAAT model focuses on capturing the components of the human, the activity and the assistive technology used within a context. "The human component includes physical, cognitive, and emotional elements; activity includes self-care, productivity and leisure; assistive technology includes intrinsic and extrinsic enablers; and the context includes physical, social cultural and institutional contexts." (Cook & Polgar, 2008, p. 36.)

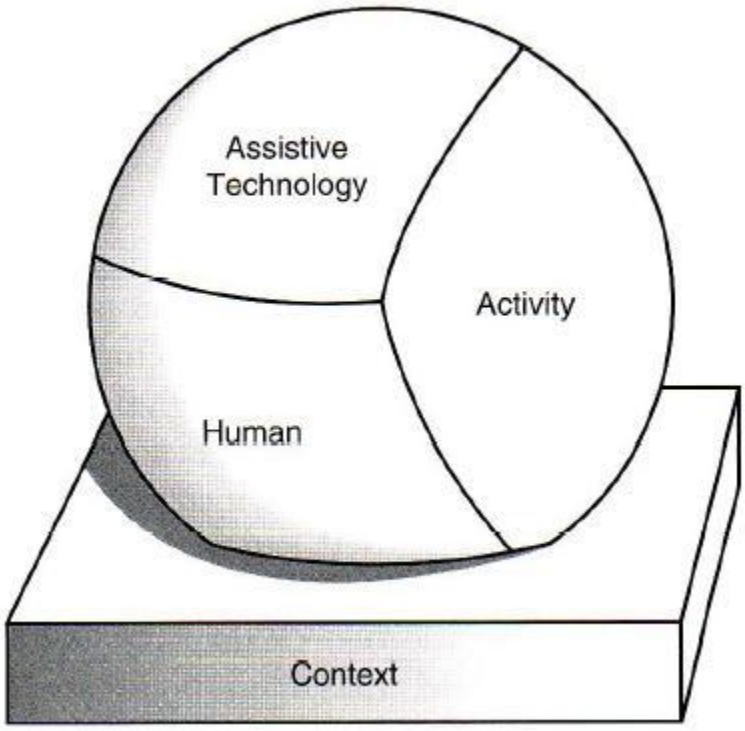

Figure 2-2: A visual representation of the HAAT model (Cook & Polgar, 2008).

When compared to the MPT model, the activity aspect of HAAT is immediately brought to the foreground. In the HAAT model, *activity* is analogous to *occupation* as previously defined. The HAAT model is arguably less developed and less tested for ATD selection because the model and its respective components have not been operationalized. However, as Lenker and Paquet (2003) suggested, the HAAT's "all-encompassing nature affords possibilities as a reference framework upon which outcomes research can be based." (p. 4). Given the exploratory nature of the research presented in the current dissertation, the use of the HAAT model served to minimally acknowledge the dynamic negotiation between these key components to ensure that they were not overlooked. The HAAT model provided a method to organize the relevant literature identified in the scoping review of LV product selection (below), and as well, suggested possible content, especially the context for which the LV-PSI was administered.

Finally, Gitlin's model (1998) depicted the person's use of a device as following a career path from the initial use of the device as a 'novice user' (e.g., in the hospital) to an 'early user' (home use for 1-6 months), to an 'experienced user' (home use for 7-12 months) and then finally as an 'expert user' (home use for 1 years and beyond). The model is grounded on a biopsychosocial framework which helps to examine "the interplay of functional, psychological, and social conditions that contribute to device use at home." (p. 119). A purposeful sampling of three patients with mobility disabilities from a larger study of older rehabilitation clients (N = 250) was used to illustrate the model. The key offering of the model is the idea that device needs change over time from being a 'novice user' to an 'early user' and beyond. The model depicts that device needs emerged in a linear fashion as a function of increased time use and exposure to the device. As such, an expert user may have accumulative experiences and insight from having gone through discrete stages of his device use career path. In the qualitative part of the current research, experienced and expert users, as defined by Gitlin (1998), were purposely sampled for the focus groups conducted. Furthermore, it was expected that by including experienced or expert users as opposed to novice users, the research would be able to leverage their specialized knowledge of having had opportunities to select and obtain LV products by themselves through the health care system, private insurance, and/ or work insurance. In addition, having used ATD or products to accommodate their LV for an

extended period of time, the experienced and expert users may be better able to share in-depth experiences of successes or failures associated with product selection.

2.2.2 A Model of the Innovation-Decision Process (Rogers' model)

Unlike the previous models reviewed, Rogers' model (1995, 2003) is drawn from the *Diffusion* of Innovation or ideas literature and not from the ATD literature. Rogers (2003) defined diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system." (p.5) The model is presented in Figure 2-3, and can be described as a five step process through which a person goes from 1) gaining initial knowledge of an innovation, say a product, 2) to forming an attitude about it (persuasion), 3) to making a decision on whether to adopt or reject it, 4) to putting the product to use (implementing), and then 5) to the [non]confirmation of the decision. A full description of the model can be found in Rogers (2003). Aspects of the model that are especially relevant to specific product section considerations by a consumer will be described based on Rogers' work (2003) in this section. In particular, the stages of persuasion and decision will be further described.

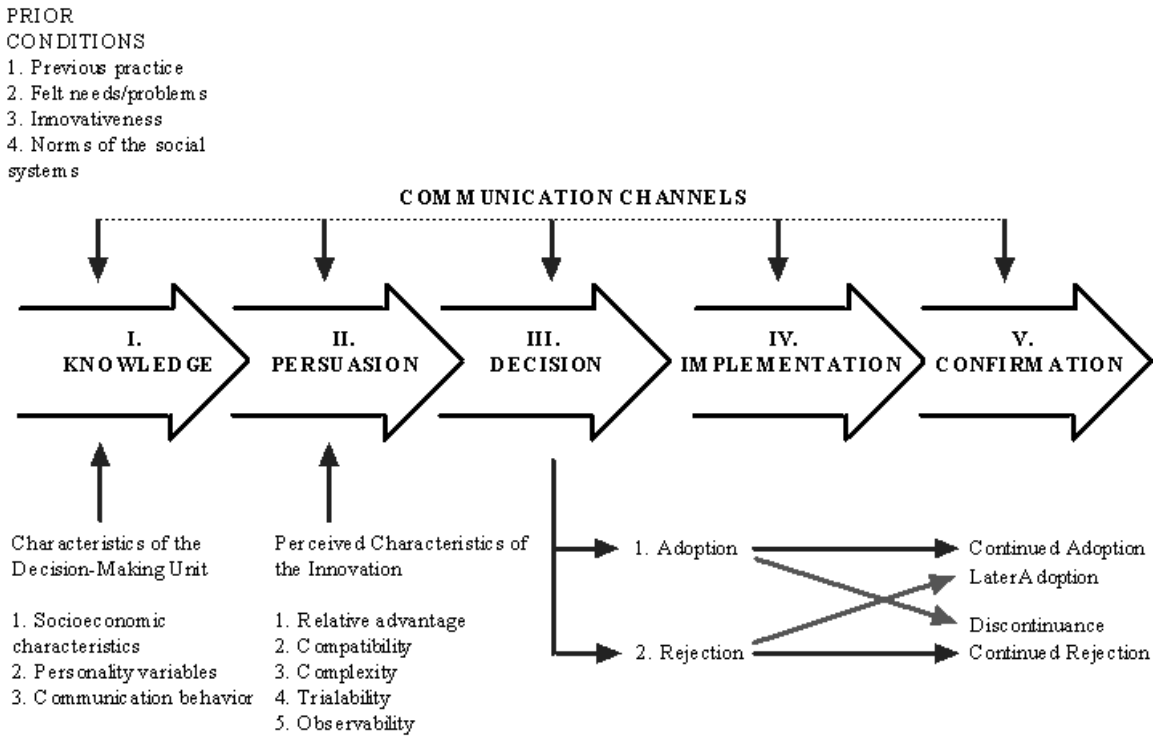

Figure 2-3: A model of five stages in the innovation-decision process (Rogers, 2003).

In the persuasion stage, a general perception of the product is developed and the main outcome of the stage is a favourable or an unfavourable attitude towards the product (Rogers, 2003). As shown in Figure 2-3, the five perceived characteristics of the innovation play a major role at this stage. The definitions from Rogers (2003, pp. 15-16) of these characteristics are illustrated below along with an example of considerations that may go into the purchase of a portable CCTV based on this model.

1. Relative advantage: is the degree to which a product is perceived as better than the product it supersedes. For example, does a person feel that the use of a portable CCTV may be more suitable, more modern and more advantageous than using a non-electronic handheld magnifier at the supermarket to look at food labels?

2. Compatibility: is the degree to which a product is perceived as being consistent with the person (e.g., needs and values). For example, does the person have an aversion to using new technology in her life such that the use of a portable CCTV

may be incompatible with her values? Has the person used electronic aids in the past to help with her activities of daily living? Note that 'compatibility' as described by Rogers (2003) is not necessarily about whether a product is compatible with another product (e.g., electronic screen reader with a computer system – discussed shortly).

3. Complexity: is the degree to which a product is perceived as easy or difficult to understand and use. For example, does a person feel that a particular design of a portable CCTV is simple such that it can be picked up and its major features and functionalities may be understood and used right away with minimal training or instructions?

4. Trialability: is the degree to which a product may be tested or experienced on a limited basis. For example, can a person take the portable CCTV out of the store for 30-days so that she can try it out in different real life use contexts?

5. Observability: is the degree to which the results of using the product are visible to people. For example, a person with low vision may notice another person with LV using a portable CCTV to read regular sized newsprint independently at her optometrist's office. As a result, she may inquire and find information about it, and adopt it later on. Note that as described by Rogers (2003), observability is distinct from visual feedback of using a product which may be closer to the idea of complexity.

Rogers explains that the decision stage, much like the previous stage is aimed at capturing the person's behaviour of attempting to reduce uncertainty. This stage often involves trying out a product, and/ or watching a demonstration, and if there is a perceived relative advantage, it may be adopted. On the other hand discontinuance can happen through active or passive rejection. Active rejection refers to having considered a product and then rejecting it, whereas passive rejection happens when the product has never been considered in the first place. The implementation stage is where the product is actually used, the step of *re-invention* may occur. Re-invention is the degree to which a product is changed or modified in the process of its adoption and implementation. For

example, electronic screen magnifiers are rarely fully compatible with all aspects of a proprietary computer system found in a workplace (unless their integration was considered during the design and implementation of the computer system), and scripting may be required to make the software and the system *technically* compatible.

Rogers' work is important in that it reminds us that a person with a disability is a consumer who happens to have a disability. Researchers need to at least conceive that the consumer with the disability may or may not have similar wants and needs, and may or may not follow similar processes for adoption of an innovation as other consumers without a disability. As mentioned in the introduction, Riemer-Reiss and Wacker's (2000) work has attempted to use and validate parts of Rogers' model (1995) with a sample of 115 persons with cognitive and mobility impairment. Riemer-Reiss and Wacker (2000) used an instrument to measure the factors of relative advantage (nine items), compatibility (one item), trialability (one item), re-invention (one item) and change agent (persons who influences the adopter) support (seven items) (Lenker & Paquet, 2003), along with other factors (consumer involvement and changes in consumer needs) found in the literature. These independent variables (factors) were examined and relative advantage and consumer involvement were found to be significant predictors of technology discontinuance (Riemer-Reiss & Wacker, 2000). Much like the work of Riemer-Reiss and Wacker (2000), the current work attempted to include the quantitative testing (see Chapter 5) of a number of general *consumer* considerations as outlined by Rogers (2003). There were at least three rationales for this decision. First, the stated goal of the selection instrument was to assist persons with LV in the selection of products as opposed to the selection of ATDs only. Second, the product selection consideration findings from the qualitative study in Chapter 4 corroborated with a number of concepts or factors identified by Rogers (2003). Finally, from the perspective of a person with LV, she may abandon a product for a number of reasons beyond just a good fit between her residual vision and the product's capabilities. Roger's model (2003) may account for some of these other reasons.

Besides Rogers' work there have also been other attempts at conceptualizing what the mass market consumer may want to consider during product selection and beyond, which

has been brought into the general ATD outcomes discourse. For example, King (1999) revamped Norman's classic work (1988) on the design of everyday things, to add to the usability of ATD literature. The ten revamped principles by King (1999) that were important to consider in the Human Factors design of ATDs include: (1) Transparency-translucency-opacity, (2) cosmesis of AT devices, tools, and systems, (3) mappings of ATD learning, use, and operation, (4) affordances, (5) learned or taught helplessness, (6) feedback from switches, controls, screens and devices, (7) knowledge of technology use that is "in the head" versus "in the world", (8) constraints of ATD use, (9) incorporations of "forcing" or failed-safe functions for systems, and (10) prevention of errors, mistakes misactivations ("miss hits") in ATD use. Generally, these ideas have not been applied to LV research for the purpose of product selection; though as the reader may note later through the scoping review, ideas related to ease of use and the intuitive use of a device have appeared in the literature.

In summary, the four models identified in this section informed the current research by enhancing the understanding of the relation between the person and the product for the purpose of product selection. First, the models reinforced that participants are much more than a homogenous group of disabled people that use ATDs. For example, Gitlin's model (1998) helped to articulate the need to include experienced and expert users of ATDs in the qualitative study in this dissertation as they have accumulated experiences and insights from having gone through the processes of selection, use and retention or abandonment of products. Rogers' model (2003) prompted the thinking that general consumer product selection considerations may be just as important as disability domain specific considerations in ensuring a proper fit. An improper fit of the product with a person and his disability, or with a person and his non-disability specific preference, may have the same consequence – abandonment of the product. Finally, all four models take into account the product, which, as previously mentioned, has been underemphasized in much of the occupation based research. The MPT and the HAAT models further added the contextual layer of product selection and usage which was important in the in-depth analysis of the qualitative data collected. While the MPT also considers the occupation or the activity, the HAAT model is more explicit about its contribution to product selection. Therefore, the HAAT model was selected to ensure that its components were

considered during the design of the qualitative and quantitative study protocols and in the scoping review to follow in the next section. While the four models as outlined in the section created an important backdrop for the current research, it is important to emphasis that these are generic, non-disability domain specific models. In other words, while themes, factors or concepts relating to product selection may be identified through these models, there is a gap in that participants with LV did not necessarily inform the development of these models. A survey of the literature was necessary to identify the potential selection considerations that have been expressed, directly or indirectly, by LV study participants.

2.3 Review of literature: LV participants' product selection considerations

More attention is needed to include consumers with LV in the development of criteria to support consumer-based product selection. To date, there is a lack of synthesis on what is known in the literature on product selection from the perspectives of LV participants that may be translated into the development of an instrument for product selection. Although some consumer-based criteria for evaluating general ATDs exists (e.g., Demers, Weiss-Lambrou, & Ska, 1996), there is only a small number of studies that may directly inform product selection considerations by persons with LV. One such study is the often cited work from Bativia and Hammer (1990) which included a small number of consumers with LV in the development of consumer-based criteria to evaluate ATDs.

Through the use of a modified Delphi Method with focus groups, Bativia and Hammer (1990) sought to identify and prioritize factors used by consumers for evaluation of a variety of ATDs. Consumer experts who have mobility impairments (N = 6) or sensory impairments (N =6) were included in the two panels. From the sensory panel of consumer experts, two were reported being legally blind. They assessed a type reader (e.g., Kurzweil machine), a recording system, and a location based system (Bativia & Hammer, 1990, pp. 429- 430).

The study resulted in a list of 17 factors deemed important by the two panels. They included: effectiveness, affordability, operability, dependability, portability, durability

compatibility, flexibility, ease of maintenance, securability, learnability, personal acceptance, physical security, consumer repair and ease of assembly. Overall, the two panels' top four priorities were consistent (Pearson's r = 0.82). The top four priorities from most important to least important included: effectiveness, affordability, operability and dependability. An important point to note, however, is that when only blind technologies were considered, operability was replaced by portability such that the ranking from most to least important was: affordability, effectiveness, dependability and portability. The stability of these rankings should be further explored with a larger number of persons with vision loss. This study showed that the list of factors was dependent upon the type of technology selected for discussion. For example, if a technology, say a desktop computer, was to be discussed, then it would be unlikely that portability will turn up as a key factor. In other words, this was a useful study as it identified concepts which may affect the selection of ATDs by persons with disabilities. However, it is unknown if the summary of concepts applies to persons with low vision. Furthermore, the consideration of contextual factors, for example as outlined by the HAAT or the MPT was underreported. Thus, knowledge of factors important to product selection for persons with LV requires further examination.

A better understanding of the extant product selection concepts specifically expressed by study participants with LV was achieved through the use of a scoping review of the literature. The scoping review adopted here provided a comprehensive synthesis and coverage (breadth) of the available literature on the topic of product selection for persons with LV (Arksey & O'Malley, 2005). The methodological framework for a scoping review offered by Arksey & O'Malley (2005, p.22) included five stages that were used in this review: Stage 1 – identify the research question; stage 2 – identify relevant studies; stage 3- study selection; stage 4- charting the data and stage 5 - Collating, summarizing and reporting the results.

2.3.1 Stage 1 – Identify the research question.

The research question for the scoping review was as follows: *What key concepts or factors have low vision study participants expressed as being important during selection, usage or abandonment of ATDs or products?* The first point to note about the research

question is that it prompted the selection of studies that were principally qualitative in nature; which was especially amenable to a scoping review as supposed to systematic review (Davis, Drey, & Gould, 2009). As this was a scoping review and not a systematic review, the quality of the studies selected varied greatly and was not assessed (Arksey & O'Malley, 2005). For the overall dissertation purpose of verifying concepts and item generation in the development of an instrument, it was important to err on the side of including more content (breadth) rather than less. The content is used in the subsequent chapters for check of congruency, revision and testing of concepts. Second, the scope of search was widened to include not only those studies that directly asked questions related to LV product selection, but also those that examine usage as abandonment. Two key rationales for this decision were that there exist only a small number of studies that focus on LV product selection, and that several factors for usage and abandonment have been theorized to influence ATD selection (Cook & Polgar, 2008; Riemer-Reiss & Wacker, 2000; Bativia & Hammer, 1990).

2.3.2 Stage 2 – Identifying relevant studies

Eight databases were searched including Abledata, CINAHL, Cochrane Review, EMBASE, Psychinfo, PubMed, SCOPUS and Socindex. Combinations of keywords were used in the search and they included: low vision, visual impairment; adaptive technology, assistive technology, technical aid, technical device, aid, device and technology. The search parameters were limited by context and time (search period) consistent with scoping review methods (Arksey & O'Malley, 2005) which included: English, Adults (18+ years old), between 1984 to 2009 (25 years span) and human (Arksey & O'Malley, 2005). The reasons for these parameters were to include all articles that the primary investigator could analyze and to reflect a time period of growth in recognized ATD usage (National Institute on Disability and Rehabilitation Research, 2006; Cornman, Freedman, & Agree, 2005). Hand searches of relevant journals were also conducted. RefWorks was used as the reference manager to the articles.

2.3.3 Stage 3 – Study selection

Articles are included in the study in accordance with the fit and relevance to the research question (Arksey & O'Malley, 2005). Thus, two key criteria for inclusion of an article in this review were established that: (1) the data presented were collected directly from LV adult participants, and (2) the data relate to factors or concepts that may affect whether the person selects a device or not (e.g., expressed preference). Please refer to Figure 2-4 below for a summary of how the articles were selected in the current review. Articles which did not provide insight on factors/ data that relate to device selection, usage or abandonment were excluded. Articles which presented data that were not directly collected from LV participants, such as opinions, and editorials were excluded. Systematic reviews were excluded but they were reviewed for possible references. Books and conference proceedings which did not provide sufficient information for the interpretation of product selection and related factors or concepts were excluded. In addition, articles related to medical device, diagnostic, surgical and papers that were out of scope (e.g., psychomotor/ tracking type studies, product and service information) were excluded. The initial search resulted in approximately 399 articles. 267 of these were further reviewed (reading of abstracts). 88 of the articles were kept for full reading, and 18 of these were included as part of the review.

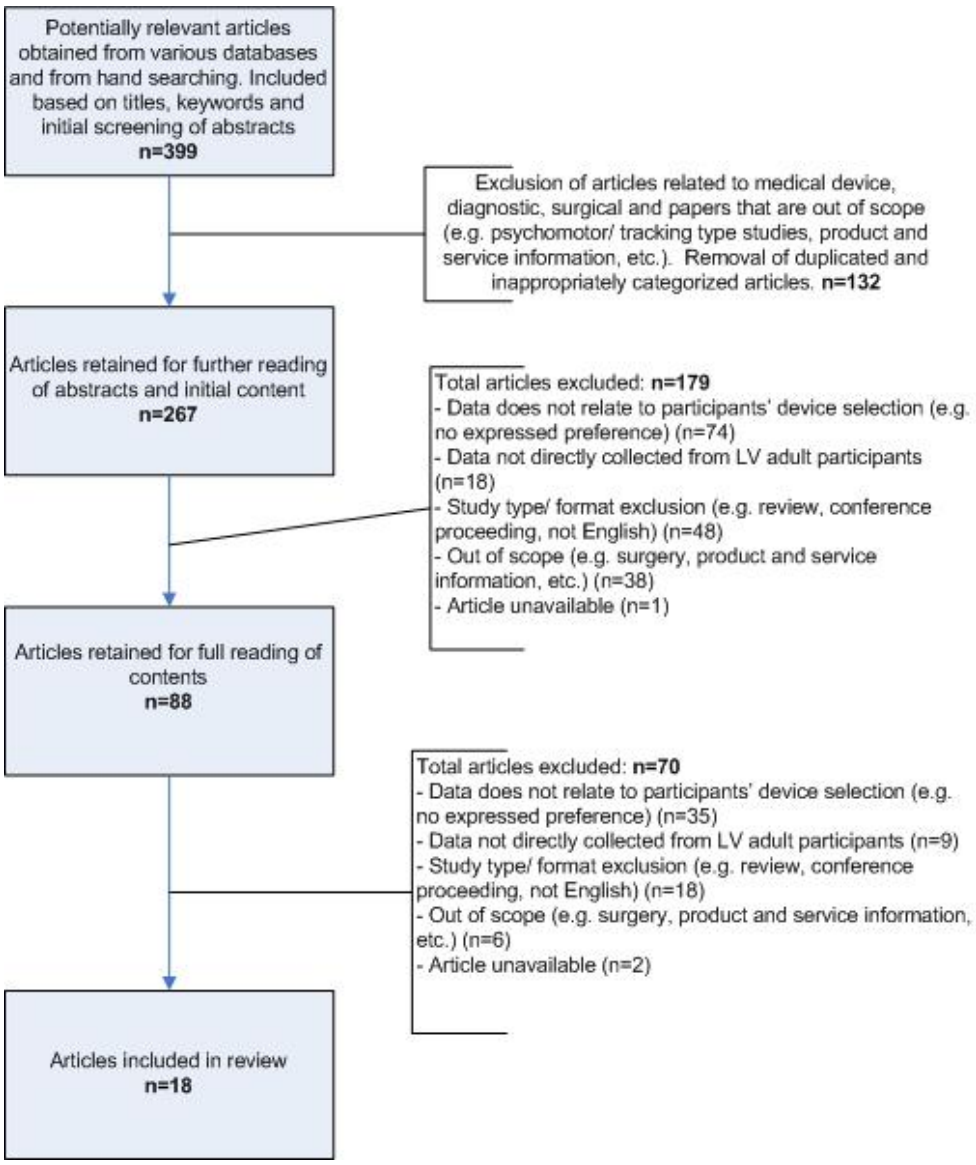

Figure 2-4: A flow summary of the process taken to including relevant articles for the purpose of this scoping review.

2.3.4 Stage 4 - Charting the data

A summary table of the articles included in this review can be found in Table 2-1. The following headings were used:

- Study/purpose – Authors, year of study, purpose of study
- Research design/ participants – Study design type, method type, N, mean age, gender, visual disability/ acuity (if stated) otherwise assume 'low vision'
- Device examined/ Context
- Relevant findings – on selection, usage or abandonment of devices

An effort was made to extract information from the articles using the HAAT model (Cook and Polgar, 2008). Information about the participants, the activity/ occupation performed in particular contexts, as well as the device under examination was included if possible. For ease of access, the studies were listed in alphabetic order.

Table 2-1: Low vision device selection, usage and abandonment: Summary of articles found in the literature

Study/ Purpose	Research Design/ participants	Device examined/ Contexts	Relevant findings – on selection, usage or abandonment of devices
Becker, Wahl, Schilling, and Burmedi (2005) - Exploring the role of control beliefs in assistive device use.	- Cross-sectional and repeated measure - Measures: ATD use and control-theory-related variables; At T1, T2. - N =71 (mean age = 79.5; 26 M, 64 F; Age-related Macular Degeneration, ARMD)	- Visual aids (not including mobility or hearing aids) - Contexts: Participant use of devices in their everyday life.	- Use of technology is predicted by different things at different times. - "We found selective primary control [i.e., invest effort to learn to attain goal] to be a significant predictor of assistive device use at time 1. - After a 1-year period of disease progression, compensatory primary control took over at time 2 [i.e., actually seeking external (ATD, others) for help to reach goal]."
Boulton (1989) - Reporting on clinical evaluation of several ATDs	- Clinical evaluation of equipment by low vision and blind - N = 17 (Age: 21 to 42) - N = 8 (Age: 9 to 20	- CCTV - Keynote (screen reader), talking word processor, Vista (electronic screen magnifier), VTS reporter (portable scan-read machine). - Context: Clinical	- 3 adults felt CCTV would increase work capabilities. - 4 other adults already had CCTV for work use. - 3 homemakers found CCTV useful for recreational reading. - Few participants liked VTS reporter for portability. - One young adult able to use keynote right away. - One adult found keynote invaluable to access information.
Buning and Hanzlik (1993) - Explore adaptive computer use by a person with visual impairment	Single-subject research - Quantitative measure for various types of reading; - Qualitative and quantitative: Occupational Performance History Interview (OPHI) - 31 yrs old, F, legally blind since 19 (acute MD)	- Mac computer, built in screen enlargement, screen reader - Context: Campus apartment	- The subject attributed changes in her roles, role balance, and interest enactment to her increased independence, empowerment and efficiently of time use as a result of her adapted computer system.
Copolillo and Teitelman (2005) - Describe individual factors affecting the likelihood to seek, acquire and use LV ATD.	- Applied ethnography (interview), grounded theory (focus groups) - N = 15 (10 M, 5 F; Mean age = 75.7) - Visual acuity between 20/70 to 20/400 in better eye	- "Low vision assistive device" (LVAD) - Contexts: Study took place in clinical and in home.	Thematic analysis results: 1) Experiences and characteristics leading to successful LVAD use decision making. (a) Positive health care experience, (b) benefits of LVAD, (c) resource exchange (informal network, support group, peers), and (d) savvy consumerism. 2) Challenges to successful LV decision making. (a) Barriers to LVAD use such as negative health care experiences (e.g., lack of discussion of device use or referral to support services) and unmet assistive technology needs (e.g., lack of access to information and

			knowledge of services), and (b) Limits of LVADs – e.g., in describing CCTV limitations the lack of features, clarity, too big, heavy or awkward, and the screen not being wide enough, emerged as issues. 3) Adjustment to LV disability included negative emotional aspects that extended beyond the decision of using a device to the employment of other mechanisms to cope with lifestyle changes. - General: Training and choice of appropriate devices assured continuous use. - Trial-ability and assistance from professional was important during selection. - Device that provides substantial solutions to serious problems preferred. - Devices that are cumbersome and require unreasonable amount of energy to use and provide limited solutions to functional loss are discarded.
Crudden (2002) - Explore and report on challenges of job retention after vision loss.	- Collective case study approach (telephone interview with participant and others such as employer, counselor – specifics not reported) - N = 10 (blind or LV)	- 9 of 10 used computers with assistive technology - Mobility aids - Context considered is work.	- Mobility aid usage for transportation - 1 participant suggested that the use of a cane was like "coming out of the closet" so people would realize the participant is visually impaired. - Impact of computer technology on job retention throughout case studies – positive - However, use of computer technology also source of stress: delay obtaining equipment, fear of not enough time to learn, fear of incompatibility
Culham, Chabra, and Rubin (2009) - Evaluate electronic vision enhancement system - Correlate opinions with performance	- Mixed-methods - N = 10 (ARMD; Mean age 41.8) - N = 10 (Early onset MD; Mean age = 73.5)	- Head mounted devices - Jordy, Flipperport, Maxport, NuVision (participants allowed to change magnification and contrast to their liking) - Contexts: Study took place in the laboratory and at the participant's home (where they were allowed to take the machine)	- 1/3 said no instructions needed. May reflect "try and see approach rather than labouring through written instructions." - Extensive training not required as long as they demonstrate they can use the device before going home. - On-going support and training may be useful. - Important features: magnification, comfort (weight not size); but only magnification was significantly predictive of rating - Newly diagnosed respond more positively - "Knowing what performance aspects influence user opinion" may help curb abandonment. - Threshold effect – 'good enough' performance (ratings increase up

			to reading of 60 wpm with device)
de Jonge, Rodger, and Fitzgibbon (2001) - Describe and understand factors perceived as important in integrating technology in the workplace (and barriers)	- Qualitative (thematic analysis) - N =15 with disability (4 with vision impairment) - N = 8 employers - N = 4 co-workers	- Braille printer, text-to-speech engine. - Contexts: Comments based on the workplace.	- Only few results were vision specific - Text to speech required extra concentration creating mental strain for one participant. - 1 participant was conscious of her Braille printer being distracted to others in the work environment.
Gerber (2003) - Benefits and barriers to computer use	- Four focus groups - Total N = 41 - Blind or visually impaired	- Computers - 35/41 mention use at work, other consideration of contexts of use – library, school, home; emphasis on reading - Considering lack of selection at malls, computer shops	Benefits: - Independence, personal meaning (being employable), self esteem, freedom/ liberty/ flexibility in access to information through internet, expression (better writer), connecting with others and the world Barriers: - Lack of training, cost for training, accessibility, technical jargons (want simplicity), dependence on sighted people (e.g., setup), change to graphic from text based operating system, low quality - "Lack of available, accessible information and inability to choose from a wide variety of products or to comparison shop…", need to know more (e.g., compatibility), lack of technical help, accessibility (menu driven display, touch screen)
Lines and Hone (2006) - Evaluation of speech output in interactive domestic alarm systems (IDAS) to support older adults	- Mixed three-factorial 2x(2x2) experimental design and subjective feedback (IV: environmental condition, speech source and speech gender; DV: participant evaluations). N = 32 adults 65+ (15 M, 17 F)	- Speech output from a laptop computer. - Context: Laboratory	- Natural male speech output preferred over synthetic in quiet conditions Post hoc tests reveal: - Natural speech significantly more 'pleasant', 'intelligent', 'less boring', 'less irritating', and more 'natural'. - Natural male speech significantly clearer than the synthetic male speech and natural female speech. - Male speech evaluated as more 'pleasant', more 'intelligent', less 'boring', less 'irritating', and more 'natural' than female speech. - Synthetic speech outputs were evaluated as more natural in noise conditions.
Lowe and Rubinstein (2000) - Surveying success and	Retrospective survey of LV patients Questionnaire 1 (Q1) N = 87	- Distance telescope - Contexts: Q2 reports usage of distance telescope in 6	- Q1 : Ease and frequency of use are significantly associated. - Q2:: From the "least successful group." Reason for disuse by 8 participants – too heavy; too unsteady for occupation (e.g., watch

failures in use of distance telescopes	Q2 N = 74	indoor and 11 out of home contexts.	TV); focusing is too difficult; cannot see out of telescope; feels unsafe using it; causes headaches; wants appropriate magnification; do not understand how to use. - From "success" group (N=57, 77% of sample) minor adaptive difficulties from 8 other participants – limited field feels unsafe for crossing road; difficult to locate area required, difficult watching moving objects or sports; cannot walk around out of doors using telescope and limits peripheral; cannot use on the move; limited light intake; prefers fuller field for TV, difficult changing from telescope to glasses and vice versa; would want hands free; greater magnification for same size and bulk ideal.
Mann, Goodall, Jutiss, and Tomita (2002) - Report on use and dissatisfaction of ATDs in a frail elderly sample	Survey within a longitudinal study of the coping strategies of elders with disabilities. N = 1056 frail elderly (N = 873 identified reasons for no using or being dissatisfied with particular ATDs; N = 397 (fair, poor, totally blind)	- Canes, magnifiers and other technology - Context: face- to-face interviews in participants' home	- Owned but not used: Canes 32.4%; Magnifiers 26.5% not used; Eyeglasses (6%) - Reasons for non-use or dissatisfaction of magnifiers listed from highest frequency count (only include when two or more people cite as an issue): Magnification not strong enough, device too small, does not help, Vision deteriorate, no longer helpful, print appears blurry or distorted, light too strong, too much glare, can't focus well with it, can't use properly; gets nauseated, damaged, difficult to hold, easier to use glasses, field of view very small, need light, not needed, scratched, too slow to use
Mann, Hurren, Karuza, and Bentley (1993) - Examine use and need for AD	Intensive interviews N=30 (2 fair vision – could still do some reading, 20 poor vision who could not read, 8 totally blind)	- Vision devices, physical disability devices, tactile devices, hearing devices, cognitive devices, other devices. - Context: Interviews done in home of participants.	- Participants report problems with 79 devices. - 59 no longer used, and 20 were used occasionally. - Example problems: glare, fear of victimization, embarrassment, and stigma (white cane, poor quality hearing aid, binoculars that were too heavy and too conspicuous, writing guide that was not worth the trouble. - Many of the participants did not have the latest information on ATD.
Okada and Kume (1999) - CCTV user survey and then prototyping and testing	Survey (no information provided on type of survey) of current CCTV users N = 115 (Mean age =33.5; 75M, 40 F)	- CCTVs (including portable). – Contexts: N=89 responded to context question (Office =26, School = 3, home = 60)	- Reasons for selecting: **Clear monochrome-reverse-image (N=44), high magnification (40), easy manipulation of control panel (29), **color image (24), low price (23), large working distance between camera and tray (21), smooth moving tray (17), small dimensions (16), clear monochrome-normal-image (15), large display area (11), portability (11), good design of appearance (11) - Major demand factors for improvement: Small size, light weight

			(40), large movement of try table (10), wide range of magnification (13), large focal/ field depths (12), automatic focusing (13), **color display (16), **monochrome reverse display (15), easy manipulation (13), adjustment of monitor's height and angle (6) **concept related to "contrast"
Ryan, Anas, Beamer, and Bajorek (2003) - Assess impact of vision loss on reading for leisure and IADL.	- In-depth semi-structured interviews - Visually impaired (moderate and severe) - N = 11 (pilot) - N = 26 (18 F, 8 M; Mean age =78.5)	- Low and high tech reading aids (magnifiers, felt pens, high intensity lamps, talking books, CCTVs, computers. - Context used: various	- Qualitative findings: Reading aids only part of compensatory options. - Computers had advantages but also drawbacks – inaccessibility, inconvenience, lack of computer training (wait list), did not know how to change settings. - Some gave up because "it did not seem worth the effort." - 1 participant suggests that his computer system to be "slow" and voice output "not pleasant." - Some participants experience frustration using ATD. E.g., magnifiers easily misplaced, unsuited for some tasks, lack of magnification adjustability. - Authors suggest guidance in selection is important.
Stone, Mann, Mann, and Hurren (1997) - Identify factors to dissatisfaction of magnifier use	- N = 15 (14 with poor vision, 1 with fair vision) 4 steps: - interview at home - try out and choose magnifier and light arrangement with staff at clinic - magnifier/ lighting arrangement brought to home and shown how to use the system by staff - follow-up by telephone after 2 weeks. - Case studies presented	- Magnifiers - Contexts: Trial at clinic and home.	- 2 of 3 case studies included: - Case study 1: Non-use of previous magnifier because too bulky and cumbersome. Likes new magnifier as it provides "sharp" image and allow her to read more than one word at a time. Magnifier and light combination allowed her to see print she was unable previously. Found the small handheld magnifier effective in restaurants and fitted easily in her purse (portability) which was important. - Case study 2: Felt power of his old magnifier not strong enough. Liked new magnifier, light not essential. Follow up call, participant able to read mail independently. - General: Necessary – on going assessment, examine lighting, provide information about available magnifiers, importance of in-home testing and assessing the environment.
Wagner, Vanderheiden, and Sesto (2006) - To examine enlargement features on cell phones.	- Mixed-methods with quantitative and qualitative results of control verse enlargement.	- Cell phone with enlargement feature - Context: Unspecified	- Quan: Significant improvement in dialing accuracy between control and the composite mode (participant selection of enlargement technique) - Qual: Enlargement feature was "nice to have" for some operations

	- N = 8 (6 F, 2M; Mean age = 61)		- Additional comment on: Shape, tactile feedback, contrast, layout of buttons, difficulty in pressing keys.
Williamson, Albrecht, Schauder, and Bow (2001) - What are the attitudes and experiences of visually impaired persons (VIP) and professionals toward accessing information through the internet	- Focus groups and interviews - N = 31 (20 legally blind)	- Access technology such as JAWS, and Zoomtext. - Context: of considered use is on the internet.	- Questions: Why are some visually impaired persons not using Internet yet? 1) Availability of other source of information 2) Cost (including maintenance) 3) Fear of technology especially in older participants (also within this theme is aesthetics and the fact that the technology is "conspicuous") 4) Difficulties using adaptive equipment and software (example given on abandonment due to unreliable performance) 5) Difficulties obtaining training in their use especially in rural area. - Additional factors of importance: Role of support from disability organizations (e.g., support independence), personal networks of support.
Wolffe, Candela, and Johnson (2003) - Reporting on discussions regarding AT training issues	Focus groups (8 consumer focus groups, 4 trainers), inductive data analysis procedure, thematic analysis N = 55 legally blind	- "Technology" for visual impairment – those that require training (e.g., computer, *mainstream* software, electronic screen reader, magnifiers, and scanner) - Context: Focus group setting across the US	- Qualitative data of importance and influences of training - 3 themes from visual impairment groups: 1) Adequacy of training (positive, negative, neutral) 2) Critical needs for AT training (hardware and software issues; core curriculum concerns, life/employability skills; gaining access to training and support services) 3) Work-related challenges of the participants during and after training (unmet equipment and software needs, difficulty finding jobs, physical limitations from diminished vision, lack of training needed to fulfill their job responsibilities)

2.3.5 Stage 5 - Collating, summarizing and reporting the results.

A majority of the 18 studies included were qualitative in nature using focus groups, interviews and related qualitative techniques (N = 11). The remaining studies may be broadly classified as quantitative or mixed-methods, using different permutations of survey designs and objective measures. It is important to note that studies were excluded if only objective measures were used, such as reading rate, and time-to-complete tasks, without a report of the subjective assessment of the performance from the participant. Data from Table 2-1 were used in two steps to collate, summarize and report the results obtained from the scoping review.

First, as the table was structured to map elements of each study to the HAAT model (Cook & Polgar, 2008), a summary description of the realm and range of the studies included based on the components of the model is provided:

1. Human: As expected, many of the studies included older adults (65+ years of age). Several studies also reported on data collected from adults (18 to 65 years of age). Although the primary interest of this dissertation was in adults with low vision, in this review, one study included children (Boulton, 1989), and at least four studies included participants who were blind (Crudden, 2002; Gerber, 2003; Mann, Goodall, Jutiss, & Tomita, 2002; Mann, Hurren, Karuza, & Bentley, 1993). These studies also provided relevant data from LV participants on selection, usage, and abandonment, so it was important that they were included. There was a discrepancy in the reporting of the visual condition of the participants between studies. The manner of reporting used in the studies included: Medical diagnosis (e.g., ARMD, early onset MD), visual acuity, and/ or categories of vision loss such as ‘severely or moderately visually impaired’, ‘legally blind’, ‘visually impaired’ or ‘low vision’. The inconsistency in the reporting of the participants’ visual conditions made it difficult to compare the results obtained between studies.

2. Activities (or occupations): The activities or occupations were not always

reported. Some sample occupations reported include: reading, crossing roads, using the computer, and dialing a number.

3. ATDs and commercial products: The products of interest in the respective studies included computers with adaptive software, portable CCTVs, text-to-speech engines, distance telescope, canes, magnifiers, and cell phones.

4. Context: 12 of the 18 studies provided some form of contextual information which afforded partial insight to the reader as to the situation and setting in which ATDs were used. Examples of setting or situational information included the selection or use of ATDs in a campus apartment, at the workplace, at home, and at a shopping mall. Five other studies focused on a description of the context in which the studies themselves took place (e.g., laboratory, room for conducting focus groups, clinic, and at a person's home). One study did not provide context information that pertained to the two categories of context mentioned above.

Second, a thematic analysis of the data from Table 2-1 for the purpose of collating concepts that related to LV product selection followed to provide a narrative understanding. Thematic labels and statements were generated iteratively through constant comparison of codes, groups of codes, notes and with the actual articles included in the review. Overall, five themes emerged and are summarized below.

1. Visual attributes: Refers to a product's function or features which allow persons with low vision to use their residual vision to conduct meaningful occupations. Several visual attributes of the products were deemed as important to consider. First, *magnification* strength, or the ability to have or adjust to the magnification that is appropriate for the user seems to be an important aspect in contributing to LV product selection, usage and abandonment (Culham, Chabra, & Rubin, 2009; Lowe & Rubinstein, 2000; Mann, Goodall, Jutiss, & Tomita, 2002; Okada & Kume, 1999; Stone, Mann, Mann, & Hurren, 1997; Wagner, Vanderheiden, & Sesto, 2006) A second important visual attribute of a product is its ability to provide *good contrast* (Wagner, Vanderheiden, & Sesto, 2006). In the summary of the survey to evaluate CCTVs, Okada & Kume (1999) suggested that clear

monochrome-reverse-image and color image/ display was relevant to the factor of contrast. Furthermore, appropriate lighting may be important to bring out good contrast (Stone, Mann, Mann, & Hurren, 1997). Though not mentioned as often as magnification or contrast in the literature, other visual attributes of the product such as *good clarity* (Copolillo & Teitelman, 2005), *low glare* (Mann, Goodall, Jutiss, & Tomita, 2002), and appropriate *sharpness* (Stone, Mann, Mann, & Hurren, 1997) have also appeared in the data in this review.

2. Access to information: Refers to the access of electronic or printed material to learn about the products or services. Two separate factors or criteria are necessary for successful access to information. The first factor refers to accessibility and the availability of information about a product or a service which may be important in deciding whether to obtain a product or not, or how to set it up (Copolillo & Teitelman, 2005; Gerber, 2003; Mann, Hurren, Karuza, & Bentley, 1993; Ryan, Anas, Beamer, & Bajorek, 2003; Williamson, Albrecht, Schauder, & Bow, 2001). Second, access to information may require the use of products (e.g., magnifier, CCTV, computer and the internet) to obtain or read the information (Boulton, 1989; Gerber, 2003). This theme does not include training which is the next theme discussed.

3. Training: Refers to the varying degrees of necessary instructions and/or hands-on training for a person with LV to use a product. One determinant of obtaining the necessary training is the factor of *training availability* (Copolillo & Teitelman, 2005). Lack of available training (e.g., long wait lists, no training facility) and high cost for training were considered as barriers to LV product use (Gerber, 2003; Ryan, Anas, Beamer, & Bajorek, 2003; Williamson, Albrecht, Schauder, & Bow, 2001). Wolffe, Candela, and Johnson (2003) reported on a comprehensive focus group study (8 consumer focus groups, N = 55 legally blind) which looked at issues that relate to low vision product training (e.g., computer, mainstream software, electronic screen reader, magnifiers, and scanners). A thematic analysis revealed three main themes from the visual impairment groups. These included: (1) Adequacy of training (positive, negative, neutral); (2) critical needs for ATD

training (hardware and software issues; core curriculum concerns, life/employability skills; gaining access to training and support services); and (3) work-related challenges of the participants during and after training (e.g., unmet equipment and software needs, difficulty finding jobs, physical limitations from diminished vision, lack of training needed to fulfill their job responsibilities). In addition to learning about a LV product or how to use a product through product information, the *trialability* (Rogers, 2003) of a product is also important. This finding was supported by several studies (Copolillo & Teitelman, 2005; Culham, Chabra, & Rubin, 2009).

4. Meaning: A fourth theme can be broadly referred to as the meaning associated by the person with the LV product. Some LV products may be a source of empowerment to the person selecting and using them and as well, a support for personal independence (Buning & Hanzlik, 1993). For example, Gerber (2003) concluded, from qualitative focus group data obtained, that the use of computers may benefit the individual by supporting independence, personal meaning (being employable), increasing self esteem, and promoting freedom and liberty. Alternately, it is important to note the feeling of being stigmatized by the use of the white cane by some has not gone away (Crudden, 2002; Spencer, 1998). Mann, Hurren, Karuza, and Bentley (1993) found that some participants had a fear of victimization, embarrassment and stigma with the use of the white cane. The ability to be 'conspicuous' or 'fit-in' when using a low vision product may be important for some people with low vision for safety, and aesthetics reasons (Mann, Hurren, Karuza, & Bentley, 1993; Williamson, Albrecht, Schauder, & Bow, 2001; Okada & Kume, 1999).

5. Performance: Finally, the LV product's ability to support occupational *performance* may be a last key theme extracted from the review. Several studies have pointed to the expressed need by participants to be productive and to maintain or increase work capabilities (Boulton, 1989; Buning & Hanzlik, 1993; Culham, Chabra, & Rubin, 2009). The functions and features of the low vision product including whether or not it is portable has been identified by numerous

studies as being important during selection and use processes (Boulton, 1989; Copolillo & Teitelman, 2005; Okada & Kume, 1999; Stone, Mann, Mann, & Hurren, 1997).

2.3.6 Discussion

The use of the scoping review on the existing literature was well suited for the identification of extant concepts that LV participants may have identified in their decision to select, use or abandon ATDs or some commercial products. For systematic reviews which considered more objective measures related to the use of LV ATDs, the reader is referred to Jutai, Strong, and Russell-Minda (2009), Virgili and Rubin (2006), Virgili and Acosta (2010) and, Wolffsohn and Peterson (2003). Although it was not possible to map every study onto the components of the HAAT model (Cook & Polgar, 2008), the analysis showed that the studies included persons with varying degrees and definitions of low vision, as well as, the examination of a variety of ATDs. To the latter point however, it is important to emphasis that the ATDs examined were not necessarily in the context of LV ATD selection. With the exception of a study by Copolillo and Teitelman (2005), the lack of studies that include direct research questions related to LV ATD selection presented a major gap in the literature. Copolillo and Teitelman's study (2005) is reviewed later on after a discussion of the thematic analysis that resulted.

The thematic analysis of the 18 studies with data on product selection, usage and abandonment from LV participants suggested that the themes of visual attributes, access to information, training, meaning and performance were important considerations. When comparing the selection concepts identified through this scoping review to those found in the general ATD literature, there are two aspects that need to be highlighted. The current review added content that may be specific to LV product selection through the themes of visual attribute and access to information. Visual attributes of a product such as its magnification strength, contrast, brightness, clarity, lack of glare, and sharpness emerged from the thematic analysis. These attributes may be added to cross-disability ATD selection tools (e.g., see Scherer, 1998) as considerations for product selection upon psychometrics testing. Access to information and the concepts that resulted should also be further considered during product selection. Access to information through available,

alternative format and device supported means have been under considered, and are especially important for persons with LV in the performance of everyday meaningful occupations (Fok & Sutarno, 2003). The three remaining themes are generally congruent with selection factors that have been deemed important in the general ATD and occupational therapy literature (Cook & Polgar, 2008; Scherer et al., 2007). For example, the meaning that a person ascribes to a device, above and beyond how it functions, has been expressed in the literature as an important factor in gauging whether someone would ultimately accept or reject the device (Hocking, 1999; Pape, Kim, & Weiner, 2002; King, 1999; Spencer, 1998).

As mentioned, there was one key study reviewed in which the research question tapped into LV ATD selection. Copolillo and Teitelman (2005) reported on an applied ethnography (interviews) and grounded theory approach (focus groups) study which involved 15 participants with low vision. The purpose of the authors' interviews and focus groups was to understand how the participants plan to acquire LV ATDs, integrate them into daily life and to "seek general reactions to current or potential LV ATD use" (Copolillo & Teitelman, 2005, p. 308). A thematic analysis of the data revealed three major themes including: Experiences and characteristics leading to successful LV ATD use decision making, challenges to successful LV decision making, and adjustment to LV disability. Of all of the studies reviewed, this study was perhaps the most relevant and valuable in providing information about LV ATD selection. However, it is important to point out several study limitations. First, the authors did not provide the types and range of LV ATDs that were examined by the participants, although some narratives presented did provide context in which the ATD was assessed. As shown previously in the review of Bativia and Hammer's (1990) study, the ranking of important factors (e.g., for selection criteria) may be dependent on the types of ATDs assessed. In addition, some factors may not be applicable at all depending on the type of ATD discussed. It was unclear why certain ATDs and their features/ issues were highlighted while others were not. Furthermore, while the authors stated that the participants had a range of experience, the study may be strengthened by a better understanding of the types of technologies that were being used by the participant, their comfort level with them and their pre-dispositions to using other technologies (Scherer, 1998). The additional data on

technology usage experience may be especially important given the age restriction to be able to enter the study (55 years old or above) and the average age of the LV participants that were actually sampled (mean age = 75.7, range =56 to 90). Lastly, it seemed that the discussions of mainstream products, which may be just as important to occupational performance, were out of scope in Copolillo and Teitelman's (2005) study.

Findings from this scoping review point to the need for future primary research specifically focused on product selection with low vision participants. Several recommendations for future research may be made to address the gaps identified. More research questions directly related to the *selection of products* should be raised. There are two separate but related points here. First, the studies that were included in this scoping review were mostly related to usage and to some extent abandonment of LV products. Though concepts related to usage and abandonment may be related to selection, this assertion needs to be validated with persons with LV. Second, while LV ATDs are important, the use of commercial products, especially in the contemporary information driven milieu for the performance of meaningful occupation, is paramount for persons with LV (Greenfield, 2006; Fok, Polgar, Shaw, Luke & Mandich, 2009). Six of the 18 studies in this review considered mainstream commercial product that may be used by persons with LV (Buning & Hanzlik, 1993; Crudden, 2002; Gerber, 2003; Lines & Hone, 2006; Wagner, Vanderheiden, & Sesto (2006); Wolffe, Candela, & Johnson, 2003). Therefore, it is no longer acceptable to ignore commercial products, especially information and communication (ICT) technology that may be useful for persons with LV to perform occupations (Greenfield, 2006; Fok et al., 2009). From the review, the *selection* of these products by persons with LV has been understudied and requires further examination. As suggested, including a wide range of LV participants in related studies in the future such as a younger cohort to supplement the work of Copolillo & Teitelman (2005), who may or may not use different types of products, would be beneficial. A framework such as the HAAT model (Cook & Polgar, 2008) may be helpful to gain a more systematic understanding of the products being assessed, its relation with persons using the product and the activities being conducted with the products, in various contexts.

2.4 Conclusions

For persons with LV, the performance of many daily occupations may be achieved through the use of products including ATDs. To elaborate, the performance of occupation by an individual is the important piece, but the product which may allow for the performance should not be overlooked. Studies have shown to varying degrees that the use of products by persons with LV may allow for the performance of occupations, thereby mitigating some of the serious consequences of occupational deprivation. As such, a proper matching of a person with LV and the product that may help with the performance of occupations is paramount. Literature exists from within and outside of the ATD field to guide the process of product selection through conceptual model/ frameworks, as well as provide factors that are deemed to be important to product selection. For example, the HAAT model (Cook & Polgar, 2008) and the MPT model (Scherer, 1998) may be useful heuristic tools for ATD provision and research evaluation (Lenker & Paquet, 2003). Rogers' model (2003) provides additional generic factors that may be considered during product selection by a consumer. Together, these models provided important backdrops of considerations that may be useful for a person with LV during product selection. However, more LV domain specific considerations need to be made available.

A scoping review of the literature for breadth of product selection considerations from LV study participants revealed that few studies have looked at the issue directly. A thematic analysis of the 18 studies with data on product selection, usage and abandonment from LV participants suggested that the themes of visual attribute, access to information, training, meaning and performance were important. Future primary research specifically focused on product selection with LV participants is necessary to validate the findings of the scoping review. Furthermore, the use of a framework such as the HAAT model or MPT model in related future qualitative or quantitative inquiry should be considered. The use of a framework will also foster ease of comparison between studies promoting the growth of the field of LV product selection. Overall, the aim of the scoping review was achieved. The review identified and synthesized a breadth of the perceived LV product selection factors or concepts that were used for the interpretation

of the qualitative data collected, especially in Chapter 4, and to provide a backdrop for item generation that took place in the development of the LV-PSI in Chapter 5 of this dissertation.

2.5 References

Arksey, H. & O'Malley, L. (2005). Scoping studies: towards a methodological framework, *International Journal of Social Research Methodology, 8*(1), 19-32.

Batavia, A. I., & Hammer, G. S. (1990). Toward the development of consumer-based criteria for the evaluation of assistive devices. *Journal of Rehabilitation Research and Development, Fall, 27*(4), 425-436.

Becker, S., Wahl, H., Schilling, O., & Burmedi, D. (2005). Assistive device use in visually impaired older adults: Role of control beliefs. *The Gerontologist, 45*(6), 739-746.

Boulton, L. M. (1989). A clinical evaluation of equipment which allows the partially sighted and blind to access computer-based information. *Australian and New Zealand Journal of Ophthalmology, 17*(1), 87-93.

Buning, M. E., & Hanzlik, J. R. (1993). Adaptive computer use for a person with visual impairment. *American Journal of Occupational Therapy, 47*(11), 998-1008.

Cardol, M., de Haan, R.J., van den Bos, G.A., de Jong, B.A. & de Groot, I.J. (1999). The development of a handicap assessment questionnaire: The Impact on Participation and Autonomy (IPA). *Clinical Rehabilitation,13,* 411-419.

Christiansen, C.H. & Townsend, W.A. (2004). *Introduction to occupation: The art and science of living*. Upper Saddle River, New Jersey: Prentice Hall.

Clark, F., Parham, D., Carlson, M. E., Frank, G., Jackson, J., Pierce, D., et al. (1991). Occupational science: Academic innovation in the service of occupational therapy's future. *American Journal of Occupational Therapy, 45*, 300-310.

Cook, A.M. & Polgar, J.M. (2008). *Cook & Hussey's assistive technologies: Principles and Practice (3rd edition).* St. Louis, MO: Mosby Elsevier.

Copolillo, A., & Teitelman, J. L. (2005). Acquisition and integration of low vision assistive devices: Understanding the decision-making process of older adults with low vision. *American Journal of Occupational Therapy, 59*(3), 305-313.

Cornman, J.C., Freedman, V.A., & Agree, E.M. (2005). Measurement of assistive device use: Implications for estimates of device use and disability in late life. *The Gerontologist, 45*(3), 347-358.

Crudden, A. (2002). Employment after vision loss: Results of a collective case. *Journal of Visual Impairment & Blindness, 96*, 615-622.

Culham, L. E., Chabra, A., & Rubin, G. S. (2009). Users' subjective evaluation of electronic vision enhancement systems. *Ophthalmic & Physiological Optics : The*

Journal of the British College of Ophthalmic Opticians (Optometrists), 29(2), 138-149.

Dahlin Ivanoff, S., & Sonn, U. (2005). Assistive devices in activities of daily living used by persons with age-related macular degeneration: A population study of 85-year-olds living at home, *Scandinavian Journal of Occupational Therapy, 12*(1), 10-17.

Davis, K., Drey, N., & Gould, D. (2009). What are scoping studies? A review of the nursing literature. *International Journal of Nursing Studies, 46,* 1386-1400.

de Jonge, D., Rodger, S., & Fitzgibbon, H. (2001). Putting technology to work: Users' perspective on integrating assistive technology into the workplace. *Work, 16*(2), 77-89.

Demers, L., Weiss-Lambrou, R. & Ska, B. (1996). The Quebec user evaluation of satisfaction with assistive Technology: QUEST. *Assistive Technology, 8*(1), 3-13

Fok, D. & Sutarno, C. (2003). Overcoming barriers: Workplace accommodations for people with vision impairment, in: *Proceedings of the 34th Annual Conference of the Association of Canadian Ergonomist*, London, ON.

Fok, D., Polgar, J., Shaw, L., Luke, R. & Mandich, A. (2009). Cyberspace, real place: Thoughts on 'doing' in contemporary occupations. *Journal of Occupational Science, 16*(1), 38-43.

Fuhrer, M.J., Jutai, J.W., Scherer, M.J., & DeRuyter, F. (2003). A framework for the conceptual modeling of assistive technology outcomes. *Disability and Rehabilitation, 25*, 1243- 1251.

Gerber, E. (2003). The benefits of and barriers to computer use for individuals who are visually impaired. *Journal of Visual Impairment & Blindness, 97*(9), 536-550.

Gitlin, L.N. (1998). From hospital to home: Individual variations in experience with assistive devices among older adults. In D.B. Gray, L.A. Quatrano, & M.L. Lieberman (Eds.), *Designing and Using Assistive Technology: The Human Perspective* (pp. 117-135). Baltimore, MD: Paul H. Brookes Publishing Company.

Greenfield,A. (2006). Everyware: The dawning age of ubiquitous computing. Berkeley,CA: New Riders.

Hocking, C. (1997). Person-object interaction model: Understanding the use of everyday objects. *Journal of Occupational Science, 4*(1), 27-35.

Hocking, C. (1999). Function or feelings: Factors in abandonment of assistive devices. *Technology and Disability, 11*, 3-11.

Horowitz, A., Brennan, M., Reinhardt, J. P., & MacMillan, T. (2006). The impact of assistive device use on disability and depression among older adults with age-related vision impairments. *Journals of Gerontology Series B: Psychological Sciences & Social Sciences, 61B*(5), S274-80.

Huber J.G., Jutai J.W., Strong J.G., Plotkin A.D. (2008). The Psychosocial Impact of Closed-Circuit Televisions on Persons with Age-Related Macular Degeneration. *Journal of Visual Impairment and Blindness*, 102 (11), 1-19.

Jutai, J.W., Strong, G. & Russell-Minda, E. (2009). Effectiveness of assistive technologies for low vision rehabilitation: A systematic review. *Journal of Visual Impairment & Blindness, 103*(4), 210-222.

King, T. W. (1999). Assistive technology: Essential human factors. Boston, MA: Allyn and Bacon.

Law, M., Baptiste, S., Carswell, A., McColl, M. A., Polatajko, H., & Pollock, N. (1998). *Canadian Occupational Performance Measure* (3rd ed.). Ottawa, Ontario: CAOT Publications.

Lenker, J. and Paquet, V. (2003). A review of conceptual models for assistive technology use and outcome. *Assistive Technology, 15*(1): 1-15.

Lines, L., & Hone, K. S. (2006). Multiple voices, multiple choices: Older adults' evaluation of speech output to support independent living. *Gerontechnology, 5*(2), 78-91.

Lowe, J. B., & Rubinstein, M. P. (2000). Distance telescopes: A survey of user success. *Optometry and Vision Science : Official Publication of the American Academy of Optometry, 77*(5), 260-269.

Mann, W.C., Goodall, S., Jutiss, M.D., and Tomita, M. (2002). Dissatisfaction and nonuse of assistive devices among frail elders. *Assistive Technology, 14* (2): 130-139.

Mann, W. C., Hurren, D., Karuza, J., & Bentley, D. W. (1993). Needs of home-based older visually impaired persons for assistive devices. *Journal of Visual Impairment and Blindness, 87*(4), 106-110.

National Institute on Disability and Rehabilitation Research. (2006). Notice of final long-range plan for fiscal years 2005-2009. *Federal Register, 71*(31), 8165-8200.

Nelson, D. L., & Jepson-Thomas, J. (2003). Occupational form, occupational performance, and a conceptual framework for therapeutic occupation. In P. Kramer, J. Hinojosa & C. B. Royeen (Eds.), *Perspectives in human occupation: Participation in life* (pp. 87-155). Baltimore, MD: Lippincott Williams & Wilkins.

Norman, D. A. (1988). *The psychology of everyday things.* New York, NY: Basic Books.

Okada, S., & Kume, Y. (1999). CCTV user survey and prototypes based on the survey results. *Technology & Disability, 11*(3), 123-131.

Pape, T., Kim, J., & Weiner, B. (2002). The shaping of individual meanings assigned to assistive technology: A review of personal factors. *Disability and Rehabilitation, 24*(1/2/3), 5-20.

Polgar, J. M., & Landry, J. E. (2004). Chapter 9: Occupation as a means for individual and group participation in life. In C. H. Christiansen, & W. A. Townsend (Eds.),

Introduction to occupation: The art and science of living (pp. 197-220). Upper Saddle River, New Jersey: Prentice Hall.

Reimer-Reiss, M. & Wacker, R. (2000). Factors associated with assistive technology discontinuance among individuals with disabilities. *Journal of Rehabilitation, 66*(3), 44-49.

Rogers, E.M. (1995). *Diffusion of innovations (4th edition)*. The Free Press. New York.

Rogers, E.M. (2003). *Diffusion of Innovation (5th edition)*. New York, NY: Free Press.

Roulstone, A. (1998). *Enabling technology: Disabled people, work and new technology.* Philadelphia, PA: Open University Press.

Ryan, E. B., Anas, A. P., Beamer, M., & Bajorek, S. (2003). Coping with age-related vision loss in everyday reading activities. *Educational Gerontology, 29*(1), 37-54.

Scherer, M., & Craddock, G. (2002). Matching person and technology (MPT) assessment *Technology and Disability, 14,* 125-131.

Scherer, M. (1998, Revision of 1994, 1991 and 1989 Editions). *The matching person & technology (MPT) Model Manual.* Webster, NY: The Institute for Matching Person & Technology, Inc.

Scherer, M., Jutai, J., Fuhrer, M., Demers, L., & DeRuyter, F. (2007). A framework for modeling the selection of assistive technology devices (ATDs). *Disability and Rehabilitation, 2*(1), 1-8.

Scherer, M., Sax, C., Vanbiervliet, A., Cushman, L., & Scherer, J. (2005). Predictors of assistive technology use: The importance of personal psychosocial factors. *Disability and Rehabilitation, 27*(21), 1321-1331.

Spencer, J.C. (1998). Tools or baggage? Alternative meanings of assistive technology. In D.B. Gray, L.A. Quatrano, & M.L. Lieberman (Eds.), *Designing and Using Assistive Technology: The Human Perspective* (pp. 89-97). Baltimore, MD: Paul H. Brookes Publishing Company.

Stalvey, B., Owsley, C., Sloane, M.E., & Ball, K. (1999). The life space questionnaire: A measure of the extent of mobility of older adults. *Journal of Applied Gerontology, 18,* 479-498.

Stone, J., Mann, W., Mann, J., & Hurren, D. (1997). Use of magnifiers by older persons with low vision. *Technology & Disability, 6*(3), 169-175.

Strong, G., Jutai, J., Bevers, P., Hartley, M., & Plotkin, A. (2003). The psychosocial impact of closed-circuit television low vision aids. *Visual Impairment Research, 5*(3), 179-190.

Trachtman, L. (1998). User-centered design: Principles to live by (editorial). *Assistive Technology, 10*(1), 1-2.

Vanderheiden, G. C. (1998). Universal design and assistive technology in communication and information technologies: Alternatives or complements? *Assistive Technology, 10*(1), 29-36.

Virgili, G. & Rubin, G. (2006). Orientation and mobility training for adults with low vision. *Cochrane Database Systematic Review,3*:CD003925.

Virgili, G. & Acosta, R. (2010). Reading aids for adults with low vision. *Cochrane Database Systematic Review, 5*:CD003303.

Wagner, J., Vanderheiden, G. C., & Sesto, M. E. (2006). Improving the usability of a mainstream cell phone for individuals with low vision. *Journal of Visual Impairment and Blindness, 100*(11), 687-692.

Whiteford, G. (2004). Chapter 10: When people cannot participate: Occupational deprivation. In C. H. Christiansen, & W. A. Townsend (Eds.), *Introduction to Occupation: The art and science of living* (pp. 221-242). Upper Saddle River, New Jersey: Prentice Hall.

Wilcock, A.A. (1993). A theory of the human need for occupation. *Journal of Occupational Science, 1*(1), 17-24.

Wilcock, A. (Ed.). (2006). *An occupational perspective of health (2nd edition)*. New Jersey: Slack Incorporated.

Williamson, K., Albrecht, A., Schauder, D., & Bow, A. (2001). Australian perspectives on the use of the internet by people who are visually impaired and professionals who work with them. *Journal of Visual Impairment & Blindness, 95*(11), 690-701.

Wolffe, K. E., Candela, T., & Johnson, G. (2003). Wired to work: A qualitative analysis of assistive technology training for people with visual impairments. *Journal of Visual Impairment and Blindness, 97*(11), 677-694.

Wolffsohn, J. S., & Peterson, R. C. (2003). A review of current knowledge on electronic vision enhancement systems for the visually impaired. *Ophthalmic & Physiological Optics : The Journal of the British College of Ophthalmic Opticians (Optometrists), 23*(1), 35-42.

Yerxa, E., Clark, F., Frank, G., Jackson, J., Parham, D., Pierce, D., Stein, C., & Zemke, R. (1989). An Introduction to occupational science, a foundation for occupational therapy in the 21st century. In J. Johnson & E. Yerxa (Eds.), *Occupational science: The foundation of new models of practices* (pp. 1-17). Binghamton, NY: The Haworth Press.

Chapter 3

3 Low vision assistive technology device usage and importance in daily occupations[1]

3.1 Introduction

In 2007, the cost of vision loss was estimated to be $15.8 billion or 1.19% of Canada's GDP (Access Economics, 2009). The direct (health system related) cost of vision loss was estimated to be $8.6 billion (Access Economics, 2009). The economic impact of vision loss on *occupational performance* is observed in the indirect costs of lost productivity, tax reduction and disability support programs, care and rehabilitation (e.g., lost productivity of caregivers, and specialized library services) and assistive technology devices (ATDs), estimated to be $7.2 billion (Access Economics, 2009). ATDs may be defined as any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain or improve functional capabilities (Assistive Technology Act, 2004). While ATDs represent a significant but relatively small indirect cost of $303.9 million (Access Economics, 2009), when selected, accepted and used appropriately, they have the potential to facilitate occupations that may increase productivity, independence, self-confidence, and overall quality-of-life and health of persons with vision loss (Day, Jutai, Woolrich, & Strong, 2001; Goodrich, 2003; Inge, 2006; Sperazza, 2001; Stelmack, Rosenbloom, Brenneman, & Stelmack, 2003).

Unfortunately, many ATDs are abandoned shortly after their purchase (Teitelman & Copolillo, 2005) and their non-use may limit occupational performance opportunities for persons with disabilities. Philips and Zhao (1993) found that 29.3% of all ATDs, like wheelchairs, canes, bath chairs, walkers and long-handled reachers, were completely

---

[1] Reprinted with permission by IOS Press: Fok, D. Polgar, J., Shaw, L. & Jutai, J. (2011, May). Low vision assistive technology device usage and importance in daily occupations. *Work. A Journal of Prevention, Assessment and Rehabilitation, 39*(1), pp. tbd.

abandoned (Phillips & Zhao, 1993). Though statistics are lacking on the abandonment of ATDs by persons with vision loss only, Mann, Goodall, Justiss, and Tomita (2002) found that, respectively, 32.4% (297 of 916) and 26.5% (110 of 415) of the canes and magnifiers owned were not used among 1056 frail elderly. An ATD left unused or abandoned inappropriately by a person with disability will not meet its intended design of use and potential for enablement through occupational performance no matter how much it is valued by service providers, vendors or designers (Polgar, 2006). Thus, it is necessary to understand the factors that affect the retention and use of ATDs by people with vision loss and the importance that they attribute to devices that facilitate daily occupations.

The current work presents data from the qualitative phase of a mixed-methods study looking at ATD selection/outcome measures for persons with *low vision*. The qualitative phase precedes the quantitative phase of the study currently underway. While no global definition of low vision exists, there is general consensus that it is a vision impairment that is not correctable and that it has a negative impact on daily occupations (Virgili & Acosta, 2006). According to the National Eye Institute (2007), "low vision means that even with regular glasses, contact lenses, and medicine or surgery, people find everyday tasks difficult to do. Reading the mail, shopping, cooking, seeing the TV, and writing can seem challenging."

Functionally, persons with low vision may have enough residual vision that allow them to use sight enhancement ATDs. Colenbrander (2002) suggested that the low vision classification from ICO and ICD-9-CM of "mild", "moderate" and "severe" may be translated to visual acuities (in the better eye) of between 20/32 to 20/63, 20/80 to 20/160 and 20/200 to 20/400 respectively. Although Colenbrander's (2002) interpretation of visual acuities is used here, the authors would like to emphasize that there are inconsistencies at the local, state/provincial, national and international levels within governmental and community agencies, in terms of the definitions of low vision and blindness. Such inconsistencies may affect whether or not services are received by an individual, and whether the individual may view herself or himself as being disabled based on associated social labels. There are two main purposes to the current work.

First, the authors will identify the breadth of ATDs currently used for daily occupations by a sample of participants with low vision. Second, the relative importance that the participants attribute to the devices for daily occupations will be examined. Descriptive data will be presented along with selected qualitative data offered by the participants. The next sections will provide a brief review of the types of occupations conducted by persons with low vision and selected categories of low vision ATDs found in the literature.

3.1.1 Occupation and persons with low vision

Occupation is sometimes synonymous with 'doing' (Wilcock, 1999), but may be defined as "engagement or participation in a recognizable life endeavour" (Christiansen & Townsend, 2004). Yerxa et al. (1989) suggest that "individuals are most true to their humanity when engaged in occupation". One key finding from a qualitative study on psychosocial issues experienced by older adults suggest that "emotional challenges" in the form of "relinquished activities, lost independence, lost spontaneity, increased effort required and impact on social interactions" (p. 412) were the toughest to experience as they adjust to vision loss (Teitelman & Copolillo, 2005). Thus, we need to be aware of the types of occupations that persons with low vision "want, need, or have to do" (Wilcock, 2006).

Given the high prevalence of vision loss later in life due to diseases like age-related macular degeneration (ARMD) (Hooper, Jutai, Strong, & Russell-Minda, 2008; Sperazza, 2001; Watson, 2001), research studies have examined the impact of low vision on occupations. While not exhaustive, Stelmack, Rosenbloom, Brenneman and Stelmack (2003), provided a list of more than 60 occupations for which ATDs were considered useful through literature review. The main categories of occupations are as follow:

- *Travel activities* (e.g., finding a clear path; recognize traffic signals, cars at intersection)
- *Food and shopping* (e.g., identify food; read menus)
- *Household tasks* (e.g., read tape measures and rulers; mow the lawn, trim the shrubs; clean the house)
- *Self-Care* (e.g., apply makeup, part hair, shave; clip and file nails and/or apply nail polish)

- *Recreation/Socialization* (e.g., watch television/movies, theatre or sporting events from a distance (8 to 12 feet away); see television up close)
- *Communication* (e.g., scan jumbo print (headlines, titles, labels); read large print (Readers' Digest, subheadings))
- *Contrast* (e.g., adjust to changes in lighting conditions; reduce glare indoors and outdoors)

One finding highlighted in Stelmack et al.'s (2003) study on patients' (M = 76 years old) perception of the need for low vision devices was an ordered ranking of the frequency with which the occupations were performed with ATDs. The top ranked occupations where ATDs are "most used" or are "most needed" all involved reading (e.g., small print, mail, and labels). Generally, the most frequently used ATDs were for "close, intermediate, and distance reading tasks; television viewing; recognizing people; and finding items." (Stelmack et al., 2003, p. 521). This finding is consistent with a number of published works which suggested that the use of ATDs is of utmost relevance to reading related occupations for persons with vision loss (Margrain, 2000; Rosenberg & Sperazza, 2008; Ryan, Anas, Beamer, & Bajorek, 2003; Watson, 2001).

In addition to the above categories of occupations, productive occupations such as paid work, volunteering and schooling needs to be included. Beyond the stated economic impacts of not being able to 'do', Wilcock's (2006) seminal work suggested negative health consequences when a person is deprived of, alienated from or has an improper balance, choice, and/or variety of occupations. More specifically, researchers have argued that occupational imbalances or a lack of a variety of labour, work and leisure occupations throughout the life course may contribute to poor health, quality of life and well-being (Gramm, 1987; Townsend & Wilcock, 2004). This assertion is relevant for people with disabilities and especially those with low vision, given the disproportionably high unemployment and underemployment rates among these groups (Butler, Crudden, Sansing, & LeJeune, 2002; O'Day, 1999; Stevens, 2002; Strobel, Fossa, Arthanat, & Brace, 2006). Several authors have suggested that appropriately selected ATDs that are used may be essential to people with low vision for gainful and productive work pursuits (Gamble, Dowler, & Orslene, 2006; Strobel et al., 2006).

3.1.2 Low vision assistive technology devices

A classical categorization scheme sometimes seen in the assistive technology literature is 'low' verses 'high' technology: "inexpensive devices that are simple to make and easy to obtain are often described as "low" technology and devices that are expensive, more difficult to make, and harder to obtain… [are] "high" technology." (Cook & Polgar, 2008). Based on this definition, low technology may be a felt tip marker or an envelope writing guide, whereas an electronic magnifier, an optical character recognition (OCR) software or an audio book player are considered to be high technology. Though useful at times, Cook and Polgar (2008) suggest that this scheme may be imprecise. Furthermore, one may be tempted to believe that 'higher' technology devices are necessarily more functional than 'lower' technology devices, which is incorrect. Another categorization presented by Jutai, Strong, and Russell-Minda's (2009) systematic review of the effectiveness of low vision technology relates to what people 'do' in terms of occupational performance. An abbreviated version is as follow:

- *Optical devices and electronic vision-enhancement systems:* May be used for reading and spotting. Examples include: Non-electronic optical devices like handheld magnifiers, monocular, telescopes; electronic magnification systems and closed-circuit televisions (CCTV).
- *Mobility devices for vision rehabilitation:* May be used to aid in the navigation in an indoor or outdoor environment at various times of the day. Examples include long white canes and night-vision devices.
- *Prisms and other field-enhancement devices*: May be used to compensate for visual field loss. Examples include Fresnel prisms which may enhance mobility.
- *Lighting and filters:* May enhance reading performance. Examples include: general lighting, task lighting and coloured filters.
- *Adaptive computer technologies:* May be used for working with the Internet or other common computer functions. Examples include: Electronic screen magnifier and/or readers and OCR software with a scanner.

The above categorization scheme is used in this paper. In addition, sub-categories such as the different types of handheld magnifiers (e.g., with or without illumination) and CCTVs (e.g., standalone, connected to the television, or portable) are used. Different types of audio players (e.g., Daisy player, mp3 player), audio recorders, electronic notetakers and manual notetakers which do not seem to fit into this scheme, but are nevertheless used by people with low vision as a means to access and produce

information in a portable manner are included (e.g., electronic books, notes, and music) (Cook & Polgar, 2008; Petty, 2005). These types of ATDs will be referred to as *audio players, recorders, notetakers*.

As defined above, mainstream technologies such as personal computers, recreational binoculars, DVD player/recorder, large screen television, cell phone and PDA may also be considered ATDs (Fruchterman, 2003; Tobias, 2003; Wagner, Vanderheiden, & Sesto, 2006). While the accessibility and usability of these technologies are sometimes questionable (Augusto & Schroeder, 1995; Tobias, 2003), the relative low cost, less stigmatizing form factors, and compatibility considerations with other mainstream technologies (e.g., Windows or Mac built-in computer accessibility features working with popular word processing, spreadsheet and internet applications) are some reasons why they should be considered when discussing contemporary ATDs. Therefore, mainstream technology (high and low technology) and low technology devices (e.g., talking watches, kitchen aids, Velcro dots and coloured tape for labeling controls) that are used by people with low vision to engage in a variety of daily occupations are also considered and will be referred to as *mainstream aids to daily living* (Cook & Polgar, 2008).

3.2 Methods

The current data presented were collected during a one-time telephone interview conducted with each participant. Demographics and ATD usage data were collected using a semi-structured instrument developed by the authors. Examples of data collected include, date of birth, gender, work status, disability type, visual acuity, devices currently used (and not used), number of years of using each device and ranking of relative importance of currently used devices. Related comments offered by the participants were also recorded in the form of hand written notes. This research received ethical approval from a University Health Sciences Research Ethics Board.

3.2.1 Sample

Adults 18 years of age or older who have used one or more low vision ATDs for more than 6 months were invited to participate. Participants were included in this research if

they self-identified as: a) having low vision as their primary disabling condition, b) using primarily sight enhancement devices such as magnifiers, illumination, closed-circuit televisions and electronic screen magnifiers (Cook & Polgar, 2008; Jutai et al., 2007; Jutai, Strong, & Russell-Minda, 2009), and c) being able to physically and mentally participate in a telephone interview. Participants were referred primarily from community non-for-profit organizations such as the Canadian National Institute for the Blind (CNIB) and an assistive devices training center for people with vision impairment in Ontario. A secondary recruitment strategy was used where advertisements were posted on community boards in malls and a local newspaper.

Please refer to Table 3-1 for a profile of the participants who were recruited for this research. 17 participants were recruited through a purposeful sampling strategy (Patton, 1990). The average age of the participants at the time of data collection was 56 years old (SD = 15.8). The age range of the participants was 30 to 89 years old. There were 9 males and 8 females who had a variety of vision diagnoses. As previously defined, based on the visual acuity in the better eye, 3, 6, and 8 participants had "mild", "moderate" and "severe" low vision respectively. According to Gitlin (1998), a person who has used one or more ATDs for greater than 6 months but less than one year can be considered an "experienced" user. If a person has used one or more ATDs for greater than one year, he or she can be considered an "expert" user. Based on these definitions, there was one "experienced" user (participant D), and the rest were "expert" users.

Table 3-1: A profile of research participants (n = 17).

ID	Age	Sex	Diagnosis	Visual acuity in better eye	Work Status
A	30	F	Retinitis pigmentosa	20/400	In school
B	36	F	Optic neuropathy	20/400	Long-term disability
C	39	F	Optic neuropathy	20/200	Volunteering/Retired
D	41	M	Uveitis	20/400	Long-term disability
E	43	F	Congenital Cataracts	20/200	In school/Working/Volunteering
F	50	M	Optic neuropathy	20/400	Working/Volunteering/Long-term disability
G	53	M	Diabetic retinopathy	20/40	Volunteering/Long-term disability/Retired
H	55	M	Retinopathy of prematurity	20/400	Working/Long-term disability
I	56	M	Retinitis pigmentosa	20/100	Long-term disability
J	59	M	Retinitis pigmentosa	20/70	Long-term disability
K	60	M	Macular dystrophy	20/200	Volunteering/Retired
L	60	F	Macular edema	20/40	Long-term disability/ Retired
M	61	F	Other - Retinal degenerative condition	20/160	Retired
N	67	M	ARMD	20/80	Working
O	69	F	Macular dystrophy	20/100	Volunteering/Retired
P	84	F	ARMD	20/150	Retired
Q	89	M	ARMD/Cataracts	20/50	Retired

3.2.2 Data collection and analysis

Telephone interviews were conducted by the primary author. On the telephone call, prior to the interview, the interviewer reviewed the letter of information and consent form including the definition of assistive technology (presented earlier), and emphasized their relation to daily activities. Examples of low vision assistive devices were read out loud by the interviewer from the letter of information. The interviewee was asked to do the following tasks, in order:

1) *Please take out a piece of paper and write down all low vision assistive devices you currently use, or have used in the past. Please tell me what devices you have written down.*
2) *Please go down the list and tell me whether or not you currently use the device.*
3) *Please go down the list and tell me how long you have used each device.*
4) *Please rank the low vision assistive devices in order of most (1) to least "important" to you.*

For participants who were not able to, or preferred not to, write or record the information through their usual method of low vision accommodation for writing tasks (e.g., fine black marker on a white page, use of a CCTV, magnifier, or computer with electronic magnifier), the interviewer assisted by repeating instructions for the tasks listed above as closely as possible. Example instructions included: "What low vision assistive devices do you currently use, or have used in the past?", "how long have you use this device?", "you have listed the following low vision assistive devices… [list devices], please rank them in order of most to least important, starting with 1 as the most important". A probe for the word "important" was used, for example: "Consider values attributed to the device, how dependent you are on the device, the frequency of use of the device, etc. for your daily activities." This probe was only used when the participant required prompting. The participants were also told that they were allowed to give multiple equal rankings if desired (e.g., giving a ranking of importance of "1" to two different ATDs). Other types of prompting were minimized to limit bias in the ranking. Notes were taken when participants provided comments during the exercise, for example, on what occupation they used the devices for, and on the rationale for particular ranking choices. These qualitative comments were used to supplement the interpretation of the usage and the ranking of importance data collected.

ATDs were coded based on a modified version of Jutai, Strong, and Russell-Minda's (2009) low vision ATD categorization scheme. The seven categories include: Optical device and electronic vision-enhancement system, mobility devices for vision rehabilitation, prisms and other field-enhancement devices, lighting and filters, adaptive computer technology and audio players, recorders and notetakers, and mainstream aids to daily living. Sub-categorizations were also developed by the authors to provide the reader with more details about particular ATDs sub-coded under a category. A visual representation of this coding scheme was produced using Microsoft Visio 2003. The codes were necessary to manage the variety of ATDs identified, and were used for the basis of presenting the usage and ranking of importance data. The usage and ranking data were summarized with descriptive statistics using Microsoft Excel 2003. Where multiple equal rankings were given by a participant, the data were consistently recoded and

presented using mean ranks. For example, the rankings of ‘1’, ‘1’, ‘2’, ‘3’ were recoded to ‘1.5’, ‘1.5’, ‘3’, ‘4’.

3.3 Results

Please refer to Figure 3-1 for a visual representation of the relations between the codes and sub-codes. Sample occupations that consumers may perform with each category of ATDs were also included in the figure. In many instances, the way (e.g., wording) in which the participants referred to the ATDs were kept as part of the sub-category (i.e., in-vivo) codes. For example, the category of ‘adaptive computer tech’ was sub-categorized to include: Screen magnifier software (e.g., ZoomText), screen reader software (e.g., JAWS), mobile phone screen reader software (e.g., TALKS), optical character recognition (OCR) software (e.g., Kruzweil, OpenBook) and specialized computer peripherals (e.g., specialized mouse and keyboard). The names of the software (or other ATDs) to which the participants referred are mentioned here but are not necessarily endorsed by the authors.

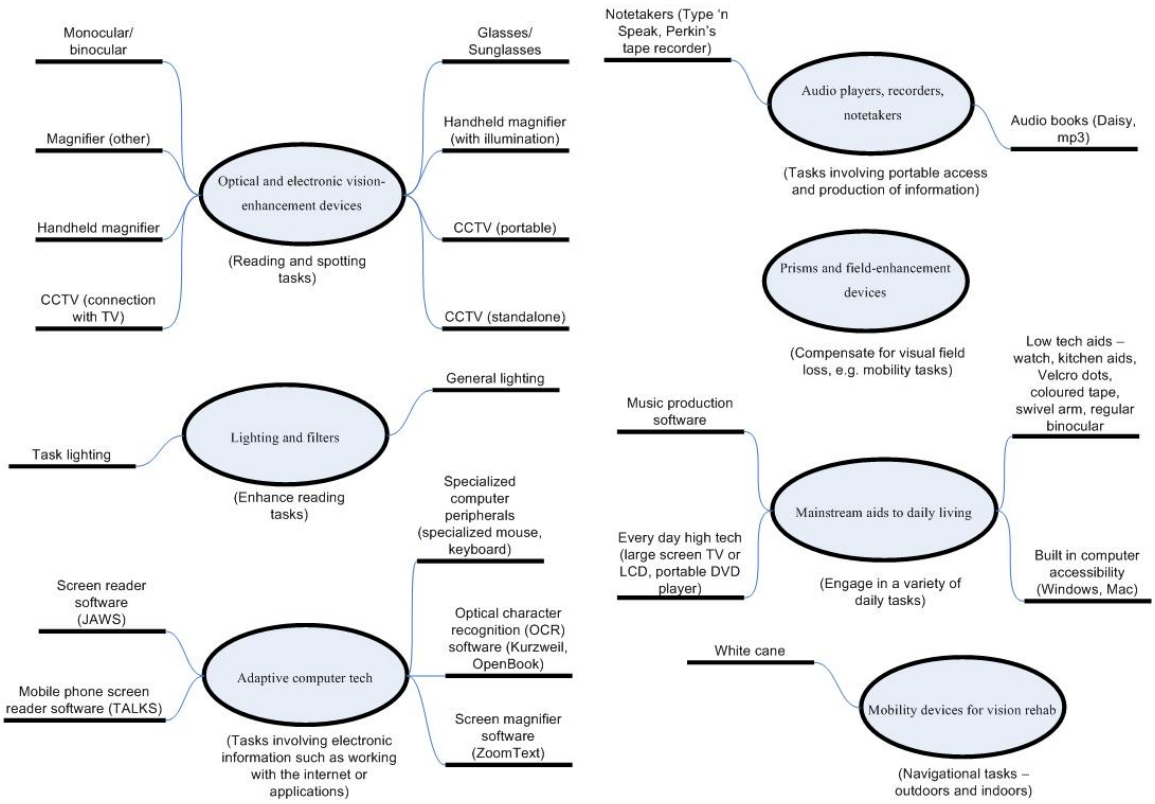

Figure 3-1: Assistive Technology Device (ATD) coding.

Table 3-2 provided information on the number of devices currently used and not used, in decreasing order of frequency of currently used devices. A modified version of the low vision ATD categorization scheme by Jutai, Strong, and Russell-Minda (2009) was used. Overall, 124 devices were identified by the participants (n = 17), of which 104 (83.9%) were currently used and 20 were not (16.1%). Table 3-3 presented a breakdown of the types and number of devices used by each participant. The types of devices currently used were also classified based on the modified Jutai, Strong, and Russell-Minda (2009) categorization scheme. This device usage table was organized by participant IDs in the same manner as Table 3-1 for ease of comparison to the demographics data. On average, each participant currently used 6.1 (SD = 2.9) ATDs. The number of devices currently used ranged from 3 to 14.

Table 3-2: ATDs currently used or not used by the participants (n = 17).

Low vision ATD	# Currently Used	% Currently used	# Currently not used	% Currently not used
Optical and electronic vision-enhancement devices	41	87.0	6	13.0
Mainstream aids of daily living	22	100.0	0	0.0
Adaptive computer tech	15	57.7	11	42.3
Audio players, recorders, notetakers	14	87.5	2	12.5
Mobility devices for vision rehab	7	87.5	1	12.5
Lighting and filters	5	100.0	0	0.0
Prisms and field-enhancement devices	0	0.0	0	0.0
Total	104		20	

Table 3-3: Types of devices currently used by each participant (n = 17).

ID	Optical and electronic vision-enhancement devices	Mainstream aids of daily living	Adaptive computer tech	Audio players, recorders, notetakers	Mobility devices for vision rehab	Lighting and filters	Prisms and field-enhancement devices	Total
A	2	4	3	4	1	0	0	**14**
B	1	0	1	1	0	0	0	**3**
C	2	1	2	0	0	0	0	**5**
D	5	1	0	0	1	0	0	**7**
E	2	2	2	2	1	0	0	**9**
F	0	0	1	1	1	0	0	**3**
G	1	4	0	2	0	0	0	**7**
H	4	0	3	2	0	0	0	**9**
I	2	0	1	0	1	1	0	**5**
J	3	1	0	0	0	0	0	**4**
K	3	1	0	1	0	0	0	**5**
L	1	1	1	0	0	0	0	**3**
M	3	3	0	0	0	0	0	**6**
N	2	2	1	0	0	4	0	**9**
O	5	0	0	0	1	0	0	**6**
P	3	0	0	1	1	0	0	**5**
Q	2	2	0	0	0	0	0	**4**

A summary of the participants' rankings of importance of ATDs that they currently used can be found in Table 3-4. In this table, sub-categories were used to provide the reader with a more detailed look at the types of ATDs that were ranked. The table was sorted from top to bottom, in decreasing order of average ranking of importance of devices currently used by participants for daily occupations (i.e., closer to "1" being more

important). For example, glasses/sunglasses were given a higher ranking of importance (average ranking of importance = 2.0), whereas, white canes were given a lower ranking of importance (average ranking of importance = 3.3) by several participants. This table provides a snapshot of the way in which the sample of participants ranked the importance of the sub-categories of ATDs they used for daily occupations.

Table 3-4: Mean ranking of importance of ATDs to one's daily occupations (n = 17).

Assistive technology device	Frequency count	Average ranking of importance
Glasses/ sunglasses	7	2.0
Screen magnifier software	6	2.4
Everyday high tech (large monitor, large screen TV, DVD player)	7	2.8
Handheld magnifier	11	2.9
Specialized computer peripherals (specialized mouse, keyboard)	2	3.1
Built in computer accessibility	7	3.1
Magnifier - other	4	3.3
Screen Reader software	3	3.3
White cane	7	3.3
CCTV (standalone)	4	3.5
Handheld magnifier (with illumination)	4	3.6
CCTV to TV	2	3.8
OCR software	4	4.0
Portable CCTV	1	4.0
Audio books (Daisy, mp3)	10	4.0
Monocular/binocular	8	4.1
Task lighting	2	4.2
Other low tech - Watch, kitchen aids, swivel arm, regular binocular	7	4.4
General lighting	3	4.4
Notetakers	4	7.2
Music production software	1	13.5

3.4 Discussion

3.4.1 Assistive technology device usage

A majority of the ATDs currently used by the participants (41 or 39%) were optical devices and electronic and vision-enhancement systems. All but one participant (participant F) used some type of optical devices and/or electronic vision-enhancement. This finding was not surprising considering the large variety of ATDs that fell into this category. Especially in the case of optical devices such as handheld magnifiers, these devices are commonly recommended by clinical professionals (Rosenberg, 2008; Sperazza, 2001), and certain types are easily and relatively inexpensive to obtain via places like pharmaceutical retail stores in Canada. For example, the most important device used by participant L was a handheld magnifier that was obtained at a local drug store. Next, the participants identified many mainstream aids to daily living (22 or 21%) that they currently used. There was a likelihood of under-reporting of the use of these devices due to the fact that participants were not specifically asked about their use of mainstream technology. For example, although the interviewer read outloud the definition of ATD to each participant, he did not explicitly state that the definition included mainstream technology. Some participants volunteered to rank and provide comments about mainstream technology after asking the interviewer if it was okay to do so (to which the interviewer would ask the participants to proceed) as the participants may not have considered ATDs as encompassing mainstream technology. Despite minimal prompting, 11 (65%) participants suggested they currently used mainstream aids to daily living. Given the fact that some of these devices (e.g., large screen television, DVD player) may be paid out of pocket by persons with low vision that may be on fixed income, and are not prescribed by health professionals or assessors, there is reason to lend further research to understand their selection, usage and effectiveness.

Many audio players, recorders and notetakers (14) were used by this sample of participants. While most of the sample of participants (n = 6) that used these devices had "severe" vision loss, some participants with "moderate" (e.g., participant P, visual acuity = 20/150) to "mild" (participant G, visual acuity = 20/40) vision loss suggested that these

devices were of high value to them. For example, participant G provided an importance ranking of "1" (most important) for two different audio devices that he currently used for listening to talking books. Participant P, gave an importance ranking of "2" for an audio mp3 player that she used for "listen[ing] to talking books on a daily basis". At the time of the research, both of these participants were able and did use sight enhancement devices. These examples suggest that while some persons with low vision have enough residual vision to read, they may *prefer* to use some sight substitution devices for this occupation. Future research should focus on the study of whether or not, and to what extent, some persons with "mild" or "moderate" low vision may also find sight substitution devices (disability specific or mainstream) useful. The results may have implications on low vision rehabilitation services and government funding priorities.

Non-use of adaptive computer devices: The number of audio players, recorders and notetakers (14) were similar to that of the number of adaptive computer devices (15) currently used. However, the non-use rate for the latter was much higher. 11 (42.3%) of the adaptive computer devices that the participants owned and have access to (or previously owned and had access to in the past) were not used. Several participants offered some rationale for not using particular adaptive computer devices. Participant F suggested that he no longer used a whole host of older adaptive hardware and software as they were replaced by newer ones, though this may be considered a 'mixed blessing'. As participant F suggested, "everything changed with the introduction of Windows… and it complicated things for the blind." He further explained that he preferred DOS (disk operating system) which was text-based and accessible to screen readers, as opposed to Windows which is icon driven, and not always accessible to screen readers. He also mentioned the abandonment of an OCR software due to computer system incompatibilities. However, despite these issues expressed, the participant did mention that he was appreciative of new improvements to adaptive computer software as new versions are released. Participant J suggested that he no longer used a screen magnifier or a CCTV because these devices were only provided as a part of a work accommodation; since he went on long-term disability he did not replace the devices for home use. As previously suggested, one's work status may influence the types and varieties of ATDs used. Participant J explained that his non-use of a screen reader was a

result of transitioning from paid work to volunteering in his early retirement years. Furthermore, when comparing participants that were either working (e.g., working, volunteering and/or in school) (n = 9) to those that were not working (e.g., retired and/or on long term disability) (n = 8), the number of devices used seemed to be higher for the former group (M = 7.4, SD = 3.2) than the latter (M = 4.6, SD = 1.4). While statistical analysis was not justified due to the small sample size of the current research, future studies may clarify this potential difference.

Low use of the white cane: While various types of canes are important for orientation and mobility, only 7 (41%) of the participants with "moderate" (n = 3) to "severe" (n = 4) low vision currently used a cane. Other participants who had "moderate" to "severe" low vision did not currently use a cane. Participant H owned a cane but had not used it since he was a highschool student said: "When I was a kid, I would use it to get on the bus for free and then I would hide it in my sleeve." Participant O owned a cane but it was rarely ever used. She mentioned that she recognized the need or the function of the cane and that she should use it more often, but she was "terrified of it". This comment may be similar to Covington's (1998) report of personal experience with the white cane in which he empathically stated: "I hated the white cane because of its terrible stigma" (Covington, 1998).

3.4.2 Ranking of importance of assistive technology devices and occupation

The goal of the current research was to understand the range and relative importance of the technologies used in a sample of participants with vision loss; several relevant findings were revealed. As participant A suggested "I did not realize how many technology [I use], until I say it outloud." She also added that the ranking of ATDs in terms of importance helped her reflect on their roles in her daily activities. In this section, the authors will focus on the ranking of importance of ATDs as they relate to daily occupation (see Table 3-4).

First, descriptive statistics in the ranking of importance revealed that some participants of this sample saw glasses and sunglasses as being "most important". While participants M

and P did not initially identify these as ATDs (but nevertheless thought they were important to discuss), they expressed enthusiasm in their description of use. For example, participant M stated that her Corning lenses were "god sent" in that they helped her function in fluorescent lighting, afforded sharper images, helped with transitions indoors to/from outdoors, and provided reduced glare from the snow. Similarly, participant P mentioned the use of her lenses on a daily basis for glare control and transitioning to/from indoors to outdoors. While these optical devices may be described as "low" technology, the sophisticated science associated with their design and production should not be overlooked.

A second noteworthy finding is the perceived importance of mainstream devices (mean ranking = 2.8). Similar to lenses, they are often not thought of as ATDs even though they significantly impact the types of activities that a person with low vision is able to engage in. For example, participant J was "not sure if a 32" LCD monitor was an assistive technology" but when he "hook[ed] it up to [his] computer" he thought it was "marvelous" in that it allowed him to do computer work like checking email at home. Participant K also enjoyed exchanging emails with family and friends, and said that the built-in magnification in the operating system of his computer was "most important" for this occupational pursuit. Interestingly, he had abandoned the use of a screen magnifier that was specifically designed for people with low vision, which he had used for over 10 years. He felt that the screen magnifier was "unnecessary" and that "after figuring out how to use the [built-in] magnifier on the new computer", he had no need for the screen magnifier. Another example worth mentioning was participant G's comment that his 58" television set (ranked as "2") was the next most important technology for his low vision after the two mainstream audio devices he used for listening to talking books. While mainstream aids to daily living are not necessarily prescribed, they nevertheless impact on what people, need, want or have to do. Therefore, they should be considered if enabling or facilitating occupational performance as part of the end goal.

Finally, a pertinent point to discuss is that the ranking of importance of the ATDs was not a straightforward task for several of the participants. 8 (47%) of the participants provided multiple equal rankings. The participants used several ATDs to conduct daily

occupations, and the multiple equal rankings from close to half the participants may suggest that there was not necessarily one ATD used for a daily occupation that was clearly more valued then others. In an extreme case, participant M gave a ranking of "1" or "most important" to a CCTV, a screen magnifier, a screen reader, an OCR software, a notetaker, a tape recorder, a white cane, a talking watch and tactile stickers. However, this type of response was not the norm, as most participants that provided multiple equal rankings did so for two items that may be related.

Combination of devices used: Several participants suggested that multiple equal rankings were due to the fact that devices were often used in combination in the performance of their daily occupations. Participant D provided an importance ranking of "1" to both his binocular glasses and his white cane which he needed to use together for getting around outside of his home. Participant E gave an importance ranking of "1" to both her large screen monitor and her built-in computer system accessibility features as she suggested that the two "are related", which allowed her to use the computer. Similarly participant M suggested that she was only able to see and access her computer monitor by attaching it to a swivel arm, and using it with the built-in computer system accessibility features such as the reverse contrast feature (e.g., white text on black screen). Finally, participant I enjoyed reading magazines using a combination of handheld magnifiers and halogen lighting.

3.4.3 Study limitations and future studies

Limitations

The telephone interview instrument was developed by the authors based on experience from research in the area of ATD outcomes. The instrument was not formally tested prior to its administration to the small sample of 17 participants, although minor modifications were made after the first three interviews. For example, the initial protocol did not explicitly ask participants to write/record down the devices they used prior to ranking them (although all participants did so when they deemed it to be necessary, e.g., if there is a large number of devices to be identified). To facilitate ease of ranking,

subsequent participants were called ahead of time and informed of the need for "note taking" for the purpose of the telephone interview.

As the collection of demographics and ATD usage data were conducted as part of the qualitative phase (telephone interview) of the overall mixed-methods study, only 17 participants were recruited through a purposeful sampling strategy (Patton, 1990). Further quantitative research with a larger sample size will be necessary to gauge the usefulness of the findings presented. The authors also wish to highlight that the participants that took part in this research were relatively young (M = 56, SD =15.8) and therefore the results obtained may be different from those found in older adults (e.g., 65 years of age and above) with low vision.

Future Qualitative Research

Findings from the current work may also benefit from future research that considers more of the context and the types of occupations conducted with ATDs (Cook & Polgar, 2008; Scherer, Jutai, Fuhrer, Demers, & DeRuyter, 2007). As participant I suggested "each one [of the devices] has its place depending on what I am doing." While participants did provide some information on context and the types of occupations performed, more of such information would strengthen the research. For example, a categorization of the devices in this research based on whether it is portable or not, revealed that out of the 104 ATDs currently used, 64 (62%) of them were portable and may be used in and across multiple contexts. For instance, using a handheld magnifier to read a clothing label under optimal lighting conditions setup by a person with low vision at home is a different occupation than the same person trying to use the same magnifier to read a similar label in a poorly illuminated department store.

The devices identified as currently used or particularly important for daily occupations may be viewed as successful exemplars that one can learn from by asking further qualitative questions such as: Why are these currently used ATDs important to persons with low vision? In what contexts and occupations are these ATDs important? What was the process used and who was involved in the selection of these ATDs? Other questions raised in this paper that may benefit from further clarification include: (1)

What is the potential role of preference in the selection of mainstream/disability specific technology? Recall participant G's preference for sight substitution devices (e.g., talking books) even though he was considered to have "mild" vision loss. (2) What specific factors contribute to the non-use or abandonment of adaptive computer devices in different occupations and contexts? (3) And finally, how does meaning ascribed to a device such as a white cane affect its usage? The latter question is especially important given that several authors have suggested that the meaning ascribed by an individual to an ATD is at least as important as the function it affords, in determining whether an ATD will ultimately be abandoned or used (Hocking, 1999; Pape, Kim, & Weiner, 2002; Spencer, 1998).

3.5 Concluding thought

The current work showed that concepts related to usage and ranking of importance are multi-faceted and complex (e.g., combination of devices used, multiple equal rankings). The results of this descriptive paper provided some data suggesting the need to consider usage and perceived importance of not just disability specific devices, but also those that can be obtained through mainstream channels which have not been thoroughly explored in previous research. The combined effects of technology use, whether mainstream and/or disability specific to enable (or disable) occupational performance should also be considered in ATD selection and outcomes research.

3.6 References

Access Economics Pty Limited. (2009). The cost of vision loss in Canada: Full report prepared for Canadian National Institute for the Blind and Canadian Opthalmological Society. Retrieved June 30, 2009, from www.cnib.ca/en/research/pages/covl.aspx

Assistive Technology Act of 1998, as amended. Pub.L. No.108-364. §3, 118 Stat. 1707 2004.

Augusto, C.R. & Schroeder, P.W. (1995). Ensuring equal access to information for people who are blind or visually impaired. *Journal of Visual Impairment & Blindness, 89*(4), 9-12.

Butler, S.E., Crudden, A., Sansing, W.K., & LeJeune, B.J. (2002). Employment barriers: Access to assistive technology and research needs. *Journal of Visual Impairment & Blindness, 96*(9), 664-667.

Christiansen, C.H. & Townsend, E.A. (2004). *Introduction to occupation: The art and science of Living.* Upper Saddle River, New Jersey: Prentice Hall.

Colenbrander A. (2002). *Visual standards : Aspects and ranges of vision loss.* Report prepared for the International Council of Ophthalmology at the 29th International Congress of Ophthalmology, Sydney, Australia.

Cook, A.M. & Polgar, J.M. (2008). *Cook & Hussey's Assistive Technologies: Principles and Practice (3rd Edition).* St. Louis, MO: Mosby Elsevier.

Covington, G. (1998). Cultural and environmental barriers to assistive technology: Why assistive devices don't always assists. In D.B. Gray, L.A. Quatrano, & M.L. Lieberman (Eds.), *Designing and Using Assistive Technology: The Human Perspective* (pp. 77-88). Baltimore, MD: Paul H. Brookes Publishing Company.

Day, H., Jutai, J.W., Woolrich, W., & Strong, G. (2001). The stability of impact of assistive devices. *Disability and Rehabilitation, 23*(9), 400-403.

Fruchterman, J.R. (2003). In the palm of your hand: A vision of the future of technology for people with visual impairments. *Journal of Visual Impairment and Blindness, 97*(10), 585-591.

Gamble, M.J., Dowler, D.L. & Orslene, L.E. (2006). Assistive technology: Choosing the right tool for the right job. *Journal of Vocational Rehabilitation, 24*, 73-80.

Goodrich, G.L. (2003). Available and emerging technologies for people with visual impairment. *Generations (spring edition),* 64-70.

Gitlin, L.N. (1998). From hospital to home: Individual variations in experience with assistive devices among older adults. In D.B. Gray, L.A. Quatrano, & M.L. Lieberman (Eds.), *Designing and Using Assistive Technology: The Human Perspective* (pp. 117-135). Baltimore, MD: Paul H. Brookes Publishing Company.

Gramm, W.S. (1987). Labor, work and leisure: Human well-being and the optimal allocation of time. *Journal of Economic Issues, 21,* 167-188.

Hocking, C. (1999). Function or feelings: Factors in abandonment of assistive devices. *Technology and Disability, 11*, 3-11.

Hooper, P., Jutai, J.W., Strong, G. & Russell-Minda, E. (2008). Age-related macular degeneration and low-vision rehabilitation: A systematic review. Canadian Journal of *Ophthalmology, 43*(2), 180-187.

Inge, K.J. (2006). Assistive technology as a workplace support. *Journal of Vocational Rehabilitation, 24*(2), 67-71.

Jutai, J., Hooper, P., Strong, G., Russell-Minda, E., Cooper, L., Hutnik C., Sheidow T., & Tingey, D. (2007). *Vision rehabilitation evidence-based review: Module 1: Terminology, demography, and epidemiology of low vision.* Unpublished manuscript, The University of Western Ontario, The Lawson Health Research Institute, and CNIB.

Jutai, J.W., Strong, G. & Russell-Minda, E. (2009). Effectiveness of assistive technologies for low vision rehabilitation: A systematic review. *Journal of Visual Impairment & Blindness, 103*(4), 210-222.

Mann, W.C., Goodall, S., Justiss, M.D. & Tomita, M. (2002). Dissatisfaction and nonuse of assistive devices among frail elders. *Assistive Technology, 14,* 130-139.

Margrain, T.H. (2000). Helping blind and partially sighted people to read: The effectiveness of low vision aids. *British Journal of Ophthalmology, 84*(8), 919-921.

National Eye Institute. (2007). What you should know about low vision. Retrieved July 29, 2009, from www.nei.nih.gov/health/lowvision/LowVisPatBro2.pdf.

O'Day, B. (1999). Employment barriers for people with visual impairment. *Journal of Visual Impairment and Blindness, 93,* 627-642.

Pape, T., Kim, J. & Weiner, B. (2002). The shaping of individual meanings assigned to assistive technology: A review of personal factors. *Disability and Rehabilitation, 24*(1/2/3), 5-20.

Patton, M.Q. (1990). *Qualitative evaluation and research methods (2nd Edition),* Newbury Park, CA: Sage Publications.

Petty, L.S. (2005). Technology and occupation: High technology vision aids for an aging population. *OT Now, Jan/Feb*, 26-28.

Phillips, B. & Zhao, H. (1993). Predictors of assistive technology abandonment. *Assistive Technology, 5*(1), 36-45.

Polgar, J.M. (2006). Assistive technology as an enabler to occupation: what's old is new again (Muriel Driver Lecture). *Canadian Journal of Occupational Therapy, 73*(4), 199-205.

Rosenberg, E.A. & Sperazza, L.C. (2008). The visually impaired patient. *American Family Physician, 77*(10), 1431-1436.

Ryan, E.B., Anas, A.P., Beamer, M. & Bajorek, S. (2003). Coping with age-related vision loss in everyday reading activities. *Educational Gerontology, 29*(1), 37-54.

Scherer, M., Jutai, J., Fuhrer, M., Demers, L. & DeRuyter, F. (2007). A framework for modeling the selection of assistive technology devices (ATDs). *Disability and Rehabilitation: Assistive Technology, 2*(1), 1-8.

Spencer, J.C. (1998). Tools or baggage? Alternative meanings of assistive technology. In D.B. Gray, L.A. Quatrano, & M.L. Lieberman (Eds.), *Designing and Using Assistive Technology: The Human Perspective* (pp. 89-97). Baltimore, MD: Paul H. Brookes Publishing Company.

Sperazza, L.C. (2001). Rehabilitation options for patients with low vision. Rehabilitation *Nursing, 26*(4), 148-151.

Stelmack, J.A., Rosenbloom, A.A., Brenneman, C.S. & Stelmack, T.R. (2003). Patients' perceptions of the need for low vision devices. *Journal of Visual Impairment & Blindness, 97*(9), 521-535.

Stevens, G. (2002). Employers' perceptions and practice in the employability of disabled people: A survey of companies in southeast UK. *Disability & Society, 17*(7), 779-796.

Strobel, W., Fossa, J., Arthanat, J. & Brace, J. (2006). Technology for access to text and graphics for people with visual impairments and blindness in vocational settings. *Journal of Vocational Rehabilitation, 24*, 87-95.

Strong, G., Jutai, J.W., Bevers, P., Hartley M. & Plotkin, A. (2003). The psychosocial impact of closed-circuit television low vision aids. *Visual Impairment Research, 5*(3), 179-190.

Teitelman, J. & Copolillo, A. (2005). Psychosocial issues in older adults' adjustment to vision loss: findings from qualitative interviews and focus groups. *The American Journal of Occupation Therapy, 59*(4), 409-417.

Tobias, J. (2003). Information technology and universal design: An agenda for accessible technology. *Journal of Visual Impairment & Blindness, 97*(10), 592-601.

Townsend, E. & Wilcock, A. (2004). Occupational Justice. In C.H. Christiansen and E.A. Townsend (Eds.), *Introduction to occupation: The art and science of living* (pp. 243-273). Upper Saddle River, New Jersey: Prentice Hall.

Virgili, G. & Acosta, R. (2006). Reading aids for adults with low vision. *Cochrane Database of Systematic Reviews, 4,* Article Number: CD003303 (46 pages).

Wagner, J., Vanderheiden, G.C. & Sesto, M.E. (2006). Improving the usability of a mainstream cell phone for individuals with low vision. *Journal of Visual Impairment and Blindness,100*(11), 687-692.

Watson, G.R. (2001). Low vision in the geriatric population: Rehabilitation and management. *Journal of the American Geriatrics Society, 49*(3), 317-330.

Wilcock, A.A. (2006). *An occupational perspective of health (2nd Edition.).* New Jersey: Slack Incorporated.

Wilcock, A.A. (1999). Reflections on doing, being and becoming. *Australian Occupational Therapy Journal, 46,* 1-11.

Yerxa, E.J., Clark, F., Jackson, J., Parham, D., Stein, C. & Zemke, R. (1989). An introduction to occupational science. A foundation for occupational therapy in the 21st century. *Occupational Therapy in Health Care, 6*(4), 1-17.

Chapter 4

4 Product selection: Perspectives of persons with low vision

4.1 Introduction

The prevalence of vision loss in Canada is projected to increase from 2.5% of the population in 2007 to 4.0% in 2032 (Access Economics, 2009). With an increase in the number of persons with vision loss in the foreseeable future, demands for the services to organizations like the Canadian National Institute for the Blind (CNIB) will continue to increase (Jutai et al., 2007). One core service that is often needed by persons with low vision (LV) is technology provision. Persons with low vision (LV) use a variety of assistive technology devices (ATD) and products to help them perform occupations or activities that they need, want or are obligated to do, throughout the day (Wilcock, 2006; Dahlin, Ivanoff, & Sonn, 2005; Goodrich, 2003). Examples of low vision ATD include: canes, talking watches, handheld magnifiers, closed-circuit televisions (CCTV) and electronic screen magnifiers. In Canada, approximately $303.9 million dollars are spent per annum on ATDs (not including mass market commercial products) for persons with visual impairments (Access Economics, 2009). Despite the increasing prevalence of vision loss and the popularity of ATDs to help them with the performance of everyday occupations, the considerations that they may have in the selection of ATDs are not well understood.

Through a scoping literature review, subjective participant data were identified to infer possible concepts that relate to product selection (see Chapter 2). Examples include the visual attributes of the product like magnification and contrast, access to information, training, performance and meaning associated with the product. However, only a couple of research studies have looked at the decision concepts (or factors) that persons with low vision have expressed as they go through the product selection process.

Batavia and Hammer (1990) included two participants in their focus group (using a Delphi technique) research which consisted of 12 participants in total, to try to

understand the criteria used by persons with disabilities to evaluate ATDs. The study resulted in a list of 17 criteria deemed important by the participants. The top four priorities from most important to the least important when talking about blind technology are: Affordability, effectiveness, dependability and portability. The ranking differs when all participants were taken into account. As such, the rankings may be different if a larger number of persons with LV were included. Furthermore, the list of concepts was dependent upon the type of technology selected for discussion. For example, if a technology, say a desktop computer, was being discussed, then it was unlikely that portability will turn up as a key concept. Though suitable for the purpose of their study, a summary of concepts without specificity on how they applied to persons with low vision limited the direct usability to extend the research on the selection of LV products.

In another study, Copolillo and Teitelman (2005) reported on an applied ethnography (interviews) and grounded theory approach (focus groups) with 15 participants with low vision. The purpose of the authors' interviews and focus groups was to understand how the participants plan to acquire LV ATDs, integrate them into daily life and to "seek general reactions to current or potential LV ATD use" (Copolillo & Teitelman, 2005, p. 308). A thematic analysis of the data revealed three major themes:

> *Theme 1: Experiences and characteristics leading to successful LVAD use decision making. Four subcategories included: (a) positive health care experience, (b) benefits of LVAD, (c) resource exchange (informal network, support group, peers), and (d) savvy consumerism.*
> *Theme 2: Challenges to successful LV decision making. Two subcategories included: (a) barriers to LVAD use such as negative health care experiences (e.g., lack of discussion of device use or referral to support services) and unmet assistive technology needs (e.g., lack of access to information and knowledge of services), and (b) Limits of LVADs – e.g., in describing CCTV limitations the lack of features, clarity, too big, heavy or awkward, and the screen not being wide enough, emerged as issues.*
> *Theme 3: Adjustment to LV disability included negative emotional aspects that extended beyond the decision of using a device to the employment of other mechanisms to cope with lifestyle changes.*

Of the available studies in the literature Copolillo and Teitelman's (2005) work was perhaps the most relevant for the consideration of the perspective of persons with LV in

the selection of products. However, there were several key aspects of the study that may benefit from further elaboration. First, the authors did not provide the types and range of LV ATDs that were examined by the participants, although some narratives presented did identify the ATD assessed. As mentioned, the ranking of important concepts (e.g., for selection criteria) may be dependent on the types of ATDs assessed. In addition, some concepts may not be applicable at all depending on the type of ATD discussed. It was unclear why certain ATDs and their features/ issues were highlighted while others were not. Furthermore, while the authors stated that the participants had a range of experience, the study may be strengthened by a better understanding of the types of technologies that were used by the participant, their comfort level with them and their pre-dispositions to using technologies. The additional data on technology usage experience may be especially important given the age restriction of entry to the study (55 years old or above) and the average age of the LV participants sampled (mean age = 75.7, range =56 to 90). Lastly, it seemed that the discussions of mainstream products that may be just as important to occupational performance were out of scope. Batavia and Hammer (1990) provided some breadth, while Copolillo and Teitelman (2005) provided depth on product selection. To better appreciate the complexities of product selection by a person with LV, it is necessary to understand the combination of the range of concepts considered, and the tacit knowledge used during the selection of a product.

4.1.1 Study purpose and LV definition

The purpose of the present study was to elicit the voice and perspectives of low vision experts on product selection. There were two main objectives. The first objective was to gain a better understanding of the breadth and depth of considerations untaken by a sample of participants with low vision during the product selection process. The second objective was to compare the findings in this study to those in the literature to build a comprehensive knowledge base for the purpose of developing a LV product selection instrument (LV-PSI) (see Chapter 5).

In this study, low vision was defined based on the existing literature. Statistics Canada's Participation and Activity Limitation Survey (PALS) defined a seeing disability as having difficulty seeing newspaper print or clearly seeing the face of someone from 4m

or 12 feet away (Statistics Canada, 2006). The National Eye Institute (2007) suggests low vision to mean "that even with regular glasses, contact lenses, and medicine or surgery, people find everyday tasks difficult to do. Reading the mail, shopping, cooking, seeing the TV, and writing can seem challenging." More precisely, Colenbrander (2002) suggested that the low vision classification from ICO and ICD-9-CM of "mild", "moderate" and "severe" may be translated to visual acuities (in the better eye) of between 20/32 to 20/63, 20/80 to 20/160 and 20/200 to 20/400 respectively.

4.2 Research Design and Methods

4.2.1 Research Design

This study used a qualitative multimodal inductive approach for the purpose of supporting the future (quantitative) development of a product selection instrument for persons with low vision (Creswell & Plano Clark, 2007). An inductive approach was used to ensure that the voice of persons with LV is shown through the use of the instrument, and add to existing knowledge in the literature. There is a dearth of studies that included persons with LV in the development of instruments and thus, persons with LV have traditionally been marginalized from not only the lack of inclusion in research, but the lack of consideration of their viewpoints in the development of ATDs and products they use to participate in everyday life.

A means through which 'giving voice' may be afforded inductively is through qualitative research where rich and in-depth knowledge may be gained from the LV participants' expression of lived experience (de Jonge, Rodger, & Fitzgibbon, 2001). Therefore, the current research is underscored by a critical approach to help empower the participants to confront this omission (Kincheloe & McLaren, 2000). The critical perspective is consistent with the need for participation of the marginalized and advocacy underpinning Paulo Freire's work. Freire (1982) eloquently argued that:

> *The silenced are not just incidental to the curiosity of the researcher but are the masters of inquiry into the underlying causes of the events in their world. In this context research becomes a means of moving them beyond silence into a quest to proclaim the world. (p. 30-31).*

4.2.2 ATD models

Additionally, two models from the ATD literature informed the design of the present study. The Human, Activity, Assistive Technology (HAAT) model focuses on capturing the components of the human, the activity and the assistive technology used within a context. "The human component includes physical, cognitive, and emotional elements; activity includes self-care, productivity and leisure; assistive technology includes intrinsic and extrinsic enablers; and the context includes physical, social cultural and institutional contexts" (Cook & Polgar, 2008, p. 36). The HAAT model was used during the design of the semi-structured interview guide to ensure that the dynamic negotiations between the key components were probed. A second model that was used was Gitlin's "career" model (1998). Gitlin suggests that the way in which people interact with ATDs over time is analogous to following a career path. The user starts out as a 'novice' (e.g., use of ATDs in the hospital) then progresses on to become an 'early user' (home use for 1-6 months), to an 'experienced user' (home use for 7-12 months) and then finally as an 'expert user' (home use for 1 years and beyond). The model depicts device needs as emerging in a linear fashion as a function of increased time use and exposure to the device. As such, an expert user may have accumulative experiences and insight from having gone through the discrete stages of his device use career path. Therefore, experts were selected to participate in the focus group sections.

4.2.3 Methods

In this study, two qualitative methods were used to gain insight into the voice and perspectives of participants with LV. The first method used was a modified version of the nominal group technique (NGT). A NGT, or an expert panel, is a qualitative data collection method that serves to build consensus and research decisions among its participants and is more controlled than a typical focus group (Powell & Single, 1996). A detailed outline of the NGT process can be found in Bartunek and Murninghan (1984); but a basic premise adopted in the present study was that each of the participants first generated and ranked a secret list of selection considerations, prior to a discussion of the considerations in context. A second method that was used was focus group discussions. Focus groups are defined as "a research technique that collects data through group

interaction on a topic determined by the researcher." (Morgan, 1996, p. 130). Focus groups were used in this study to explore and investigate what people have to say, and to provide insights into the sources of complex behaviours and motivations for persons with LV in product selection (Morgan, 1996; Morgan & Krueger, 1993). When comparing the two methods, focus groups generate more divergent views/ experiences, have a higher interaction quality, and allow for the participants to provide more in-depth of experiences (Powell & Single, 1996, p. 503).

Taking a balanced approach to enable an opportunity for participants to provide their voice and contribution to the overall development of the LV-PSI, a modified NGT method was designed to gain relative *breadth* where as the facilitated focus group discussions were used to gain relative *depth* (Powell & Single, 1996). More specifically, the modified NGT was used to identify initial considerations for selection that may be important to the individual, and in-depth discussion of a selected number of these concepts then took place through a focus group. In other words, the NGT is *modified* here in that there was no attempt to reaching consensus when compared to a traditional NGT. Participants were only asked at the end of an exercise if they would like change their selection considerations after a focus group discussion and if so in what way.

4.2.4 Recruitment

Two methods of recruitment were used: advertisements through disability organizations via the regular channels they use to communicate with their clients (e.g., email, or word-of-mouth), and in a local newspaper. The eligibility for participation included: a) self-identified as having low vision but not complete blindness, b) 18 years of age or older, c) have used ATDs for more than or equal to 6 months, and d) the ability to participate in a 90 minutes session (involving the use of the modified NGT and focus group discussions) conducted in English.

4.2.5 Research protocol

The protocol for this research received ethical approval from a university Health Sciences Research Ethics Board. The two sessions took place at the Qualitative Research Lab (QRL) in a university setting. The QRL is a space designed for focus groups that

optimizes audio and video recording and is uniquely designed to maximize confidentiality. Ahead of the sessions, the participants each completed the Survey of Technology Use (SOTU) which provided a short profile of their previous experiences with technology.

Prior to participating in the sessions, participants were given an opportunity to provide input and feedback over the telephone on the semi-structured focus group questions to be used in the sessions. Each session consisted of three main topics of discussion: (1) Low vision technology – Non-portable home use (e.g., CCTV, electronic screen magnifier), (2) Low vision technology – portable outside of home use (handheld magnifier, portable CCTV, monocular), and (3) Everyday mainstream technology (e.g., cell phone, mp3 player, GPS navigation, watch). For each topic of discussion, there were two main steps used to gain voice and perspective from the participants. In *step one (modified NGT)* participants were asked to write down a technology and "three or four things you would think about or things you would consider if you are asked to select or purchase the technology today." Participants were asked to start with writing down the most important thing they would consider, and then the next important, and so on. In a round robin fashion in *step two (focus group discussions)*, each participant would then shared the technology she picked and the most important consideration for selection and purchase on her list; this was followed by a discussion of the selection and purchase consideration. Once everyone had a chance to share their most important consideration, the next most important consideration was then shared (i.e., reading down the list from step one) by the participants followed again by discussions (step two). Along with audio and video recordings taken during the sessions, the lists of product selection produced by the participants were collected for further data analysis.

4.2.6 Low vision research considerations

Three facilitators conducted each of the two sessions. Each session consisted of five participants, as opposed to six to 10 participants that some authors have suggested (Powell & Single, 1996). The ratio of facilitators to participants was high to ensure that the participants' visual and other accessibility needs were accommodated during the session. For example, while large papers with thick markers were provided for

participants to write down their product selection consideration, participants were also given the choice to have a facilitator help with writing down the information. Furthermore, Morgan (1996) suggests that a smaller number of participants allow for a high level of involvement as each participant is given more time to discuss her views and experiences.

Prior to the commencement of each session, the lead facilitator described the building and room layout (e.g., the spatial location of the circular table that the facilitators and the participants sat around, and any power cords or tripping hazards). The lead facilitator offered the assistance of the facilitators to find the washroom, get refreshments, and exit the building in case of emergency should they require it. All facilitators were familiar with basic sighted guide techniques.

4.2.7 Data analysis

Demographics and SOTU data were collected to gain basic information about the participants including pervious experiences with technology. These data were used to supplement and interpret the key data collected in steps one (modified NGT results) and two (focus group results) of the study. In addition, a summary of the products discussed during the two sessions, with three exercises in each session, was compiled to provide context and range for the interpretation of the key data collected from step one and two of the study.

From step one, a content analysis for identifying the breadth of the product selection considerations expressed by the participants was performed. First, concepts that were similar but worded differently were labeled/ grouped together. The frequencies with which the concepts appeared were totaled. Second, each concept was reviewed and it was noted whether or not it was mentioned in each of the three exercises in each of the two focus groups. In other words, a concept could be mentioned zero times or a maximum of six times (2 focus groups x 3 exercises).

The audio recordings of the focus group discussions were transcribed. The video recordings were used to supplement the audio recordings for the purpose of identifying

interactions between the participants and the facilitators. From step two, a grounded theory approach was used to identify the process of selection choices to provide a depth of understanding of applying selection considerations (Corbin & Strauss, 2008) (see Figure 4-1, under "Grounded theory approach, analysis process"). Constant comparison within and between the two focus group transcripts, as well as, with the other data collected was completed. The first researcher generated preliminary concepts through memo writing, open and axial coding[1]. The second researcher independently generated concepts and these were compared to the first researcher's findings. Concepts and themes that emerged from the reading and the analysis of the transcripts were discussed until consensus was reached. The third researcher verified that the clustering of concepts and themes was logical.

4.3 Results

4.3.1 Description of participants

Ten adults (18+) with low vision who were "expert" product users (used devices for one year or more) (Gitlin, 1998) participated in two product selection qualitative research sessions. In session 1, the average age of the participants was 52.4 (SD = 11.9). Per Colenbrander's (2002) definitions of the varying degrees of low vision, three of the participants had severe low vision, and two participants had moderate low vision. In session 2, the average age of the participants was 62.6 (SD =18.9). Two participants had severe low vision, two had moderate low vision, and one other had mild low vision. On average, participants from session 1 were exposed to ATDs for a longer period of time, although this exposure does not speak to the quality or the quantity of ATD interactions. A profile of the ten participants can be found in Table 4-1.

---

[1] Open coding refers to "breaking data apart and delineating concepts to stand for blocks of raw data", whereas axial coding refers to "the act of relating concepts/categories to each other" (Corbin & Strauss, 2008, p. 198). The distinction is artificial and only serves to make clear that the coding process involves breaking the data apart to identify concepts to stand for the data, but the data also needs to be brought back together through relating the concepts of the work being analyzed (Corbin & Strauss, 2008).

Table 4-1: A profile of research participants (n = 10).

ID	Age	Sex	Diagnosis	Visual disability	Number of years since first ATD use	Session number
C	39	F	Optic neuropathy	Severe	29	1
E	43	F	Congenital Cataracts	Severe	30	1
H	55	M	Retinopathy of prematurity	Severe	49	1
I	56	M	Retinitis pigmentosa	Moderate	14	1
O	69	F	Macular dystrophy	Moderate	40	1
B	36	F	Optic neuropathy	Severe	4.5	2
M	61	F	Other - Retinal degenerative condition	Moderate	20	2
N	67	M	ARMD	Moderate	3	2
K	60	M	Macular dystrophy	Severe	15	2
Q	89	M	ARMD/Cataracts	Mild	2	2

4.3.2 Participants' product selection considerations

Table 4-2 provides a list of the products that were discussed by the participants during the two sessions, containing three exercises in each session.

Table 4-2: Products discussed during the focus groups

Exercise 1: Low vision technology: Non-portable home use	Exercise 2: Low vision technology: Portable outside of home use	Exercise 3: Everyday technology (mainstream)
LCD display	Glasses	Watch
Computer	Monocular	Cell phone
Keyboard	Handheld magnifier	Portable CCTV
Electronic screen magnifier	Light	Laptop computer
Electronic screen reader	Portable book reader/ Notetaker	Audio player (mp3)
Windows accessibility	Portable CCTV	Audio player (Daisy)
	Laptop computer	GPS device
		Portable DVD player

Content analysis of criteria used in selecting devices (breadth)

A summary of the content analysis of the lists of product selection considerations (step one data) provided by the participants can be found in Table 4-3. In order to compare the lists of important considerations for product selection by the participants, it was important that we be able to group the concepts under common concepts. While there were slight changes, an effort was made to keep as closely as possible to the wording/

language that was used by the participant. In examination of the product selection considerations collected from step one, some notable patterns emerged.

First, the *cost, ease of use* and *visibility* of a product were mentioned as important selection considerations in each of the three exercises in both focus groups by at least one person. Each of these concepts was also expressed by the participants as important selection criteria more than 10 times. Cost referred to the initial cost, maintenance and training cost, ease of use refers to both hardware and software products, and visibility refers to the size of icons, or letters which affect readability. *Durability*, which referred to a product lasting a long time, or the ruggedness of the product, was also mentioned at least once across both sessions and the exercises with the exception of exercise 1 in the second session. *Visual quality* (e.g., contrast, brightness, colour, clarity) and *functionality* (of hardware and software functions) were also frequently mentioned across the exercises and sessions. After the durability concept, the frequency count drops to below five. The following were expressed by the participants as being important with a minimum frequency count of two: *magnification, portability, audibility, battery life* and *compatibility*. One other point to highlight is that as expected, portability and battery life were mentioned at least once in both sessions during exercise 2 on the discussion of portable low vision technology that is used outside of the home. Portability and battery life were also mentioned in exercise 3 in the second session.

Table 4-3: Summary of content analysis from step one data collection.

'X' denotes that the corresponding selection consideration was mentioned in an exercise or in a focus group sample.

Selection consideration from step one data collection	Frequency Count	Session sample 1 Exercise 1	Session sample 1 Exercise 2	Session sample 1 Exercise 3	Session sample 2 Exercise 1	Session sample 2 Exercise 2	Session sample 2 Exercise 3
Cost	17	X	X	X	X	X	X
Ease of use	15	X	X	X	X	X	X
Visibility	13	X	X	X	X	X	X
Visual quality	9	X		X	X	X	
Functionality	8	X	X	X		X	
Durability	6	X	X	X		X	X
Magnification	5		X		X	X	
Portability	4		X			X	X
Audibility	4	X		X			X
Battery life	4		X			X	X
Compatibility	2	X	X				
Support	1	X					
Learning	1				X		
Tactile feedback	1				X		
Unobtrusiveness	1		X				
Easy to obtain	1	X					
Other feedback	1						X
Outdoor use	1						X
The "cool" fact	1			X			
Independence	1		X				
Total	96						

Grounded theory analysis of selection process (Depth)

Over one hundred memos and notes were written by the first researcher as part of the qualitative analysis of the transcripts. Two researchers agreed on concepts which supported the emergence of three major themes that underscored the device selection process. The major themes included the consideration of the: (1) product attribute, (2) personal compatibility and (3) personal meaning.

(1) The theme of *product attribute* emerged from 6 concepts. Expert users suggested that a product's attribute may be characterized by: 1) having the necessary functions and features; 2) easy to setup; 3) intuitive to use and consistent design; 4) having good contrast and size; 5) affording technical compatibility with other products; and 6) providing multiple feedback options to enable individual use.

(2) The theme of *personal compatibility* captured 10 of the concepts identified. Expert users suggested that the product's compatibility and fit with their lives may be characterized as 1) fitting with their (personal) preference; 2) allowing them to perform desired activities; 3) being customizable to their needs; 4) being familiar with use from frequent expose to the product or related products; 5) fitting with the context of use; 6) flexible to use, especially in multiple situations and contexts; 7) fitting with their budget (price/ cost/ funding restrictions (lack of choice), and with their learning style. This included the ability 8) to trial the product (trialability/ Process/ Procedural way of knowing); 9) to learn about it through training; and 10) to obtain support where necessary.

(3) The theme of personal *meaning* emerged from 5 concepts. Expert users suggested that they consider selecting a product that 1) has the cool "look"; 2) is unobtrusive and does not single them out in a crowd; 3) gives a sense of liberation or freedom; 4) is essential to their basic existence (e.g., cannot live without the product), and 5) promotes their own independence.

An example of the grounded theory approach used in this study to generate a theme which started from raw data collected from the focus group discussions (step two data) can be found in Figure 4-1 (Corbin & Strauss, 2008). In the example, memo writing through within focus group constant comparison resulted in the in-vivo coding, as well as, the concept of unobtrusiveness. Axial coding of the concept along with others (independence, the cool "look", feeling of liberation and essential to existence) resulted in the theme of *meaning.* Table 4-4 provides some examples of concepts and quotes from all three themes which is referred to in the discussion.

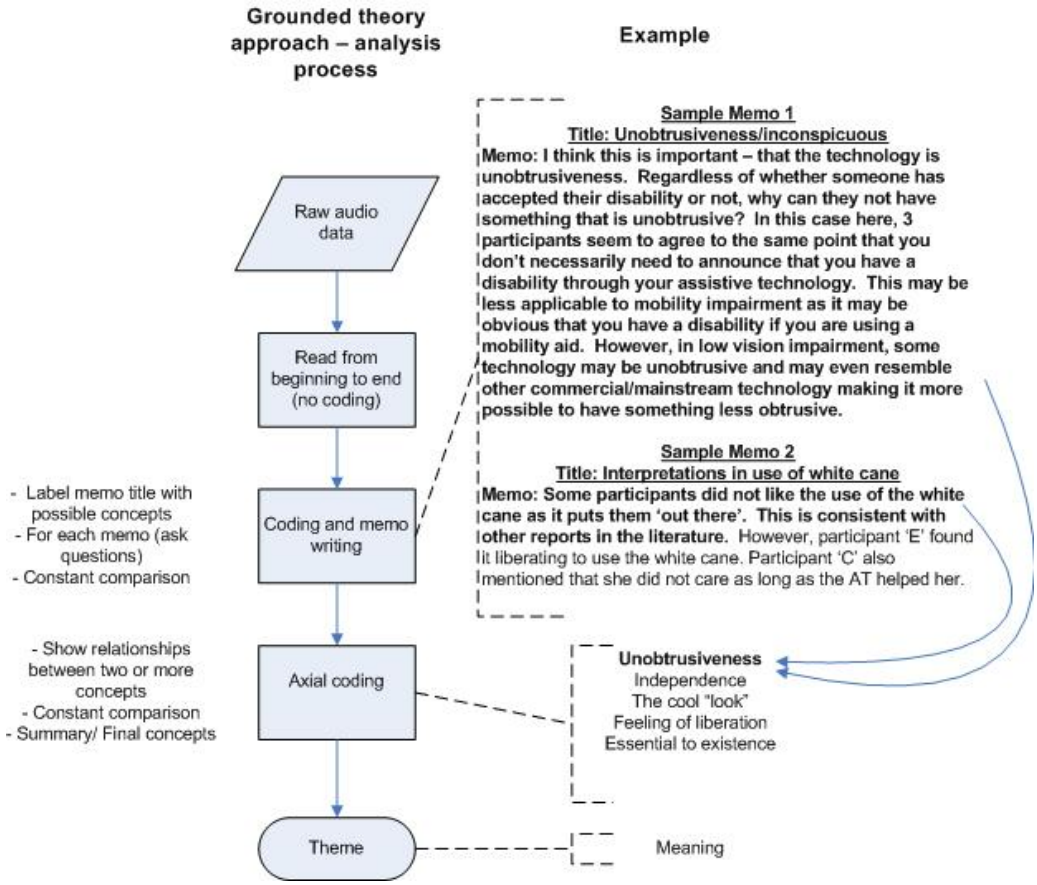

Figure 4-1: Grounded theory approach used in this study.

Table 4-4: Sample concepts and quotes from two of three main themes.

Themes	Concepts	Sample quotes
Product attribute	Has expected and necessary functions and features	1. Participants suggested the following functions and features are important for a portable CCTV: magnification level, contrast, size and portability, battery life, positioning of camera.
		2. Preference for necessary functions and features only is shown here when participant 'M' said: "One of the main things [about] using the magnifiers… I have this little one and I don't like it because, I never use the light on it because it bothers my eyes so if I was buying another one I wouldn't get another one with light on it."
	Easy to setup/ Ease of use/ Uncomplicated/ Immediate usage	3. In talking about an electronic screen magnifier, participant 'I' said: "It's a matter of looking at them [options] and saying… is it easy to use? Is it going to take a long time for me to configure and set up the system and how complicated is it going to be… how complicated is it going to be before I actually start to use it in such… and that was my one, number one thing [consideration]"
	Good contrast and size	4. Participant 'N' said: "I was thinking of the microwave…. They always design it [so that it's] very classy -- silver on silver. I can't see silver on silver. I need black on white. I need something with contrast and big print and I cannot find that." Participant 'Q' added that the "aluminum keyboard" on the latest computer his son brought him was not usable and his sons ended up getting him a white on black large print keyboard and it was great.

Personal compatibility	Personal preference (general)	5. Participant 'E' said: “the people that have been most successful and satisfied I think are the ones that have a clear vision of what they want and then they go out and find the thing that they want. Or some solution that you may not have even really thought of to whatever their issues are.” Participant 'C' added “or know what the goal is and going to find the correct tools and the open-mindedness to what they have to do to get that goal.” Related and perhaps the most powerful quote: “We’re not always the expert. We are the expert on how we want to use the damn thing.”
	Flexibility of use/ Context of use	6. Participant ‘I’ said: “You can go to some of these vision fares and see all of this equipment and this one will do something and that one would do something but there's nothing combining the two and put it together and do everything for me.”
	Trialability/ Process/ Procedural way of knowing	7. Participant ‘M’ said: “I always knew that you could make adjustments, I wasn't sure how you could do it… and that's why [I] have to mess around with it until I found the way to do it because… I had gotten the XP and I hadn’t had that before and I knew I had to do something to adjust the colouring or whatever. And that’s how I found it. So within a week or two of the time I got it just by fumbling around.” Participant ‘K’ added: “I am with you <participant ‘M’> I was basically the same. I went to the accessories part for accessibility and I didn't know that you can change the colour either. You know I didn't have a computer and I got a computer and I just started fooling around with it and I found that I can adjust it, it kind of suits me.” 8. Participant ‘N’ on trialing a magnifier at a retail store “Yeah, I would do that or my thumb. Can I see my thumb print?”
	Support	9. Participant ‘K’ said: “I'm hearing a lot of the same things. People don't know about the technology. They are amazed when they find out and a lot of people, truth cannot afford some of the technology but there's a lot of people out there who really can and still are not aware that there's a lot of stuff out there that can make life livable when they think of life is kind of over.” 10. Participant ‘I’ said: “Availability of support. You know, is there some support system available

		for us. Especially when it comes to these types of devices, what's the mechanism or support out there so that I can make use of [it] should I need it. I've never had to use them but still."
Meaning	Aesthetics	11. Participant 'I' said: "I call it the cool look…The iPod has a nice look and such to it and if you look at what's available for blind community. The Victor reader, Victor stream right? It's just a keypad…and I am like errrr…. So I could buy the Victor reader and it will do everything I want but I want to be with the rest of the crowd and have an iPod."
	Independence	12. Participant 'K' said: "I've met a lot of people who have very very discouraged and I think one of the things sometimes happens is that people are not allowed to be independent. Some of the families take their independence completely away from them… mother or father can't do something now so one lady told me one day when she went to use her walking stick… oh my that you don't need that when you're with me. And she said I do need it because it's part of me. She said… there's a lot of the independence that is taken away."
	'Existence'	13. Participant 'E' said: "Cost would not have been first [consideration] because I feel that I can't function without them [glasses]. But I think maybe for things that I don't think about as necessarily for my existence... they're nice but I don't have to have them cost is the most important thing…"

4.4 Discussion

To meet the stated objectives of the study, the discussion here was intended to: (1) integrate the data captured in this study to provide a depth of understanding related to LV product selection, and (2) establish the congruence of the findings from this study to those published in the literature. The discussion section was organized by the three themes that emerged from the grounded theory approach of analyzing the focus group data, namely: product attribute, personal compatibility and the meaning of the product. The strengths and limitations of the present study were also discussed towards the end of the paper.

4.4.1 Theme 1: Product Attribute

The participants identified and elaborated on product functions and features which are important for specific technologies in particular situations. For example participant 'E', who has a severe low vision condition and enjoys reading (i.e., listening) through the use of her Book Port described the function and features she cared about "I cared about how long the battery life was and I cared about how durable it was. A lot of times it's just one little drop and it just doesn't work anymore. And things do have a way of dropping if you can't see well." Both *battery life* and *durability* were also extracted through the content analysis of the modified NGT but the focus group discussion provides the context of use and explicates these as important features particularly for those with low vision. Durability was mentioned in the general ATD selection literature while battery life was mentioned more indirectly through concepts such as *portability* (e.g., Batavia & Hammer, 1990).

The considerations of *functionality* as well as the *visual quality* of a product such as *contrast, clarity,* and *sharpness* identified in this study, are consistent with considerations found in the literature as being important to selection, use or abandonment decisions (e.g., Wagner, Vanderheiden, & Sesto, 2006; Stone, Mann, Mann, & Hurren, 1997; Copolillo & Teitelman, 2005). Sample quotes demonstrating the extremely important concepts of having the '*necessary functions and features*' and '*good contrast and size*' are abundant and a few can be found in Table 4-4 (quote 1, 2, 4). It should also be noted

that functionality, visual quality and *visibility* which are similar to concepts of sizing and readability (Boulton, 1989; Gerber, 2003) of a product were also mentioned numerous times during the modified NGT data collection. Two other product attributes that may be particularly important to persons with low vision which emerged in the focus group discussions but were under emphasized in the modified NGT results include *technical compatibility* (e.g., electronic screen readers or magnifiers with various operating systems) and *multiple feedback* options (e.g., tactile, voice, visual) (Rogers, 2003; Crudden, 2002; Gerber, 2003; Wagner, Vanderheiden, & Sesto, 2006).

A sub-theme of product attribute is *ease of use* which was mentioned in both focus groups and in all three modified NGT exercises regardless of the type of technology being discussed (vision technology in exercise 1, portable low vision technology in exercise 2, and everyday portable technology in exercise 3). An example quote presented in table 4-4 (quote 3) showed that the sub-theme of ease of use or *uncomplicated use* also captures the concepts of *ease of or uncomplicated setup*, as well as, *immediate usage*. The product should also be "intuitive and consistent" to use as suggested by participant 'H', who has a wealth of knowledge as a person with severe low vision, and also a user and instructor of sight enchantment and substitution technologies.

In summary, the theme of product attributes identified here reinforced some key concepts found in the LV literature on LV product selection, such as the visual quality and necessary function and features of a product for use in context (Copolillo & Teitelman, 2005). Other concepts that emerged, such as visibility, technical compatibly and multiple feedback were consistent with the LV literature that may relate to selection, use and abandonment. The theme also identified some gaps in the LV literature that should be highlighted. While the general ATD literature has identified some human factors and usability principles in evaluating and designing an ATD (e.g., King, 1999), based on the present work, the findings suggested that more research should be dedicated to describing the multi-faceted concept of *ease of use* that a person with low vision deems as essential.

4.4.2 Theme 2: Personal compatibility

Personal compatibility as a theme captured the fit between an individual and a product. It also speaks to the logic of how the individual sees that he would use a product in given context, and includes how he would go about evaluating this logic during the selection process. One of the key aspects of the theme is that it considers how a person may pragmatically evaluate the fit between himself and the product. As participant 'E' poignantly stated, "we are not always the expert. We are the expert on how we want to use the damn thing." (see Table 4-4, quote 5). Here, the participants moved beyond evaluating the available visual attributes or functions and features of a product to evaluating their personal compatibility with the *cost, personal preference, context and flexibility of use, and learning and support* of the product

Not surprisingly, the *cost* (i.e., price, funding available, or subsidy) of a product is a key consideration in the selection of a product across both focus groups and all exercises from the modified NGT results. The cost factor some times dictates ("though it shouldn't" as participant 'H' suggests) whether a person selects a particular technology or not. Participant 'E' articulated that a person with low vision may evaluate her personal financial situation and decide on the less expensive or subsidized option over another that is more suitable to meet his physical/ sensory need. Participant 'C' adds: "some of us we have no choice because we're on disability income and a lot of these things are expensive and it would be out of the question to buy something like that." Cost, including the cost of the product, the maintenance and the training to use the product, has been mentioned by many study participants in the low vision literature as being a barrier or a serious consideration to obtaining certain products (Batavia & Hammer, 1990; Gerber, 2003; Williamson, Albrecht, Schauder, & Bow, 2001; Okada & Kume, 1999; Access Economics, 2009). However, the literature has not clarified whether LV persons paying for and selecting suitable products themselves results in a lower abandonment rate than if they obtained a less suitable product through subsidized means. On the other hand, focus group data collected here has also shown that cost is not the de-facto deciding factor in the selection of a product especially when the product affects a person's very 'existence'. This point be further discussed under the meaning theme.

Personal preference as a sub-theme encompasses several concepts including whether the product can help with the *performance of desired activities* or occupations, and whether the product is *familiar to the person* so that he is predisposed to select and use it. These concepts are especially congruent with Dr. Scherer's MPT research (Scherer, 1998). Generally, personal preference speaks to whether a product is suitable to an individual, thus customizability to meet individual needs also falls into this sub-theme. For example, in speaking about a new computer that his sons brought him, participant 'Q' says: "When I say that it's not as user friendly…they [his sons] say 'it's the best technology in the world!' The best technology? I can't read the damn thing…like the keyboard I described [with poor contrast], it's just stupid." Here, the quote shows that while the product may be marketed as being the 'best', there is no personal fit with the participant. In speaking about the selection of an electronic magnifier participant 'I' provides the following questions: "Can I modify [it]? …will [it] adapt to the way I want it to function on the computer and allow me to explore all the different things that I do with the computer? So not only am I suitable for it, but is it suitable for me? Can it conform to what my requirements and such are?"

Context and flexibility in the selection and use of a product are also something that is heavily advocated by occupational therapist, other practitioners and researchers (Cook & Polgar, 2008; Scherer, 1998; Gerber, 2003; Batavia & Hammer, 1990). The focus group discussion results reiterated these points. For example participant 'C' ponders the context and flexibility of use of her glasses: "Umm… can it be used for a lot of things? Can I read the menu or can I do the newspaper. If it was only one or two things then it wouldn't be very good. It would [be good] if I can read a lot of things with [my glasses]…different fonts and more." Throughout the two focus groups and with the discussion of various products in the three exercises, many context of use (e.g., settings and occupations) were mentioned. Some of these include: reading at home, reading at the cottage, reading the newspaper and restaurant menus, working, cooking, using the Internet, shopping at stores, performing household tasks, watching TV, and watching DVD on portable player.

Finally, *learning and support* were only mentioned one time each during the modified NGT exercises but they emerged as a key sub-theme in the thematic analysis of the focus group data. Participant learning starts at the initial phase of product introduction where it may be trialed (i.e., *trialability*); it can also be seen as a process or procedural way of knowing about a product, for example through *'trial and error'* or through other personal strategies (see Table 4-4, quotes 7 and 8) (see Rogers, 2003; Copolillo & Teitelman, 2005; Culham, Chabra, & Rubin, 2009). Learning may also involve *training* to use the product after purchase. It may also relate to peer or professional support prior to, during or after purchase (see Table 4-4, quotes 9 and 10). Within the LV literature, a lack of available training (e.g., long wait lists, no training facility) and high cost for training were considered as barriers to LV product use (Gerber, 2003; Ryan, Anas, Beamer, & Bajorek, 2003; Williamson, Albrecht, Schauder, & Bow, 2001; Copolillo & Teitelman, 2005; Wolffe, Candela, & Johnson, 2003).

Although not necessarily a factor, one point to note is the trend that participants evaluate their personal need relative to what an ATD can do versus what a mainstream product can do in different situations and contexts. In several discussions during the focus groups, participants expressed that they have abandoned ATDs to adopt mainstream products or simply prefer the use of these products in the first place. For example participant 'K' replaced his add-on electronic screen magnifier software with the use of built-in computer features such as adjusting the fonts and icons. As mainstream technology is built with more accessibility and usability functions in mind, an evaluation of the suitability of mainstream products for persons with low vision becomes increasingly necessary (Crudden, 2002; Gerber, 2003; Wagner, Vanderheiden, & Sesto, 2006).

In summary, the theme of personal compatibility captured a lot of different concepts that may be related to product selection. Four sub-themes were used to encompass the concepts identified. First, consistent with the literature, cost *may* be the main factor of determining whether a product is selected or not. If a funder decides to pay for product A but not product B, given the limited resources of many persons with LV, product A may be selected over product B based on the cost factor alone. The sub-themes of personal

preference, as well as, context and flexibility were found to be important. These ideas are congruent with some of the literature found in the fields of ATD selection and occupational therapy. Finally, the importance of learning and support in LV product selection is well documented in the literature and is reiterated here in the current work.

4.4.3 Theme 3: Meaning

The meaning or the feeling that an individual with LV attributes to the selection and use of a product is at least as important as the function of the product (Hocking, 1999). Personal meaning has been well established in the general, ATD and low vision literature as being important to consider for product selection, use and the mitigation of abandonment (Gray, Quatrano, & Lieberman, 1998, Hocking, 1999; Gerber, 2003; Crudden, 2002; Norman, 2004). Interestingly, concepts related to meaning such as *unobtrusiveness, independence* were only mentioned once each in step one data collection through the modified NGT even though they emerged as key concepts in the thematic analysis of the focus group discussions. This finding supports the idea that the multimodal methods used in the two steps of data collection complemented each other; as the focus group discussions provided more depth and extracted tacit knowledge that would have been overlooked by the use of the modified NGT alone.

Clear examples of the importance of the unobtrusiveness of a product to some were provided in Figure 4-1. In addition, Mann, Hurren, Karuza, and Bentley (1993) finds that some participants had a fear of victimization, embarrassment and stigma with the use of the white cane and other products. The ability to be ‘inconspicuous’ or ‘fit-in’ when using a low vision product may be important for some people with low vision for safety, and aesthetics reasons (Mann, Hurren, Karuza, & Bentley, 1993; Williamson, Albrecht, Schauder, & Bow, 2001; Okada & Kume, 1999). Participant ‘I’ who has moderate low vision and is an advocate of community accessibility further adds to the point of *aesthetics* (or ‘cosmesis’, see King, 1999) being important in his preference of using a mainstream audio player over a specialized one designed for persons with visual impairment (see Table 4-4, quotes 9 and 11).

It is important here to highlight that, especially in focus group 2, there was a considerable amount of time spent on the discussion of using the white cane and the meaning behind its use. The discussion was rich in that several important concepts related to meaning emerged. Although, the feeling of being *stigmatized* by the use of the white cane was still present for some participants (Crudden, 2002; Spencer, 1988), others felt that its use promoted *independence*. For example, as person with severe low vision who has participated in numerous community self-help groups for people who are blind or have low vision, participant 'K' offered his observations of complex issues surrounding the use of the white cane and the idea of independence (see Table 4-4, quote 12). His comments added the dimension of caregivers and others who may not be the end user of the product but may nevertheless influence whether the person with LV will use the product and the meaning she associates with the product. In addition, the white cane and other LV product may be a source of empowerment to the person selecting and using them, as well as, a support for personal independence (Buning & Hanzlik, 1993). In further discussion about the white cane, participant 'E' says: "I found it [use of the white cane] pretty *liberating* actually."

A final concept to be highlight in this section is what participant 'E' refers to as the *need of the product for existence.* The participant suggested that having glasses was essential and that the cost consideration was secondary (see Table 4-4, quote 13). In other words, if participant 'E' didn't have glasses, she would be deprived of activities that she may deem as essential and 'cannot live without'. The performance of activities or occupations may be as elemental as food and water for our survival (Wilcock, 1993; Wilcock, 2006). This finding may also lend support to the study by (Horowitz, Brennan, Reinhardt, & MacMillan, 2006) who found efficacy in optical device use by persons with LV for declines in functional disability and depression symptoms over time. Finally, participant 'B' passionately expresses her need to *read*, for which she felt devastation when she was initially deprived of it after her vision loss. Although participant 'B' is relatively young, this finding concurs with those found in the literature where reading is one of the primary activities or occupations that is essential for older persons with low vision (Stelmack, Rosenbloom, Brenneman, & Stelmack, 2003; Virtanen & Laatikainen, 1993; Ryan, Anas, Beamer, & Bajorek, 2003).

In summary, the theme of meaning being important in the product selection process, as captured by the current study in the concepts of aesthetics, unobtrusiveness, sense of liberation, and independence, are well supported in the literature. Furthermore, it is important to emphasize that the same device, as in the case of the white cane, can hold very different meanings to users. While one person may see a product as liberating to use in public, another may see the same product as obtrusive. Lastly, findings here revealed that another important concept requires further development - the idea of a product being essential for existence. As demonstrated above, the concept may be so powerful that it overrides the cost of the product as the main determinant of whether one selects a product, or not.

4.4.4 Limitations and strengths of the present study

There were several limitations in this study. First, due to resource limitations, there were only two focus groups which included 10 participants with low vision in this study. A larger number of focus groups may provide further breadth and depth to this research. Similarly, Scherer's (1998) Matching Person and Technology Model (MPT) originally emerged from a grounded theory study with 10 adults with physical disabilities (five participants with spinal cord injury and five with cerebral palsy) (Lenker and Paquet, 2003). A second limitation is that the participants were quite young (M = 52.4, SD = 11.9 years old) when compared to most of the population with low vision (WHO, 2010; Statistics Canada, 2006), as well as, study participants from many studies found in the current literature. For example, the average participant age in Copolillo and Teitelman's (2005) study was 75.7 years old.

On the other hand, this limitation may also be seen as a strength since the present work supplemented and extended the work of Copolillo and Teitelman (2005) by reporting data from a younger cohort. As indicated, many of the concepts generated were comparable between the two studies. A second strength of the study is that it included participants who used a variety of technologies, as demonstrated through the SOTU data (see Appendix at the end of this chapter). The participants also had a wide-range of experiences with the technologies (e.g., 2 to 49 years of experiences). The SOTU results also noted that six of nine participants who responded to the SOTU had relatively more

positive experiences with technology overall then those who had negative experiences. By using the SOTU, important information about the participant's experiences with technology can be used to provide participant profiles for further interpretation and comparison with findings from other studies. Lastly, the decision in the design of the methods to include the discussion of several categories of products may be argued as an additional strength. This design decision yielded contextual and occupational knowledge on a number of different products (see Table 4-2).

4.5 Conclusion

This study invited persons with LV to be part of the instrument development process, thereby affording an opportunity for them to express their voice and perspective on product selection. A multimodal method was used to extract concepts and themes from the qualitative data collected. Key results that will be useful for the next study to develop and test a low vision product selection instrument are found in section 4.3. The results help to steer and emphasize certain important product selection considerations by persons with LV, which has for the most part, been presented in a piecemeal fashion in the extant LV literature. Findings from the current work were shown to be congruent with the findings from the LV, ATD, human factors, and/or the general consumer literature.

4.6 References

Access Economics Pty Limited. (2009). *The cost of vision loss in Canada: Full report for Canadian National Institute for the Blind and Canadian Opthalmological Society.* Retrieved June 30, 2009, from www.cnib.ca/en/research/pages/covl.aspx

Batavia, A. I., & Hammer, G. S. (1990). Toward the development of consumer-based criteria for the evaluation of assistive devices. *Journal of Rehabilitation Research and Development, Fall, 27*(4), 425-436.

Bartunek, J.M. & Murninghan, J.K. (1984). The nominal group technique: Expanding the basic procedure and underlying assumptions. *Group & Organization Studies, 9*(3), 417-432.

Boulton, L. M. (1989). A clinical evaluation of equipment which allows the partially sighted and blind to access computer-based information. *Australian and New Zealand Journal of Ophthalmology, 17*(1), 87-93.

Buning, M. E., & Hanzlik, J. R. (1993). Adaptive computer use for a person with visual impairment. *American Journal of Occupational Therapy, 47*(11), 998-1008.

Colenbrander A. (2002). *Visual standards: Aspects and ranges of vision loss.* Report prepared for the International Council of Ophthalmology at the 29th International Congress of Ophthalmology, Sydney, Australia.

Cook, A.M. & Polgar, J.M. (2008). *Cook & Hussey's assistive Technologies: Principles and Practice (3rd edition).* St. Louis, MO: Mosby Elsevier.

Copolillo, A., & Teitelman, J. L. (2005). Acquisition and integration of low vision assistive devices: Understanding the decision-making process of older adults with low vision. *American Journal of Occupational Therapy, 59*(3), 305-313.

Corbin, J. & Strauss, A. (2008). *Basics of qualitative research (3rd edition).* Thousand Oaks: CA: Sage Publications, Inc.

Creswell, J. & Plano Clark, V. (2007). *Designing and conducting mixed-methods* research. Thousand Oaks, CA: Sage Publications, Inc.

Crudden, A. (2002). Employment after Vision Loss: Results of a Collective Case. Journal of Visual Impairment & Blindness, 96, 615-622.

Culham, L. E., Chabra, A., & Rubin, G. S. (2009). Users' subjective evaluation of electronic vision enhancement systems. *Ophthalmic & Physiological Optics : The Journal of the British College of Ophthalmic Opticians (Optometrists), 29*(2), 138-149.

de Jonge, D., Rodger, S. & Fitzgibbon, H. (2001). Putting technology to work: Users' perspective on integrating assistive technology into the workplace. *Work, 16*(2), 77-89.

Dahlin Ivanoff, S., & Sonn, U. (2005). Assistive devices in activities of daily living used by persons with age-related macular degeneration: A population study of 85-year-olds living at home, *Scandinavian Journal of Occupational Therapy, 12*(1), 10-17.

Freire, P. (1982). Creating alternative research methods. Learning to do it by doing it. In B. Hall, A. Gillette and R. Tandon (Eds.), *Creating Knowledge: A Monopoly,* (pp. 29-37). New Delhi: Society for Participatory Research in Asia.

Gerber, E. (2003). The benefits of and barriers to computer use for individuals who are visually impaired. *Journal of Visual Impairment & Blindness, 97*(9), 536-550.

Gitlin, L.N. (1998). From hospital to home: Individual variations in experience with assistive devices among older adults. In D.B. Gray, L.A. Quatrano, & M.L. Lieberman (Eds.), *Designing and using assistive technology: The human perspective* (pp. 117-135). Baltimore, MD: Paul H. Brookes Publishing Company.

Gray, D.B., Quatrano, L.A. & Lieberman, M.L. (1998). *Designing and using assistive technology: The human perspective*. Baltimore, MD: Paul H. Brookes Publishing Company.

Goodrich, G.L. (2003). Available and emerging technologies for people with visual impairment. *Generations (spring edition),* 64-70.

Hocking, C. (1999). Function or feelings: Factors in abandonment of assistive devices. *Technology and Disability, 11*, 3-11.

Horowitz, A., Brennan, M., Reinhardt, J. P., & MacMillan, T. (2006). The impact of assistive device use on disability and depression among older adults with age-related vision impairments. *Journals of Gerontology Series B: Psychological Sciences & Social Sciences, 61B*(5), S274-80.

Jutai, J., Hooper, P., Strong, G., Russell-Minda, E., Cooper, L., Hutnik C., Sheidow T., & Tingey, D. (2007). *Vision rehabilitation evidence-based review: Module 1: Terminology, demography, and epidemiology of low vision.* Unpublished manuscript, The University of Western Ontario, The Lawson Health Research Institute, and CNIB.

Kincheloe, J.L. & McLaren, P. (2000). Rethinking Critical Theory and Qualitative Research. In N.K. Denzin & Y. S. Lincoln (Eds.). *Handbook of Qualitative Research (2nd edition)* (pp.279-313). Thousand Oaks, CA: Sage.

Lenker, J. and Paquet, V. (2003). A review of conceptual models for assistive technology use and outcome. *Assistive Technology, 15*(1): 1-15.

King, T. W. (1999). *Assistive technology: Essential human factors.* Boston, Massachusetts: Allyn and Bacon.

Mann, W. C., Hurren, D., Karuza, J., & Bentley, D. W. (1993). Needs of home-based older visually impaired persons for assistive devices. *Journal of Visual Impairment and Blindness, 87*(4), 106-110.

Morgan, D.L. (1996). Focus groups. *Annual Review of Sociology, 22*, 129-152.

Morgan, D.L., Kruegar, RA. (1993). When to use focus groups and why. In D.L. Mogran (Ed.), *Successful Focus groups: Advancing the state of the Art* (pp. 3-19). Thousand Oaks, CA: Sage.

National Eye Institute. (2007). What you should know about low vision. Retrieved July 29, 2009, from www.nei.nih.gov/health/lowvision/LowVisPatBro2.pdf.

Norman, D. (2004). Emotional design: Why we love (or hate) every day things. New York, NY: Basic Books.

Okada, S., & Kume, Y. (1999). CCTV user survey and prototypes based on the survey results. *Technology & Disability, 11*(3), 123-131.

Powell, R.A. & Single, M. (1996). Methodology Matters – V: Focus Groups. *International Journal for Quality in Health Care, 8*(5), 499-504.

Rogers, E.M. (2003). *Diffusion of Innovation (5th edition)*. New York, NY: Free Press.

Ryan, E. B., Anas, A. P., Beamer, M., & Bajorek, S. (2003). Coping with age-related vision loss in everyday reading activities. *Educational Gerontology, 29*(1), 37-54.

Scherer, M. (1998, Revision of 1994, 1991 and 1989 Editions). *The Matching Person & Technology (MPT) Model Manual.* Webster, NY: The Institute for Matching Person & Technology, Inc.

Spencer, J. (1998). Tools or baggage? Alternative meanings of assistive technology. In D.B. Gray, L.A. Quantrano, & M.L. Leiberman (Eds.), *Designing and using assistive technology: The human perspective.* (pp. 89-98). Baltimore: Paul H. Brookes Publishing Company.

Statistics Canada. (2006). Participation and Activity Limitation Survey. Retrieved July 29, 2009, from www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3251&lang=en&db=imdb&adm=8&dis=2

Stelmack, J. A., Rosenbloom, A. A., Brenneman, C. S., & Stelmack, T. R. (2003). Patients' perceptions of the need for low vision devices. *Journal of Visual Impairment & Blindness, 97*(9), 521-535.

Stone, J., Mann, W., Mann, J., & Hurren, D. (1997). Use of magnifiers by older persons with low vision. *Technology & Disability, 6*(3), 169-175.

Virtanen, P. & Laatikainen, L. (1993). Low vision aids in age-related macular degeneration. *Current Opinion in Ophthalmology, 4,* 33-5.

Wagner, J., Vanderheiden, G. C., & Sesto, M. E. (2006). Improving the usability of a mainstream cell phone for individuals with low vision. *Journal of Visual Impairment and Blindness, 100*(11), 687-692.

Wilcock, A.A. (1993). A theory of the human need for occupation. *Journal of Occupational Science, 1*(1), 17-24.

Wilcock, A. (Ed.). (2006). *An occupational perspective of health (2nd edition).* New Jersey: Slack Incorporated.

Williamson, K., Albrecht, A., Schauder, D., & Bow, A. (2001). Australian perspectives on the use of the internet by people who are visually impaired and professionals who work with them. *Journal of Visual Impairment & Blindness, 95*(11), 690-701.

Wolffe, K. E., Candela, T., & Johnson, G. (2003). Wired to work: A qualitative analysis of assistive technology training for people with visual impairments. *Journal of Visual Impairment and Blindness, 97*(11), 677-694.

World Health Organization (WHO). (2010). World report on disability: Concept note. Retrieved December 20, 2010, from www.who.int/disabilities/publications/concept_note_2010.pdf

Appendix: Survey of Technology Use (SOTU)

For the SOTU instrument, please refer to Scherer (1998). Data collected using the SOTU from this chapter is presented below:

Table: Survey of Technology Use. (+), (-) and (neutral) denotes positive, negative and neutral opinion respectively. **'*'** denotes that the survey was incomplete or not completed at all.

ID	Number of frequently used technology	Technology (most to least frequently used)	Overall experience with technology [5 questions]	Perspectives on technology [8 questions]	Typical activity [4 questions]	Personal/ Social Characteristics [14 questions]
C	4	PC, CD, VCR, DVD	(+) 3 (-) 2 (neutral) 0	(+) 4 (-) 1 (neutral) 3	(+) 0 (-) 0 (neutral) 4	(+) 13 (-) 1 (neutral) 0
E	4	Large monitor, Windows magnifying, Victor Reader, Monocular	(+) 3 (-) 0 (neutral) 2	(+) 6 (-) 0 (neutral) 2	(+) 1 (-) 2 (neutral) 1	(+) 13 (-) 0 (neutral) 1
H	11	PC, text-to-speech, bifocals, monocular, type n' speak, cell, ATM, DVD, Scanner with OCR, Perkins Brailler, CCTV	(+) 2 (-) 3 (neutral) 0	(+) 5 (-) 0 (neutral) 3	(+) 1 (-) 2 (neutral) 1	(+) 11 (-) 0 (neutral) 3
I*	-	-	-	-	-	-
O	3	VCR, DVD, TV	(+) 1 (-) 3 (neutral) 1	(+) 4 (-) 2 (neutral) 2	(+) 2 (-) 1 (neutral) 1	(+) 11 (-) 1 (neutral) 2
B	8	PC, Zoomtext, Cell, DVD burner, ATM, handheld magnifiers, Victor stream, Victor daisy	(+) 2 (-) 0 (neutral) 3	(+) 7 (-) 0 (neutral) 1	(+) 1 (-) 1 (neutral) 2	(+) 6 (-) 1 (neutral) 7
M*	9	PC, ATM, cell, DVD, CD, miniature music player, microwave, house alarm, stove	(+) 4 (-) 0 (neutral) 0	(+) 2 (-) 2 (neutral) 0	(+) 3 (-) 0 (neutral) 1	(+) 14 (-) 0 (neutral) 0
N	6	PC, Digital cable box, coffee maker, ATM, digital Camera, Stove/ Microwave	(+) 1 (-) 1 (neutral) 3	(+) 1 (-) 1 (neutral) 6	(+) 1 (-) 2 (neutral) 1	(+) 9 (-) 2 (neutral) 3
K	4	PC, ATM, CD, Cell	(+) 5 (-) 0 (neutral) 0	(+) 4 (-) 0 (neutral) 4	(+) 4 (-) 0 (neutral) 0	(+) 14 (-) 0 (neutral) 0
Q	5	PC, handheld magnifier, portable DVD player, CD, VCR	(+) 5 (-) 0 (neutral) 0	(+) 1 (-) 4 (neutral) 3	(+) 1 (-) 2 (neutral) 1	(+) 13 (-) 0 (neutral) 1

Chapter 5

5 Development and initial testing of the Low Vision Product Selection Instrument (LV-PSI)

5.1 Introduction

Products including assistive technology devices (ATDs), such as white canes, magnifiers, closed circuit television, electronic screen magnifiers, accessible audio players and other devices are important for persons with low vision (LV) to perform daily activities or occupations. In Canada, approximately 2.5% of the population has a visual impairment (Statistics Canada, 2006); and $303.9 million dollars are spent per annum on ATDs for persons with visual impairment (Access Economics, 2009). This cost to the stakeholders including tax payers (federal and provincial governments), employers, individual with vision loss and their family and friends, does not include the cost of mass market products also used for vision loss management (Access Economics, 2009). When products are used properly, they enable performance of meaningful daily activities (Vanderheiden, 1988; Whiteford, 2004; Polgar & Landry, 2004). Although further research is needed (Jutai, Strong & Russell-Minda, 2009; Jutai, Coulson, & Russell-Minda, 2009), several authors have provided data which showed that the use of products by some individuals with LV may improve mobility, decrease depression and increase psychosocial well-being (Dahlin Ivanoff, & Sonn, 2005; Horowitz, Brennan, Reinhardt, & MacMillan, 2006; Strong, Jutai, Bevers, Hartley, & Plotkin, 2003; Huber, Jutai, Strong, & Plotkin, 2008). Unfortunately, many products used by persons with LV that are initially adopted are abandoned soon after (Strong et al., 2003). For example, Mann, Goodall, Justiss, and Tomita (2002) have found that persons with visual impairment abandon canes and magnifiers at a rate of 32.4% and 26.5% respectively. In addition to the obvious wasted cost implications to the stakeholders, when products are abandoned by the user, they will not meet any degree of intended design of use or potential for enablement regardless of how much it is appreciated by the user's support team (Polgar, 2006).

A proper fit of the product, and needs and wants of the person, is crucial to reduce unnecessary abandonment (Scherer, Jutai, Fuhrer, Demers, & DeRuyter, 2007). A failure to successfully achieve this matching process is theorized as the first step towards abandonment (Scherer, Sax, Vanbiervliet, Cushman, & Scherer, 2005). One potential method of helping with the process is through the use of checklists or instruments that allow and/ or remind the person with LV of the gambit of personal considerations that have been theorized to be important during product selection. A small number of primarily qualitative studies have looked at the perspective of persons with LV during product selection. These will be reviewed shortly. However, the literature does not go beyond identifying and describing these concepts related to product selection, and as such, these qualitative data are inadequate by themselves for enacting change (Creswell & Plano Clark, 2007). In other words, an instrument that would prompt a person with LV to consider her needs and wants, as opposed to the needs and wants of her service provider, is necessary. Though both sets of needs and wants are important, the person with LV who will ultimately be using the product should be given the primary focus (Wessels, 2004; Polgar, 2006). Such an instrument is currently missing from research and practice. Translating and testing the qualitative concepts identified in the literature into practice through instrumentation is possible with the help of quantitative methods. The present study aimed to help persons with low vision in product selection through the development of a low vision product selection instrument (LV-PSI).

5.1.1 Literature review

The ATD literature on selection and abandonment provides a starting point for discussing factors that may influence product selection for persons with LV. There has been an accumulating body of literature on factors theorized or inferred to be influential to ATD selection. Examples of factors include but are not limited to: the function of a device, the human factors design of the device, the feelings or meaning attributed to a device, the relative advantage of using the device over not using it and whether the person is involved in the selection process (Hocking, 1999; Scherer, et al., 2005; King, 1999; Pape, Kim, & Weiner, 2002; Reimer-Reiss & Wacker, 2000; Spencer, 1998). Though these and a host of other factors may be important, the extent to which they apply to the

selection of products by persons with LV is less clear. What seems to be clearer is that ATD selection is a complex construct and multi-dimensional in nature.

Recently, Scherer, et al. (2007) presented a framework that may be used to organize ATD selection research and provision. In their framework, there are two sets of pre-disposition factors that influence ATD selection. They include environmental (cultural and financial priorities, legislation and policy, attitudes of key others) and personal factors of the consumer and the provider (resources, knowledge and information, expectations, personal preferences and priorities). Together, these two main factors provide the context for which evaluations of objective and subjective needs may take place (Scherer et al., 2007). This framework is useful in that it allows investigators to locate their research in the complex construct of ATD selection.

Related to the framework, Scherer and colleagues have provided a system of instruments which have advanced and focused our understanding of these pre-dispositions (Scherer, 1998; Scherer & Craddock, 2002). An example of one instrument is the Assistive Technology Device Predisposition Assessment - consumer form (ATDPA – C). It provides a section which asks the consumer to rate ten general, non-disability specific items relating to "how do you feel about using the device?" (Scherer, 1998) In terms of locating these personal factor items, they fall under the subjective needs of the consumer. Though the ATDPA may be useful for general ATD selection, there exists an opportunity to add LV product selection content to supplement the overall system of instruments offered by Scherer and colleagues.

In the current study, the generation of items for the purpose of instrument development was informed by three studies directly related to *product selection* by persons with LV. First, Batavia and Hammer (1990) used a modified Delphi method with focus groups which involved participants with disabilities (N = 12) to develop a list of 17 criteria for the evaluation of ATDs. Of the 12 participants who took part in the study, two had visual impairments. A further analysis of the data revealed that the rankings of criteria were different when only 'blind technologies' were taken into account. The top four priorities in order from most important to least important were: affordability, effectiveness,

dependability and portability. The external applicability of these results should be further explored with a larger number of persons with vision loss using a greater variety of products.

Copolillo and Teitelman (2005) used an applied ethnography (interviews) and grounded theory approach (focus groups) with LV participants (N = 15) to provide in-depth insight on how persons with LV plan to acquire ATDs and to integrate them into their daily life. A thematic analysis of the data revealed three major themes including: Experiences and characteristics leading to successful LV ATD use decision making, challenges to successful LV decision making, and adjustment to LV disability (Copolillo &Teitelman, 2005).

Though this study made an important contribution to our understanding of several barriers and facilitators to LV ATD selection by the participants, further investigations may prove to be useful for a more comprehensive understanding of the LV product selection process. For instance, related studies may fully consider and report on the types and range of LV ATDs being discussed so the reader may better gauge the applicability of the results to LV ATD selection and evaluation. This additional information may be especially important given the age restriction of entry to the study (55 years old or above) and the average age of the LV participants actually sampled (mean age = 75.7, range =56 to 90). Consequently, it was unclear whether the discussion of other types of ATDs or products may have occurred if a younger cohort of participants was sampled, and whether it would affect the reported results.

Finally, product selection considerations were explored with LV participants (N =10; Mean age = 52.4, SD = 11.9) through the use of a modified nominal group technique and focus group discussions as reported in Chapter 4 of this dissertation. The types of products that were examined through these two methods included: (1) Low vision technology – Non-portable home use (e.g., CCTV, electronic screen magnifier), (2) Low vision technology – portable outside of home use (handheld magnifier, portable CCTV, monocular), and (3) Everyday mainstream technology (e.g., cell phone, mp3 player, GPS navigation, watch). A multimodal method of integrating the data collected through

content analysis and a grounded theory approach resulted in three key product selection themes and a multitude of concepts within each theme. The themes and concepts were compared to those identified in a scoping review of the literature on data and concepts identified by study participants that may relate to product selection, usage and/ or abandonment (Chapter 2) (Polgar, 2003).

The first theme identified was product attribute and it encompassed concepts such as visual quality (e.g., contrast, clarity, sharpness); necessary function and features which may be dependent on the product being selected and the context of use (e.g., desirable to have good battery life for devices that are portable); technical compatibility with the use of other products; and multiple feedback options (e.g., tactile, voice, visual). A sub-theme of product attribute was ease of use (e.g., intuitive and consistent layout of an audio player) which has been underemphasized in the LV literature. The second theme of personal compatibility captured the sub-themes of the cost of the product which may sometimes be the main factor in determining selection; personal preference; context and flexibility of the use of the product; and available learning opportunities and support for the use of the product. The last theme of meaning being an important theme for product selection is well documented in the literature and was verified by the study. This theme included concepts such as the aesthetics of a product; the relative unobtrusiveness (non-stigmatization) of the product in everyday use, especially in public; a sense of liberation; and a feeling of independence through the use of the product. Together the studies reviewed here provided a qualitative knowledge-base specifically on the topic of product selection for persons with LV, and informed the development of the low vision product selection instrument (LV-PSI) presented in this study.

5.1.2 Study purpose and purpose of the LV-PSI

The purpose of the present study was to report on the development and initial testing of an instrument to aid persons with LV in the selection of products. The low vision product selection instrument (LV-PSI) consists of key components theorized to be important in the selection process of a product from the Human Activity Assistive Technology model (Cook & Polgar, 2008). The four components include: the human, the activity, the assistive technology and the context. The components were embedded in the

design of the instrument, along with a list of items that could be used to help the respondent evaluate the product-person fit. The LV-PSI may be thought of as a screening tool which was intended for independent use by persons with low vision or ideally, where available, alongside a service provider to determine the fit between the person and the product.

To locate this study, it represented the last leg of a larger mixed-methods study characterized by what Creswell and Plano Clark (2007) described as a *sequential exploratory design for instrument development*. The first leg involved reviewing and gaining knowledge on LV product selection as summarized in the previous section. There are two phases to the study presented in the present paper. *Phase one* involved the development of the instrument (iterations 1, 2, 3) through the generation of items from the relevant qualitative studies, as well as, modifying and reducing the number of items based on feedback from expert reviewers. In *phase two*, the initial testing of the factor structure of the set of items based on a refined version of the instrument was conducted. How well the instrument represented the domain of concern was examined using factor analysis, or more specifically through principal component analysis (PCA). The rationale for the use of the PCA as an initial analysis was to reduce the number of factors as much as possible so as to account for most of the variance *and* to get a more parsimonious explanation of the data collected (Suhr, 2006; Norman & Streiner, 1998). The authors of this paper are interested to see if the data set could be reduced to a smaller number of items that could comprise a new scale. Note that the term 'factor' and 'component' are used interchangeably in this paper (Harman, 1976). Internal consistencies were tested using Cronbach's coefficient alpha. The present study received ethical approval from research ethics boards at The University of Western Ontario (UWO) and the University of Waterloo (UW).

5.2 Phase one – Item Generation

5.2.1 Methods for instrument development (iterations 1, 2, 3)

The instrument itself was designed to consider, to varying degrees, all four components of the HAAT model (Cook & Polgar, 2008). Within the introduction description of the

instrument, the context in which it was to be used and the exercise (i.e., selecting a product for daily use) the participants were asked to complete for the study was provided (AERA, APA, NCME, 1999). In completing the instrument, the respondents were asked to specify the product they were considering, the types of activities for which the product would be used, and where the product would be used. The respondents were then asked to consider a list of product selection items.

The combination of the context, the stem and response option constituted an item. The development of items was informed by the "Assistive Technology outcome Profile – Mobility Devices (ATOP/M) – Development of Item Pool Guide for Item Selection and Review" (Bode, Jutai, Heinermann, & Fuhrer, 2010; Jutai, Demers, DeRuyter, Finlayson, Fuhrer, Hammel & Lenker, 2009; Jutai, Hammel, Finlayson, Fok & Fuhrer, 2008) and the work of DeWalt, Rothrock, Yount, and Stone (2007). The former sets out the following definitions of context and stem of each item for the present study (p. 4): *Context* referred to the instructions associated with answering the item; and s*tem* referred to the part of the item that makes it unique from others in the same scale. In the latter, DeWalt et al. (2007) sets the definitions for the processes that took place here for the development of the item pool (pp. S13-S16).

> *Binning:* A systematic process for grouping items according to meanings and specific latent constructs.
> *Winnowing:* The reduction of the large item pool down to a representative set of items
> *Item revision:* Revision of items based on characteristics such as style in phrasing, response options and literacy demands to form a coherent test/instrument.

The following item *context* was adopted: "It is important to me that the [product name] I purchase…." Sample item *stems* along with their respective *binning* can be found in Table 5-1.

Table 5-1: Sample item stems.

Sample item stems along with associated 'bins' are provided in the table. **The 'additional LV literature support' column provided sample references where, in addition to the previous study in this dissertation (Chapter 4), study participants elsewhere have expressed the importance of the idea captured in the 'sample stem'.

Sample stem	Bin	Sample LV literature support**
...offers the contrast that I desire.	Product attribute	Wagner, Vanderheiden, and Sesto (2006); Stone, Mann, Mann, and Hurren (1997); Copolillo and Teitelman (2005)
….is easy to transport so that I can take it with me to use in different places.	Product attribute	Boulton (1989); Copolillo and Teitelman (2005); Okada and Kume (1999); Stone, Mann, Mann, and Hurren (1997)
…. comes with the necessary training I will need in order to use it.	Personal compatibility	Gerber, 2003; Ryan, Anas, Beamer, and Bajorek (2003); Williamson, Albrecht, Schauder, and Bow (2001); Copolillo and Teitelman (2005); Wolffe, Candela, and Johnson (2003)
…. will not break as I learn to use it through trial and error.	Personal compatibility	Rogers (2003); Copolillo and Teitelman (2005); Culham, Chabra, and Rubin (2009)
…. Helps me to achieve the independence I want.	Meaning	Buning and Hanzlik (1993); Crudden (2002)
…. is one the will not single me out from a crowd (e.g., non-stigmatizing).	Meaning	Mann, Hurren, Karuza, and Bentley (1993); Crudden (2002)

In total, an initial set of 83-items was generated by two researchers. The 'bins' along with item *stems* were generated based on the literature supported themes and sub-themes that resulted from an analysis of Chapter 4 (see section 5.1.1). More specifically, two researchers reviewed the raw qualitative data collected (e.g., transcripts, and notes) from the study reported in Chapter 4 against the themes and concepts identified in that study, as well as, in the literature and generated the items (Polgar, 2003). The two major bins included were: *Product attribute* (35 items) and *personal compatibility* (40 items). A third minor bin which included a smaller number of items was *meaning* (8 items). The initial response option used was a five-point Likert scale with anchors at '1' (strongly disagree) and '5' (strongly agree). A 'not applicable' (N/A) option was also provided for each item.

5.2.2 Winnowing and item revision with expert reviewers

Winnowing and item revision, as defined above, were *both* done in two separate steps. Step one was completed by the first author in concert with one of his two dissertation

committee co-chairs who was not involved in the initial item generation process. Step two was completed by a sample of expert reviewers. The expert reviewers were purposely sampled by the authors to give a balance of expertise in the evaluation of the instrument (AERA, APA, NCME, 1999). The reviewers classified their expertise as demonstrated through the knowledge they gained professionally as psychometrics/ instrument development experts, content experts, clinicians, and 'other'. The expert reviewers were also asked to approximate the experience (years and months) they have gained through working in the respective area/ role. The experts reviewed the instrument electronically. Experts were provided with instructions to complete the review. An excerpt is provided here:

> *Please review the content and wording of the instrument that will be administered over the telephone to participants with low vision (LV). In reviewing the content, please consider the following questions: Do the numbered instrument items that follow adequately address the considerations people with LV may have during device selection? More specifically, what instrument items would you remove? What instrument items would you add? In reviewing the wording of the instrument: Would you change any instructions to the LV participants to complete the instrument? Would you change the wording of any specific instrument items?*

The instrument was revised by the first author and his two dissertation co-chairs based on the feedback obtained from the expert panel.

5.2.3 Results

A summary of the item revision process from phase one *and* phase two (discussed later) of this study can be found in Figure 5-1. The original version of the instrument can be found in Appendix D.

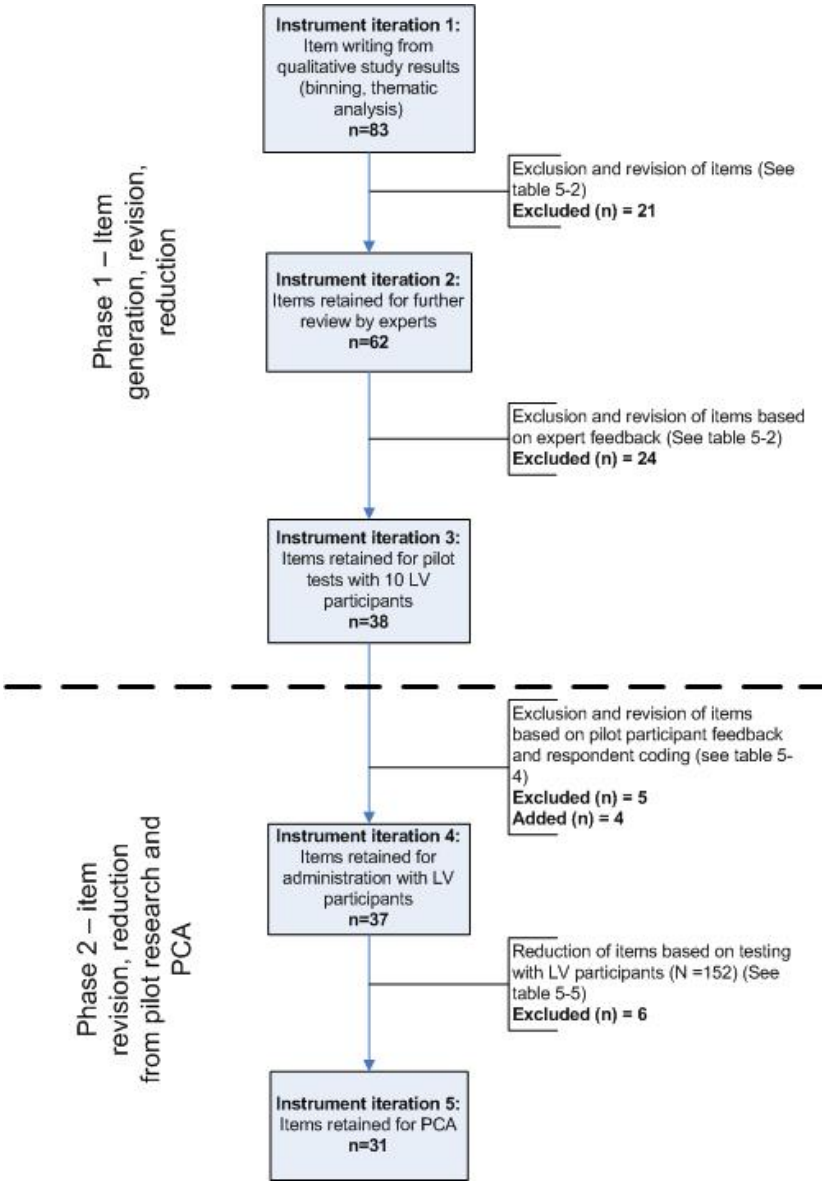

Figure 5-1: Summary of the item revision process for phase one and two of this study.

The first author along with his two dissertation committee co-chairs revised and reduced the 83-item instrument (iteration 1) to a 62-item instrument (iteration 2). A total of 11 experts then participated in the review of iteration 2 of the instrument. The experts self identified themselves as content experts (N= 3), psychometrics/ instrument development experts (N= 3), clinicians (N= 2) and assistive technology specialist/ practitioner (N =3). The number of years of expert experience ranged from 3 to 28 years and averaged 13.3

years (S.D. = 7.4 years). With the exception of two reviewers, all other reviewers independently reviewed the instrument and submitted feedback to the researchers electronically. The feedback obtained resulted in the revision and reduction of items.

Table 5-2 provide examples of items that were dropped from the survey and those that were revised. Reasons to winnow selected items were similar to those presented by DeWalt et al. (2007), such as: item redundancies, item too narrow, too confusing, or too vague. Examples of item revision rationales included changes to an item made for consistency, or for clarity. A total of 24 items were dropped resulting in a 38-items instrument (iteration 3) that was used for phase two of the study.

Table 5-2: Winnowing and item revision samples.

Item	Revised	Dropped	Rationale	Sample reviewer feedback
…can be used hands-free		X	Item too narrow	- Are there any devices really hands-free? - Will not affect most products.
…has a clear display		X	Item redundant	- To me "clear display" would include brightness, contrasts, letters etc… If the specific items remain, then the general item appears redundant. - Three reviewers agree that this item may be redundant.
…helps me to do what I want to do		X	Item too vague	- Afraid you will get no discrimination in responses here.
…. comes in the colour I desire (e.g., display colour, device colour, etc.).		X	Too many ideas in one item and item is redundant	- Re: "display colour"… This is very different from the aesthetics of the device itself. - Item seems confusing as there are a couple of ideas. Both are somewhat covered elsewhere
…offers the brightness that I desire.	X		Revised for consistency	Removed the word "that" to be consistent with other items.
…has a logical layout.	X		Revised for literacy demands	- Not clear what a "logical" layout would be. - Revised to: "…has an easy to understand layout."
…does not require batteries that need to be specially ordered	X		Revised for clarification	- Why specifically ordered? What does that mean – from a supplier? - Revised to …uses standard readily available parts (e.g., light bulbs and batteries)

Other editorial comments by the reviewers were made in the introduction to the study. For example, one reviewer suggested the use of the word "product" in place of "device", or "technology." Additionally, there were two key pieces of feedback related to the use

of the 5-point Likert scale with an N/A option that was used to rate the 'importance' of an item for product selection. First, one reviewer suggested that 'importance' is a uni-polar construct. He stated "a device can be 'very important to me, but it doesn't make sense to describe a device as 'very unimportant' or 'somewhat unimportant'". Therefore, he suggested the use of a 4-point response option (1 = not important, 2 = somewhat important, 3 = very important and 4 = essential). Second, another reviewer suggested that in completing the survey, many participants will likely respond with the N/A option for a number of the items. These concerns prompted the revisions of some of the items, and a re-consideration of a suitable response option. Both of these concerns were examined through pilot testing with participants recruited for phase two of the study.

5.3 Phase two – Pilot and factor structure testing of the instrument (iterations 4 and 5)

The 38-item instrument (iteration 3) from phase one of the study was used in phase two of the study which consisted of two pilot studies (herein referred to as 'pilot research'), followed by the testing of a refined version instrument (iteration 5) with a larger sample of persons with LV. The purpose of the pilot research was to help to clarify and set the format of the instrument (iteration 4) in terms of wording, and response format for use in the data collection for the PCA. The purpose of testing the instrument was to explore its initial factor structure.

5.3.1 Participant recruitment

Primary recruitment was done through the Centre for Sight Enhancement, University of Waterloo School of Optometry, herein referred to as the 'School'. Working with a data base administrator, the director of the Centre for Sight Enhancement identified patients who had previously given permission to be contacted by researchers for possible participation in research. A representative from the School made initial contact with the potential participant to see if he or she agreed to be contacted by the first author for the purpose of providing further information about the current study. If the potential participant agreed to be contacted, the first author sent a letter of information about the phase two study prior to further contact. Depending on the preference or accommodation

of visual needs required by the potential participant, the letter of information can be read out loud over the telephone. If the potential participant was interested and was eligible to participate in the phase two study, the first author then obtained explicit verbal consent over telephone. The inclusion criteria for the study were as follows:

(1) Male and female adults (18+) with vision difficulties (low vision only).
(2) The participant must be able to use a phone (hear and speak English) in order to participate in a telephone interview/ survey which may last approximately 15-30 minutes.

If the potential participant did not meet the eligibility criteria of having low vision, but still wished to participate, he or she was offered to participate in the part of the pilot research which pertained to the evaluation of the response option preferences. Based on the filter questions from the Participation and Activity Limitations Survey (PALS), if participants "cannot see" even with the help of corrective lens and/or assistive aids they were excluded from the data collection aspect for the PCA (Statistics Canada, 2006). This exclusion criterion was necessary given that the types of technologies used by those who are blind are different then those who have low vision (Massof, 2003; Jutai et al., 2007). For example, blind participants may only be able to use sight substitution technology which may rely on voice output (e.g., screen reader, talking calculator) and tactile feedback (e.g., Braille, keyboards with actual keys as opposed to a touch screen), whereas those with low vision may use a combination of sight enhancement (e.g., large print, large telephone keypads and display) and substitution technology.

A secondary recruitment strategy used advertisements through local newspapers and posters in public places (e.g., local library, mall, employment center). Potential participants contacted the first author directly via telephone or email if interested. The first author then provided information about the study through the letter of information, determined eligibility and obtained verbal consent in the same manner outlined above. The only instance where the first author contacted a potential participant first was if consent to do so was given by the potential participant to a person within his circle of care (e.g., care giver or service provider). This strategy was used with potential participants from the Ivey Eye Institute in London, Ontario. For both recruitment strategies, a lottery incentive was used to encourage participation.

5.3.2 Pilot research procedures

The pilot research consisted of two parts, both of which were conducted over the telephone. First, an administration of the instrument (iteration 3) for the purpose of improving the wording, intelligibility, length and format took place (AERA, APA, NCME, 1999; Polgar, 2003). Behaviour coding was adopted, along with participant feedback, to identify problems experienced by the participants during the pretest of the items. According to Schwarz and Sudman (1996) behaviour codes can be used to identify cognitive problems during telephone interviews at the pretest stage. Selected behaviour codes related to interviewer question-reading (S = slight change to item; M = major change to item), and respondent behaviour (A – interruption (interrupts question with answer); B – clarification (ask for repeat or clarification); C – inadequate answer (answer does not meet question objective); D – don't know; E – refuse to answer) were recorded during the presentation and participant response to each item (where applicable). Upon the completion of the instrument (iteration 3), each participant also responded to debrief questions pertaining to the clarity of the instructions to complete the instrument and the items, the length and flow of the instrument, and whether the items asked were expected or not. Content analysis of the behaviour codes was performed. An item was considered to be problematic and required intervention (major change to item or deletion of item) if a code of "M" (major change) and/or "B" (clarification) was used two times or more. The findings were discussed among three researchers. The findings helped to further refine the instrument to iteration 4.

Following suggestions from a reviewer in phase one of the study, the second part of the pilot research consisted of asking participants to consider two different response formats. Specifically, participants experienced the use of two different response formats: A 4-point scale (1 = not important, 2 = somewhat important, 3 = very important, or 4 = essential), and an 11-point scale (0 to 10; 0 being not important and 10 being essential). The order of administration of the two scales varied with half of participants (N = 5) using the 4-point scale first on the first 5 items and then the 11-point scale on the next 5 items. The other half of the participants (N = 5) used the 11-point scale first and the 4-point scale after. The participants were asked to provide feedback on the pros and cons

of each of the two response options, to indicate which option they prefer and to provide the rationale for their choice.

5.3.3 Procedures for the Principal Component Analysis

Upon completion of the pretests and revisions based on participant input, the instrument (iteration 4) was administered to a sample of eligible participants with LV over the telephone. Data collected from each participant included: Age, gender, the selection of a product for discussion, the activities performed with the product, the settings where the product would be used and the frequency of its use. As the study was about product selection, the product selected for discussion must be one that the participant was familiar with (used at least 6 months, several times a week), and must be primarily selected and purchased by the participant. Using the product selected as a reference, the participants then responded to each of the items in the instrument (iteration 4). Notes were also taken throughout the administration in order to help with removing items from the final instrument (iteration 5) prior to performing a PCA of the data with SPSS version 15.0.

For the purpose of data analysis of the scores collected, the following steps were adopted from Creswell and Plano Clark (2007), Myers and Oetzel (2003), DeVellis (1991), Arthanat, Wu, Bauer, Lenker, and Nochajski (2009), and H. Prapevessis (personal communication, February 20, 2007) and Norman and Streiner (1998):

i) *Preparing for data analysis:* Numeric values were entered into SPSS and variables were created. Data entered were then checked for potential errors.
ii) *Exploring the data:* General inspection of the data took place (e.g., checked for missing data, anomalies). The step also resulted in descriptive data.
iii) *Principal Component Analysis (PCA):* The following steps took place in the generation of a PCA.
    a. *Assess suitability of data for PCA:* Bartlett's test of sphericity should be statistically significant ($p < 0.05$) and Kaiser-Meryer-Olkin measure should be ≥ 0.6 to ensure sampling adequacy. It should be emphasized that items with more than two 'not applicable' responses were excluded prior to conducting the PCA.
    b. *Factor extraction:* Number of factors to retain depended on the Kaiser's criterion (eigenvalue ≥ 1.0) and the Scree plot.
    c. *Factor rotation:* Orthogonal rotation (Varimax) was used for better interpretation of the item loading. More specifically, in the use of Varimax, each factor tends to load high on a smaller number of variables and low or very low on the other variables making the

interpretation of the resulting factors easier (Stevens, 2002, p. 391). This method was suitable given the exploratory nature of this study. An oblique rotation (Promax) was also used to obtain a components correlation matrix as a check of the assumption that an orthogonal rotation can be used as a result of relative low correlation (i.e., < 0.32 per suggestion by Tabachnick and Fidell, 2007) between the factors.

d. *Variance explained:* Final set of items included considered a balance of parsimony and variance explained.

iv) Items to retain: Loadings on factors which are statistically significant based on the sample size were retained. The follow equation was adopted from Norman and Streiner (1998), where CV represents the critical value accepting a factor loading, N represents the sample size, and $1/(N-2)^{1/2}$ is the standard error (S.E.) for a correlation. Stevens (2002) recommended the doubling of the 1% level of significance (z score for α of 0.01 is 2.576; 2 x 2.576 = 5.152) because the S.E. of factor loadings are conservatively estimated to be twice those of ordinary correlations.

$$CV = 5.152/(N-2)^{1/2} \qquad \text{(eq. 1)}$$

v) Internally consistency: A check of internal consistency of the items included within each factor was completed using Cronbach's coefficient alpha. Factor with $\alpha \geq 0.6$ were retained (Moss et al., 1998).

Data representation for this section will include a table of components extracted along with component loadings.

5.3.4 Results

A total of 172 people took part in phase two of the study, consisting of pilot research with 20 participants (part one: pretest of instrument (iteration 3), N = 10; part two: response options comparison, N =10) and the administration of the instrument (iteration 4) to 152 persons with low vision. Of the ten pilot LV participants involved in part one of the pilot research, six were male and four were female. The average age of the participants was 62.8 years old (SD = 23.7). Of the ten pilot participants involved in part two of the pilot research, four were male and six were female; four with low vision, one was blind, and five had no visual impairment. The average age of the participants was 57.6 years old (SD = 16.9). In the data collection for the PCA (N = 152) involving participants with low vision, 38.2 % were male (N = 58) and 62.8% (N=94) were female. The average age of the sample was 68.9 years old (SD = 16.6) and the age ranged from 19 to 98 years old.

Four products accounted for over half (53.3%) of the different types of product that were selected by the participants for discussion in the telephone interviews. They included: handheld magnifiers, telephones (corded or cordless), computer system (including large monitors but not including laptops), and closed circuit televisions (CCTVs). A summary of the products selected can be found can be found in Figure 5-2.

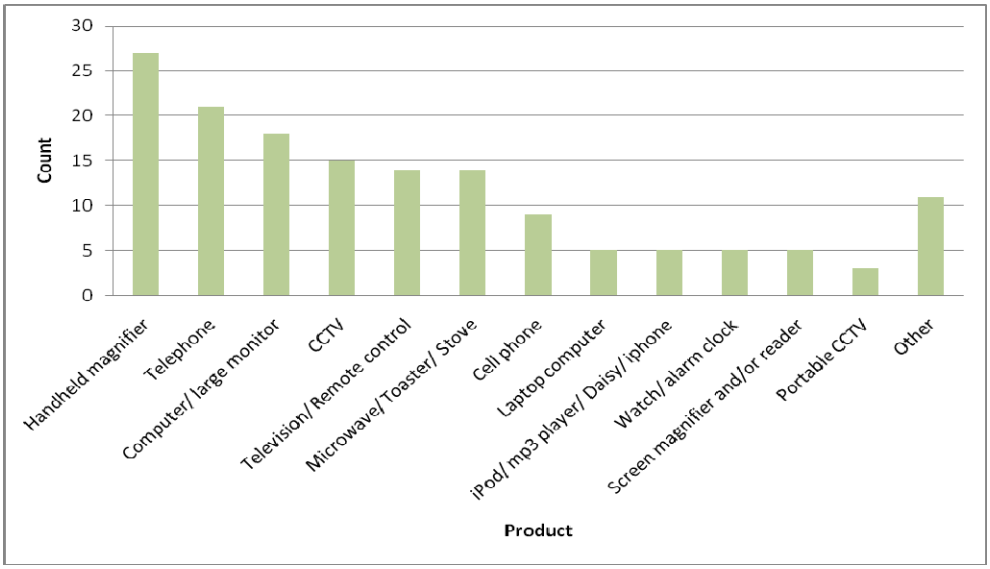

Figure 5-2: A summary of products selected during data collection for the PCA.

Pilot research

Please refer to Table 5-3 for a summary of the results from part one of the pilot research involving the administration of the 38-item instrument (iteration 3) to pilot participants (N = 10). A content analysis, per criteria of flagging a problematic item specified earlier of the behaviour codes (items with two more "M" major change or "B" clarification request codes) and feedback data, revealed that there were seven problematic items that required revision or deletion. Items were revised (N = 2) if a change in wording was sufficient. Items were dropped (N = 5) if they were considered by the participant as redundant, too narrow in focus, or too confusing (DeWalt, et al., 2007). In addition, items were added (N = 4) to ensure that the ideas that were taken out along with the items dropped would still be captured. Overall, this resulted in the net reduction of one-item to an iteration 4 version of the instrument at 37-items.

Table 5-3: Results of content analysis based on behaviour coding.

Item	Added	Revised	Dropped	Comments
…has the functions that I will need for the foreseeable future.			X	- "Foreseeable future" is confusing and if the phrase is removed, it will be redundant with another item ("…includes key features I want to use")
…uses standard readily available parts (e.g., light bulbs and batteries).		X		- Change to "…easy to maintain."
…is easy to remember how to use even if I haven't used it for a long time.			X	- The question does not apply to many devices and does not read properly. - Replace with new item "…has functions that are familiar to me."
…provides a sufficient mix of feedback I desire (e.g., see, hear and/or touch).			X	- Too many ideas in one item. Split to two items about "hearing" and "tactile"
…is less expensive than a comparable device.			X	- Item redundant with the following: "…is inexpensive."
…has the functions I want			X	- Item redundant.
…is easy to hold.		X		- Changed to "…is easy to physically handle or manipulate."
…has functions that are familiar to me	X			- New item used to replace "…is easy to remember how to use even if I have not used it for a long time."
…can be used without the help of others	X			- New item to capture the idea of independence which seems to be missing.
…Provides feedback I can hear (e.g., tones, verbal instructions, etc.)	X			- New Item used to split up "…provides a sufficient mix of feedback I desire (e.g., see, hear and/or touch)."
…Provides tactile feedback I can feel.	X			- New Item used to split up "…provides a sufficient mix of feedback I desire (e.g., see, hear and/or touch)."

Part two of the pilot research involved soliciting preference feedback from pilot participants (N = 10) on the use of two different scales (4-point scale verses 11-point scale) on 10 items from the instrument (iteration 3). The participants were unanimously in favour of the 4-point scale. Representative comments in favour of the 4-point response option included: "Simple to the point…", "concise", "there are words to each number [so we] know we [the interviewer and the respondent] are thinking [about] the same thing". Representative comments against the 11-point response option included: "more complicated to think about…four choices is easier", "What is [the meaning] of a 4 or a 3?", "too much granularity", "if you put a description in every number [it] might be

meaningful but may be too much", "I think people may mix up [the meaning of] 0 and 10…"

Principal Component Analysis

Prior to the factor analysis of the instrument items, six items were dropped based on notes collected by the researcher during the administration of the instrument (iteration 4) over the telephone (see Table 5-4). Generally, when an item needed explanation or clarification by the researcher/ telephone interviewer, it was dropped. It was believed that no interpretations by the researcher should be made on behalf of the participant. The reasons for this decision were that: (1) the final instrument may be used by various interviewers (e.g., clinicians) who may have different interpretations of the items, and (2) the telephone interviewer should merely act as a replacement to reading by participants with low vision. Key rationale for deleting an item included the fact that it was too narrow (i.e., if two or more participants responded with 'not applicable' to a particular item) or that it was redundant. At this stage, items could only be dropped as opposed to revised since it would be invalid to include revised items for testing in the PCA. Recommendations will be made in the discussion section as to which items may benefit from revision and further testing. In summary, six items were removed from the 37-item instrument (iteration 4) which resulted in a set of 31 items (iteration 5) that was subjected to a PCA (N =152 participants).

Table 5-4: Final elimination of items based on participant feedback and instrument administration findings.

Item	Rationale for elimination
… is inexpensive to maintain	- Item too narrow. Many N/A responses. - For example, a participant may ask 'what cost is there to maintain a microwave?' A magnifier? Etc. - Also, several participants mentioned that this question seemed repetitive to the warranty item.
…can be used with other commercially available products	- Item required clarification. - This and the next item likely required the most explanations of all the items mentioned in this section. Many times, the participants would ask what do you mean or give me an example. The question of compatibility seem to apply only to a very specific case, and that is, between electronic magnifiers (e.g., ZoomText) or screen readers (e.g., JAWS) and other assistive or not assistive software and operating system.
… can be used with other assistive devices (or products)	- Item required clarification. See above.
… provides feedback I can hear (e.g., tones, verbal instructions, etc.)	- Item too narrow. Many N/A responses. - Many participants did not how to deal with the item, and asked for extra explanations. This makes sense as many devices do not rely on hearing feedback.
…provides tactile feedback I can feel.	- Unlike the previous item where for some devices, hearing feedback definitely does not apply, participants want to answer this item but need clarification. - Several participants asked about the words "feedback" and "tactile". Since item wording cannot be changed, the item is dropped. - A revised context may be "can be used by sense of touch."
…has long battery life, before the batteries need to be recharged or replaced.	- Item too narrow. Many N/A responses.

The results of the PCAs using an orthogonal rotation (Varimax) are reported shortly. First, it is important to note that the assumptions to use a PCA were checked. The Bartlett's test of sphericity was significant ($p < 0.01$) and the Kasier-Meyer-Olkin measure was acceptable (0.73). A components correlation matrix through the use of an oblique rotation (Promax) can be found in Table 5-5. The table showed that the correlations between the components are small (< 0.32) which supports the use of an orthogonal rotation (Tabachnick & Fidell, 2007; Kline, 1994; Conway & Huffcutt, 2003).

Table 5-5: Component correlation matrix.

Component	1	2	3	4
1	1.000	.214	.219	.208
2	.214	1.000	.213	.261
3	.219	.213	1.000	.236
4	.208	.261	.236	1.000

The number of factors extracted was based on Kaiser's criterion (eigenvalue ≥ 1.0) *and* the Scree plot (see Figure 5-3).

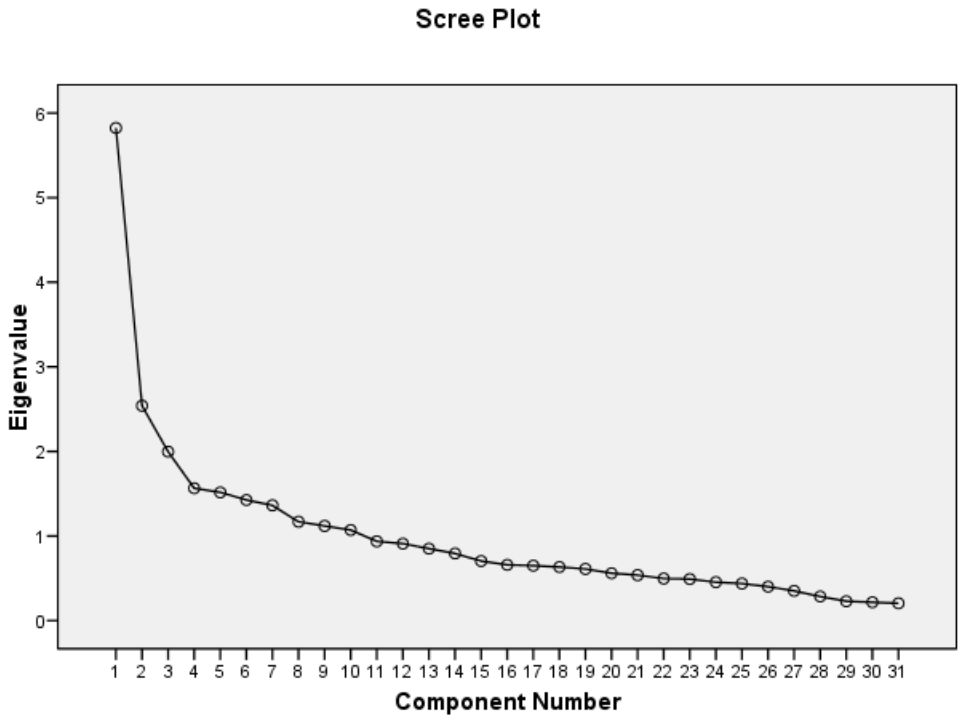

Figure 5-3: Scree Plot from the PCA of the scores obtained (N = 152 LV participants).

Based on the eigenvalue criteria only, a ten factor solution resulted which explained 63% of the variance. However, when the Scree plot was applied, four, five, six or more factor solutions were possible. Unlike the four factor solution, the five and six factor solutions did not have sets of factors that had items which could be grouped together in a reliable manner (i.e., low Cronbach's coefficient alpha values). A four factor solution which

accounted for 39% of the variance was selected. Based on eq. 1, a loading of 0.421 was used to determine items to be retained on each factor given a participant sample size of 152. Cronbach's coefficient alpha for factors one through four were as follows: Factor 1: 0.77 (six items), factor 2: 0.63 (five items), factor 3: 0.63 (five items), and factor 4: 0.59 (five items). Please refer to Table 5-6 for a list of the items that were retained and loaded on each of the four factors.

Table 5-6: Principal Component Analysis of the instrument (iteration 5).

The rotation method of Varimax with Kaiser Normalization was used.

Ref. no.	Item stem	Component			
		1	2	3	4
1	...offers the contrast I desire.	0.771			
2	...offers the brightness I desire.	0.762			
3	...offers the magnification, zoom or sizing I desire.	0.664			
4	...works well in places where there is glare (e.g., outside on a sunny day, very bright indoor lighting).	0.590			
5	...can be easily positioned, so I can use it to best meet my visual needs.	0.581			
6	...has letters, labels, displays and/or controls I can see.	0.569			
7	...is acceptable to my family and friends.		0.654		
8	...is enjoyable to use.		0.648		
9	...looks modern.		0.602		
10	...is a product that is also used by people I know so that we can support each other.		0.507		
11	...is a product I can learn about from a sales clerk.		0.480		
12	...helps me to cope with my disability.			0.688	
13	...helps me to perform the activities I desire.			0.630	
14	...is easy to transport, so I can take it with me to use in different places.			0.621	
15	...can be used without the help of others			0.584	
16	...is easy to handle or manipulate physically.			0.510	
17	...works well in places with poor lighting (e.g., indoors and outdoors; day and night)				0.544
18	...is inexpensive.				0.512
19	...comes with the necessary training or tutorial.				0.506
20	...comes with access to professional product support.				0.470
21	...requires minimal instruction reading before I can start using it.				0.453

5.4 Discussion

5.4.1 Interpretation and labeling of factors

The development of items in phase one of the study was based on the three conceptual themes of product attributes, personal compatibility and meaning that emerged from Chapter 4. These conceptual themes were considered along with the factor loadings results to guide interpretation of the factors that resulted from the PCA. The highest loading items for each factor suggested their relative importance within the factor and offered possible factor labeling. The proposed factor labels for the final 21-item LV-PSI were as follow:

1. Product (visual) attribute (six items)
2. Meaning (five items)
3. Independence (five items)
4. Personal compatibility (five items).

These four factors are distinct in that they were minimally correlated with each other.

The first factor was labeled product (visual) attribute as four of the highest loaded items included desired contrast, brightness, magnification or sizing and glare. All four of these items clearly related to the visual characteristics of the product. Support for the importance of these items was very consistent with selection criteria that may be inferred from the LV literature (Culham, Chabra, & Rubin, 2009; Lowe & Rubinstein, 2000; Mann, Goodall, Jutiss, & Tomita, 2002; Okada & Kume, 1999; Stone, Mann, Mann, & Hurren, 1997; Wagner, Vanderheiden & Sesto, 2006). The idea of being able to position the product to meet one's visual needs (e.g., to reduce glare, to meet a person's visual needs) seemed intuitive but has not received much attention in terms of an attribute that may be considered during LV product selection. Finally, the last item in the group was functional in that it may help the user of the instrument evaluate whether he can see letters, labels, displays and or controls. These last couple of items relate to the concept of visibility which may affect readability (Chapter 4; Boulton, 1989; Gerber, 2003). When compared to the qualitative findings of Chapter 4, the PCA seem to have highlighted items more related to visual attributes as opposed to general attributes of the product. Overall, in terms of content, the factor of product (visual) attribute and its six items may

add LV domain specific supplements to other popular ATD selection instruments such as the Matching Person and Technology system of instruments (Scherer, 1998; Scherer & Craddock, 2002).

Factor two was made up by five items and may be summarized by a factor label of meaning. People may ascribe personal, social or cultural meaning to the use of an object (e.g., product, or ATD) (Hocking, 1997; Pape, Kim, & Weiner, 2002). Judging from the items that emerged under this factor in the PCA, personal and social meaning may be in play. Two of the items were related to the meaning that a person may attribute to the selection and use of the product. The first item included whether the person feels the product would be enjoyable to use. The second item is related to the idea of aesthetics or cosmesis as a person decides whether something looks modern or not (King, 1999; Mann, Hurren, Karuza, & Bentley, 1993; Williamson, Albrecht, Schauder, & Bow, 2001; Okada & Kume, 1999). These items were consistent with the personal meaning theme that emerged in Chapter 4. The social aspect of product selection or use may refer to the product's ability to afford the kinds of interaction that a person may value or deem meaningful. As specified in three items, these interactions may include whether the product is acceptable to one's family and friends, whether the product affords interactions with peers, and related, whether a person can learn about a product from someone else such as a sales clerk. It should be mentioned that though the idea of social meaning of a product may be supported by Hocking's (1997) work and the results of the PCA, it did not emerge as a theme in Chapter 4.

Two other points related to the factor of meaning is raised here. First, Hocking (1997) suggested that cultural meaning of an object may also be important. However, the qualitative study from Chapter 4 did not identify the concept, and therefore no items were generated in the design of the instrument. Second, the idea of stigma, which was deemed by many LV participants in the selection, use or abandonment process as being important, did not load with the factor of meaning (Chapter 4; Mann, Hurren, Karuza, & Bentley (1993); Crudden, 2002). In the current work, stigma was represented by the item stem of '…will not cause me to be the focus of people's attention.' It may be possible that either the idea of stigma was not apparent in the item or that it may be theorized as a

factor in and of itself and an insufficient number of items related to the factor was included in the research and analysis.

Another important idea that seemed to be missing from the meaning factor is *independence*, though it is theorized here to be captured in factor three. Together, the five items comprising this factor seemed to provide an evaluation of the ability of the product to support independence and control (Pape, Kim, & Weiner, 2002). The factor seemed to support the idea of persons with LV being able to decide to perform occupations with the product on their own when they wanted, how they wanted and/ or where they wanted. Specifically, two items referred to an evaluation of whether a product may afford independence and control to the individual by allowing the ability to 'cope' with his disability or to perform desired activities. These two items had higher factor loadings than the other three items which seemed to tap into whether the product may support independent use and provide control to the individual (e.g., easy to transport, use without help from others, and easy to handle or manipulate physically). The importance of a product to promote and support independence is well supported in the LV literature (Chapter 4; Buning & Hanzlik, 1993; Gerber, 2003; Stone, Mann, Mann, & Hurren, 1997).

Note that from the qualitative study in Chapter 4, the concept of portability which is closely related to the item stem of '…is easy to transport so that I can take it with me to use in different places', was thematically grouped as a product attribute as opposed to meaning or independence and control. The discrepancy may be due to the wording of the item stem. For example, different results may be obtained if the item was written as 'it is important to me that the product is portable'. A second discrepancy that was found between the qualitative thematic analysis (Chapter 4) and a finding of the PCA was the categorization of the idea of 'performance of desired activities with a product'. In the former, the idea was grouped under the general theme of personal compatibility and a sub-theme of personal preference, whereas in the latter, the idea was grouped with independence and control. This difference may be due to the fact that the idea of control emerged to be strong in the PCA to supplement the idea of independence. Further testing

to see whether the ideas of portability and the performance of desired activities fall into the factor of independence and control is necessary.

Finally the fourth factor extracted from the PCA closely aligned with the theme of personal compatibility in Chapter 4 as capturing the fit between an individual and a product. In addition, the theme, speaks to the logic of how the individual sees the use of a product in given context, and includes how he would go about evaluating this logic during the selection process. (Chapter 4). The sub-themes include cost, personal preference, context and flexibility of use, and learning and support of the product. A discussion of how these sub-themes were supported by the LV, ATD, as well as, the consumer literature can be found in Chapter 4. As the sub-themes match reasonably well with the five items that loaded on the fourth factor, the factor is labeled as personal compatibility. The decision to use this label was also due to the fact that none of the items had a substantially higher relative factor load then the others. Specifically the selection consideration of the product working well in poor lighting in multiple contexts may be related to personal preference, as well as, context and flexibility of use. The item related to the importance of a product being inexpensive mapped onto the sub-theme of cost. And finally, the three items related to support through training or tutorial, professional product support and minimal instruction reading is relevant to the sub-theme of learning and support. Note that an earlier item from the (social) meaning theme also made a reference to product support. The distinction between that particular item and this set of three items was that the former item made a specific reference to an interaction with a person (e.g., sales clerk) where as the set of three items did not.

In summary the four factors identified through the PCA were labeled as product (visual) attribute, meaning, independence and personal compatibility. The corresponding internal consistency values, as described by Cronbach's coefficient alpha were 0.77, 0.63, 0.63 and 0.59. The 21-item instrument explained only 39% of the variance. The low α in the personal compatibility factor will be discussed along with the low variance explained by the instrument in the next section.

5.4.2 Limitations and future studies

Study limitations and recommendations for future research will be discussed. The first set of limitations pertained to methods and findings obtained through the reliability analysis of the instrument. The second limitation primarily referred to the low variance explained from the PCA. Recommendations to countermeasure this limitation through an improvement of the content and construct validity of the instrument will be offered.

Instrument reliability

First, an argument may be made that the cut-off value α at 0.6, as a test of internal consistency, was low. However, it is important to remember that depending on the purpose of the test, different cut-off α values may be appropriate (Polgar, 2003). For example, Nunnally (1978) recommended that a cut-off α value of 0.7 should be used. However, Moss et al. (1998) suggested that a lowered alpha such as 0.6 does not indicate that the instrument will not work well for screening purposes, however they recommended against using the criteria for instruments intended to give a medical diagnosis. In other words, because the implication of a medical diagnosis is high, a relatively higher cut-off α value should be used. On the other hand, given the intended use of the LV-PSI to help persons with low vision to make a purchase or selection decision and not for the purpose of providing a medical diagnosis, the use of the lower criteria of $\alpha \geq 0.6$ seemed to be acceptable.

The factor of personal compatibility was kept as the Cronbach's coefficient alpha was close to 0.6 ($\alpha = 0.59$). Inclusion of this item in a future study with a larger sample size will verify whether the factor should be retained. In the present study a sample of 152 persons with LV were used to perform a PCA on 31 items. Though this number may be minimally acceptable from both an absolute number of participants (150-300) or a participants-to-items ratio point of view (~5:1) for running a factor analysis (Hutcheson & Sofroniou, 1999; Bryant & Yarnold, 1995), a larger number of participants may be desirable. Recall that equation one ($CV = 5.152/(N-2)^{1/2}$) was used to determine a CV for accepting a factor loading rather than to arbitrarily impose a value, like 0.3 or 0.4, which does not account for sample size (Norman & Streiner, 1998; Stevens, 2002). If a

sample size of 300 was used, the critical value obtained using equation one would be 0.3. Note that a less stringent criteria of using a 5% instead of 1% significance level would also produce a lowered CV for the sample size (N =152) used in the PCA portion of this study (CV = $3.92/(152-2)^{1/2} = 0.321$). A lowered CV would mean that a greater number of items are kept which would increase reliability (Moss et. al, 1998; UCLA, n.d.). For example, if the item stem of "…is easy to use" which loaded on factor four at 0.323 was kept based on the lowered CV criteria of 0.3, the α value would jump from 0.59 to 0.61, which is over the specified α cut-off of 0.6. Therefore, future studies may wish to clarify the stability of the personal compatibility factor with the use of a large sample size.

Content and construct validity

The four factor solution selected only accounted for 39% of the variance which is low, especially considering that a PCA was used to maximize explained variance (Suhr, 2006). Therefore, caution should be taken to ensure that additional sources of information about product selection from the person with LV and other stakeholders are considered where possible. As mentioned, a ten factor solution resulted in a relatively higher variance explained (63%). Though this solution did not perform optimally (e.g., factors with two items, factors with poor internal consistency), the relatively higher variance explained may suggest further investigation, with potential practical application of the solution in future research and practice. Testing a larger number of items with a larger sample size, while ensuring a high subject to variable ratio (i.e., 10:1 as suggested by Nunnally, 1978) may be necessary to improve the results. A future study may consider the use of an exploratory factor analysis (EFA) to improve the content validity, and also to validate and further interpret the initial data structure resulted in this study.

It is possible that the items included for initial testing did not represent the underlying constructs as well as had been hoped. To elaborate, two possible reasons for the low variance finding may be due to: (1) limited resources - given the small sample size available (N = 152) (through the generous donation of resources to recruit participants from the School of Optometry and the Ivey Eye Institute) to test a small number of items (N=31); (2) the conscious efforts by the researchers to mitigate respondent fatigue by limiting the test to 37-items over the telephone. For example, while the concept of

contrast was sampled and included as an item in the instrument, the concept of colour contrast was not tested with the participants as the authors and reviewers mentioned that the concepts may be similar. However, feedback volunteered by several participants during the administration of the 37-item instrument suggested that the concept may be useful to at least consider. To further improve the content validity of the instrument, future studies may also wish to revise items that were dropped for the final analysis (see Table 5-4). For example, the idea of tactile feedback seemed useful to some of the participants, however, they did not know how to respond to the item without clarifications. Perhaps a change in wording such as asking the participant to consider the importance of using the sense of touch to operate a product may be possible. Including multiple items that may tap into a concept would also be useful (e.g., recall the above discussions on the concepts of portability, performance of desired activities and stigma). Furthermore, there were many items that were dropped as they had too narrow a focus and resulted in 'non applicable' responses (e.g., compatibility of access software with operating systems, battery life, auditory feedback, maintenance requirements). In addition, future studies should consider whether a reason for the relatively poor fit of a four-component solution (i.e., product (visual) attribute, meaning, independence, and personal compatibility) was that there might be some variables that account for significant variation in device selection that were not captured in this study, and need to be discovered.

Testing a larger number of items may be practically achieved through the use of other methods such as interviews over multiple sessions, paper protocol, automated telephone system, or computer administered protocol (Cella, Gershon, Lai, & Choi, 2007). Related to these recommendations is that a testing of the accessibility and usability of the response format, especially considering the needs of persons with severe low vision will be necessary (AERA, APA, NCME, 1999; Polgar, 2003). Note that the format of administration of the instrument was beyond the scope of this paper[1].

---

[1] As an aside for future testing, leaving room for qualitative comments at each item should also be considered. The further prompting of thinking through the considerations during selection through this format may be just as, if not more important than the scores themselves.

One other point to note is the external applicability of the results obtained through this study. Although only 39% of the variance was explained, it should be highlighted that the study inclusion criteria for persons with LV and the spectrum of products they were allowed to discuss were very broad. Both of these study design decisions encouraged a wide application of the instrument which has received initial testing of factor structure and reliability.

Finally, to further test the construct validity or construct structure of LV product selection, confirmatory factor analyses (CFA) should be conducted using a separate sample of participants with LV to gauge whether the four factors structure identified through the PCA in the present study (or future improvements in the instrument through an EFA) is robust (Brown, 2006). These studies may also consider collecting and interpreting scores obtained from evaluations of different classifications of products and ATDs. The interpretation and meaning of the scores obtained from the subscales and from all of the items in the instrument should also be explored. Depending on the sensitivity of the instrument to distinguish between levels of scores, the individual may be able to base their product selection on the instrument scores.

In addition, as Strong, Jutai, Plotkin, and Bevers (2008) suggested, given the large number of ATDs [and products] that are available to consumers, it is no longer acceptable to recommend what works, "but rather to identify one device that works best" (p. 176). Upon improvement of the content and construct validity of the instrument, future studies should also examine the ability of the instrument and its subscales to discriminate between products so as to provide a recommendation to select or not to select one product over others. Finally, an examination of the predictive value of the instrument for product abandonment will also be beneficial. This study can be accomplished through the comparison of two groups in terms of product abandonment over a period of time (i.e., 6 months) and the respective scores obtained — one group that uses the instrument to evaluate the product prior to purchase and a control group that does not.

5.5 Conclusion

The present study outlined the development and testing of the factor structure of the multi-dimensional LV-PSI. The 21-item instrument is the first of its kind to specifically focus on assisting persons with low vision in product selection. It provides a means of systematically evaluating different components of product/visual features and functions, meaning and compatibility to aid device selection. As suggested, personal considerations may be one key aspect in the determination of whether a product will be selected, used or retained. A product is useless if it is abandoned by the person with LV no matter how much it may be valued by her circle of care. Future work to examine the content and construct validity, the interpretation of scores, the utility and the predictive value of the instrument was recommended.

5.6 References

Access Economics Pty Limited. (2009). *The cost of vision loss in Canada: Full report for Canadian National Institute for the Blind and Canadian Opthalmological Society.* Retrieved June 30, 2009, from www.cnib.ca/en/research/pages/covl.aspx

American Educational Research Association (AERA), American Psychological Association (APA), National Council on Measurement in Education (NCME). (1999). *Standards for Educational and Psychological Testing.* Washington, DC: American Educational Research Association.

Arthanat, S., Wu, Y., Bauer, S., Lenker, J. & Nochajski, S. (2009). Development of the Usability Scale for Assistive Technology-Wheeled Mobility: A preliminary psychometric evaluation. *Technology and Disability, 21*, 79-95.

Batavia, A. I., & Hammer, G. S. (1990). Toward the development of consumer-based criteria for the evaluation of assistive devices. *Journal of Rehabilitation Research and Development, Fall, 27*(4), 425-436.

Bode, R., Jutai, J., Heinemann, A. & Fuhrer, M. (2010). The Assistive Technology Outcomes Profile for Mobility (ATOP/M): Development of activity limitations and participation restriction item banks. *Archives of Physical Medicine and Rehabilitation, 91*(10), e36.

Boulton, L. M. (1989). A clinical evaluation of equipment which allows the partially sighted and blind to access computer-based information. *Australian and New Zealand Journal of Ophthalmology, 17*(1), 87-93.

Bowling, M., Rimer, B., Lyons, E., Colin, C., Frydman, G., & Ribisl, K. (2006). Methodological challenges of e-health research. Evaluation and Program Planning, 29, 390-396.

Buning, M. E., & Hanzlik, J. R. (1993). Adaptive computer use for a person with visual impairment. *American Journal of Occupational Therapy, 47*(11), 998-1008.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York: Guilford.

Bryant, F. B., & Yarnold, P. R. (1995). Principal components analysis and exploratory and confirmatory factor analysis. In L. G. Grimm & P. R. Yarnold (Eds.), *Reading and understanding multivariate analysis*. Washington, DC: American Psychological Association.

Cella, D., Gershon, R., Lai, J.S. & Choi, S. (2007). The future of outcomes measurement: item banking, tailored short-forms, a computerized adaptive assessment. *Quality of Life Research, 16 (Supplement 1)*, 133-141.

Conway, J. & Huffcutt, A. (2003). A review and evaluation of exploratory factor analysis practices in organizational research. *Organizational Research Methods, 6*(2), 147-168.

Cook, A. & Polgar, J. (2008). *Assistive technology: Principles and practice (3rd ed.).* St. Louis, MO: Elsevier.

Copolillo, A., & Teitelman, J. L. (2005). Acquisition and integration of low vision assistive devices: Understanding the decision-making process of older adults with low vision. *American Journal of Occupational Therapy, 59*(3), 305-313.

Creswell, J. & Plano Clark, V. (2007). *Designing and conducting mixed-methods research.* Thousand Oaks, CA: Sage Publications, Inc.

Crudden, A. (2002). Employment after Vision Loss: Results of a Collective Case. *Journal of Visual Impairment & Blindness, 96*, 615-622.

Culham, L. E., Chabra, A., & Rubin, G. S. (2009). Users' subjective evaluation of electronic vision enhancement systems. *Ophthalmic & Physiological Optics : The Journal of the British College of Ophthalmic Opticians (Optometrists), 29*(2), 138-149.

Dahlin Ivanoff, S., & Sonn, U. (2005). Assistive devices in activities of daily living used by persons with age-related macular degeneration: A population study of 85-year-olds living at home, *Scandinavian Journal of Occupational Therapy, 12*(1), 10-17.

DeVellis, R. (1991). *Scale development: Theory and application.* Newbury Park, CA: Sage Publications, Inc.

DeWalt, D.A., Rothrock, N., Yount, S., Stone, A.A. (2007). Evaluation of item candidates: The PROMIS qualitative item review. *Medical Care, 45*(5): Supp 1, S12-S21.

Gerber, E. (2003). The benefits of and barriers to computer use for individuals who are visually impaired. *Journal of Visual Impairment & Blindness, 97*(9), 536-550.

Harman, H.H. (1976). *Modern Factor Analysis (3rd edition).* Chicago: University of Chicago Press.

Hocking, C. (1999). Function or feelings: Factors in abandonment of assistive devices. *Technology and Disability, 11,* 3-11.

Hocking, C. (1997). Person-object interaction model: Understanding the use of everyday objects. *Journal of Occupational Science, 4*(1), 27-35.

Horowitz, A., Brennan, M., Reinhardt, J. P., & MacMillan, T. (2006). The impact of assistive device use on disability and depression among older adults with age-related vision impairments. *Journals of Gerontology Series B: Psychological Sciences & Social Sciences, 61B*(5), S274-80.

Huber J.G., Jutai J.W., Strong J.G., Plotkin A.D. (2008). The Psychosocial Impact of Closed-Circuit Televisions on Persons with Age-Related Macular Degeneration. *Journal of Visual Impairment and Blindness*, *102* (11), 1-19.

Hutcheson, G., & Sofroniou, N. *(*1999*). The multivariate social scientist: Introductory statistics using generalized linear models.* Thousand Oaks, CA*:* Sage*.*

Jutai, J., Demers, L., DeRuyter, F., Finlayson, M., Fuhrer, M., Hammel, J. & Lenker, J. (2009). Assistive Technology Outcomes Profile for Mobility (ATOP/M)–Item Pool Development. RESNA, New Orleans, June 24-27.

Jutai, J., Hammel, J., Finlayson, M., Fok, D., & Fuhrer, M. (2008). The Assistive Technology Outcomes Profile for Mobility (ATOP/M) – Item Pool Development. American Congress of Rehabilitation Medicine, Toronto, October 15-19.

Jutai, J., Hooper, P., Strong, G., Russell-Minda, E., Cooper, L., Hutnik C., Sheidow T., & Tingey, D. (2007). *Vision rehabilitation evidence-based review: Module 1: Terminology, demography, and epidemiology of low vision.* Unpublished manuscript, The University of Western Ontario, The Lawson Health Research Institute, and CNIB.

King, T. W. (1999). Assistive technology: Essential human factors. Boston, MA: Allyn and Bacon.

Kline, P. (1994). *An easy guide to factor analysis.* London, UK: Routledge Taylor & Francis Group.

Lowe, J. B., & Rubinstein, M. P. (2000). Distance telescopes: A survey of user success. *Optometry and Vision Science : Official Publication of the American Academy of Optometry, 77*(5), 260-269.

Mann, W.C., Goodall, S., Jutiss, M.D., & Tomita, M. (2002). Dissatisfaction and nonuse of assistive devices among frail elders. *Assistive Technology, 14* (2): 130-139.

Mann, W. C., Hurren, D., Karuza, J., & Bentley, D. W. (1993). Needs of home-based older visually impaired persons for assistive devices. *Journal of Visual Impairment and Blindness, 87*(4), 106-110.

Massof, R.W. (2003). Auditory assistive devices for the blind. *Proceedings for the International Conference on Auditory Display,* Boston, MA, pp. 6-9.

Moss, S., Patel, P., Prosser, H., Costello, H., et al. (1998). Reliability and validity of the PAS-ADD Checklist for detecting psychiatric disorders in adults with intellectual disability. *Journal of Intellectual Disability Research, 42*, 173-183.

Myers, K. & Oetzel, J. (2003). Exploring the dimensions of organizational assimilation: Creating and validating a measure. *Communication Quarterly, 51*(4), 438-457.

Norman, G. & Steiner, D. (1998). Biostatistics: The bare essentials. B.C. Decker Inc.: Hamilton, Ontario.

Nunnally, J.C. (1978*). Psychometric Theory (2nd edition)*. New York: McGraw Hill.

Okada, S., & Kume, Y. (1999). CCTV user survey and prototypes based on the survey results. *Technology & Disability, 11*(3), 123-131.

Pape, T., Kim, J. & Weiner, B. (2002). The shaping of individual meanings assigned to assistive technology: A review of personal factors. *Disability and Rehabilitation, 24*(1/2/3), 5-20.

Polgar, J. (2003). Critiquing assessments. In E.B Crepeau, E.S. Cohn, B.A. Boyt Schell (Eds.). *Willard & Spackman's Occupational Therapy* (pp. 299-313). Philadelphia, PA: Lippincott, Williams & Wilkins.

Polgar, J. (2006). Assistive technology as an enabler to occupation: what's old is new again (Muriel Driver Lecture). *Canadian Journal of Occupational Therapy, 73*(4), 199-205.

Polgar, J. M., & Landry, J. E. (2004). Chapter 9: Occupation as a means for individual and group participation in life. In C. H. Christiansen, & W. A. Townsend (Eds.), *Introduction to occupation: The art and science of living* (pp. 197-220). Upper Saddle River, New Jersey: Prentice Hall.

Reimer-Reiss, M. & Wacker, R. (2000). Factors associated with assistive technology discontinuance among individuals with disabilities. *Journal of Rehabilitation, 66*(3), 44-49.

Rogers, E.M. (2003). *Diffusion of Innovation (5th edition)*. New York, NY: Free Press.

Ryan, E. B., Anas, A. P., Beamer, M., & Bajorek, S. (2003). Coping with age-related vision loss in everyday reading activities. *Educational Gerontology, 29*(1), 37-54.

Scherer, M., & Craddock, G. (2002). Matching Person and Technology (MPT) assessment *Technology and Disability, 14,* 125-131.

Scherer, M. (1998, Revision of 1994, 1991 and 1989 Editions). *The Matching Person & Technology (MPT) Model Manual.* Webster, NY: The Institute for Matching Person & Technology, Inc.

Scherer, M., Jutai, J., Fuhrer, M., Demers, L., & DeRuyter, F. (2007). A framework for modeling the selection of assistive technology devices (ATDs). *Disability and Rehabilitation, 2*(1), 1-8.

Scherer, M., Sax, C., Vanbiervliet, A., Cushman, L., & Scherer, J. (2005). Predictors of assistive technology use: The importance of personal psychosocial factors. *Disability and Rehabilitation, 27*(21), 1321-1331.

Schwarz, N. & Sudman, S. (1996). *Answering questions: Methodology for determining cognitive and communicative processes in survey research*. San Francisco: Jossey-Bass Publishers.

Spencer, J. (1998). Tools or baggage? Alternative meanings of assistive technology. In D.B. Gray, L.A. Quantrano, & M.L. Leiberman (Eds.), *Designing and using assistive technology: The human perspective.* (pp. 89-98). Baltimore: Paul H. Brookes Publishing Company.

Statistics Canada. (2006). Participation and Activity Limitation Survey. Retrieved July 29, 2009, from www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3251&lang=en&db=imdb&adm=8&dis=2

Stevens, J. (2002). *Applied multivariate statistics for the social sciences (4th edition).* LEA publishers: Mahwah, New Jersey,

Stone, J., Mann, W., Mann, J., & Hurren, D. (1997). Use of magnifiers by older persons with low vision. *Technology & Disability, 6*(3), 169-175.

Strong, G., Jutai, J., Bevers, P., Hartley, M. & Plotkin, A. (2003). The psychosocial impact of closed-circuit television low vision aids. *Visual Impairment Research, 5*(3), 179-190.

Strong, G., Jutai, J., Plotkin, A. & Bevers, P. (2008). Competitive enablement: A consumer-oriented approach to device selection in device-assisted vision rehabilitation. In W.C. Mann (Ed), *Aging, Disability and Independence: Selected Papers from the 4th International Conference on Aging, Disability and Independence.* (pp.175-195). Gainseville, FL: University of Florida.

Suhr, D. (2006). Exploratory or Confirmatory Factor Analysis. *SUGI 31 Proceedings,* San Francisco, CA, paper 200-31 (17 pages).

Tabachnick, B. & Fidell, L. (2007). *Using multivariate statistics (5the edition).* Upper Saddle River N.J.: Pearson Allyn & Bacon.

UCLA (n.d.). *What does Cronbach's alpha mean?* Retrieved from www.ats.ucla.edu/stat/spss/faq/alpha.html

Vanderheiden, G. C. (1998). Universal design and assistive technology in communication and information technologies: Alternatives or complements? *Assistive Technology, 10*(1), 29-36.

Wagner, J., Vanderheiden, G. C., & Sesto, M. E. (2006). Improving the usability of a mainstream cell phone for individuals with low vision. *Journal of Visual Impairment and Blindness, 100*(11), 687-692.

Wessels, R. (2004). *Ask the user. User perspective in the assessment of assistive technology. Thesis.* Maastricht University.

Williamson, K., Albrecht, A., Schauder, D., & Bow, A. (2001). Australian perspectives on the use of the internet by people who are visually impaired and professionals who work with them. *Journal of Visual Impairment & Blindness, 95*(11), 690-701.

Wolffe, K. E., Candela, T., & Johnson, G. (2003). Wired to work: A qualitative analysis of assistive technology training for people with visual impairments. *Journal of Visual Impairment and Blindness, 97*(11), 677-694.

Whiteford, G. (2004). Chapter 10: When people cannot participate: Occupational deprivation. In C. H. Christiansen, & W. A. Townsend (Eds.), *Introduction to occupation: The art and science of living* (pp. 221-242). Upper Saddle River, New Jersey: Prentice Hall.

Chapter 6

6 Conclusion: Product selection considerations by persons with low vision

The primary aim of this dissertation was to examine the considerations that persons with low vision (LV) express as being important in the selection of products to meet their occupational needs. The investigation began with a scoping review of the literature pertaining to product selection, usage and abandonment concepts that study participants (from the literature) with vision loss have pointed out. A limited number of articles with research questions directly related to *product selection considerations* by persons with LV, along with a lack of transfer of this knowledge in a form that is usable by consumers, prompted a more detailed examination of the topic in this dissertation through a mixed-methods approach.

In this final chapter, a brief summary of the three articles and how they related to each other is provided. Second, the HAAT model (Cook & Polgar, 2008) is used as a conceptual way of integrating the knowledge that emerged from the overall study. Four key points will be reinforced: (1) voice and perspective of the participants matter in terms of the exploration of the complex and multi-faceted product selection process; (2) visual attributes matter in product selection, (3) mainstream products matter in enabling some occupations and they should be considered, and (4) context and occupation matter and may influence selection considerations. In addition, an evaluation of the use of mixed-methods in the dissertation is presented. Lastly, consistent with the pragmatic nature of a mixed-methods approach, use and practice implications of the LV-PSI will be explored.

6.1 Overview and key findings

The mixed-methods study involved a total of 189 participants and 11 professional expert reviewers. Data for the dissertation were collected through a sequential exploratory design with the use of qualitative methods, followed by quantitative methods. There were three articles produced in total (Chapters 3, 4 and 5). The first two articles were

primarily qualitative in nature, whereas the final article involved the use of both qualitative and quantitative methods.

6.1.1 Article one: Low vision assistive technology device usage and importance in daily occupations (Chapter 3)

The purpose of this article was to gain initial insights related to ATDs usage, and perceived and relative importance of ATDs from a sample of 17 participants with low vision. The data were collected during a one-time telephone interview conducted with each participant. A total of 124 devices were identified by the participants of which 104 (83.9%) were used and 20 (16.1%), mostly adaptive computer technologies, were not. 22 (21%) mainstream aids to daily living were identified (large monitor, large screen TV, DVD player) and they ranked high in terms of perceived importance by the participants for daily activities. Overall, the article showed that concepts related to usage and ranking of importance of devices for daily occupations were multi-faceted and complex. As such, opportunities to perform further qualitative research were recommended.

6.1.2 Article two: Product selection - Perspectives of persons with low vision (Chapter 4)

This article explored product selection considerations by ten low vision expert product users through an inductive approach informed by a critical perspective. Two qualitative research sessions that involved persons with low vision were conducted. Each session was comprised of two data collection modes that were used to elicit the voice and perspectives of the experts on product selection. For each session, a modified nominal group technique (NGT) involved participants in identifying and ranking product selection criteria. This was followed by a focus group discussion which elicited insights into processes and choices made during the selection of products. In each session, three different types of devices were discussed. To understand the scope of criteria used in selection, a multimodal approach to analyze the data was undertaken. A content analysis of the rankings of important selection criteria collected from the modified NGT exercises occurred. Further to this, a grounded theory approach was used to analyze the focus group discussions to gain an in-depth understanding of the product selection process by persons with low vision. Three major themes that may inform product selection emerged

from concepts identified which included: (1) Product attribute, (2) personal compatibility, and (3) meaning. This information formed an important knowledge base and framework from which items may be generated for the development of an instrument to aid in product selection by persons with LV in the next study.

6.1.3 Development and initial testing of the Low Vision Product Selection Instrument (LV-PSI) (Chapter 5)

The final article in this dissertation consisted of two phases. Phase one was the development of the low vision product selection instrument (LV-PSI), and phase two was the initial testing of its psychometric properties. Phase one of the study consisted of an initial generation of 83 items. This instrument was reduced to 37 items, based on inputs from a panel of experts (N=11) and LV pilot participants (N=20). The 37-item instrument was then administered to a sample 152 main study LV participants.

Scores obtained from the main study participants on a reduced version of the instrument with 31 items were subjected to a principal component analysis (PCA) to examine how well it represented the domain of concern. A four component solution was selected based on the Scree plot and a desire for parsimony. The four components, which were similar to the key themes and sub-themes from those presented in article two included: Product (visual) attribute (6 items), meaning (5 items), independence (5 items) and personal compatibility (5 items). Internal consistencies as measured by Cronbach's coefficient alpha were: 0.77, 0.63, 0.63 and 0.59.

6.2 Integration of knowledge

Several research findings that are common across the three articles reported are worthy to note. These common elements will be explored through the use of the HAAT or the Human, Activity, Assistive Technology (and context) model which was outlined in Chapter 2 (Cook & Polgar, 2008). The four components of the HAAT model are theorized as necessary for product selection research and therefore, they will be used to explicate and organize four key findings that emerged from the dissertation (Cook & Polgar, 2008).

6.2.1 Finding 1 - Human component: Voice and perspective matters in the exploration of the complex product selection process

Within the resources available, one of the strengths of the exploratory research in this dissertation was the inclusion of a number of participants with low vision in the development of the LV-PSI. A total of 183 LV participants accepted the invitation to take part in this research. The inclusion of LV participants in both the qualitative and quantitative parts of the research afforded persons with LV the opportunity to provide their perspective in the development and testing of the instrument. Not including data analysis or soliciting feedback on the instrument with expert reviewers, an estimated 100 hours was spent talking to participants and collecting data on LV product selection. The goal oriented nature of taking LV participants through the initial process of discussing about the topic of product selection, taking part in the development/ refinement of the selection items and response options, and testing the selection instrument, was uncommon in the literature.

From interactions with the participants, several ideas that relate to general ATD selection were reinforced. Consistent with the literature, the primary ideas that emerged as being relevant are that the selection consideration of products by persons with LV is complex, multi-faceted, individualized, and beyond the functions and features of a product (Scherer 2002; Scherer, Jutai, Fuhrer, Demers, & DeRuyter, 2007; Hocking, 1999). For example, in the first article, it was difficult for participants to clearly rank the importance of the myriad of ATDs they used throughout the day, as close to half of the participants provided multiple equal rankings for several ATDs. Among other factors, the ways in which products were used by individuals, as well as, their feelings toward the products were identified as playing a role in ranking outcomes. It can also be theorized from the findings of article two that participants had different selection criteria which may be based on individualized evaluations of personal fit, and meanings associated with the products (e.g., recall the white cane focus group discussion presented in Chapter 4). In article three, three of the four factors from the PCA were related to the personal elements of: Meaning (i.e., feelings a person may associate with the product); independence (i.e., whether a person feels the she has a sense of control, to be able to perform activities on

her own); and personal compatibility (i.e., whether a person feels he may be able to trial, learn, use and get support for the product as he wishes).

6.2.2 Finding 2 – AT component: Visual attributes matter in product selection

Though the meaning or feeling a person associates with a product are important in terms of ATD provision and outcomes research (Hocking, 1999; Pape, Kim & Weiner, 2002; Spencer, 1998), the current research provided further data to demonstrate that the attributes of a product (including visual attributes) should not be overlooked (Chapter 4; Chapter 5; Bativia & Hammer, 1990). Through a thematic analysis of the data collected in article two, a major theme of product attribute emerged. Some of these attribute considerations were generic and applied to many products whether they were assistive devices or commercial products. Other attributes were more relevant for persons with low vision to consider (e.g., contrast, sizing, clarity, and voice feedback). Similarly, in article three, the first factor that emerged from the PCA was labeled as visual attribute. Comparable results were obtained by running different analyses with the same data set (i.e., restricted and unrestricted, orthogonal and oblique rotations), and items related to the label of visual attributes emerged as explaining a relatively high proportion of the explained variance. The items pertained to contrast, brightness, magnification (zoom or sizing), glare, positioning and visibility. In summary, these low vision domain specific concepts were found to be important and should be considered during product selection by persons with LV.

6.2.3 Finding 3 – AT component: Mainstream products matter in enabling some occupations

While the definition of ATD encompasses “commercial” devices (Assistive Technology Act, 2004), the limited research on LV ATD selection has focused on specialized devices or systems that are designed for persons with LV. Yet, article one demonstrated that some persons with low vision did not only think about specialized devices, when asked to identify the ‘assistive devices’ they use for daily activities. With minimal to no prompting, one in five products that were identified and used by participants fell into the ‘mainstream aids to daily living’ category which had to be added to Jutai, Strong and

Russell-Minda's (2009) LV ATD classification scheme that was adopted for the study. Furthermore, it seemed that the participants did not necessarily have artificial divisions (or a consistent definition of ATD even though one was provided) in terms of what is and what is not an assistive device. Rather, they were focused on any number of products that were useful for their daily performance of activities. Two participants did not think of optical devices (e.g., glasses and sunglasses) as assistive devices but yet, they were deemed important enough to be brought into the discussion. These optical devices were described as "god sent" and essential to one's very "existence". In another example, a participant thought that his large screen television was one of the most important 'assistive devices' he owned.

In all three articles, a number of participants elected to mention or discuss the use of information and communication technology (ICT) (e.g., laptop computer, cell phone, iPods and accessibility software to access applications and the Internet). In the contemporary milieu, the use of ICT by persons with disabilities including LV is worth highlighting (Emiliani, 2006; Fruchterman, 2003; Tobias, 2003; Wagner, Vanderheiden, & Seto, 2006; Greenfield, 2006; Fok, Polgar, Shaw, Luke, & Mandich, 2009). Research in the area of mainstream products and how they may influence the occupations of persons with LV may have implications on device provision, and policy/ funding decisions. Overall, the three articles advanced the knowledge base in terms of selection considerations of products, including ATD and, commercial products (e.g., ICTs) by persons with LV.

6.2.4 Finding 4 - Context and occupation matter and may influence selection considerations

The need to think about the occupation (i.e., the 'doing' of the activity) that a person with LV will perform with a product and the context in which the occupation will take place was recommended from article one. The recommendation came about from qualitative data obtained which suggested that whether an ATD is or is not important to a person may be relative to, and moderated by, the activity and the context.

The assertion that activity and context matter was further demonstrated in article two where the product selection concepts were generated based on contextualized and situational qualitative data collected from the participants. For example, three participants inferred that the concept of unobtrusiveness (or a product being inconspicuous) may be more relevant if a LV product is used in public situations and contexts where it would willingly or unwillingly "announce" their disability (see Figure 4-1). Similarly, a participant suggested the "cool" look of a product (aesthetics) was important as he wanted to fit in with the crowd when using the device. In another example, a participant expressed that being able to use a product in many situations and contexts was important (e.g., use of glasses to read a menu at a restaurant and read a newspaper at home). Her comments supported the theme of personal compatibility for LV product selection.

Finally, in the data collection for the purpose of initial testing of the LV-PSI in article three, LV participants were asked to consider a set of product selection items in context (e.g., asking the participant to think about the settings and the activities that he would perform with the product identified at the beginning of the instrument). It would not be informative for instance, to ask whether contrast or brightness was important without a minimal consideration of when, where and how an activity was performed with the product. One other point to note is that many participants volunteered additional contextual and occupational information on why particular scoring decisions were made, hence further supporting the idea that these two components of the HAAT model matter, or at the very least provide the background for which instrument items are considered during selection.

6.2.5 Summary

The HAAT model (Cook & Polgar, 2008) was used to highlight common threads that emerged from the outcomes of the three articles which utilized different methodology and methods to examine the topic of product selection considerations by persons with LV. The findings point to specific aspects that matter when examining the process of LV product selection which included: the voice and perspective of persons with LV, an appreciation of the complexity of the process, the visual attributes of a product, the use of

both mainstream and ATDs to meet the occupational needs of persons with LV, and an appreciation of the occupation and the context in which the process takes place.

6.3 Evaluation of the mixed-methods research

Mixed-method is a genuine effort to be reflexive and more critical of the process for instrument development and, ideally, more useful and accountable to broader audiences. A research strategy integrating different methods is likely to produce better results in terms of quality and scope, and in addition, it encourages researchers to probe the underlying issues assumed by mixed-methods (J. Jutai, personal communication, March 8, 2011; Greene, Caracelli, Valerie, & Graham, 1989; Caracelli & Greene, 1997). Together, the three articles presented the findings produced through the use of a mixed-methods study design. According to Creswell and Plano Clark (2007), an evaluation of a mixed-methods study involves judging it against qualitative and quantitative, as well as, mixed-methods elements. Along with an examination of the foundational aspects of the study, these elements are important for the purpose of construct validation of an exploratory mixed-methods research design (Leech, Dellinger, Brannagan, & Tanka, 2010).

6.3.1 Foundational elements

The use of a scoping review as opposed to a systematic review of the literature was purposeful to gain a comprehensive coverage (breadth) of the available literature on the topic of product selection, usage and abandonment by persons with LV. The scoping review allowed for a greater range of studies to be included as quality appraisal is not part of the technique (Arksey & O'Malley, 2005). Breadth was necessary to ensure that concepts related to product selection were synthesized and considered for the purpose of item generation later on. To contribute to rigor, a systematic framework to perform a scoping review offered by Arksey and O'Malley (2005) was used.

6.3.2 Qualitative and quantitative elements

Leech et al.'s (2010) work was used as a basis for judging the qualitative and quantitative elements of the mixed-methods study. To evaluate the traditional qualitative elements of

an exploratory mixed-methods study, emphasis was placed on an evaluation of the trustworthiness of the results (Leech et al., 2010). In the evaluation of the traditional quantitative elements, the focus was placed on an evaluation of a match between the research questions, the methods and whether the statistical tests used and results presented were appropriate (Leech et al., 2010).

In the main qualitative research that involved the use of modified NGT and focus group discussions (article two), the analyses of the data collected were verified by multiple researchers. One researcher conducted a content analysis based on frequency counts of the rankings of important product selection considerations collected from the participants using the modified NGT. A second researcher verified the findings. In the analysis of the focus group data a systematic coding process based on a grounded theory approach was used. Constant comparison was completed within and between the data collected from the two focus groups. This analysis process was used by two researchers independently and the results were compared until consensus was reached on the concepts and themes. A third researcher verified that the concepts and themes generated were logical. One aspect that was missing from article two that may have improved the trustworthiness of the results was that member checking of the findings was not done with the participants. However, items generated in the third article from the themes and concepts developed in the second article were reviewed and subjected to a pretest by a separate group of ten LV participants.

In article three, the primary purpose was to develop and test the LV-PSI. The instrument and items were developed by two researchers in a systematic fashion based on the work of well respected instrument development experts and psychometricians (Bode, Jutai, Heinermann, & Fuhrer, 2010; Jutai, Demers, DeRuyter, Finlayson, Fuhrer, Hammel & Lenker, 2009; Jutai, Hammel, Finlayson, Fok & Fuhrer, 2008; DeWalt, Rothrock, Yount, & Stone, 2007). A third researcher and eleven expert reviewers provided revisions and item reduction suggestions. Note that only one round of feedback was solicited from the expert reviewers. Iterative feedback and revisions through the use of a Delphi technique (Dalkey & Helmer, 1963) with the expert reviewers, instead of soliciting one round of feedback only, may ensure that any concerns raised were adequately addressed and

consensus reached. Upon pilot testing of the refined instrument, further revisions were made prior to its administration to a separate pool of 152 LV participants. Responses were analyzed through a PCA to examine the structure of the items. Cronbach's coefficient alpha results were presented to help the reader gauge the reliability of the sets of items within the four factors solution that was selected. A correlation component matrix was also provided to allow the reader to see the low correlations between the components, which may indicate the appropriate use of an orthogonal rotation in the PCA (Tabachnick & Fidell, 2007; Kline, 1994; Conway & Huffcutt, 2003). The correlations within the matrix also made sense and showed coherence with general ATD literature findings as the components of product (visual) attributes, meaning, independence and personal compatibility all contributed positively to LV product selection.

6.3.3 Mixed-methods elements

Though there is little consensus on the criteria that should be used to evaluate mixed-methods studies, Creswell and Plano Clark (2007) suggested a few questions that need to be addressed. The questions relate to "basic knowledge of methods research, the rigor of the research, and more advanced knowledge of specific designs" (p. 163). To avoid repetition, some of the questions have been combined and reorganized to the three questions that are presented below. Correspondingly, responses to these questions are provided.

Question one: Is the study a mixed-methods study?

Overall, the dissertation was designed and conducted as a mixed-methods study. Specifically, the first two articles presented were qualitative in nature, where qualitative data were primarily collected. The last article consisted of both qualitative (development of instrument and pilot testing) and quantitative elements (testing of the factor structure and the internal consistency of the instrument).

Question two: Does the study include advanced methods features consistent with a type of mixed-methods design?

By ‘advanced methods’, Creswell and Plano Clark (2007) were referring to whether a specific *type* of mixed-methods design along with a corresponding visual diagram of the procedure was included. An elaboration of the purpose of the sequential exploratory design was done in Chapter 1 of the dissertation along with the presentation of a diagram outlining the procedures (see Figure 1.2). Chapter 1 also included a discussion of the specified design using the work of DePoy and Gitlin (1998); both authors have extensive experience in disability and assistive technology research.

Question three: Does the study show rigorous mixed-methods research?

Question three as stated here is similar to another set of questions that Creswell and Plano Clark (2007) asked pertaining to the sensitivity of the challenges of using a particular mixed-methods design. More specific to the exploratory design, Creswell and Plano Clark (2007) asked: Does one phase clearly build on the other? Are steps in the development of the instrument clearly identified and are they rigorous? Supplementing the discussions on qualitative and quantitative elements above, both of these questions are addressed in this section. Three aspects define the concept of rigor in mixed-methods. They include having the researcher acknowledge his paradigm stance and express the implications of this decision, making the intention of collecting the two forms of data explicit and ensuring that inferences or interpretations follow findings (Creswell and Plano Clark, 2007; Leech et al., 2010).

As mentioned in Chapter 1, in the selection of using mixed-methods to guide my research, I chose to use the paradigm of pragmatism. In mixed-methods research, an understanding of the relation between epistemological, methodological and methods concern are important (Morgan, 2007). From an epistemological stand point, or “what is the relationship between the researcher and that being researched?” (Creswell & Plano Clark, 2007, p. 24), I was interested in a practical way to meet the objective of creating an instrument that would help LV persons in product selection. The process to achieve this or the ‘methodology’ was to collect both qualitative and quantitative data and then mixing them in a sequential manner with the former informing the latter. Finally, the mechanics of the qualitative and quantitative methods were fully described in each of the

articles but will be briefly reviewed below. In addition, I have emphasized that values played a role in interpreting, especially, the qualitative results (axiology) (Tashakkori & Teddlie, 1998). My personal location was made explicit and can be found in Appendix F.

There was intentional collection of both forms of data and the reasons for doing so were made explicit. Interpretations from one article flowed into the next one in a logical manner. In the first article, demographics data were collected analyzed to gain a better understanding of the LV participants, some of whom participated in qualitative sessions reported in the second article. The products that the sample of LV participants retained or abandoned were examined in the first article, which helped to refine the protocol used in the second article in the discussion of three different types of products. In the second article, the analysis of the modified NGT and focus group discussion transcripts were completed through content analyses and the use of a grounded theory approach. The second article presented the content (themes and concepts) for the generation of items that was reported in the third article. The results obtained through these analyses were generally consistent with those found in the consumer and ATD literature. The modified NGT provided breadth to ensure that key items would be included during item generation. The focus group discussions were also used to gain depth and tacit knowledge which contributed to item generation. The development of the instrument, revising it and reducing it to a manageable form were clearly laid out in five sequential 'iterations' followed by the PCA. The PCA resulted in four components, which closely aligned with the themes that emerged from the thematic analysis of the data collected in article two.

6.3.4 Summary

An evaluation of the approach taken in this dissertation to inform the product selection process by persons with LV demonstrated that rigor was shown in the qualitative, quantitative as well as the mixed-methods elements of the study. In terms of the qualitative elements of the study that involved LV and expert review participants, better trustworthiness may be gained through the addition of iterative processes to evaluate the researchers' findings and interpretations. Overall the dissertation was pragmatic with the end goal of devising the LV-PSI. The process of coming up with an initial instrument

also yielded noteworthy contribution to the literature to build on our understanding of LV product selection which shall be discussed in the next section.

6.4 Next steps: Further research, use and practice implications

The research resulted in an initial version of the LV-PSI. The reader should be reminded that while the instrument has received basic testing of its domain of concern and internal consistency, instrument development is an iterative process and as such would benefit from further research and development as suggested at the end of article 3. Briefly, an improvement of the content and construct validity of the instrument may be realized through testing a larger number of variables and items with a larger sample size (i.e., 10:1 subject to items ratio) using an exploratory and/ or a confirmatory factor analysis (EFA/ CFA). More investigation with the 10 factor solution may also be merited based on the relatively larger variance explained. Future work should also examine the interpretation of scores, the utility and the predictive value of the instrument.

For the reminder of this section, I will speak to some additional work that may be required to move the instrument from a format that was used in research to one that may be used in practice. To orient the reader, a brief description of the existing state of the instrument will be provided, followed by a brief discussion of possible formats of the instrument that may be considered for practice in the future. From article 3, an exercise was devised where participants were asked to imagine that they needed to replace a commercially available product with a comparable one. They were asked to consider the factors (i.e., items) that may play into their selection decision. This exercise presented item scores, based on a 4-point response option, which aided in the testing of some of the instrument psychometric properties. However, to actually use the instrument for product selection, the format needs to be changed such that the hypothetical exercise is removed from the instrument, while key elements of the tested instrument remain intact.

The original LV-PSI was designed to be administered over the telephone. Therefore, should other formats be used (e.g., paper-and-pen, computer adapted testing, or automated telephone system) additional testing would be required to validate and make

sure that the instrument is accessible and usable for persons with low vision (AERA, APA, NCEM, 1999). Second, only the items and the response format (4-point rating scale) have received initial pilot or factor structure testing. The pre-survey questions that pertained to elements of the HAAT model to ensure that the users understand the contexts of their item responses may be tested through cognitive interviews (Tourangeau, Rips, & Rasinski, 2000; DeMaio & Rothgeb, 1996; Cook & Polgar, 2008). The pre-survey questions related to a brief examination of: (1) the product being evaluated, (2) the activities that the product may help the user perform, and (3) the settings in which the product may be used. Thirdly, areas for additional comments as users respond to each item should also be considered. The suggestion to provide areas for additional comments is intended to prompt the user of the instrument to think through the selection decisions. As well, a layperson's definitions of each of the four components identified from the principal component analysis (PCA) (i.e., product (visual) attribute, meaning, independence and personal compatibility) should be provided. The proposal to include a layperson's definitions of the components is for organizational purposes, as well as, for ease of understanding of the key areas being evaluated. Ensuring the maintenance of the consistency and appropriateness of the level of language used in future iterations of the instrument will also be important. As discussed, the LV-PSI is intended to be usable by the person with LV, but it may be more ideal if it is used with the help of a service provider. In the absence of a service provider (e.g., in rural, lack of funding situations), the content is designed to be understandable by the adult user with LV alone. The initial LV-PSI proposed here, including the language used and its intelligibility was designed through knowledge gained from qualitative and quantitative feedback from LV adult participants that took part in this research.

6.4.1 Summary

The research in this dissertation resulted in a list of LV product selection items and several contextual questions that have received basic pilot and psychometric testing. More research to develop and test the instrument's construct validity (e.g., CFA), scoring procedure, interpretation and format will be required to transform the instrument, which

had hitherto been used as a research tool, into a form that is useable to consumers and service providers.

6.5 Conclusions

The mixed-methods approach is a creative alternative to traditional or more monolithic ways to conducting research and developing an instrument (J. Jutai, personal communication, March 8, 2011). This approach was adopted in the dissertation to explore product selection considerations by persons with LV and for the purpose of developing the LV-PSI. This chapter provided (1) an examination of the integrated knowledge gained, (2) an evaluation of the mixed-methods approach, and (3) a discussion of next steps to translate the instrument from a research into a practice instrument.

More specifically, important considerations that relate to product selection research were reinforced through interactions with persons with LV. In summary, the selection process is complex and it is necessary to give primacy to the voice and perspective of the person with the disability in order to gain a better appreciate of his needs and wants. Consistent with the HAAT model (Cook & Polgar, 2008), personal, occupational, contextual and product considerations likely contribute to selection decisions in different ways.

Next, the quality of the mixed-methods approach taken in this dissertation was critiqued, and the strengths and weaknesses of the overall study discussed (Creswell & Plano Clark, 2007; Leech et al., 2010). As a mixed-methods approach aligns itself with the paradigm of pragmatism (Creswell & Plano Clark, 2007; Morgan, 2007), the pragmatic nature of the dissertation was apparent; starting right from the beginning of the dissertation, with the purposeful design of the scoping review of the literature. This was followed by the collection of qualitative data to add to the understanding of the product selection process, and for the purpose of item and instrument generation. The quantitative testing of the LV-PSI resulted in some potentially useful items that may be translated to a usable form for practice use in the future (DePoy & Gitlin, 1998).

6.6 References

American Educational Research Association (AERA), American Psychological Association (APA), National Council on Measurement in Education (NCME).

(1999). *Standards for Educational and Psychological Testing.* Washington, DC: American Educational Research Association.

Assistive Technology Act of 1998, as amended. Pub.L. No.108-364. §3, 118 Stat. 1707 2004.

Arksey, H. & O'Malley, L. (2005). Scoping studies: towards a methodological framework, *International Journal of Social Research Methodology, 8*(1), 19-32.

Batavia, A. I., & Hammer, G. S. (1990). Toward the development of consumer-based criteria for the evaluation of assistive devices. *Journal of Rehabilitation Research and Development, Fall, 27*(4), 425-436

Bode, R., Jutai, J., Heinemann, A. & Fuhrer, M. (2010). The Assistive Technology Outcomes Profile for Mobility (ATOP/M): Development of activity limitations and participation restriction item banks. *Archives of Physical Medicine and Rehabilitation, 91*(10), e36.

Caracelli, V., & Greene, J. (1997). Crafting mixed-method evaluation designs. In J. C. Greene, & V. J. Caracelli (Eds), *Advances in mixed-method evaluation: The challenges and benefits of integrating diverse paradigms* (pp. 19-32). San Francisco: Jossey-Bass.

Cook, A.M. & Polgar, J.M. (2008). *Cook & Hussey's assistive technologies: Principles and Practice (3rd edition).* St. Louis, MO: Mosby Elsevier.

Conway, J. & Huffcutt, A. (2003). A review and evaluation of exploratory factor analysis practices in organizational research. *Organizational Research Methods, 6*(2), 147-168.

Creswell, J. & Plano Clark, V. (2007). *Designing and conducting mixed-methods research.* Thousand Oaks, CA: Sage Publications, Inc.

Dalkey, N. C., & Helmer, O. (1963). An experimental application of the Delphi method to the use of experts. *Management Science* 9, 458–467.

DeMaio, T. & Rothgeb, J. (1996). Cognitive interviewing techniques: In the lab and in the field. In N. Schwarz & S. Sudman, (Eds.), *Answering questions: Methodology for determining cognitive and communicative processes in survey research* (pp. 177-195). San Francisco: Jossey-Bass.

DePoy, E. & Gitlin, L. (1998). *Introduction to research: Understanding and applying multiple strategies (2nd edition).* St. Louis, MO: Mosby.

DeWalt, D.A., Rothrock, N., Yount, S., Stone, A.A. (2007). Evaluation of item candidates: The PROMIS qualitative item review. *Medical Care, 45*(5): Supp 1, S12-S21.

Emiliani, P. (2006). Assistive technology (AT) versus mainstream technology (MST): The research perspective. *Technology and Disability, 18,* 19-29.

Fok, D., Polgar, J., Shaw, L., Luke, R. & Mandich, A. (2009). Cyberspace, real place: Thoughts on 'doing' in contemporary occupations. *Journal of Occupational Science, 16*(1), 38-43.

Fruchterman, J.R. (2003). In the palm of your hand: A vision of the future of technology for people with visual impairments. *Journal of Visual Impairment and Blindness, 97* (10), 585-591.

Greenfield, A. (2006). Everyware: The dawning age of ubiquitous computing. Berkeley,CA: New Riders.

Greene, J., Caracelli, V., & Graham, W. (1989). Toward a conceptual framework for mixed-method evaluation design. Educational Evaluation and Policy Analysis, 11(3), 255-74.

Hocking, C. (1999). Function or feelings: Factors in abandonment of assistive devices. *Technology and Disability, 11*, 3-11.

Jutai, J., Demers, L., DeRuyter, F., Finlayson, M., Fuhrer, M., Hammel, J. & Lenker, J. (2009). Assistive Technology Outcomes Profile for Mobility (ATOP/M)–Item Pool Development. RESNA, New Orleans, June 24-27.

Jutai, J., Hammel, J., Finlayson, M., Fok, D. & Fuhrer, M. (2008). The Assistive Technology Outcomes Profile for Mobility (ATOP/M) – Item Pool Development. American Congress of Rehabilitation Medicine, Toronto, October 15-19.

Jutai, J.W., Strong, G. & Russell-Minda, E. (2009). Effectiveness of assistive technologies for low vision rehabilitation: A systematic review. *Journal of Visual Impairment & Blindness, 103*(4), 210-222.

Kline, P. (1994). *An easy guide to factor analysis.* London, UK: Routledge Taylor & Francis Group.

Leech, N., Dellinger, A., Brannagan K. & Tanka, H. (2010). Evaluating mixed research studies: A Mixed-methods Approach. *Journal of Mixed-methods Research, 4*(1), 17-31.

Morgan, D. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed-methods Research, 1*(1), 48-76.

Pape, T., Kim, J. & Weiner, B. (2002). The shaping of individual meanings assigned to assistive technology: A review of personal factors. *Disability and Rehabilitation, 24*(1/2/3), 5-20.

Scherer, M.J. (2002). The change in emphasis from people to person: introduction to the special issue on Assistive Technology. *Disability & Rehabilitation*, 24(1/2/3), 1-4.

Scherer, M., Jutai, J., Fuhrer, M., Demers, L. & DeRuyter, F. (2007). A framework for modeling the selection of assistive technology devices (ATDs). *Disability and Rehabilitation, 2*(1), 1-8.

Tabachnick, B. & Fidell, L. (2007). *Using multivariate statistics (5the edition).* Upper Saddle River N.J.: Pearson Allyn & Bacon.

Tashakkori, A. & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches.* Thousand Oaks, CA: Sage Publications, Inc.

Tobias, J. (2003). Information technology and universal design: An agenda for accessible technology. *Journal of Visual Impairment & Blindness, 97*(10), 592-601.

Tourangeau, R., Rips, L.J., & Rasinski, K. (2000). *The Psychology of Survey Response.* Cambridge: Cambridge University Press.

Wagner, J., Vanderheiden, G.C. & Sesto, M.E. (2006). Improving the usability of a mainstream cell phone for individuals with low vision, *Journal of Visual Impairment and Blindness, 100*(11), 687-692.

Appendix A: Ethics approval

Office of Research Ethics

The University of Western Ontario
Room 4180 Support Services Building, London, ON, Canada N6A 5C1
Telephone: (519) 661-3036 Fax: (519) 850-2466 Email: ethics@uwo.ca
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. J.M. Polgar
Review Number: 15530E **Review Level:** Expedited
Review Date: October 08, 2008
Protocol Title: Assistive technology device selection by consumers with impairments: A focus group research study
Department and Institution: Occupational Therapy, University of Western Ontario
Sponsor: SSHRC-SOCIAL SCIENCE HUMANITIES RESEARCH COUNCIL
Ethics Approval Date: November 19, 2008 **Expiry Date:** August 31, 2010
Documents Reviewed and Approved: UWO Protocol, Letter of Information (Main), Letter of Information and Consent (Pilot), Advertisement, Telephone Script.
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced study on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. Joseph Gilbert

Ethics Officer to Contact for Further Information			
☐ Janice Sutherland	☐ Elizabeth Wambolt	☑ Grace Kelly	☐ Denise Grafton

This is an official document. Please retain the original in your files.

cc: ORE File

Western

Office of Research Ethics

The University of Western Ontario
Room 4180 Support Services Building, London, ON, Canada N6A 5C1
Telephone: (519) 661-3036 Fax: (519) 850-2466 Email: ethics@uwo.ca
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. J.M. Polgar
Review Number: 15530E **Revision Number:** 1
Review Date: March 05, 2009 **Review Level:** Expedited
Protocol Title: Assistive technology device selection by consumers with impairments: A focus group research study
Department and Institution: Occupational Therapy, University of Western Ontario
Sponsor: SSHRC-SOCIAL SCIENCE HUMANITIES RESEARCH COUNCIL
Ethics Approval Date: March 05, 2009 **Expiry Date:** August 31, 2010
Documents Reviewed and Approved: Revised study methods, participant recruitment. Recruitment Forms - Long Form, Short Form and Script. Letter of Information and Consent.
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. Joseph Gilbert

Ethics Officer to Contact for Further Information			
☐ Janice Sutherland	☐ Elizabeth Wambolt	☑ Grace Kelly	☐ Denise Grafton

This is an official document. Please retain the original in your files.

cc: ORE File

Office of Research Ethics

The University of Western Ontario
Room 4180 Support Services Building, London, ON, Canada N6A 5C1
Telephone: (519) 661-3036 Fax: (519) 850-2466 Email: ethics@uwo.ca
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. J.M. Polgar
Review Number: 15530E **Revision Number:** 2
Review Date: June 26, 2009 **Review Level:** Expedited
Protocol Title: Assistive technology device selection by consumers with impairments: A focus group research study
Department and Institution: Occupational Therapy, University of Western Ontario
Sponsor: SSHRC-SOCIAL SCIENCE HUMANITIES RESEARCH COUNCIL
Ethics Approval Date: July 03, 2009 **Expiry Date:** August 31, 2010
Documents Reviewed and Approved: Administrative changes.
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. Joseph Gilbert

Ethics Officer to Contact for Further Information			
☐ Janice Sutherland	☐ Elizabeth Wambolt	☑ Grace Kelly	☐ Denise Grafton

This is an official document. Please retain the original in your files.

cc: ORE File

Office of Research Ethics

The University of Western Ontario
Room 4180 Support Services Building, London, ON, Canada N6A 5C1
Telephone: (519) 661-3036 Fax: (519) 850-2466 Email: ethics@uwo.ca
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. J. Polgar
Review Number: 16748E **Review Level:** Expedited
Review Date: January 13, 2010 **Approved Local # of Participants:** 300
Protocol Title: Development of a Technology Selection Survey for people with vision difficulties.
Department and Institution: Occupational Therapy, University of Western Ontario
Sponsor: SSHRC-SOCIAL SCIENCE HUMANITIES RESEARCH COUNCIL
Ethics Approval Date: January 29, 2010 **Expiry Date:** May 31, 2011
Documents Reviewed and Approved: UWO Protocol, Letter of Information and Consent, Telphone Script, Participant Recruitment Form. Advertisement.
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced study on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. Joseph Gilbert
FDA Ref. #: IRB 00000940

Ethics Officer to Contact for Further Information			
☐ Janice Sutherland	☐ Elizabeth Wambolt	☑ Grace Kelly	☐ Denise Grafton

This is an official document. Please retain the original in your files.

cc: ORE File
LHRI

Office of Research Ethics

The University of Western Ontario
Room 4180 Support Services Building, London, ON, Canada N6A 5C1
Telephone: (519) 661-3036 Fax: (519) 850-2466 Email: ethics@uwo.ca
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. J. Polgar
Review Level: Expedited
Review Number: 16748E
Revision Number: 1
Review Date: May 04, 2010
Approved Local # of Participants: 300
Protocol Title: Development of a Technology Selection Survey for people with vision difficulties.
Department and Institution: Occupational Therapy, University of Western Ontario
Sponsor: SSHRC-SOCIAL SCIENCE HUMANITIES RESEARCH COUNCIL
Ethics Approval Date: May 04, 2010
Expiry Date: May 31, 2011
Documents Reviewed and Approved: Revised recruitment.
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. Joseph Gilbert
FDA Ref. #: IRB 00000940

Ethics Officer to Contact for Further Information			
☐ Janice Sutherland	☐ Elizabeth Wambolt	☑ Grace Kelly	☐ Denise Grafton

This is an official document. Please retain the original in your files.

cc: ORE File
LHRI

UNIVERSITY OF WATERLOO

OFFICE OF RESEARCH ETHICS

Notification of Ethics Clearance of Application to Conduct Research with Human Participants

---

Faculty Supervisor: Dr. Jan Miller Polgar **Department:** School of Occupational Therapy, The University of Western Ontario

Student Investigator: Daniel Fok **Department:** Health & Rehab Sci Program, The University of Western Ontario

Collaborator: Dr. J. Graham Strong **Department:** Optometry, School of

ORE File #: 16125

Project Title: Development and Initial Psychometric Testing of an Assistive Technology Selection Instrument (For participant or potential participant facing materials: Development of a Technology Selection Survey for people with vision difficulties.)

---

*This certificate provides confirmation that the additional information/revised materials requested for the above project have been reviewed and are considered acceptable in accordance with the University of Waterloo's Guidelines for Research with Human Participants and the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. Thus, the project now has received ethics clearance. This clearance is valid for a period of **four years** from the date shown below and is subject to an **annual ethics review process** (see Note 2). A new application must be submitted for on-going projects continuing beyond four years.*

***Note 1**: This project must be conducted in accordance with the description in the application and revised materials for which ethics clearance has been granted. All subsequent modifications to the application must be submitted for prior ethics review using ORE Form 104 and must not be intiated until notification of ethics clearance has been received.*

***Note 2**: All ongoing research projects must undergo annual ethics review. ORE Form 105 is used for this purpose and must be submitted by the Faculty Investigator/Supervisor (FI/FS) when requested by the ORE. Researchers must submit a Form 105 at the conclusion of the project if it continues for less than a year.*

***Note 3**: FIs and FSs also are reminded that they must immediately report to the ORE (using ORE Form 106) any events related to the procedures used that adversely affected the participants and the steps taken to deal with these.*

Susan E. Sykes, Ph.D., C.Psych.
Director, Office of Research Ethics

Date

OR
Susanne Santi, M. Math
Senior Manager, Research Ethics

OR
Julie Joza, B.Sc.
Manager, Research Ethics

Appendix B: Letters of information and consent form

Letter of Information – Main Study Participants (Study 1)

Study Title: Assistive technology device selection by consumers with impairments: A focus group research study

Introduction and background

We are researchers at the Faculty of Health Sciences at the University of Western Ontario (UWO) and we invite you to participate in this focus group study. This study is part of Daniel Fok's doctoral dissertation research and is supervised by Drs. Janice Miller Polgar (Co-chair), Lynn Shaw (Co-chair), Jeffrey Jutai and Craig Hall at UWO. This study is funded by a doctoral fellowship from the Social Sciences and Humanities Research Council.

We are conducting a focus group study to explore the considerations in the selection of assistive technology devices by consumers with impairments (low vision or mobility impairment). An assistive technology device (ATD) may be defined as any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain or improve the daily functioning of consumers with impairments. Examples of ATDs for consumers with low vision may include: magnifiers, illumination, closed-circuit televisions, and electronic on-screen magnifiers. Examples of ATDs for consumers with mobility impairment may include: wheelchairs, scooters, canes, walkers crutches, etc. for daily activities.

What does participation in this study involve? Where will this study take place?

As a participant, you will complete a demographics and pre-focus group questionnaire related to ATD selection, a survey of common technologies you use on a daily basis, and a verbal discussion of ATD selection in a focus group format.

The demographics and pre-focus group questionnaire will be conducted over the telephone through a 60-90 minutes interview. The demographics questionnaire will provide us with basic but non-identifying information about you that will be useful for our data analyses and interpretations. A sample telephone interview question is: “Think about a device that you have stopped using. Knowing what you know now, what information about its functions or features did you wish you had during its selection?”

The focus group will take approximately 60-90 minutes (a 10 to 15 minutes break will be provided) to be conducted in a quiet conference room at Elborn College (UWO) or another accessible location to meet the travel needs of the participants as necessary (e.g., Parkwood Hospital). The area where the study will take place is wheelchair accessible; this includes the conference room, washrooms, entrances, etc. Alternative large print formats, including large text PowerPoint slides, written text with dark thick markers on large flip chart size papers, dark thick markers on white paper for note taking, etc. will be available to participants with low vision as necessary. The facilitator will also repeat and read aloud written text as necessary. A focus group will involve 5 to 10 participants and with at least two facilitators.

A sample focus group question is: “Please list items about the attributes or the characteristics of an assistive device that may influence whether or not you would ultimately use or not use the device.” As a participant in a focus group you will engage in a discussion about your views and experiences with other participants. Each focus group will be video-taped and audio-taped and transcribed into a written format for further data analysis. Each telephone interview will also be audio-taped and transcribed into a written format for further data analysis. The transcribed data will not contain any personal information that might identify you. **If you do not wish to be video taped or audio taped, you should not participate in this study.**

Once the <u>focus group is complete</u>, we may contact you by phone or email only to ensure that our interpretations of the information collected from you are accurate. However, you do not have to agree to be contacted afterwards to participate in the focus group in this

study. In the consent form attached, please indicate your preference to be contacted or not after your participation in the focus group.

Who may participate in this study?

We are interested in having up to 40 participants in this study. There are several eligibility criteria:

1) **Participants with low vision or mobility impairment**, as their primary disabling condition, will be included in this study. Participants with low vision will have less than normal vision, are not completely blind, and are best helped by primarily the use of vision enhancement devices such as magnifiers, illumination, closed-circuit televisions, and electronic on-screen magnifiers. Participants with mobility impairment include those that have difficulties with locomotion (e.g., walking) inside and/or outside of their homes and may benefit from the use of wheelchairs, scooters, canes, walkers crutches, etc. for daily activities.

2) Participants must be **18 years of age or older**, and **have used one or more ATDs for 6-18 months OR more than 3 years.**

3) Each study participant must be able to participate in a telephone interview (60 to 90 minutes) **and** a focus group (60 to 90 minutes). All interviews and focus groups will be conducted in English.

Confidentiality and informed consent

Focus group members are asked to keep everything they hear confidential and not to discuss it outside of the meeting. However, we cannot guarantee that confidentiality will be maintained by group members.

All of the information collected by the researchers will remain confidential. If the results of the study are published, your name will not be used and no information that discloses your identity will be released or published without your explicit consent to the disclosure. Only individuals directly involved with this study (that is, the researchers identified above) will have access to any information that would reveal your identity. The one exception is where the

representatives of the University of Western Ontario Health Sciences Research Ethics Board may contact you or require access to your study-related records to monitor the conduct of the research

Data storage and security measures are in place: The recorded study, transcribed information and any identifying information will be kept in a locked filing cabinet in the research laboratory of Dr. Polgar, in the School of Occupational Therapy at the University of Western Ontario. The transcribed data and any identifying information will be maintained in separate, secure locations. Any electronic data or files will be password protected and or stored in password protected computers. The information collected will not be retained and will be destroyed after 5 years of the completion of the study through a professional shredding company.

If you agree to participate, we will request that you sign the attached consent form once you have asked any questions you have about participating in this study. You will be given a copy of this letter once you have signed the consent form. If you would like a copy of the summary of results upon completion of the study, please indicate this to one of the study investigators. We will record your name and contact information on a page separate from other information we collect.

Are there associated benefits or risks with participating in this study?

There are no direct benefits to you for the participation in this research. However your participation may help reveal and contribute to greater research understanding of the considerations that people with impairments may have in the selection of assistive technology devices. A honourarium of $10 will be given to you regardless of whether you complete the study or not. We will reimburse parking or transportation costs (e.g., bus or Paratransit fare). Refreshments will be provided. Your participation in this study is completely voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time.

There are no known risks, harms or discomforts associated with participating in this study. You may experience emotional reactions

during the study in the discussion of their impairments, disabilities, use of ATDs, etc. At least one facilitator will be present at all times before, during and after a focus group to address any potential concerns. You will be referred to appropriate counseling resources should you become distressed.

In order to be sure that the study is accurate and unbiased, we are unable to provide suggestions as to which ATD may be best suited for your needs if you choose to procure one in the future. Please let us know if you are currently participating in any other research.

If you have any questions about the science or care associated with this project, please do not hesitate to contact us. If you have any questions about subject rights please contact the Office of Research Ethics at the University of Western Ontario at (519) 661-3036 or ethics@uwo.ca.

Sincerely,

Daniel Fok, BSc, MEng
PhD Candidate

Co-chair of thesis committee and principal ethics applicant
Jan Miller Polgar, PhD, OT Reg (Ont.)
Associate Professor
School of Occupational Therapy,
The University of Western Ontario

Co-chair of thesis committee
Dr. Lynn Shaw

Advisory committee members of thesis committee
Dr. Jeffrey Jutai, Dr. Craig Hall

Consent Form – Main Study Participants

Assistive technology device selection by consumers with impairments: A focus group research study

I have read the Letter of Information, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Name of Participant	Name of Person Obtaining
Signature	Signature
Date	Date

Please check one of the following:

- ☐ I agree to be contacted once the study is completed to ensure information is accurate
- ☐ I do not agree to be contacted once the study is completed to ensure information is complete

Daniel Fok, BSc, MEng, PhD candidate
Drs. Polgar, Shaw, Jutai & Hall

Letter of Information/Consent (Study 2)

Development of a Technology Selection Survey for people with vision difficulties.

Introduction and background

Researchers from the University of Western Ontario (UWO) and the University of Waterloo (UW) are inviting you to participate in a research study entitled: Development of a Technology Selection Survey for people with vision difficulties. The purpose of this study to see whether the use of a technology selection survey may be useful in helping persons with vision difficulties decide on whether or not to purchase a commercially available device that may be used for their daily activities.

Commercially available devices include those items that are readily available for purchase. The researchers are interested in understanding how you select devices for use in your daily life. In particular the researchers are interested in those items that you can purchase in a retail store, for example a home health (or drug) store, a department or electronics store. You may have purchased some of these devices for activities that you perform throughout your day. Some examples include: computer, cell phone, mp3 player, radio, microwave, DVD players, non-prescribed handheld or pocket magnifier, flashlights liquid level indicators, telephone with large numbers and display and much more.

This study is part of Daniel Fok's doctoral dissertation research and is supervised by Drs. Janice Miller Polgar (Co-chair), Lynn Shaw (Co-chair), Jeffrey Jutai and Craig Hall at UWO. Dr. Graham Strong from UW, School of Optometry, is a collaborator to this study. This study is funded by a doctoral fellowship from the Social Sciences and Humanities Research Council.

Where will this study take place? What does participation in this study involve?

This study will take place entirely over the telephone. As a participant, you will be entered into one of two phases of the study – a "setup" phase or a "main" phase. The "setup" phase is meant to help the researchers improve the study such that it runs smoothly in the "main" phase. The "setup" phase will take up to up to 30 minutes on the telephone. The "main" phase will take approximately 15-20 minutes on the telephone. You will be asked by the telephone interviewer to be involved in the "setup" or the "main" phase of the study.

During the telephone interview, you will be asked basic questions about how your vision affects your participation in daily activities including reading newsprint and seeing faces from across the room. You will also be asked to think of a commercially available device that you have used several times a week for at least 6 months. We will ask you to imagine that this device is in need of replacement. As you go through this scenario, you will be asked to think about things that you may consider when you are deciding whether or not to purchase the commercially available device or something similar.

Who may participate in this study?

There are several eligibility criteria:

1) **Participants with vision difficulties (low vision).** Participants will have difficulties seeing even with the help of corrective lens, for the past 6 months or more. People who "cannot see" even with the help of corrective lens and/or assistive aids will be not be part of the study given that the types of technologies used by those who are blind are different than those who have low vision.

2) Participants may be **male or female and are 18 years of age or older**

3) A study participant must be able to participate in a telephone interview that **lasts 15-20 minutes (for "main" phase participants) or up to 30 minutes (for "setup" phase participants).** The telephone interview will be conducted in English.

Are there associated benefits or risks with participating in this study?

There are no direct benefits to you. There may be indirect benefits in your exploration as a consumer with impairment, of some strategies to select a technology for the purpose of doing daily activities. Your participation in this study is completely voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time.

There are no known risks, harms or discomforts associated with participating in this study.

We are unable to provide suggestions as to which technology may be best suited for your needs if you choose to procure one in the future. Please let us know if you are currently participating in any other research.

Will I receive compensation for this study?

No, but by participating, you will automatically be entered into a draw to win grocery gift certificates totaling $300 (e.g., 3 draws of $100, or 6 draws of $50 in grocery gift certificates). It is expected that 150 to 300 participants will participate in this study.

Confidentiality and informed consent

All of the information collected by the researchers will remain confidential. If the results of the study are published, your name will not be used and no information that discloses your identity will be released or published without your explicit consent to the disclosure. Only individuals directly involved with this study will have access to any information that would reveal your identity. The one exception is if the representatives of the University of Waterloo or University of Western Ontario Health Sciences Research Ethics Board contact you or require access to your study-related records to monitor the conduct of the research.

Data storage and security measures are in place: The study paper work and identifying information will be kept in separate and locked

filing cabinet in the research laboratory of Dr. Polgar, in the School of Occupational Therapy at the University of Western Ontario. Data being transported for the purpose of analysis offsite will not be attached to any identifying information (and will be locked in a secure cabinet when not in used). Any electronic data or files will be password protected and or stored in password protected computers. The information collected will not be retained and will be destroyed 5 years after the completion of the study through a professional shredding company.

You will be asked by the facilitator over the telephone whether you would like to participate in this study or not after he has answered questions you may have about the study to your satisfaction. You indicate your consent to participate in the study by allowing the facilitator to proceed with, and complete the telephone interview with you. Please indicate to the facilitator if you would like a copy of the summary of results upon completion of the study, or agree to be contacted after the telephone interview to ensure that our (the researchers) interpretations of the information collected from you are accurate.

If you have any questions about the science or care associated with this project, please do not hesitate to contact us. If you have any questions about subject rights please contact the Office of Research Ethics at the University of Western Ontario at (519) 661-3036.

Sincerely,

Daniel Fok,
PhD Candidate

Co-chair of thesis committee and principal ethics applicant
Jan Miller Polgar, PhD, OT Reg (Ont.)
Associate Professor
Co-chair of thesis committee
Dr. Lynn Shaw
Advisory committee members of thesis committee
Dr. Jeffrey Jutai, Dr. Craig Hall
Study Collaborator
Dr. Graham Strong

Appendix C: Sample data collection protocols and form

DEMOGRAPHICS QUESTIONNAIRE (Study 1)

1) Date of birth: _____ (dd/mm/yyyy)

2) Gender: ☐ Male ☐ Female

3) What is the highest level of education that you obtained (check one)?

☐ Grade School ☐ Some High School
☐ High School Graduate ☐ Trade School
☐ Some College/University ☐ College Diploma/Certificate ☐ University Degree ☐ Postgraduate Degree
☐ Other_____

4) What is your current work status (you may check more than one response)?

☐ In school
☐ Working
☐ Volunteering
☐ On short-term disability
☐ On long-term disability
☐ Retired

5) Do you:

☐ Live alone
☐ Live with spouse only
☐ Live with family (please indicate the family members you live with)_____
☐ Other living arrangement (please specify) _____

6) Do you live in a(n):

☐ Apartment
☐ House
☐ Supervised group living

☐ Assisted living centre
☐ Other (Please specify) _____

7) a) What is your vision impairment (you may check more than one response)?

Main category	Specific type (optional)	Functional abilities (optional)
☐ Age related macular degeneration (AMD) ☐ Diabetic retinopathy (DR) ☐ Cataracts ☐ Glaucoma ☐ Retinitis pigmentosa (RP) ☐ Other (please specify) _____		

b) When did you receive this diagnosis?
☐ Within the first two years of your birth
☐ Year (please specify the year for which your condition was diagnosed) _____

c) Your disability is:
☐ Stable for the past: ___ years, ___ months
☐ Deteriorating over a period of: ___ years, ___ months

d) Do you know the current visual acuity in your better eye?

(There are several ways to report visual acuity. These include the decimal notion (e.g., 0.2), the US notation (e.g., 20/100) or the 6m notation (6/30). For the purpose of answering this question, any of the three visual acuity format is acceptable.)

Yes, the visual acuity in my better eye is _____
No, my overall visual acuity is _____
No, I do not know my visual acuity. _____

e) Step 1: Please take out a piece of paper and write down all low vision assistive devices you currently use, or have used in the past. Please tell me what devices you have written down.

Step 2: Please go down the list and tell me whether or not you currently use the device.

Step 3: Please go down the list and tell me how long you have used each device.

Step 4: Please rank the low vision assistive devices in order of most (1) to least important. (When deciding by ranking whether a device is most or least "important", consider how often you use the device and how dependent you are on the device for vision.)

Device	**Rank**	**Time used (years, months)**	**Currently use? Y/N**

8) Physical Health

Please indicate how much each of the following health problems interferes with your ability to perform your daily activities by circling one of the numbers. *If you do not experience a particular health problem, please check the "Not Applicable" box.* For example, if you have a complete hearing loss (e.g., Deaf), a physical health problem described as "Difficulty hearing in noisy situation" is not applicable.

Health Problem	Not Applicable	Never Interferes	Rarely Interferes	Sometimes Interferes	Often Interferes
Difficulty seeing objects up close		1	2	3	4
Difficulty seeing objects in the distance		1	2	3	4
Difficulty hearing in noisy situations		1	2	3	4
Difficulty moving legs		1	2	3	4
Difficulty moving arms		1	2	3	4
Difficulty moving hands		1	2	3	4
Difficulty with fine finger movements		1	2	3	4
Difficulty moving your back		1	2	3	4
Difficulty moving neck		1	2	3	4

9) Memory and Concentration. Please circle one number for each of the following statements.

	Never	Rarely	Sometimes	Often	Always
I have problems making decisions.	1	2	3	4	5
I have problems concentrating.	1	2	3	4	5
I have problems remembering things that happened yesterday.	1	2	3	4	5

I have problems remembering things that happened last year.	1	2	3	4	5

12) Recall the definition of assistive technology: An assistive technology device may be defined as any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain or improve the daily functioning of consumers with impairments.

a) Do you use assistive devices that are not related to your vision/mobility impairments?

☐ **Yes** ☐ **No**

b) If you checked "yes", please list the assistive devices below:

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

Study 1

A. Introduction to focus group

Daniel → will lead this section.

- Daniel Fok– PhD Candidate from the Health & Rehab Sci Program here at Western
- Dr. Lynn Shaw – Co-Supervisor. Other supervisors of my thesis are Drs. Jan Polgar, Jeff Jutai and Craig Hall.
- Helper

I don't want to repeat the letter of information but I will highlight some key points

The focus group we are conducting today is part of my PhD studies in looking at the considerations or what people think about when they select assistive technology. This is the first focus group that we are conducting but there will be others in the coming weeks.

At the risk of sounding repetitive, I am going to restate the definition of "Assistive Technology" which can be defined as any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain or improve the daily functioning of consumers with impairments.

Examples of low vision assistive technology may include but are not limited to: magnifiers, illumination, closed-circuit televisions, and electronic on-screen magnifiers.

You will note that this definition is quite broad and so we will indeed be talking about everyday technology you use as well in the last portion of this focus group.

Part of the end goal of my thesis is to create an instrument or a survey that may help other people with low vision as they select low vision assistive technology. We thought that it was only fitting to get the perspective of experts such as yourselves who have used these technologies for many years.

Before we begin these are some housekeeping items I want to address and then also give you an opportunity to ask any questions:

- Washrooms – the male washroom… the female washroom…

- Room – This room is especially made for conducting focus groups. We are at the center of the room sitting around a circular table. The room is generally free of clutter but you should be aware of… (Easel, table, *power cord especially is a tripping hazard*, etc.) In case of emergency, we will lead you out of the building.

- Exercise – There will be 3 exercises in this focus group where I will ask you to write down some point form notes. You will be writing using markers or pens, whatever you prefer on sheets of paper I will hand out to you. You will not be writing on the large piece of glossy paper in front of you. This glossy piece of paper is only there to make sure that we don't leave any permanent marker marks on the table.

- Refreshments - There will be a break but feel free to just go to the washroom or get something to drink or a bite to eat during the session.

- Confidentiality – A word about confidentiality. Please ensure that anything we discuss stays in the room. As I had mentioned over the phone, this session will be video and audio recorded but only myself or the researchers of this study will have access to the information.

- Sharing – In order to stay within the timeframe of finishing the focus group in 60-90 minutes, I may ask you to expand or hold certain comments. This will also ensure that everyone gets a fair chance to speak.

- Assistance – if you require any assistance try to get the attention of Lynn or the helper. They can help you with refreshments, directions to the washrooms, doing the exercises, etc.

- And finally, there is no right or wrong answers so please feel free to share, relax and enjoy the session.

- Anything else to add Lynn? Helper?

- Does anyone have any other questions before we begin?

B. Main focus group questions

Daniel → will lead this section.

1) Ice-breaker activity: Each person to introduce himself or herself - Name, favorite hobbies or activities, disability (if the person wants to share), assistive devices used.

2) Warm-up activity: Today, we are going to be talking about technology and what are some things you consider in their selection or purchase. Before we get into that let's warm-up with a question.

   Think about a home appliance you use on a daily basis (fridge, toaster oven, DVD player, TV, stereo). What are some things you would think about or things you would consider if you are asked to select or purchase this home appliance today? Who would like to share something first? (Round robin – each person say 1 appliance and 1 consideration.)

3) Read off a list of low vision technology from the telephone interviews.

ATD
CCTV (standalone)
CCTV to TV
Portable CCTV
Daisy (audio books, mp3 for books, voice notes)
Windows Accessibility
Mac Accessibility
Handheld magnifier
Handheld magnifier (with illumination)
Magnifier - other
glasses/ sunglasses
Zoomtext
JAWS
White cane
monocular
Kruzweil/Openbook/Scanner
Music adaptive tech
Specialized computer peripherals (Large monitor (e.g., LCD), mouse, keyboard)
Everyday tech (Large screen TV, dvd player, swivel arm)
task lighting
general lighting
Watch
Type and speak (notetaker)
Binocular
Perkin's Brailler
kitchen low tech

Helper/Daniel/Lynn → For each participant, handout the "Exercise 1" form to the appropriate participant (name indicated on each form). Also handout writing instrument of choice and remind the participants to complete the form over, but not on, the large glossy paper in front of them.

4) *Low vision technology: Non-portable home use*
    a. Think about one non-portable low vision technology that you use in your home (e.g., CCTV, Zoomtext software on your computer). Write this down. Write down 3 or 4 things you would think about or things you would consider if you are asked to select or purchase this non-portable low vision technology today. Start with writing down the most important thing you would consider, and then the next important, and so on.
    b. Who would like to share something first? (Round robin – say one non-portable LV technology and discuss)
    c. From our discussion, would you change your list and if so in what way?

Helper/Daniel/Lynn → Collect Exercise 1 form. Ensure the form is complete.

Helper/Daniel/Lynn → For each participant, handout the "Exercise 2" form to the appropriate participant (name indicated on each form).

5) *Low vision technology: Portable outside of home use*
    a. Think about one low vision technology that you use outside of your home that you take with you (e.g., handheld magnifier, portable closed circuit television, monocular). Write this down. Write down 3 or 4 things you would think about or things you would consider if you are asked to select or purchase this low vision technology today. Start with writing down the most important thing you would consider, and then the next important, and so on.
    b. Who would like to share something first? (Round robin – say one LV technology and discuss)
    c. From our discussion, would you change your list and if so in what way?

Helper/Daniel/Lynn → Collect Exercise 2 form. Ensure the form is complete.

Helper/Daniel/Lynn → For each participant, handout the "Exercise 3" form to the appropriate participant (name indicated on each form).

6) *Everyday technology (mainstream)*
    a. Think about one everyday technology that you use outside of your home that you take with you (e.g., cell phone, mp3 player, GPS navigation, or even a watch). Write this down. Write down 3 or 4 things you would think about or things you would consider if you are asked to select or purchase this everyday technology today. Start with writing down the most important thing you would consider, and then the next important, and so on.
    b. Who would like to share something first? (Round robin – say one technology and discuss)
    c. From our discussion, would you change your list and if so in what way?

Helper/Daniel/Lynn → Collect Exercise 3 form. Ensure the form is complete.

C. Session summary and debrief

Lynn → will lead this section.

1) Based on the notes I have taken throughout the focus group, I would like to follow up on….

2) Is there anyone in the group that thinks we have missed any other important things that we need to think about or things we need to consider when we select or purchase a low vision technology?

3) Is there anyone in the group that thinks we have missed any other important things that we need to think about or things we need to consider when we select or purchase an everyday technology?

Product Selection Instrument - Telephone interview (Study 2)

Hi, may I speak with [name of potential participant]?

You had previously indicated that you may be interested in participating in a 20 minutes study telephone interview study on the selection of technology (or products) by people with vision difficulties. Is this a convenient time for us to speak or should I call back at another time that may be more convenient for you?

You should have received a letter of information and consent form about the study. Do you have any questions about this information? (Student investigator answers questions, explains letter of information/ consent form where necessary).

Please note that you do not have to answer any questions you do not want to, and you may stop participating at any time. Regardless of whether you complete the session, you will be entered in a draw to win a total of $300 worth of grocery gift certificates (3 x $100 or 6 x $50). There may be 150 to 300 people participating in this study. Do I have your verbal consent to proceed with conducting this telephone interview?

Screening questions

Background

What is your age: _____

Gender of participant: M/F

The next few questions are about your ability to see. I am asking about vision difficulties that have lasted or 6 months or more. (Have you had vision difficulties even with the help of glasses or contact lenses that have last 6 months or more?)

1) Do you wear glasses or contact lenses? You may select **Yes or No**
2) (With your glasses or contact lenses only) Do you have any difficulties seeing ordinary newsprint without any aids like magnifiers or a closed circuit television? You may select **Yes or No**
    a. **(If yes)** How much difficulty? You may select **Some difficulty; A lot of difficulty; You cannot see*; or Don't know**
3) (With your glasses or contact lenses only) do you have any difficulty clearly seeing the face of someone from across a room, that is, from 4 meters or 12 feet? You may select **Yes or No**
    a. **(if yes)** how much difficulty? You may select **Some difficulty; A lot of difficulty; You cannot see*; or Don't know**

*If this response is selected, ask for further elaboration

- Can you describe what you mean by 'you cannot see'?
- Question 3 follow up (if necessary): Do you have any difficulties seeing ordinary newsprint with aids such as magnifiers or a closed circuit television? You may select **Yes or No**
    - (If yes) How much difficulty? You may select **Some difficulty; A lot of difficulty; You cannot see; or Don't know**
- Question 4 follow up (if necessary): Do you have any difficulties clearly seeing the face of someone from across a room, that is, from 4 meters or 12 feet, with aids such as a telescope or binoculars? You may select **Yes or No**
- (If yes) How much difficulty? You may select **Some difficulty; A lot of difficulty; You cannot see*; or Don't know**

Product Selection Instrument – Product selection exercise (low vision participants) (study 2)

Commercial products are items that are readily available for purchase that you use for daily living. The purpose of this survey is to find out what you, as a person with visual difficulties, consider when you select and purchase a commercial product.

You may have purchased commercial products from retail stores, home health (or drug) stores, department stores or electronics stores. Some examples of commercial products include: computers, mp3 players, cell phone, telephones with large numbers and displays, radios, microwaves, liquid level indicators, flashlights, non-prescribed handheld or pocket magnifiers, and much more.

I want you to think of a commercial product that you have used several times a week for at least 6 months. This product must be one that you have selected and purchased on your own. Imagine that this product is in need of replacement and you have to select and purchase a comparable product. I am going to read you some factors you may consider when you are selecting and purchasing this replacement product and I want you to let me know how important these factors are to you.

What is the commercial product you are thinking of replacing? _____

Did you select this device on your own? (Note that you may have had advice from others but the final decision to choose or select the product must be made on your own) Y/N (If N, select a new product)

Did you purchase the product on your own? (Note that the product must not be a gift) Y/N (If N, please select a new product)

How long have you used this product for; years _____; months _____? _____

List up to three activities for which you have used the product for:

1._____ Frequency (no. of days/ week) _____

Where*? _____

2._____ Frequency (no. of days/ week) _____

Where*? _____

3._____ Frequency (no. of days/ week) _____

Where*? _____

*Home (specify where in home), outside of home (specify where outside of home), both (specify where)

Considering the **commercial product** that you have indicated above, please respond to the following statements by telling me the most appropriate rating that I read out to you:

For each of the following items, please choose a number from 1 to 4, where:

1 = not important
2 = somewhat important
3 = very important
4 = essential

If you feel that an item is not relevant for the product you have in mind, please say "not applicable".

Item no.	Item Stem	Response options
1	It is important to me that [the commercially available product] that I purchase….**is easy to use.**	1 2 3 4 N/A
2	It is important to me that [the commercially available product] that I purchase ….**can be setup (or prepared for use) without the help of others.**	1 2 3 4 N/A
3	It is important to me that [the commercially available product] that I purchase …. **is durable (or last a long time)**.	1 2 3 4 N/A
4	It is important to me that [the commercially available product] that I purchase …. **can be easily positioned, so I can use it to best meet my visual needs.**	1 2 3 4 N/A
5	It is important to me that [the commercially available product] that I purchase ….**is inexpensive.**	1 2 3 4 N/A
6	It is important to me that [the commercially available product] that I purchase ….**can be returned after a sufficient trial period.**	1 2 3 4 N/A
7	It is important to me that [the commercially available product] that I purchase …. **requires minimal instruction reading before I can start using it.**	1 2 3 4 N/A
8	It is important to me that [the commercially available product] that I purchase …. **is a product I can learn about from a sales clerk.**	1 2 3 4 N/A
9	It is important to me that [the commercially available product] that I purchase ….**comes with the necessary training or tutorial.**	1 2 3 4 N/A

10	It is important to me that [the commercially available product] that I purchase …. **comes with a warranty.**	1 2 3 4 N/A
11	It is important to me that [the commercially available product] that I purchase …. **will not cause me to be the focus of people's attention.**	1 2 3 4 N/A
12	It is important to me that [the commercially available product] that I purchase …. **helps me to perform the activities I desire.**	1 2 3 4 N/A
13	It is important to me that [the commercially available product] that I purchase …. **helps me to cope with my disability.**	1 2 3 4 N/A
14	It is important to me that [the commercially available product] that I purchase …. **is acceptable to my family and friends.**	1 2 3 4 N/A
15	It is important to me that [the commercially available product] that I purchase ….**is enjoyable to use.**	1 2 3 4 N/A
16	It is important to me that [the commercially available product] that I purchase …..**has functions that are familiar to me.**	1 2 3 4 N/A
17	It is important to me that [the commercially available product] that I purchase ….**can be used without the help of others**	1 2 3 4 N/A
18	It is important to me that [the commercially available product] that I purchase …. **works well in places with poor lighting (e.g., indoors and outdoors; day and night)**	1 2 3 4 N/A
19	It is important to me that [the commercially available product] that I purchase …. **comes with access to professional product support.**	1 2 3 4 N/A
20	It is important to me that [the commercially available product] that I purchase …**is easy to maintain.**	1 2 3 4 N/A

21	It is important to me that [the commercially available product] that I purchase ….**is inexpensive to maintain.**	1 2 3 4 N/A
22	It is important to me that [the commercially available product] that I purchase …. **is a product I can learn to use through trial and error.**	1 2 3 4 N/A
23	It is important to me that [the commercially available product] that I purchase …**looks modern.**	1 2 3 4 N/A
24	It is important to me that [the commercially available product] that I purchase …. **works well in places where there is glare (e.g., outside on a sunny day, very bright indoor lighting).**	1 2 3 4 N/A
25	It is important to me that [the commercially available product] that I purchase ….**is a product that is also used by people I know so that we can support each other.**	1 2 3 4 N/A
26	It is important to me that [the commercially available product] that I purchase …. **can be used with other commercially available products.**	1 2 3 4 N/A
27	It is important to me that [the commercially available product] that I purchase …. **can be used with other assistive devices (or products).**	1 2 3 4 N/A
28	It is important to me that [the commercially available product] that I purchase …. **has letters, labels, displays and/or controls I can see.**	1 2 3 4 N/A
29	It is important to me that [the commercially available product] that I purchase …**provides feedback I can hear (e.g., tones, verbal instructions, etc.)**	1 2 3 4 N/A
30	It is important to me that [the commercially available product] that I purchase …..**provides tactile feedback I can feel.**	1 2 3 4 N/A
31	It is important to me that [the commercially available product] that I purchase …. **is easy to handle or manipulate physically.**	1 2 3 4 N/A

32	It is important to me that [the commercially available product] that I purchase ….**is easy to transport, so I can take it with me to use in different places.**	1 2 3 4 N/A
33	It is important to me that [the commercially available product] that I purchase …. **has long battery life, before the batteries need to be recharged or replaced.**	1 2 3 4 N/A
34	It is important to me that [the commercially available product] that I purchase ….**has an easy to understand layout.**	1 2 3 4 N/A
35	It is important to me that [the commercially available product] that I purchase …. **offers the magnification or zoom (or sizing) I desire.**	1 2 3 4 N/A
36	It is important to me that [the commercially available product] that I purchase …. **offers the brightness I desire.**	1 2 3 4 N/A
37	It is important to me that [the commercially available product] that I purchase …. **offers the contrast I desire.**	1 2 3 4 N/A

Final debrief questions (optional, if time permits): Based on the purpose of the study, to produce a low vision technology selection survey, did I ask the questions you expected? Are there any statements that you thought were repetitive or redundant? Are there any other selection considerations you may want to add? Do you have any other comments about the survey?

Thank you for your participation in this study!

Appendix D: Low Vision Product Selection Instrument – Original version

Low Vision Product Selection Instrument (Study 2, iteration 1)

Commercially available devices include those that are mass produced for the general public and assistive technologies that are mass produced for people with disabilities (Cook & Polgar, 2008, p.7). You may have purchased some of these devices for activities that you perform thought you day. Some examples include: computer, cell phone, mp3 player/ radio, microwave, DVD players, non-prescribed handheld or pocket magnifier, flashlights and much more. The purpose of this exercise is to look at how you may select a commercially available device based on what you may know about it.

As an individual with difficulties seeing, I want you to think of a commercially available device that you have used several times within the past seven days. Imagine that this device is in need of replacement and you are looking to purchase the same device or something that is comparable.

What is the commercially available device you are thinking of: _____

How long have you used this device for (yrs, months)? _____

What are three main activities that you use or have used the device for?
1._____
2._____
3._____

Considering the **commercially available device** that you have indicated above, please respond to the following statements by circling the most appropriate rating to the right of each statement:

Item no.	**It is important to me that the commercially available device that I purchase…**	**Rating** **1 = Strongly disagree** **5 = Strongly agree**
	Product attribute**	
1	…. helps me to do what I want to do.	1 2 3 4 5 N/A
2	…. is easy (or simple) to setup/ configure.	1 2 3 4 5 N/A
3	…. enables me to "get started" with using it right away.	1 2 3 4 5 N/A
4	….easy to transport so that I can take it with me where I need to go to use it.	1 2 3 4 5 N/A

5	…. is easy to grip or hold.	1 2 3 4 5 N/A
6	…. can be sufficiently altered or customized to meet my specific needs.	1 2 3 4 5 N/A
7	…. will last for a long time.	1 2 3 4 5 N/A
8	…. is durable.	1 2 3 4 5 N/A
9	…. has a clear display/ layout.	1 2 3 4 5 N/A
10	…. offers the brightness that I desire.	1 2 3 4 5 N/A
11	…. has long battery life.	1 2 3 4 5 N/A
12	…. does not require batteries that need to be specially ordered	1 2 3 4 5 N/A
13	…. offers the contrast that I desire.	1 2 3 4 5 N/A
14	…. provides large enough sizes in terms of lettering, display, dials, keys, etc.	1 2 3 4 5 N/A
15	…. includes key functions and features that I want to use.	1 2 3 4 5 N/A
16	…. provide prompts/cues to help me use it.	1 2 3 4 5 N/A
17	…. has functions and features that are familiar to me.	1 2 3 4 5 N/A
18	…. allows for easy positioning/adjustment to let me see what I need to.	1 2 3 4 5 N/A
19	…. offers the colour contrast I desire.	1 2 3 4 5 N/A
20	…. can be setup by the use of touch.	1 2 3 4 5 N/A
21	…. can be used hands-free.	1 2 3 4 5 N/A
22	…. is readable rather than being small in display size.	1 2 3 4 5 N/A
23	…. have lots of controls rather than being small in display size.	1 2 3 4 5 N/A
24	…. Is readable rather than looking good.	1 2 3 4 5 N/A
25	…. has a bright display rather than use little (battery) power.	1 2 3 4 5 N/A
26	…. looks like it is designed for use by everyone (with or without a visual disability)	1 2 3 4 5 N/A
27	…. have useful functions and features.	1 2 3 4 5 N/A
28	…. allows me to remove unwanted functions or features.	1 2 3 4 5 N/A

29	…. is flexible so that I can use it in multiple activities or situations.	1 2 3 4 5 N/A
30	…. has a protective casing/ covering.	1 2 3 4 5 N/A
31	…. is light in weight.	1 2 3 4 5 N/A
32	…. offers the magnification/ zoom that I desire.	1 2 3 4 5 N/A
33	…. offers the colour scheme I desire.	1 2 3 4 5 N/A
34	…. has audio output so that the device speaks to me.	1 2 3 4 5 N/A
35	…. has audio input so that I can speak commands to the device.	1 2 3 4 5 N/A
	Personal compatibility**	
36	…. is one that I can try for a desired period time.	1 2 3 4 5 N/A
37	…. is low cost so I don't have to think too much about whether it will be suitable or not.	1 2 3 4 5 N/A
38	…. is priced within my budget and I can afford it.	1 2 3 4 5 N/A
39	…. provides both audio and visual feedback.	1 2 3 4 5 N/A
40	…. is useable outside when it is dark.	1 2 3 4 5 N/A
41	…. is able to play the audio format I desire.	1 2 3 4 5 N/A
42	…. is able to turn text to speech.	1 2 3 4 5 N/A
43	…. helps me learn to use it through trial and error.	1 2 3 4 5 N/A
44	…. is compatible with other (commercially available) technology I may use.	1 2 3 4 5 N/A
45	…. is compatible with specialized assistive technology I may use.	1 2 3 4 5 N/A
46	…. comes with the necessary training I will need in order to use it.	1 2 3 4 5 N/A
47	…. is easy to learn.	1 2 3 4 5 N/A
48	…. does not require that I read the instruction manual before I can use it.	1 2 3 4 5 N/A
49	…. can be tried when I perform an activity.	1 2 3 4 5 N/A
50	…. helps me to read different fonts with ease.	1 2 3 4 5 N/A
51	…. is one I can talk about/ learn to use it with my peers.	1 2 3 4 5 N/A
52	…. is one that a sales person at a retail store could explain to me whether it may fit my needs or not.	1 2 3 4 5 N/A
53	…. is somewhat appropriate for me but I have to pay for most of it	1 2 3 4 5

	myself.	N/A
54	…. is somewhat inappropriate for me but I do not have to pay for most of it (e.g., government funding).	1 2 3 4 5 N/A
55	…. is cheaper than a comparable device.	1 2 3 4 5 N/A
56	…. is completely individualized to my needs.	1 2 3 4 5 N/A
57	…. helps me to read newspaper, books and magazines.	1 2 3 4 5 N/A
58	…. helps me to read pill bottles.	1 2 3 4 5 N/A
59	…. helps me to read work documents like reports and charts.	1 2 3 4 5 N/A
60	…. helps me to read the mail.	1 2 3 4 5 N/A
61	…. helps me to read recipes and performing cooking activities.	1 2 3 4 5 N/A
62	…. helps me to watch television.	1 2 3 4 5 N/A
63	…. helps me to use the computer and internet.	1 2 3 4 5 N/A
64	…. helps me to read outside of the home (e.g., price tags at supermarkets and retail store).	1 2 3 4 5 N/A
65	…. helps me to read a menu at a restaurant.	1 2 3 4 5 N/A
66	…. works well in places with poor lighting.	1 2 3 4 5 N/A
67	…. works well against glare (e.g., from the sun through windows or other light sources in a room).	1 2 3 4 5 N/A
68	…. helps me in work or volunteer settings.	1 2 3 4 5 N/A
69	…. helps me to complete my indoor household tasks.	1 2 3 4 5 N/A
70	…. helps me to complete my outdoor household tasks.	1 2 3 4 5 N/A
71	…. helps me to watch movies in the theatre.	1 2 3 4 5 N/A
72	…. comes with access to training opportunities.	1 2 3 4 5 N/A
73	…. comes with access to technical support should I need it.	1 2 3 4 5 N/A
74	…. comes with a warranty should I need it.	1 2 3 4 5 N/A
75	…. helps to decrease my rate of visual deterioration and preserve my visual function.	1 2 3 4 5 N/A
	Meaning**	
76	…. is one that I would enjoy using.	1 2 3 4 5 N/A
77	…. is one the will not single me out from a crowd (e.g., non-stigmatizing).	1 2 3 4 5 N/A
78	…. gives me the freedom and choices to do what I want to do.	1 2 3 4 5

		N/A
79	…. helps me to cope and adjust to my disability.	1 2 3 4 5 N/A
80	…. helps me to achieve the independence.	1 2 3 4 5 N/A
81	…. helps me to independently perform a range of activities.	1 2 3 4 5 N/A
82	…. looks “cool” or “sexy” when I am using it in public.	1 2 3 4 5 N/A
83	…. is acceptable to my family and friends.	1 2 3 4 5 N/A

Appendix E: Copyright for publication

---------- Forwarded message ----------
From: Daniel Fok
Date: Fri, Jan 7, 2011 at 9:32 AM
Subject: Re: Request for Republication in Thesis
To: Carry Koolbergen

Thank you Mrs. Koolbergen.

Daniel

On Fri, Jan 7, 2011 at 8:12 AM, Carry Koolbergen
wrote:
> Dear Daniel Fok,
>
> We hereby grant you permission to reproduce the below mentioned material in
> print and electronic format at no charge subject to the following
> conditions:
>
> 1. If any part of the material to be used (for example, figures)
> has appeared in our publication with credit or acknowledgement to another
> source, permission must also be sought from that source. If such permission
> is not obtained then that material may not be included in your
> publication/copies.
>
> 2. Suitable acknowledgement to the source must be made, either as
> a footnote or in a reference list at the end of your publication, as
> follows:
>
> "Reprinted from Publication title, Vol number, Author(s), Title of article,
> Pages No., Copyright (Year), with permission from IOS Press".
>
> 3. This permission is granted for non-exclusive world English
> rights only. For other languages please reapply separately for each one
> required.
>
> 4. Reproduction of this material is confined to the purpose for
> which permission is hereby given.
>
> Yours sincerely
>
> Carry Koolbergen (Mrs.)
> Contracts, Rights & Permissions Coordinator
> IOS Press BV

> Nieuwe Hemweg 6B
>
>
>Please consider the environment before printing this email.
>
> Van: Victoria Hall
> Verzonden: donderdag 30 december 2010 4:20
> Aan: Carry Koolbergen
> CC: Daniel Fok
> Onderwerp: Fwd: Request for Republication in Thesis
>
> Hi Carry,
>
> Please see this author's request to publish the attached article in his
> thesis. The article is scheduled for publication in issue 39(1), May 2011.
>
> Best,
>
> Victoria
>
> ---------- Forwarded message ----------
> From: Daniel Fok
> Date: Mon, Dec 27, 2010 at 9:57 PM
> Subject: Re: Status of Manuscript Submitted to WORK
> To: Victoria Hall
>
> Hi Victoria,
>
> I have made the two edits (please see tracked changes). The first is
> on page 3 and the other is on page 21.
>
> Also, would you (or Dr. Jacobs?) please send me a confirmation that I
> am allowed to use this publication as one of my chapters to be
> published in my thesis.
>
> Thanks for your help. Hope you are having an enjoy holiday season!
>
> Daniel

Appendix F: Personal location

A mixed-methods approach was employed in this dissertation to explore the topic of product selection by persons with low vision. To review, a mixed-methods approach acknowledges that both subjective and objective methods are used. The subjective piece was especially relevant in part one of the study during the qualitative data collection with participants with low vision, as well as, in the presentation and interpretation in the results. As such, it was important here that I as the researcher acknowledged and located my influence on the research based on my work history, academic history and personal interest (Schwandt, 1994; Hesse-Biber, 2004). In addition, my curriculum vitae may be found in Appendix G.

I started pursing Ph.D. studies at the University of Western Ontario (UWO), Health and Rehabilitation Program (Occupational Science), in the fall of 2006. Prior to that, I had worked for the Canadian National Institute for the Blind (CNIB), as a workplace accommodation consultant (EAC) for three years. It was through this role that I became interested in working with persons with vision loss. My main responsibility involved going into the workplace and working with a client (person with low vision or blindness), the employer and other stakeholders to ensure that there was a good fit between the client and productive work occupations (activities). It was in this role that I first became exposed to assistive technology devices (ATDs), and their potential to enable occupations. Furthermore, the role gave me an appreciation of the dire consequences of a mismatch between a person with vision loss and an ATD. In one case, a person with low vision did not read for five years as he was prescribed an inappropriate reading technology, and could not afford to purchase a proper replacement ATD. It also became apparent to me that the reliance on a technological solution only cannot ensure a satisfactory work accommodation or retention. From my experiences, I proposed a framework for workplace accommodation for persons with vision loss, which included components such as access to information, access to technology, ergonomics, social and business integration, along with a consideration of the client's abilities, work demands and the contexts (Fok & Sutarno, 2003). The understanding of the need to consider beyond the technology also prompted me to look at models such as the Human, Activity,

Assistive Technology (HAAT) model which would comprehensively consider the issues of ATD or product selection (Cook & Poglar, 2008). Furthermore, I recognized the need to be able to communicate effectively with engineers to achieve optimal outcomes for persons with disabilities. Therefore, I started pursing a Master of Engineering (M.Eng.) Degree at the University of Toronto at the same time I was worked for the CNIB. I also completed an Assistive Technology Applications Certificate Program at California State University, Northridge.

In 2005, I started working for Research In Motion (RIM), the maker of the BlackBerry Smartphone, in the area of accessibility. While my interest remained in the visual impairment space (e.g., help to implement a font type and font face that many persons with low vision prefers on the Blackberry), I developed new and renewed interests in the potential of commercial products to allow for persons with vision, hearing, mobility and or cognitive disabilities to pursue various occupations. Upon completion of my M.Eng., I decided to pursue Ph.D. studies at UWO given that my research interests were similar to that of my supervisors. My doctoral thesis committee included Drs. Jan Polgar (co-chair), Lynn Shaw (co-chair), Jeffrey Jutai and Craig Hall. Dr. Polgar is a co-author of the Human Activity Assistive Technology (HAAT) Model (Cook & Polgar, 2007), and Dr. Jutai is an expert on ATD outcomes research and co-author of the widely used outcome measure called the Psychosocial Impact of Assistive Devices Scale (PIADS) instrument (Day & Jutai, 1996). Dr. Shaw is an expert on qualitative methods, such as grounded theory and Dr. Hall is an expert on quantitative methods, such as the factor analysis.

References:

Cook, A.M. & Polgar, J.M. (2008). *Cook & Hussey's assistive technologies: Principles and Practice (3rd edition).* St. Louis, MO: Mosby Elsevier.

Day, H., & Jutai, J. (1996). Measuring the psychosocial impact of assistive devices: The PIADS. *Canadian Journal of Rehabilitation, 9*, 159-168.

Fok, D. & Sutarno, C. (2003). Overcoming barriers: Workplace accommodations for people with vision impairment, in: *Proceedings of the 34th Annual Conference of the Association of Canadian Ergonomist*, London, ON.

Hesse-Biber, S.N., & Leavy, P. (Eds.) (2004). *Approaches to qualitative research*. New York, NY: Oxford University Press.

Schwandt, T.A. (1994). Constructivist, interpretivist approaches to human inquiry. In N.K. Denzin & Y.S. Lincoln (Eds.), *Handbook of qualitative research*. Thousand Oaks, CA: Sage Publications.

Curriculum Vitae

Daniel Fok

Post-secondary Education and Degrees:

Doctor of Philosophy, The University of Western Ontario, London, Ontario, Canada (2006-2011)

Master of Engineering, University of Toronto, Toronto, Ontario, (2003-2006)

Bachelor of Science (Co-op Kinesiology: Ergonomics Option), University of Waterloo, Waterloo, Ontario, (1997-2002)

Scholarships, Fellowships and Awards*

Year	Awards	Value (CAD)
2008-2010	**Social Sciences and Humanities Research Council of Canada (SSHRC) Doctoral Fellowship	$40,000
2008-2009	**Ontario Graduate Scholarship (awarded but declined - $15,000)	N/A
2008	**International Conference on Aging, Disability and Independence (ICADI) at the University of Florida - Graduate Student Scholarship	$650
2007-2008	**Lawson Health Research Institute, St. Joseph's Health Care, Mary Horney Fellowship in Rehabilitation* (Administered through Parkwood Hospital, London, Ontario)	$19,000
2006-2007	**Lawson Health Research Institute, St. Joseph's Health Care, Mary Horney Fellowship in Rehabilitation* (Administered through Parkwood Hospital, London, Ontario)	$19,000
2006-2010	University of Western Ontario Research Scholarship	$32,000
2010	University of Western Ontario Graduate Thesis Research Award (University-wide competition)	$660
2010-2011	**Ontario Graduate Scholarship	$15,000
Total Amount:		**$126,310**

*This table does not include RA compensations or TAships.
**Denotes external research awards obtained through competitive processes

Related Academic Work Experience

2008-2010 (Winter)	Lecturer, Bachelor of Health Sciences Program, Faculty of Health Sciences, The University of Western Ontario, London, Ontario Course: *HS4092 Special Topic – Human Factors and Universal Design*
2009 (Fall)	Lecturer, Masters of Science in Occupational Therapy Professional Program, School of Occupational Therapy, Faculty of Health Sciences, The University of Western Ontario, London, Ontario Course: *OT9641 Enabling Occupation: Environmental Modification and Assistive Technology.*
2007 to present	Research Assistant to Dr. Janice Polgar, The University of Western Ontario, London, Ontario Research Project: *Canadian Institutes of Health Research (CIHR)/Ontario Neurotrauma Foundation (ONF) funded project entitled "Cognitive load: A window for the study of the older driver, road and vehicle triad"*
2006	Teacher Assistant, Department of Occupational Therapy, The University of Western Ontario, London, Ontario Course: *Change agency: enabling occupational competence through occupational adaptation and micro-environmental change*

Publications (Journals):

Fok, D., Polgar, J., Shaw, L. & Jutai, J. (2011, May). Low vision assistive technology device usage and importance in daily occupations. *Work. A Journal of Prevention, Assessment and Rehabilitation, 39*(1), pp. tbd.

Fok, D., Polgar, J., Shaw, L., Luke, R. & Mandich, A. (2009). Cyberspace, real place: Thoughts on 'doing' in contemporary occupations. *Journal of Occupational Science, 16*(1), 38-43.

Fok, D., Shaw, L., Jennings, M.B. & Cheesman, M. (2009). A comprehensive approach for managing transitions of older workers with hearing loss. *Work: A Journal of Prevention, Assessment and Rehabilitation, 32*(4), 365-376.

Rudman, D., Dennhardt, S., **Fok, D.**, Huot, S., Molke, D., Park, A. & Zur, B. (2008). A vision for occupational science: Reflecting on our disciplinary culture. *Journal of Occupational Science, 15*(3), 136-146.

Hammel, J., Finlayson, M., Jutai, J., Coulson, S. & **Fok, D.** (Under Review). Evaluating Use and Outcomes of Mobility Technology: A Multiple Stakeholder Analysis. *Disability and Rehabilitation: Assistive Technology.*

Shaw, L., **Fok, D.**, Pelkman, K. (Work in preparation). Development of a guideline for evaluating safety and care in the use of safety technologies in health care environments. *Work: A Journal of Prevention, Assessment and Rehabilitation: Special issue for evaluating work environments.*

Publications (proceedings):

Fok, D., Middleton, R., Fischer, N. & Polgar, J. (2010). Integration of task and activity analysis to evaluate seniors' use of a vehicle navigation system (GPS). *Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) Annual conference*, Las Vegas, NV. (4 pages). (Online: http://web.resna.org/library/conference_2010/JEA/FokD.html)

Jutai, J., Hammel, J., Finlayson, M., Coulson, S., **Fok, D.** & Fuhrer, M. (2008). Poster 57: The assistive technology outcomes profile for mobility item pool development. *Archives of Physical Medicine and Rehabilitation, 89*(10), e23.

Fok, D., Shaw, L., Jennings, M.B. & Cheesman, M. (2007). Universal accessibility and usability for hearing: Considerations for design, *Canadian Acoustics (Canadian Acoustical Association Proceedings Edition)*, 35 (3), 84-85.

Dougall, D. & **Fok, D.** (2006). BlackBerry and the hearing impaired community. Telecommunications for the Deaf (US): *2006 National Directory & Resource Guide*, 28-31.

Fok, D. & Sutarno, C. (2003). Overcoming barriers: Workplace accommodations for people with vision impairment, in: *Proceedings of the 34th Annual Conference of the Association of Canadian Ergonomist*, London, ON. (8 pages).

Presentations:

Fok, D. (2010). Low vision technology selection considerations. *"Now I know my ABCs": Access Braille, Communication (CNIB 2010 Conference)* (October 28-29). Toronto, ON.

Fok, D., Middleton, R., Fischer, N. & Polgar, J. (2010). Integration of task and activity analysis to evaluate seniors' use of a vehicle navigation system (GPS). *Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) Annual conference* (June 26-30). Las Vegas, NV. (Poster presentation).

Dougall, D. & **Fok, D.** (2010). Communicating with BlackBerry – The world at your fingertips. *Voice for hearing impaired children* (May 8, 2010), University of Guleph, Guelph, ON.

Fok, D. (2010). Invited Speaker – Low vision assistive technology selection and perceived importance. *Canadian National Institute for the Blind* (Feb 2). London, Ontario.

Fok, D. (2010). Invited Speaker - Low vision assistive technology selection (2 hours presentation. *Bloorview Research Institute: The Participation and Inclusion Research Team (PIRT) talk series* (January 12). Toronto, Ontario.

Molke, D. & **Fok, D.** (2009). Enabling occupation online: Disability, virtual accessibility and professional responsibility. *Canadian Association of Occupational Therapist* (June 3-6). Ottawa, Ontario.

Shaw, L., Jennings, M.B., **Fok, D.**, Cheesman, M., Hodgins, H., & Kuchar, A. (2008). Older workers with hearing loss: Practice innovations through interprofessional collaboration. *Canadian Association of Occupational Therapists* (June 12-14). Whitehorse, Yukon.

Fok, D. & Polgar, J. (2008). Information and communication technology and the separation of space, place and time. *4th Canadian Occupational Science Symposium: Placing Occupation.* (May 15-17), Thunder Bay, ON.

Molke, D., Dennhardt, S., **Fok, D.**, Huot, S., Rudman, D., Park, A. & Zur, B. (2008). Reflecting on Relevance: Making occupational science matter. *4th Canadian Occupational Science Symposium: Placing Occupation.* (May 15-17), Thunder Bay, ON.

Molke, D. & **Fok, D.** (2008). Real space, virtual space and the avatar: Reflecting on occupational identity in the 21st century. *4th Canadian Occupational Science Symposium: Placing Occupation.* (May 15-17), Thunder Bay, ON.

Zur, B., Rudman, D., Dennhardt, S., **Fok, D.**, Huot, S., Molke, D. & Park, A (2008). Placing Occupational Science: Reflecting on our disciplinary culture. *4th Canadian Occupational Science Symposium: Placing Occupation.* (May 15-17), Thunder Bay, ON.

Coulson, S., Jutai, J., **Fok, D.**, Hammel, J. & Finlayson, M. (2008). Development of an Assistive Technology Outcomes Profile for Mobility (ATOP/M): Consumer and caregiver perspectives. *GTA Rehab Network Best Practice Day* (February 29), Toronto, ON.

Fok, D., Shaw, L. & Pelkman, K. (2008). Moving toward client-centered care when using mechanical lifts in health care settings. *International Conference on Aging, Disability and Independence* (February 21-23), St. Petersburg, FL.

Fok, D., Shaw, L. & Pelkman, K. (2008). The aging consumer's participation and involvement in AT processes: Implications for measurement. *International Conference on Aging, Disability and Independence* (February 20), St. Petersburg, FL.

Jutai, J., Teasell, R., Coulson, S., & **Fok, D.** (2008). Aging and Mobility Device Outcomes Research: Challenges and Opportunities. *ARGC/FHS Symposium: Bridging Partnerships in Aging and Rehabilitation Research* (February), London, ON.

Fok, D. (2008). Invited Speaker - Universal Design for Hearing. *Hearing Sciences Seminar* (January 25), London, ON.

Coulson, S., **Fok, D.**, Jutai, J., Hammel, J. & Finlayson, M (2007). Development of the Assistive Technology Outcomes Profile/Mobility (ATOP/M) instrument – The client and caregiver perspectives. *Aging, Rehabilitation, and Geriatric Care Annual Research Day* (November 1), London, ON.

Fok, D., Shaw, L., Jennings, M.B., Cheesman, M. & Prangley, M. (2007). Assessing the built environment for hearing. *Aging, Rehabilitation, and Geriatric Care Annual Research Day* (November 1), London, ON.

Fok, D., Shaw, L., Jennings, M.B. & Cheesman, M. (2007). An occupational perspective for the development of universal hearing accessibility: Implications for health professionals and consumers. *Society for Study of Occupation: USA Conference* (October 25-27), Albuquerque, NM.

Fok, D., Shaw, L., Jennings, M.B. & Cheesman, M. (2007). Universal accessibility and usability for hearing: Considerations for design. *Canadian Acoustical Association Conference* (October 9-12), Montreal, QC.

Fok, D. (2003). Overcoming barriers: Workplace accommodations for people with visual impairment. *34th Annual Conference of the Association of Canadian Ergonomist* (October 15-18), London, ON.

Sutarno, C. & **Fok, D.** (2003). A holistic approach to accommodating persons with disabilities, *34th Annual Conference of the Association of Canadian Ergonomist* (October 15-18), London, ON.

Reviewer for Journals and Conferences

2010-present	AER Journal: Research & Practice in Visual Impairment & Blindness – 2 papers reviewed
2010-present	International conference on aging disability and independence (ICADI) – 2 papers reviewed
2008-present	Work: A Journal of Prevention, Assessment and Rehabilitation (registered reviewer)
2008-present	Journal of Occupational Science (registered reviewer)