Designing for the Elderly User: Internet Safety Training

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Abstract

The following qualitative study examines the usability of a custom-designed Internet safety tutorial, targeted at elderly individuals who use the Internet regularly, for effectively conveying critical information regarding online fraud, scams, and other cyber security. The elderly population is especially at risk when it comes to fraudulent activity, both online and via other methods (mail, phone, etc.), which is why a safety tutorial of this nature could be extremely beneficial. Additionally, growth in the population of individuals over the age of 65 is boosting the number of elderly people using Internet technologies (desktop/laptop, SmartPhones, tablets, and other networked devices) to go online. In order to design appropriate training material for this demographic, research was undertaken regarding the older population's computer use, age-related physical and cognitive differences, vulnerability to scams, and efficacy of currently available training modules. Based on this research, age-specific design principles were developed and applied to an Internet safety tutorial, which was then tested on a selection of elderly participants. Design and delivery of the tutorial were effective; participants were able to complete the tutorial as intended and gave very positive feedback. Results of the usability testing indicated that users over age 65 already have some basic understanding of Internet threats, either from personal experience or via training through an employer. Therefore, the target age group for further testing may need to be adjusted upward by 5-10 years to filter out seniors who recently exited the workforce and do not need the basic level of training. However, specialized training on the topic areas of safe browsing, safe emailing, safe shopping, etc., would be beneficial to all elderly users, especially if broken down by experience level (novice, intermediate, expert). Minor adjustments to the design, as well as the addition of leveled training options, would be an ideal solution to providing the right information to the right users.

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Introduction

Due to a significant rise in the U.S. population of individuals over 65 in relation to the general population, and because adults are tending to remain in the workforce later in life, Internet usage is no longer limited to the stereotypical 'young and tech-savvy' demographic. Older individuals are migrating to technologies such as personal computers (PCs), laptops, tablets, and SmartPhones more than ever, with adoption rates at their historical highest. As of 2012, 59% of seniors over 65 were reported to be using the Internet, which was a 6% jump from the previous year (Smith, 2014).

For older adults, going online can provide numerous benefits from information gathering to social networking; seniors are able to conveniently access much more than they have in the past. In fact, 81% of older adults who use social networking sites reported being more likely to regularly socialize with friends and family on a daily (or near daily) basis, as opposed to 63% of those who don't go online (Smith, 2014). This ability to be connected to their social circles can combat issues often associated with older adults such as isolation, depression, and other health problems.

While the benefits of Internet use are vast for all ages, so too are the potential threats. Because older adults are typically less technically savvy, and because they are statistically more likely to fall victim to fraud and scams than their younger counterparts, there is an increased risk involved in their Internet use. If even the most skilled computer users are often unable to avoid scams and fraud online, what hope is there for those less experienced? Unfortunately, the odds are stacked against them; not only are seniors the most targeted demographic, they are also the least likely to report fraudulent activity when it does occur (Federal Bureau of Investigation, 2014).

The Internet provides scammers the perfect medium through which to exploit a large number of people quickly and anonymously. Many of the criminals associated with Internet fraud perform these acts from abroad and are therefore physically and legally protected from the Federal Trade Commission (FTC) and the U.S. court system. According to the Consumer Sentinel Network (managed by the FTC), adults over the age

of 50 accounted for 49% of all fraud complaints in 2014. Of the fraud methods used, 34% were Internet-related. The original contact method in the majority of fraud cases was email, accounting for 40% of complaints in 2014, followed by phone (24%), Internet/web (22%), mail (7%), and other (8%) (Federal Trade Commission, 2015).

In order to enable this age group to be mindful of potential threats and scams online, it is important to provide effective training opportunities and mechanisms. Unfortunately, because seniors have been historically slow to join the technology wave, much of the training material available is targeted toward a 'typical' user, not toward the elderly. Usability research involving older adults and technology is a relatively recent phenomenon, which means that design principles for this age group are difficult to acquire.

The purpose of this study is twofold: 1) to learn, develop, test, and improve upon methods for educating the elderly via an online training module, and 2) to impart knowledge to seniors about common Internet threats and the ways they can protect themselves from becoming victims of fraud. The usability research acquired through testing the training module contributes to overall usability principles for this demographic, which are currently lacking, and will also educate seniors on how to safely manage their online identities.

Literature Review

Elderly Population and Computer Use/Activity

As America's reliance on technology—specifically digital and computer technology—increases, the more crucial it becomes for individuals to be at least marginally competent in utilizing and manipulating everyday devices. From cell phones to keypads at the checkout counter, modern technology has changed the way in which we live. While many would argue that these changes save us time, effort, and the risk of human error, some might claim otherwise: that the intrusion of technology into everyday life can instead be a hindrance. One particular group who tends to fall behind the learning curve with new technology—and who therefore may resist these changes—is the elderly.

Due to advances in health and medical technology, life expectancy in the U.S. has risen, while overall population growth has fallen; as a result, older adults now constitute a larger portion of the total demographic than ever before. According to the 2010 U.S. Census, the percentage of elderly in the U.S. is growing, with an overall increase of 15.1%, as compared to the total population (9.7%) since 2000. It is, in fact, the largest reported segment of adults over 65 in census history, which dates back to 1790. By 2030, the number of elderly is projected to be 72 million (Greenblatt, 2011), an even greater overall increase (80%) as compared to only 15% of those under 65 (Werner, 2010). This dramatic shift in population will force the U.S. to evaluate the economic, social, and financial implications of fewer people entering the workforce at the same time that more support is needed for programs associated with the elderly, such as Medicare and Social Security.

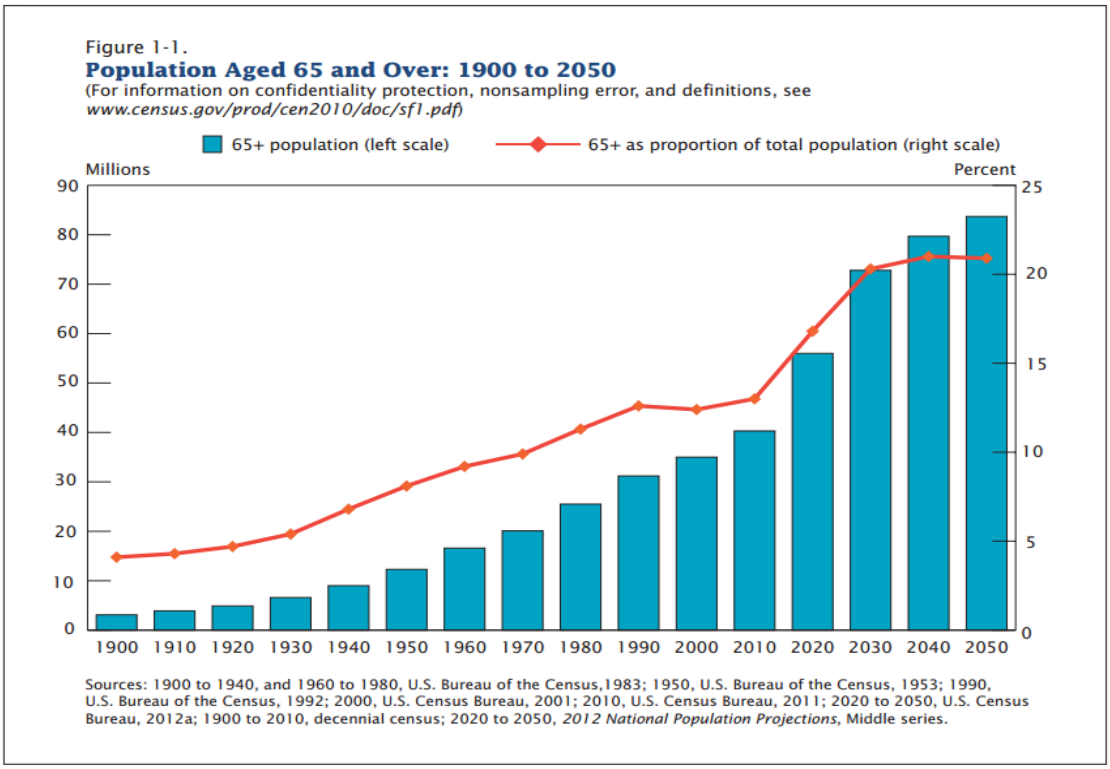

Figure 1: Population aged 65 and over: 1900 to 2050 (Census.gov, 2010).

The intersection between technology growth and elderly population growth has recently drawn attention to the use of computers, the Internet, and mobile devices (SmartPhone, tablet, etc.) by the elderly. Although digital technology has been traditionally associated with younger generations, its use has become widespread in areas that affect older adults, such as health care, commerce, telephony, media, and entertainment. This has resulted in a gap (often referred to as one component of the 'digital divide') in making technology accessible to everyone. Key to bridging this gap is a comprehensive understanding of the use of technology by older adults who have already adopted it, what activities they are engaging in, what barriers older adults may encounter to technology use, and what may motivate non-users in this age group to adopt technology use.

The average American senior citizen (aged 65+) typically has more leisure time than other adults, and tends to spend it in several ways: relaxing and thinking, watching

television, sleeping, running errands or completing household chores, eating and drinking, shopping, volunteering, and working (Brandon, 2012). Although computer use was not specifically mentioned in the Brandon report, other sources indicate that around 74% of seniors between the ages of 65-69 regularly interact with computers and, of those seniors, 59% access the Internet. Internet users in this group are also taking advantage of updates in Internet technology: 65% are using broadband connections at home (Smith, 2014). But according to Aaron Smith of Pew Internet Research, computer and Internet use drops significantly in those older than age 75. And despite the increasing numbers of seniors, adoption by elderly users still trails the general population by about 10% (Smith, 2014).

The two most common ways in which older adults adopt digital technology are via work experience, and via a friend or family member. The children of elderly adults often provide their parents with computer equipment they no longer use. However, the majority of seniors using the Internet are self-taught, and their time spent online ranges from three to ten hours per week on average (Gatto & Tak, 2008). Of those seniors regularly using a computer, most tend to be younger, male, Caucasian, well educated, and affluent. But a growing number of elderly females are also using the Internet, and the gender gap is rapidly closing. Notably, seniors who are married or live with others are more likely to use a computer compared to those who are single, widowed, or living alone (Gatto & Tak, 2008). Financial factors also affect which seniors have access to computers: lower income seniors typically do not own a computer or have regular computer access (Zickuhr & Smith, 2012). Disability is another factor in terms of access and motivation to use the Internet: aging often leads to both physical and cognitive impairments that can limit the ability of an individual to interact with technology. Seniors who are unable to work due to a disability are the least likely to use the Internet, accounting for only 10% of the total Internet-using population (Wright & Hill, 2009).

Once online, however, elderly adults are just as enthusiastic about the Internet as younger users and typically seek to connect with friends (Gatto & Tak, 2008). Email is the most prevalent internet activity of older adults. Ninety-one percent of seniors that go

online use email. (Rainie, 2009). Email is used almost entirely for personal correspondence, enabling older adults to keep in contact with family and friends. Another favorite activity is 'Googling': searching the Internet for various types of information, including weather access, genealogy research, travel details, and financial advice. Sixty-eight percent of online seniors reported looking up health information on the Internet, especially information on prescription drugs, although only five percent actually purchase prescriptions online (Gatto & Tak, 2008). Some seniors do use the Internet for other financial transactions, though, such as online banking and participating in online auctions. Forty-seven percent of elderly Internet users have purchased merchandise online. Despite the preference for using email, forty-six percent of seniors also use social networking sites such as Facebook, Twitter, and the like (Smith, 2014). Twenty-seven percent have used Instant Messaging technology to communicate with friends or family over the Internet (Gatto & Tak, 2008). However, while younger Internet users often replace physical social interaction with email, Instant Messaging, and other social media outlets, elderly users do not. Instead, they consider time spent online to be more of a replacement for information-gathering activities such as visiting the library, and they continue to maintain their face-to-face interactions as usual (Gatto & Tak, 2008).

While some—primarily younger—seniors are already using computers and the Internet, access to technology can be a significant challenge for elderly adults. In one study involving 32,001 seniors over the age of 55, in the median age range (65-74) only about half (48.2%) reported having a computer in the home, while slightly fewer (42%) reported having Internet access. Of those without Internet access, the reasons were as follows: 1) lack of interest – 54.5%, 2) inadequate computer – 20.2%, 3) cost – 13.3%, 4) lack of skills/confidence – 6.2%, or 5) other – 5.8% (Wright & Hill, 2009). These results generally indicate that among those seniors not online, physical access is often less of an issue than the fact that many in this age group simply aren't interested in accessing the Internet. Among those who claim to not be interested in using the Internet, the reasons include relevance (they believe the Internet is not relevant to them or is a waste of time), ease of use (the Internet is too complicated to use), expense (the expense of owning a computer or paying for Internet connectivity is too much), and lack of physical access to

the Internet (Zickuhr, 2013). This lack of interest will be an important factor to address in designing ways to bridge the technology gap for the elderly.

Even for those seniors who do want access to computers and the Internet, there are other barriers. Finances are a factor that influences technology use. Low-income seniors may not be able to afford newer computers that are capable of accessing the Internet, even if they can afford the costs (dial-up or broadband) of having Internet access at home (Tolbert, 2006). In fact, the higher the household income, the more likely individuals are to have access to the Internet in the household, use the computer for personal use, and access the Internet in general (Wright & Hill, 2009). A related factor—the level of education of the individual—also impacts overall adoption. For every year of education an older adult has, the likelihood of Internet use triples (Wright & Hill, 2009).

As previously stated, physical and cognitive disabilities also play a significant role in computer use and Internet access for elderly persons. Such disabilities can make it difficult for seniors to get to an area with a computer and/or to interact with the components of a computer, such as a mouse, monitor, and keyboard. Of the respondents who reported using the computer for personal use, 20% reported having a disability. Only 17% of those with a disability reported using the computer to access the Internet, as compared to 37% of those without a disability (Wright & Hill, 2009). Regardless of any other disability, the aging process itself generally causes changes in sensation, perception, cognition, and movement control (Hawthorn, 2005). These changes also have an impact on the ability to use technology. The differences in disability status between elderly adults (65+) and all adults, as shown in Figure 1, make it clear that age-related declines in physical wellness are a significant factor in technology use (Smith, 2014).

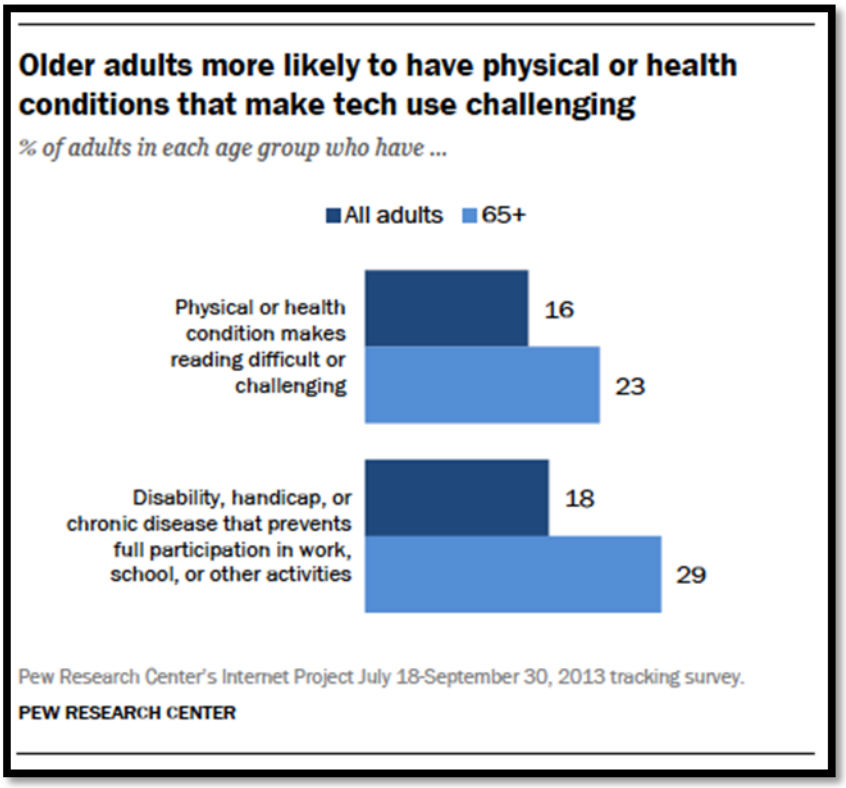

Figure 2. Health conditions among younger and older Adults, Smith, A. (2014, April 3).

Other barriers to technology use are related to seniors' lack of confidence in their own skills and abilities. In a small study of 58 older adults (age 55+), participants identified frustration, functional (physical) limitations, mistrust (considering information found online to be unreliable), and time (concerns that Internet use is habit-forming) as their top barriers to using a computer or the Internet. Frustration was the most prevalent barrier and arose from the following: the fact that there are multiple ways to accomplish the same task on the computer; the loss of pages of documents without knowing how to get them back; the inability to follow directions, which leads to becoming easily discouraged; the constant changes in technology that require the relearning of prior skills; and the lack of standardization in language and buttons across various platforms (Gatto & Tak, 2008). Another frustration these seniors mentioned was the fact that online social correspondence requires everything to be typed, as opposed to a more engaging and detailed spoken dialogue. Interestingly, the elderly subjects in the study also reported having many hesitations about using the computer based on security and privacy

concerns. Spam, pop-up advertisements, pornography, unsolicited emails, and a fear of identity theft were prevalent issues raised by the group. Not knowing how to avoid such nuisances added to their frustrations (Gatto & Tak, 2008). The particular vulnerability of the elderly population to these issues will be addressed in more detail later in this chapter.

As noted above, the single biggest factor for non-users of technology in this age group is a lack of interest. In order to understand what motivates or could motivate seniors to become more involved with technology as a population, it is vital to identify the benefits seniors gain by utilizing computers and/or the Internet. One common complaint among seniors is loneliness, whether due to the loss of a spouse, because of a physical or mental impairment that makes socialization difficult, or simply related to a lack of physical proximity to friends and loved ones. Therefore, it stands to reason that elderly adults could benefit greatly from online socialization and interaction. In fact, "social support has been reported to be the main benefit of online communication with friends, family, and companions," with entertainment being a close second (Gatto & Tak, 2008, p. 803). Some seniors reported benefiting from online research regarding health issues, diseases, and treatment options, although many felt that there was too much information or that it was inaccurate. According to the small study described earlier, the top four benefits to using the Internet included connectedness (keeping in touch with friends/family), satisfaction (having experiences that are fun and stimulating), utility (accessing financial, health, and travel resources), and positive learning experiences (learning technology by doing, or taking computer classes) (Gatto & Tak, 2008).

As the use of technology in our society expands into seemingly every aspect of life, having the ability to go on the Internet (in terms of both skills and access) is becoming less and less optional, as the friends, children, and grandchildren who are encouraging the elderly to go online may realize (Gatto & Tak, 2008). Even today, a significant amount of information, including forms and other documents, is either housed primarily online or is moving to a digital medium of some kind. Financial institutions encourage 'paperless' banking; books and other paper-based materials are being transferred to digital form; education and training is more prevalent online; videos and

photographs are almost entirely digital; movies and television are being accessed online as opposed to via physical media; and the list goes on. Growing advances in the information technology field have benefited the younger demographic in a number of ways. As technology continues to evolve, and with the number of 'silver surfers' growing rapidly, including and accommodating the older population is an area that could potentially experience significant improvement. However, a common complaint in the research of older adults and technology is the fact that the study of human-computer interaction and the elderly is quite limited. In order to target specific areas for improvement, it is necessary to consider the unique problems that seniors experience with regard to technology use. These include age-related changes and/or declines, the particular vulnerability of seniors to fraud and scams, and the educational requirements of the senior population. Examining these issues will help in developing some guiding principles for technology design for the elderly.

Age-related differences – effects on computer use.

Because the elderly population in the United States is on the rise in proportion to the total population, and because a substantial part of the U.S. population's wealth and disposable income is identified with this age group, marketers are looking for ways to better understand and accommodate elderly consumers. Additionally, workplaces will likely see a rise in older employees, due to the lower number of younger adults entering the workforce, in combination with the need and/or desire for older adults to work longer into their lives. Although "becoming older is accompanied by increases in the likelihood of suffering from more chronic illnesses in general, [and] also of experiencing health events such as a new diagnosis of a severe illness (e.g., cancer)," the ability of older adults to interact with technology remains strong. In 2010, Internet usage among the older population was up 31 percentage points from a decade prior (U.S. Census Bureau, 2014), and as of 2014, 74% of seniors between the ages of 65-69 claim to regularly interact with computers and, of those seniors, 59% access the Internet (Smith, 2014).

Despite some of the stigmas associated with senior citizens, research has shown that "with well designed learning support some older users can be trained to use relatively complex software and computing concepts" (Hawthorn, 2005, p. 9).

It is no secret that aging causes a number of changes in the human body, and that those changes can have a significant effect on daily functions and abilities. However, some stigmas associated with aging are a result of incorrect perceptions and stereotypes held by both younger and older people. For instance, one study found that

> most people age 65 or older regarded having less energy and becoming more dependent on others as normative changes in age. Sometimes, even specific illnesses are perceived as caused by the aging process rather than by other factors (such as unhealthy behavior, genetics): It has been shown that illnesses such as arthritis, stroke, or even heart attacks are often considered as caused by aging. (Wurm et al., 2013, p. 1089)

Consequently, one important step in designing technology for elderly users is distinguishing between false stereotypes and the genuine physiological changes caused by aging. (The role of *perceived* health and cognition will be discussed further on because of its potential impact on *actual* cognitive function.) In order to accommodate these differences between older and younger adults, it is crucial to understand the specific changes that are associated with aging, especially as it relates to cognition and what techniques have been successfully implemented, in terms of design, for an elderly user.

Physiological changes that impair perception, cognition, and social interaction are among the most prevalent in older people, and the impact is evident in the way that they interact with computers:

> The elderly have more limited perceptual and cognitive capabilities, which often degrade the informative communication process compared with younger people. Working memory capacity, processing speed, and recall of information often decline with age. Motor skills and visual and auditory abilities are also more

> limited due to aging. These restrictions can interfere with the elderly's use of Internet technology. (Allerhand, Gale, & Deary, 2014, p. 307)

The specific physiological changes related to aging that affect the utilization of computers can be broken down into the following categories:

Vision

Visual acuity – The ability to see fine spatial detail is a measurement of visual acuity, and is the standard for determining vision ability by eye doctors. The crystalline lens in the eye increases in opaqueness and becomes less capable of bending as we age. Eyeglasses and contacts are typically used to correct problems with visual acuity, and 92% of adults over age 70 wear eyeglasses or contacts (Schieber, 2002).

Adaptation to brightness/contrast – A quick transition from a high level of ambient illumination to a very low one has been shown to cause a significant reduction in visual sensitivity among older adults (Geldard, 1972). Targets with varying contrast can be challenging for older people, as they tend to have weakened visual acuity with lower contrast stimuli (Haegerstrom-Portnoy, Schneck, & Brabyn, 1999).

Glare – Acuity and other vision-related functions are impaired significantly by the presence of glare, especially in older people. Additionally, the ability to recover visual acuity after glare is slower in older adults (Burg, 1967; Elliott & Whitaker, 1990; Schieber, 1994).

Peripheral vision – A 23% reduction in peripheral visual acuity was observed between younger and older people, and age-related decrements in peripheral acuity were also observed in contrast sensitivity assessments (Collins, Brown, & Bowman, 1989).

Oculomotor function – Declines in the latency, velocity, and accuracy of saccadic eye movements have been noted in elderly adults. Studies have shown that younger people can accurately track targets with angular velocities up to 30 degrees per second, while the accuracy among older people decreases for targets exceeding ten degrees per second (Hutton, Nagel & Lowenson, 1983; Sharpe & Sylvester, 1978). The accuracy worsens

among older individuals with the presence of background stimuli (Kaufman & Abel, 1986).

Motion perception – The general consensus among researchers (e.g., Schieber, Hiris, White, Williams, & Brannan, 1990; Elliott & Whitaker, 1990) is that motion perception is dramatically lower in older adults. However, the difference seems to be more related to neural changes than to visual ones. Older females particularly have a harder time identifying a car's 'time of arrival' based on movement (Schiff, Oldak, & Shah, 1992).

Color vision – Age-related decline in the ability to differentiate and identify the number of hues seen has been observed (Dalderup & Fredricks, 1969). Specifically, hues in the short wavelength region of the spectrum are more difficult to determine, such as blues and greens (Gilbert, 1957).

Recommendations for accommodating older users with regard to visual degradation include the following: using at least a 14-point font (18-point for users over 80 years of age) for text, choosing text fonts specially designed for older people (e.g., those used on street signs), providing ample lighting and task illumination, minimizing dependence on peripheral vision, giving careful attention to the use of green and blue colors, especially with regard to contrast, and considering the use of computer-based image processing techniques for optimizing the legibility of spatial form (Schieber, 2002).

Hearing

Absolute sensitivity – Aging is associated with the need for an increase in the intensity of a sound in order for it to be detected (Fozard, 1990). This loss of sensitivity is noted at one decibel per year after age 60. The incidence is much higher in males as opposed to females (Davis, Ostri, & Parving, 1991; Fozard, Metter, & Brant, 1990).

Frequency and intensity discrimination – Older adults have a much more difficult time discerning between two similar sounds at different intensities and/or frequencies,

especially in short tones compared to longer tones (He, Dubno, & Mills, 1998; Humes, 1996; Abel, Krever, & Alberti, 1990).

Sound localization – Studies have demonstrated that the ability of the auditory system to differentiate between varying intensity sounds is key to sound localization. Sound localization is therefore more of a challenge for older adults (Herman, Warren, & Wagener, 1977; Häusler, Colburn, & Marr, 1983; Tillman, Carhardt, & Nicholls, 1973), as they tend to have a particular problem localizing events or objects associated with low frequency sounds (Schieber, 2002).

Speech recognition – Studies have reported a correlation in degradation of speech recognition among older adults (Jerger, 1973). "Speech recognition for monosyllabic words decreased from just below 100% at 20 years of age to less than 60% correct for those 80-89 years of age" (Schieber, 2002, p. 17). This degradation is made worse by ambient noise.

Recommendations for overcoming hearing impairments/changes in older adults include the following: increasing the stimulus intensity or frequency, minimizing background noise, avoiding the need to spatially localize low-frequency noises and/or providing redundant localization via visual cues, using a reasonable and consistent pace when utilizing audio narration, and embedding computer systems with real-time signal processing capabilities (Schieber, 2002).

Attention

Useful field of view (UFOV) – This refers to the ability to correctly identify and discriminate visual stimuli without making an eye movement. The ability decreases as demand for attention is altered by additional discrimination tasks (Ball, Beard, Roenker, Miller, & Griggs, 1988). The ability also decreases with age, although the changes appear to be attributed to cognitive and attentional mechanisms rather than visual limitations (Schieber, 2002). Research has confirmed this via eye-tracking studies in which older adults are asked to track varying-sized targets over varying visual search widths. Older

persons were discovered to process much smaller chunks of visual information than younger persons (Scialfa & Joffe, 1997).

Selective attention – Selective attention is the process by which we filter out the usable, prominent information from the vast amount of environmental stimuli generated by our senses. For older adults, this function becomes much more difficult, and it worsens as stimuli increases (Rabbitt, 1965).

Divided attention – Divided attention refers to the process of focusing attention on two or more tasks simultaneously (e.g., while driving a vehicle). Research in this area has shown "large and robust age-related declines that have been consistently observed in studies of dual-task performance" (Schieber, 2002, p. 28). The declines in this area have also been attributed to cognitive changes rather than visual impairments.

Sustained attention – Also known as 'vigilance,' sustained attention has to do with being able to continuously monitor, detect, and correctly respond to a rare event (0.01-0.25Hz) over a prolonged duration (Giambra & Quilter, 1988; Parasuraman, Nestor, & Greenwood, 1989; Surwillo & Quilter, 1964). While studies on this type of attention are limited, the research that does exist suggests that older individuals are more likely to miss a rare event altogether.

Recommendations for accommodating age-related deficits having to do with attention include the following: restricting the size of the visual frame, presenting visual information in smaller chunks, minimizing stimuli where possible (removing the 'clutter' unrelated to tasks), providing ample space between stimuli, minimizing the need to develop new perceptual skills, and employing the use of robust voice recognition technology where possible (Schieber, 2002).

Memory

Even in healthy older adults, memory loss is often associated with a decline in memory and other cognitive processes. However, research suggests that these changes may be overstated, if not altogether untrue. In fact, some types of

> memory remain unchanged or even improve with age. (Rosenbaum, Winocur, Binns, & Moscovitch, 2012)
>
> Using neuroimaging and increasingly sensitive psychological tests, researchers have refuted the model that people, as they get older, go into a general mental decline. Instead, psychologists are developing a model of specific deficits that show very different rates of decline and also vary widely among individuals (American Psychological Association, 2006).

Episodic memory, memory of autobiographical events or past experiences, tends to be the most susceptible to the effects of aging, while semantic memory, the portion of long-term memory that processes ideas or concepts that have not necessarily been personally experienced, seems to resist age-related effects (Rosenbaum et. al. 2012). Semantic memory, used to process words, facts, and concepts, and Procedural Memory, remembering how to perform a certain process, decline the least over time (American Psychological Association, 2006).

A variety of neural changes, most notably in the hippocampus, contribute to difficulties of older individuals when it comes to forming and retaining new spatial memories, the part of memory responsible for understanding information about one's environment and its orientation (Rosenbaum et. al. 2012). The brain's volume peaks in the early 20's, and then gradually deteriorates from there; in the 40's, the brain's cortex begins to shrink, leading to more noticeable changes in memory such as increased difficulty remembering new information (American Psychological Association, 2006). Additional changes include shrinkage or atrophy of nerve cells, a reduction in the connectedness of neurons, and lower overall blood flow to the brain (American Psychological Association, 2006).

Below is a breakdown of the types of memory and their associated age-related changes.

Primary memory – The ability to remember a given set of information (e.g. single digit numerals) and immediately (within 30 seconds) repeat the set correctly and in order.

Numerous studies on primary memory indicate that this ability is only slightly worse in older adults than younger adults (Parkinson, 1982).

Access speed – Despite the fact that primary memory isn't affected by age, the access speed by which primary memory is attained slows significantly with age (Strayer, Wickens, & Braune, 1987). Therefore, although an older person would be able to recall the list of single digit numerals, as in the example above, it would take them a tenth of a second longer to determine if the given set of numerals contained a '5' as compared to a younger person (Schieber, 2002).

Working memory – This refers to the "dynamic extension of primary memory," or the ability to temporarily manipulate information in short-term storage (Baddeley, 1989). Working memory is responsible for the transient holding and processing of new and already-stored information, and is an important process for reasoning, comprehension, and learning. Large age-related declines have been found in working memory, which vary based on the complexity of cognitive processing required in a particular task (Craik, 1986). Declines in working memory have been attributed to dysfunction in the prefrontal cortex (PFC), and can result in forgetfulness, distractibility, inflexibility and impaired executive functions (Wang, Gamo, Yang, Jin, Wang, Laubach, Mazer, Lee, & Arnsten, 2011).

Long-term memory – Long-term memory can be broken down into subsets of memory: episodic (personal experiences or episodes happening in the past), semantic (understanding of words and phrases), and procedural (e.g., riding a bike). While episodic memory tends to decline during the aging process, semantic and procedural memory remain intact (Kausler, 1991; Salthouse, 1982; Smith & Earles, 1996).

Prospective memory – Prospective memory has to do with remembering to perform a specific task at a later time. Older individuals have a more difficult time recalling these future events, but are more likely to use memory aids in order to do so, such as calendars, notes, etc. (Maylor, 1990). The use of these memory aids, in fact, enables them to outperform younger persons in completing these tasks.

Recommendations for assisting older persons with age-related memory deficits include the following: minimizing the need to manipulate information in short-term memory, reducing the incidence of unnecessary clutter/stimuli that can use up working memory in older adults, and enhancing memory by using systematic cueing and pictorial representations alongside text (Schieber, 2002).

One of the most important elements of technology ability/use, especially in older adults, is cognitive ability. Although stereotypes of elderly people tend to negatively represent this population as being slow, senile, or in some stage of dementia, research has shown that cognition levels vary based on a number of factors that are not *necessarily* related to age. Salthouse (2014) describes some of the potential correlates of cognitive change, including the following:

Health – "Health is a plausible correlate of cognitive change because a number of health conditions are known to affect the level of cognitive functioning, and at least some of them could be associated with more rapid cognitive decline" (p. 1027).

Lifestyle – Preliminary evidence suggests that greater amounts of physical activity and activities that stimulate the mind are associated with better cognitive function.

Education – Mixed results have been found between level of education and cognition, though many studies found that the higher the level of education, the better the retention of cognitive function.

Sex – Gender has been shown in some studies to present differences in cognitive function; however, several other studies show no difference between males and females relating to cognition.

Mood – Although study findings have been somewhat inconsistent, it is proposed that "negative mood is associated with high levels of cortisol, which contribute to dysregulation of the hypothalamic-pituitary-adrenal axis, with negative consequences for hippocampal integrity and memory" (p. 1027). In other words, a negative or depressive mood contributes to a decline in cognitive function. "There is considerable evidence from

experimental studies that induced states of positive well-being improve performance on a range of cognitive tasks, possibly because of raised dopamine levels" (Allerhand, Gale, & Deary, 2014, p. 307).

Designing for the elderly.

In a study involving training older users on a program called FileTutor, Hawthorn (2007) — noted something critical about why it is so important to understand older users prior to designing a tool or interface: "As part of the FileTutor project, older people in beginners' computer classes were observed. Thirty-six hours of observation gave a depressing picture of the problems older people faced in learning in an environment not especially designed for them" (p. 336). Hawthorn went on to explain that the administrators were not prepared to deal with the issues that arose when dealing with elderly users, including "older people's problems with vision, mouse manipulation, simple typing, comprehension and remembering instructions," as well as the slower pace required and the need for practice and repetition (Hawthorn, 2007, p. 336).

Hawthorn summarized the training's pitfalls and explained something integral to the process of teaching older users, which relates to both the differences in expectation between designer, administrator, and user, and the perception older users have of themselves:

> The older people were dispirited and learned mainly that they were incapable of computer use. Both tutors and older people shared a view that the problems were attributable to the older people's general incapacity as learners: they were too old, there was just too much they did not know, it was pointless trying to teach them. Given what was observed, one might have expected the older students to complain and point out that what the tutors were doing did not work for them, as well as making suggestions for changes. Instead the older learners were unfailingly polite, blaming themselves for failure while seeing the tutors as doing the best that could be done in the situation when, 'we're a bit hopeless really.' (Hawthorn, 2007, p. 336)

Although the need for more research in the area of usability for older adults is great, Hawthorn's study reveals some other relevant guidelines for accommodating the age-related problems experienced by seniors, in addition those outlined above:

Language – Due to the extreme inexperience of some older users, there tends to be a lack of common language related to design elements. Therefore, a designer and a potential user may have difficulty communicating, especially since stopping to explain such elements tends to overload the older user.

Feedback – Frequent and rapid feedback is essential in designing for the elderly user.

Appeal – Training materials should relate in some way to the user's interests in order to motivate him/her to overcome some of the age-related barriers.

Recovery – Older users often come with the expectation that when learning a new skill, especially involving technology, they will fail. Either by design or feedback, it is important to counteract older users' inherent tendency to blame themselves for undesired outcomes or confusion. Incorporation of a versatile 'undo' function is one way to accomplish this (Hawthorn, 2007).

Prototype design – According to Hawthorn, elderly users find it difficult to make the imaginative leap from paper to computer, and therefore paper and other low-fidelity prototypes do not work well in training these users (Hawthorn, 2007). However, other researchers, such as Summers, Chisnell, Davies, Alton, and McKeever, have not reported these issues (Summers, K., Chisnell, D., Davies, D., Alton, N., & McKeever, M., 2014).

Additionally, in order to get proper feedback from older users during the design process, researchers need to create a casual, non-threatening environment in which problems and issues are shown to be design flaws rather than failures of the user. Researchers have found that a group of older individuals offers more feedback together than is gained from singular observations (Hawthorn, 2007). By evaluating design experiences involving older adults, and pairing those evaluations with research about the

typical effects of aging, designers can leverage this information to better customize technology to meet the needs of an older user.

Seniors' Vulnerability to Scams and Fraud

The unique vulnerability of seniors to fraud is a significant problem that must be considered when promoting the adoption of technology by seniors. In the U.S., the elderly population is often the primary target of various types of scams, theft, and fraud. "Older persons comprise the vast majority of fraud victims, and are deprived of a substantial proportion of the more than 100 billion dollars lost annually to financial and health-related scams in the United States" (Boyle, Lei, Wilson, Gamble, Buchman, & Bennett, 2012). Between 2008 and 2010 alone, the cost associated with scams targeting the elderly increased by 12% (Wolpert, 2012). Scams directed at senior citizens vary by method and delivery, but the Internet is quickly becoming a prime environment for such activity, since more and more older adults are going online. It is estimated that $36 billion is lost to elder financial abuse, as illustrated in Figure 3 below.

Summary findings

Category	Annual cost to seniors	Avg. five year loss	Defining feature	Examples
Exploitation	**$16.99 billion**	$2,617	Operating openly claiming consent of the victim	• Hidden shipping and handling or subscriptions • Work-from-home schemes • Quack weight loss or dietary products • Excessive gifts • Misleading financial advice[1]
Criminal fraud	**$12.76 billion**	$13,107	Anonymous illegal activity	
Con artists	$9.85 billion	$13,225	Attempt to get you to give them money	• Grandparent scam • Nigerian prince emails • Fake lottery winnings or government grants • Sweetheart scam
Identity theft	$2.91 billion	$7,633	Opening or using accounts without authorization	• Opening new credit cards, bank accounts, or payday loans • Car title or home equity loans on your property • Using card data gained by phishing, in data breach, or from the mail
Caregiver abuse	**$6.67 billion**	$26,879	Abuse of trusting relationship	• Theft by family members or caregivers • Rewritten wills or powers of attorney • Borrowing money hoping senior will forget • Sometimes combined with physical abuse or neglect
Total losses	**$36.48 billion[2]**	**$11,583**		

Figure 3: TrueLink Report Summary, Annual Financial Loss by Seniors, 2015

Several factors contribute to the level of vulnerability in this age group as compared to younger adults, including financial independence, presumed wealth, isolation/loneliness and depression, and a lack of overall ability to determine trustworthiness. The elderly are a prime target of scams, fraud, and other methods of exploitation for a number of reasons, and the typical offenders tend to be strangers, caretakers, or family members. Some of the risk factors for these crimes include cognitive impairment, lack of financial knowledge, inability to manage finances, sensory loss, and emotional vulnerability. Of over 35 million elderly, it is estimated that half are in need of mental health services (Benek-Higgins, McReynolds, Hogan, & Savickas, 2008). However, only a small population of seniors actually pursues treatment. Of those that do, depression is the most common diagnosis. In fact, adults over 65 comprise about 13% of the U.S. population and account for 19% of the suicides. In other words, one elderly suicide occurs every 90 minutes (Mental Health Association of Colorado, 2011).

Depression can also be associated with cognitive decline in older adults: “Intellectual abilities may decline, leading to confusion and distractibility; as cognitive processing speed and mental functioning decrease, the person may be unable to remember details or solve simple problems” (Benek-Higgins et al., 2008, p. 5). Elderly persons are less likely to seek treatment for depression and other mental ailments due to the stigmas surrounding depression and the notion that depression is just a natural part of aging (Benek-Higgins et al., 2008).

Other cognitive differences between younger and older adults may contribute to difficulties seniors experience in distinguishing a trustworthy individual from an untrustworthy individual. According to one study the fact that older adults are “disproportionately vulnerable to fraud” is no coincidence. In fact, they found that the way in which seniors perceive trustworthiness in individuals differs from that of younger adults based on facial cues (Castle, Eisenberger, Seeman, Moons, Boggero, Grinblatt, & Taylor, 2012). In the study, younger and older adults compared the facial characteristics of photographs depicting trustworthy, neutral, or untrustworthy faces. The results revealed that “older adults rated untrustworthy faces as significantly more trustworthy and approachable than younger adults did” (Castle et al., 2012, p. 20848).

Additionally, despite the high number of suicides among elderly persons, seniors are generally said to have a ‘positivity bias,’ which means that they generally report being happy and satisfied in life, they experience fewer negative emotions after interpersonal conflict than younger adults, they respond neutrally or positively to negative information, they remember more positive information than negative, and they recover more quickly from negative emotions. These differences were confirmed via examination of the neurocognitive mechanism—the anterior insula, a region in the brain believed to contribute to decision-making (Castle et al., 2012). These findings suggest that older adults are vulnerable to scams and fraud due to this neurocognitive variance.

Another study, related to memory recall, found that older adults were more likely to be deceived by false memories than younger adults. One common telemarketing fraud involves the con artist calling an elderly person and gaining as much personal

information about him/her as possible; that information is then used during a subsequent call to create a false memory, enabling the con artist to trick the older individual into either providing more information or sending money to the con artist based upon some invented ploy. These schemes tend to be successful due to memory impairments associated with aging: "Any memory deficit suffered by the elderly might make them particularly vulnerable to untrue claims about past events" (Jacoby, 1999, p. 417).

Another reason why senior citizens are often targets of various crimes, according to the FBI, is that:

> older Americans are less likely to report a fraud because they don't know who to report it to, are too ashamed at having been scammed, or don't know they have been scammed. Elderly victims may not report crimes, for example, because they are concerned that relatives may think the victims no longer have the mental capacity to take care of their own financial affairs. (Federal Bureau of Investigation, 2014)

In this way, the problem of fraud against the elderly is almost self-perpetuating, since law enforcement is unable to combat attacks that remain unknown.

Many scams are being carried out in the U.S. each year, and the levels of both sophistication and manipulation are constantly increasing. According to the National Council on Aging (NCOA), the top ten scams that target seniors in the U.S. are as follows:

1. *Health care/medical insurance fraud* – Because all U.S. citizens over 65 qualify for Medicare, scam artists use that knowledge to pose as Medicare representatives and ask for personal information or offer medical services at fake mobile clinics.
2. *Counterfeit prescription drugs* – This particular scam is on the rise. "Since 2000, the FDA has investigated an average of 20 cases per year, up from 5 in the 1990s" (National Council on Aging, 2011, para. 10). This scam is most often found on the Internet, where seniors are searching for the cheapest place to

purchase prescription drugs. Not only do the victims lose money, but also the counterfeit drugs may be made of unsafe substances that could cause harm.

3. *Funeral and cemetery scams* – Two popular scams involving funerals and/or cemeteries include 1) con artists attending the funeral service of someone listed in an obituary in order to extort grieving family members, and 2) funeral homes adding unnecessary services to their bill in order to take advantage of naïve relatives.
4. *Fraudulent anti-aging products* – Older adults tend to seek out products to mask the outward signs of aging. Scammers use this knowledge to sell fake beauty products and services (e.g., fake Botox treatments).
5. *Telemarketing scams* – Phone scams are the most popular method of fraud to date, partially due to the fact that older adults make twice as many purchases over the phone than the national average (National Council on Aging, 2011). Popular ploys include soliciting donations to fraudulent charity groups, asking for money to help injured family members, and requesting the target to withdraw funds as a good-faith payment to a scammer who claims that he/she will share a large sum of money with the target. The difficulties that seniors experience in determining trustworthiness make them a particularly tempting target for these kinds of scams. "The Federal Bureau of Investigation (FBI) has estimated that 80% of fraudulent telemarketing firms have focused on swindling older persons" (Grimes, Hough, Mazur, & Signorella, 2010, p. 177).
6. *Internet fraud* – Email/phishing scams are common, as well as pop-up ads that claim a computer's anti-virus definitions are out of date, but that—if clicked—proceed to install harmful viruses or malware. "Unfamiliarity with the less visible aspects of browsing the web (firewalls and built in virus protection, for example) make seniors especially susceptible to such traps" (National Council on Aging, 2011, para. 29).
7. *Investment schemes* – Retirement planning and investment savings scams are commonly targeted at this age group, due to the fact that many are planning for the future as they exit the workforce.

8. *Homeowner/reverse mortgage scams* – Because many older adults own their homes, and because legitimate reverse mortgages are on the rise, this particular scam is becoming more and more popular. These scammers, while appearing authentic, offer fake refinancing and reverse mortgages, scamming the elderly out of money and sometimes their homes.
9. *Sweepstakes/lottery scams* – Seniors may be told—either by mail, email, telephone, or pop-up window—that they have won a lottery or sweepstakes. These con artists often provide a fraudulent check that bounces only after the victim has paid bogus taxes and fees to the scammer.
10. *The 'Grandparent' scam* – In this scam, the perpetrator calls an elderly person, pretending to be his/her grandson/granddaughter and asking for money to be wired for some supposed financial crisis. (National Council on Aging, 2011)

While computer and Internet use among older adults can prove beneficial in the areas of information gathering and social connectedness, there are a number of risks that tend to be overlooked by this population. Confidentiality and privacy are two of the primary concerns with Internet use, since the dissemination of personal or private information over a network comes with the inherent risk of interception and/or coercion to send data to unintended individuals. These risks to seniors have increased as older adults are often able to access a computer or the Internet at little or no cost (Grimes et al, 2010). Many initiatives have been enacted to provide seniors with free computer access via senior and learning centers (e.g. Senior Technology Initiative, SeniorNET, etc.), eliminating some of the barriers that hindered computer use in the past. "This ease of access, combined with increasingly sophisticated user interfaces designed to facilitate navigation for even unskilled novices, has enabled an environment where interested older adults can readily and inexpensively experience the benefits of IT" (Grimes et al., 2010, p. 175).

These unskilled novices, however, are less likely than younger users to be aware of Internet hazards such as viruses, phishing, spam, and social engineering. For many seniors, computers were not introduced into the workforce until after they retired, with

the result that they missed out on mandatory provisions or training exercises to inform individuals of Internet threats. Libraries and senior centers offer training regarding protection against viruses and other threats, but home computers are especially vulnerable (Grimes et al., 2010). And because the elderly have always been a specific target of scams and fraud—even before computers—"the history of older persons' victimization in the pre-computer era may foreshadow their heightened vulnerability in the Internet age" (Grimes et al., 2010, p. 176).

Without proper training, older users are more at risk of exposing personal or private information online via phishing, spyware, and other scams. Seniors are more likely to open malicious emails and click on links from untrusted addresses than other age groups, and are therefore more likely to download viruses and make purchases on fraudulent websites (Grimes et al., 2010). A study comparing the overall knowledge of Internet threats between older and younger adults found that, in general, older adults are less knowledgeable about security threats involving privacy, passwords, viruses, and spam. Although older adults did exhibit a healthy mistrust of online information and a fear of computer viruses, older women specifically showed less knowledge of Internet threats than their male counterparts (Grimes et al., 2010).

As the population of seniors in the U.S. increases, along with their access to computer technology and the Internet, the need to develop the means to protect naïve, untrained, elderly users from scams also increases. Because so many cases of fraud go unreported, the ability of law enforcement and advocates for the elderly to prevent—or at least protect against—specific threats is diminished. Further, very little research has been performed in the topic area of technology fraud prevention for seniors, resulting in a grossly inaccurate impression of the significance of this issue. Better training for elderly computer users, as well as a more convenient means of reporting crimes, would certainly help to mitigate some of the risks associated with this age group. Information security developers and designers could also improve tools and interfaces to better protect home Internet users, who may not have access to the security training or infrastructure common in the public space.

Based on the above research involving scams on the elderly, the training developed as part of this project will focus on the areas that are the biggest online threats (to all Internet users, not just the elderly) and that pertain specifically to activities older adults engage in most online: email, internet browsing, shopping, and social media. Internet safety topic areas will include viruses, spam, phishing, setting passwords, and recognizing secure websites. Armed with the knowledge of how and why the elderly often fall victim to the various scams detailed above, training material will be tailored to older adults' specific vulnerabilities, such as the inability to differentiate between someone who is trustworthy and someone who is not, unfamiliarity with various computer protections, and lack of awareness of typical online scams.

Educating the Elderly Online

As the population shifts to the largest percentage of elderly persons in U.S. history and is projected to reach 72 million by 2025 (Werner, 2010), a growing body of research in the area of technology for older adults is emerging. Additionally, adoption of technology by older adults for activities such as email, web browsing, and social networking is on the rise. This trend encourages marketers to consider the aging population when designing websites, training, games, and other online media consumed by this age group. The effect of elderly population growth on the U.S. workforce is one of the driving reasons behind much of the research specifically related to web-based training and/or e-learning, because older adults are tending to stay in the workforce longer, while younger adults are joining at lower rates. Understanding the motivations of older adults and what inspires them to seek out technology for certain activities is imperative to both training-related content and design, and is an essential precursor to designing online training focused on internet safety/security.

While there may be many societal needs for older individuals to adopt information technology, such as lower-cost dissemination of information (paper reduction), online forms and interactivity with various businesses, self-service modules and kiosks, online shopping/merchandise sales, and general communications, imposing those requirements on the elderly population does not necessarily elicit *willing* adoption.

When it comes to encouraging online training or e-learning, determining what motivates older adults is especially important, since training modules often require time, effort, and a general level of commitment above typical technology use.

One of the reported barriers to utilization of technology for older adults is the fact that they tend to require assistance in learning new devices and skills:

> A substantial majority of seniors express trepidation about using new digital tools or devices without assistance. When asked how they would learn how to use a new technology device such as a tablet computer or SmartPhone if they wished to do so, only a small proportion of seniors—18%—express comfort with learning how to do so without assistance, while 77% indicate that they would need someone else to help them. (Smith, 2014, p. 12)

Such a high level of discomfort with self-learning, as it now exists, suggests the need for the development of educational tools— specifically better self-learning tools—designed for this age group.

The promise of keeping skills alive is one way older people can be motivated to learn: "Older users expect a clear vision of how technology will allow them to retain their independence and achieve practical benefits that will help them maintain their everyday well-being" (Durick, Robertson, Brereton, Vetere, & Nansen, 2013, p. 472). According to Trentin (2004), it is important to

> develop education projects to allow elderly people to keep their skills alive and up to date (even when they are no longer directly usable following retirement) or acquire new ones, as well as enabling them to participate in the innovative processes and rapid changes that are occurring in our society, experiencing progress as consciously as possible, thus avoiding the progressive obsolescence of their knowledge and skill (p. 21).

Another potential motivation for seniors is the desire to connect with other people, regardless of physical isolation or disability: "Older adults have a desire to not

only engage with technology and media, but to create content and share their personal selves with others" (Durick et al., 2013, p. 469). Mapping ancestry and writing autobiographies are two examples of some compelling ways in which older individuals can find meaning and benefit in computer use. Despite being stereotyped as frail, senile 'old people,' in reality older adults have a vast set of knowledge, skills, and experiences, gained throughout their lives that could benefit others and enrich society.

As mentioned earlier, a critical step in working with users in this age group is to set aside the assumptions typically associated with elderly persons and to objectively determine what they actually require. Numerous studies have found that these assumptions often narrow the focus of design and limit the potential of individuals by incorrectly projecting certain traits. For example, "one of the most damaging stereotypes of older adults is that they are rigid and do not want to learn" (Githens, 2007, p. 331). Further, when researchers have made assumptions about older adults' abilities, they have often become self-fulfilling prophecies: "Researchers often viewed older users as 'old' first and 'users' much further down the proverbial list—somewhere after 'physically impaired,' 'socially bereft,' 'technically illiterate,' and 'struggling to use unmodified versions of mainstream technologies'" (Durick et al., 2013, p. 468). Other age-related myths include the notion that older people are all the same: socially isolated and/or lonely, a burden on society, chronically ill, incapable of learning newer technologies, or even unable to use technology at all. In reality, actual older users have varying degrees of age-related declines in cognition, motor function, and sensation, and do not always feel that they require any specialized support from technology (Durick et al., 2013). Further, the variability in health, cognition, and other characteristics is vast among adults over age 60. A healthy 60-year-old is much different from a frail person in his/her 80s (Newell, Dickinson, Smith, & Gregor, 2006). One senior instructional designer at Moore Stephens corroborates this idea: "We should banish the thought that the age of the learner dictates in any way the design of the learning." (Waller, 2008, p. 12). Making an active choice to set aside the typical assumptions regarding elderly users when it comes to designing material could be beneficial to overall satisfaction and absorption of the training content.

Today, technology-related training for older adults can be found in a number of places: public libraries, senior centers, community colleges, and lifelong-learning centers. Websites like the American Association of Retired Persons (AARP.com) and SeniorNet (seniornet.org) provide numerous resources to assist older individuals in finding training opportunities in their local area, and some even offer free online alternatives to classroom instruction. SeniorNet, specifically, has over 200 centers that teach basic computer skills to older adults by older adults. AARP recommends and supports online learning in a number of areas, and suggests free online lectures and courses at www.researchchannel.org, www.videolectures.net, and www.academicearth.org. The website YouTube.com has also published a number of online lectures and other learning-related videos targeted at older adults. Osher Lifelong Learning Institutes (OLLI), set up at nearly 120 universities across the country, focuses on meeting the needs of older learners. Scholarships for senior citizens are becoming more popular as well, due to the number of older adults seeking new skills: "Approximately 60 percent of accredited degree-granting educational institutions offer tuition waivers for older adults, according to a November 2008 survey by the American Council on Education" (Brandon, 2009, para. 2). At many community colleges, older adults are provided the opportunity to audit courses, which allows them access to lectures and other materials without necessarily performing all of the work. The various e-learning programs for this age group can be divided into three categories: programs for personal growth (offered by community education programs), workforce development (offered by community colleges and workforce development centers), and workplace learning (offered by employers or volunteer worksites) (Githens, 2007).

A 2003 e-learning study involving 600 elderly persons sought to understand the attitudes and reactions participants had to distance training activities (Trentin, 2004). The training was focused on using IT tools and accessing the Internet, and it included both distance learning (with an instructor) and online learning (self-learning). Surveys were conducted both before and after the training to examine the level of participation and involvement in the modules, the retention of knowledge, and the overall satisfaction of

the participants. Results showed a moderate level of participation, as well as suggesting some useful considerations for developing and deploying e-learning to this age group:

- Older people have a significant amount of free time, so the ability to work asynchronously and on their own schedules is very helpful.
- Seniors require, at least initially, a level of personal, hands-on instruction; therefore, a blended solution of both in-person and e-learning instruction would be most effective,
- Older persons require more time per task (moving a mouse, typing a response, and concentrating).
- Both designers and tutors should have specific training on how to accommodate older individuals. (Trentin, 2004)

In terms of satisfaction, Trentin received many notes from participants up to six months after the study, detailing their new love for computer technology and their enjoyment of its many benefits.

Another study involving elderly adults, which was focused on a cyber portal designed for their age group, resulted in similar findings. Researchers found that one of the difficulties in working with older individuals is that they

> tend to be very positive about the prototypes which are presented to them, wanting to praise the developers rather than give an objective view. Their confidence in their ability to use technology can also be very fragile, and it is important from an ethical perspective not to put them in a position where any confidence they have is threatened. (Newell et al., 2006, p. 351)

Among the other challenges uncovered in the study was a high degree of unfamiliarity with the basic concepts of computers and the Internet. One woman in the study kept a list of the detailed steps required to perform elementary tasks—such as switching from a word processing application to email—in a journal. However, the group's desire and enthusiasm for being able to use the portal was very high (Newell et al., 2006).

In terms of what older adults *want* from e-learning software, the participants in a different study asked for an attractive layout, one that was simple but did not sacrifice visual appeal. Also, they preferred that any audio used in e-learning be slowed down to allow speech to be effectively heard and understood. Another finding was that written transcripts alongside an audio segment—for those individuals who have difficulties in audio perception—should also be considered. In terms of content, researchers found that older adults appreciated the asynchronous learning platform because it allowed them more time to go through the modules. They also preferred informal organization as opposed to traditional, linear structure (Githens, 2007).

One conclusion that can be derived from the established research is that there exists a balance between designing training/e-learning for older adults and designing well for anyone: "when designing for 'older users' we need, first and foremost, to regard them as 'users' who are defined by their specific and contextual needs, and not their age. Most important is our ability to remain mindful of how embedded notions of what aging [sic] means may limit our design thinking" (Durick et al., 2013, p. 473). It should also be remembered that any existing guidelines used by designers for building websites are not necessarily equally applicable to e-learning platforms. These differences may have a particular impact on older adults; therefore, it is important for e-learning designs to be thoroughly tested by multiple age groups prior to launching.

Motivations for technology use among older adults are not much different from those of younger adults. Older users require technology to be "useful, functional, useworthy and meaningful," and "pushes for new technology, which older users may not see the immediate benefits of, and a lack of user-involvement will not break any of the stereotyped definitions of older users" (Durick et al., 2013, p. 472). What *does* set older

users apart is their need for technology that will allow them to retain their independence and improve their everyday well being (Durick et al., 2013). And what *is* certain is that older adults can benefit greatly from e-learning and other distance learning programs, both in their personal and professional lives – particularly, training about internet safety.

Guiding Principles for Design in This Study

While it is important to understand the physical and mental capacities and potential limitations of the elderly population in general, these findings must be translated into prescriptive guidelines for design. Consequently, the methodology employed in this project is based on the design-related recommendations for web-based interaction for elderly adults described in this section. Guidelines by high-level design category are as follows:

General Principles

- Emphasize the benefits of technology to increase adoption, and leverage users' familiarity of other technologies. (Pernice, Estes, & Nielsen, 2013).
- Avoid jargon, marketing/technical terms, and complex language (Pernice et al., 2013; National Institute on Aging, 2009; Newell et al., 2006).
- Where possible, ensure that there is only one way to complete a given task (Pernice et al., 2013).
- Provide a guide, either in print or displayed prominently on the site, for basic actions (Pernice et al., 2013).
- Provide ample and adequate feedback. Display clear feedback during any process or workflow (Pernice et al., 2013).
- Ensure that the home page/landing page loads quickly (Pernice et al., 2013).
- Internet connectivity and speed are factors in feedback; slower Internet speeds can further increase memory impairments/issues and cause the user to lose focus (Pernice et al., 2013).
- Offer closed-captioning and a transcript for videos; seniors often prefer reading text over watching a video, or will watch a video at extremely loud

volumes in order to hear (Pernice et al., 2013; National Institute on Aging, 2009).

- Offer voice augmentation to support text where possible. (Sato, Kobayashi, Takagi, Asakawa, Tanaka, 2011; National Institute on Aging, 2009).
- Use precise, informative wording on error messages and prompts that is clear and non-threatening; describe the problem and how to fix it (Pernice et al., 2013).

- Use a pleasant, relaxed atmosphere for testing to elicit the best results and feedback. Manage the environment to reduce the number of distractions (Pernice et al., 2013).

Text

- Use at least a 12-point font (Githens, 2007; National Institute on Aging, 2009; Newell et al., 2006).
- Use a sans serif font (Githens, 2007; National Institute on Aging, 2009).
- Use medium or boldface typeface (National Institute on Aging, 2009).
- Never use all capital letters; it is very difficult to read (National Institute on Aging, 2009).
- Avoid using italics, which are hard to read, especially online (National Institute on Aging, 2009).
- Provide strong contrast between text and background color (Pernice et al., 2013; National Institute on Aging, 2009; Newell et al., 2006).
- Use scalable text (Githens, 2007; National Institute on Aging, 2009).
- Use left justification (Githens, 2007; National Institute on Aging, 2009).
- Differentiate hyperlinks from regular text (Pernice et al., 2013).
- Change the color of links/pages that have been visited to avoid confusion (Pernice et al., 2013).
- Do not use automatically scrolling text (National Institute on Aging, 2009).

Search

- Display search as an open, visible field on all pages on the upper right (Pernice et al., 2013).
- Allow for at least 18 visible characters in the search box (Pernice et al., 2013).
- Provide search suggestions (Pernice et al., 2013).
- Allow for typos and provide query suggestions on search results (Pernice et al., 2013; National Institute on Aging, 2009).
- Choose a search engine that uses keywords and does not require knowledge of special characters or Boolean terms (National Institute on Aging, 2009).
- Ensure search results are relevant and helpful (Pernice et al., 2013).
- Provide easy-to-find contact information or online chat (Pernice et al., 2013; National Institute on Aging, 2009).

Content

- Do not stereotype or generalize about seniors; do not assume all seniors are interested in the same or limited topics (Pernice et al., 2013).
- Do not patronize seniors; write factually (Pernice et al., 2013).
- Arrange content by topics, not ages; aging affects everyone differently (Pernice et al., 2013).
- Use tables for information that is commonly compared (Pernice et al., 2013).
- Prioritize content on pages (Pernice et al., 2013).
- Separate information directed at different audiences (professional vs. general) (Pernice et al., 2013).
- Write at 8th grade reading level or lower (Pernice et al., 2013).
- Use only well-organized material that avoids unnecessary complexity. (Pernice et al., 2013).
- Define terms that may be unfamiliar in the context; avoid using them if not necessary. (Githens, 2007; Pernice et al., 2013; National Institute on Aging, 2009).

- Use descriptive terms instead of marketing terms for products, descriptions, and links (Pernice et al., 2013).
- Use common social networking terms cautiously (Pernice et al., 2013).
- Focus information by addressing users' top tasks and top questions first (Pernice et al., 2013).
- Chunk information into easy-to-scan formats (Pernice et al., 2013; National Institute on Aging, 2009).
- Use clear headings and descriptions (Pernice et al., 2013).
- Use information-layering techniques to present long or complex content (Pernice et al., 2013).
- Display pagination links in the top right or bottom center of pages, above or below the content; ensure consistency throughout (Pernice et al., 2013).
- Avoid the need for excessive scrolling (Pernice et al., 2013; National Institute on Aging, 2009; Newell et al., 2006).
- Put key information first, typically at the top of the page (National Institute on Aging, 2009).
- Write in the active voice, which puts the focus on people and actions (National Institute on Aging, 2009).
- Write in the positive (National Institute on Aging, 2009).
- Provide summary information to reinforce and aid in recall (National Institute on Aging, 2009).

Navigation

- Use a consistent layout throughout (Githens, 2007; National Institute on Aging, 2009).
- Provide a clear path to commonly accessed content (Pernice et al., 2013).
- Use clear navigation with mutually exclusive categories (Pernice et al., 2013).
- Clearly display the user's location in the interface or process (Pernice et al., 2013).

- Expose subcategories upon hover where possible (Pernice et al., 2013).
- Thoroughly test timing of opening menus on hover (Pernice et al., 2013).
- Provide instructions where possible (keep a navigation key on all pages, for instance) (Pernice et al., 2013).
- Avoid changes to overall navigation designs; seniors use lists of instructions about how to perform tasks and can be caught off guard by design changes to their method (Pernice et al., 2013).
- Ensure main navigation menus are clearly visible at all times (Pernice et al., 2013).
- Structure navigation to ensure the fewest number of clicks is needed to achieve a given task (National Institute on Aging, 2009).
- Use signposts (page titles, breadcrumbs, etc.) to help users understand where they are on the site and where they can go (Pernice et al., 2013).
- Use static navigation elements; avoid moving menus or click targets (Pernice et al., 2013; National Institute on Aging, 2009).
- Do not use menus that require users to slide the mouse and click in one movement (National Institute on Aging, 2009).
- Ensure the main logo links to the home page (Pernice et al., 2013).
- Do not use color, underlining, or bolded text that looks the same as link formatting (Pernice et al., 2013).
- Provide adequate space between links and other click targets (Pernice et al., 2013; National Institute on Aging, 2009).
- Do not use pop-up windows. (Pernice et al., 2013; National Institute on Aging, 2009).
- Treat double-clicks as single clicks. Ignore subsequent clicks on a single target (National Institute on Aging, 2009).

Graphics

- Avoid patterned backgrounds (Githens, 2007; National Institute on Aging, 2009).
- Use only images that add value and support the content; use text alternatives where possible (Githens, 2007; National Institute on Aging, 2009).
- Ensure images are easy to see (Pernice et al., 2013).
- Avoid abstract symbols (for example, use an arrow with words rather than the 'play' symbol common on remotes, DVD players, etc.) (Pernice et al., 2013).
- Use graphical elements to enhance text, not replace it (Pernice et al., 2013; National Institute on Aging, 2009).
- Avoid using rotating images on main page (or any page) due to the level of distraction (Pernice et al., 2013).
- Make sure pictures of people reflect the diversity of the intended audience (National Institute on Aging, 2009).
- Keep the number of actions or buttons per screen to a minimum (below 10) (Newell et al., 2006).
- When graphical elements appear close to a text link, make those elements part of the working link (Pernice et al., 2013).
- Avoid presenting important text as part of an image (Pernice et al., 2013).
- Offer large click targets and provide adequate space between them (Pernice et al., 2013; National Institute on Aging, 2009).
- Use videos to supplement text, not replace it (Pernice et al., 2013).
- Use large buttons that do not require precise movements to activate; make buttons and icons stand out (National Institute on Aging, 2009).
- Make buttons obviously clickable (National Institute on Aging, 2009).
- Avoid the use of yellow, blue, or green in close proximity (Githens, 2007; National Institute on Aging, 2009).
- Use ALT tags and text where possible (Pernice et al., 2013; National Institute on Aging, 2009).

- Clearly label links that are videos using a video icon or the word 'video' along with the topic's description (Pernice et al., 2013).
- Keep videos short and to the point (Pernice et al., 2013).
- Provide closed captioning and/or transcripts of video content (Pernice et al., 2013).

Forms

- Ask for only necessary information (Pernice et al., 2013).
- Provide clear instructions (Pernice et al., 2013).
- Expose required fields by default (Pernice et al., 2013).
- Limit use of pull-down menus or scrolling lists (Pernice et al., 2013).
- Be forgiving of errors (Pernice et al., 2013).
- Use forgiving forms and text fields that allow for various characters for phone numbers, etc. (Pernice et al., 2013).
- When there are errors or missing information, provide an explanation of what is needed to fix the errors (Pernice et al., 2013).
- Ensure that buttons are clearly named, with visual signals that make them look like buttons, at the bottom of the form (Pernice et al., 2013).
- Do not use a 'Reset Form' button (Pernice et al., 2013).

These guidelines, along with the incorporation of findings from an earlier eye-tracking study researching the usability of existing online Internet training for older adults (detailed in Chapter 3 and Appendix E), will be applied where possible in the design and execution of the Internet Safety Training module being tested as a part of this study. Special attention will be paid to text size (left justified, over 12-point, sans serif), image placement (no moving or rotating images), color choices (high contrast, standard link formatting), navigation (consistent menu options, transcripts of spoken audio), supplemental audio options (mute/unmute), and graphics (no patterned backgrounds, easy to see images, text in place of symbols/images) in the design process for the training to

ensure ease of use for older adults. Additionally, the content will be prioritized, organized well, and written at an 8th grade reading level to accommodate most users.

Research and Design Methodology

In order to obtain a comprehensive view of usability and the interaction between seniors and technology, this study employed several research methods. Initially, in 2012, a pilot study was conducted that explored the design and content efficacy of an existing Internet safety training module offered by the Goodwill Community Foundation (GCF). Subsequently, an original training module was developed and tested both in paper form (paper prototype) and in digital form (online) with elderly participants.

Eye-Tracking Pilot Study (2012)

A pilot eye-tracking study was performed on a small subset of regular Internet users (six users between the ages of 50 and 79, and one 'expert' pilot user under age 50) to determine the usability and comprehensiveness for seniors of an existing online training module on Internet safety: Goodwill Community Foundation (GCF) Internet Safety Tutorial suite (http://www.gcflearnfree.org/internetsafety). This site was chosen due to the material presented and the fact that it was one of very few online training modules available free of charge. Participants were volunteers, primarily friends and family of the tester, who met the age and Internet use/familiarity requirement of 3-5 hours of online activity per week. The testing was conducted at the University of Baltimore usability lab using Tobii II eye-tracking software. The lab consisted of two rooms separated by 2-way glass; the control room, wherein the tester and other observers (classmates, instructor) monitored audio/video recording and observed the tests, and the testing room wherein participants sat at a desk with a desktop computer, monitor, mouse and microphone. Participants were tested one at a time, and were asked to interact with the training tutorial as if they were at their home computer. Participants were encouraged to ask questions or think aloud as desired. If a participant got stuck or was in some way unable to complete the task, the tester would go to the testing room to assist.

The purpose of the study was to glean knowledge regarding what worked well for the target users and what could be improved for the training that would be developed as

part of this project. The eye-tracking portion specifically sought to determine the following:

- What attracts attention?
- Where are the areas of focus?
- Why do users fail at certain tasks?
- How hard do users need to work to complete certain tasks?

Initial research into eye-tracking elderly users confirmed the following observations:

- Elderly people need longer fixations than younger people.
- Elderly people have difficulties with memory or organizing of visited pages (Fukuda & Bubb, 2003).
- The deficit of visual function can negatively influence visual information perception.
- Tiny characters and navigational buttons, as well as low contrast between individual elements and the background, can disturb visual information perception.
- Due to deficits in fine motor control, placing the mouse cursor on small hyperlinks can be a difficult task for elderly users.
- If the target navigational button is visible only with scrolling, this creates problems for easy use. It takes a long time for seniors to notice that the required navigational button is not visible. Consequently, their visual search on the visible area of the page results in long eye movements.
- The eye-tracking study into specific information search by Ito, Y., Tamakoshi, A., Yamaki, K., Wakai, K., Kawamura, T., Takagi, K., & Ohno, Y (2000) shows that users tend to focus more frequently on the left-hand side or upper part of the page rather than on the right-hand side or lower part of the page.

Test plan.

Since the purpose of the eye-tracking pilot test was to test the design, layout, content, and overall ease of use of the GCF free online Internet Safety Tutorial for elderly users (65+), the original plan was to recruit six to eight computer users in that age cohort. Ultimately, the age range was modified to include users between the ages of 50 and 79. An 'expert' user (under age 50) was also recruited to pilot the eye-tracking test.

Each of the participants was asked to fill out a pre-study questionnaire. The questionnaire contained the following questions:

1. How often do you use the Internet in any given week?
2. On a scale of 1-10 (1 low, 10 high) how comfortable are you on the computer?
3. Have you ever been a victim of an (attempted) Internet scam?
4. What precautions, if any, do you take when using the Internet to avoid identity theft, scamming, etc.?
5. Do you ever shop online?
6. What is your biggest fear about using the Internet?

The participants were asked to complete two of three possible modules on Internet safety on the Goodwill Community Foundation (GCF) Internet Safety Tutorial site (http://www.gcflearnfree.org/internetsafety):

1. Introduction to Internet Safety
2. Protecting Your Computer from Internet Threats
3. Email Tips for Scams and Spam

Participants were also to engage with the interactive portions of the media. The expected time for completing these tasks was about 20 minutes.

After completing the testing, participants were asked to fill out a post-study survey that contained the following questions:

1. Was it easy or difficult to navigate the tutorial on Internet safety/other modules?

2. What did you learn that you didn't know about Internet safety?
3. What was your overall impression of this tutorial?
4. What would you have liked to learn more about?
5. What improvements would you suggest for this tutorial, if any?

Recruiting – Participants were recruited via friends/family in the local area (suburban MD); Participants were required to be over the age of 65 and utilize the internet at least 3-5 hours per week.

Materials – Participants utilized a lab-supplied PC computer with monitor, mouse, keyboard, speakers, and microphone. The PC ran a Windows Operating system and participants used Internet Explorer to access the training website. Tester(s) used a PC computer with multiple monitors, cameras, sound system, and Tobii-II Eye-tracking software.

Location – Testing was performed in the University of Baltimore's usability lab in Maryland. The lab consisted of two rooms separated by 2-way glass; the control room, wherein the tester and other observers (classmates, instructor) monitored audio/video recording and observed the tests.

Participants.

Although the participants in the eye-tracking pilot study were not of the exact age group as those in the eventual usability study (65+), they could still be considered seniors. The breakdown was as follows:

- 1 pilot (expert) user (< age 50).
- 6 users aged 50-79.
- 4 male, 3 female.
- 57% English as first language; 43% English as second language*.
- All participants had at least some college education.

The participants' typical computer use is shown in Figures 4 and 5. Participants were mostly avid computer users, with a range of experience. Most used the computer on

a daily basis, while others used it sporadically. Their comfort level with using a computer tended to be high: on a scale of 1-10, with 10 being the most comfortable, the participants' comfort levels ranged from 5-10. Three of the participants noted the highest comfort level of 10.

*The reason for the diversity in language was the recruitment limitations of friends/family. The 43% spoke German as their first language, but have been in the United States for over 50 years.

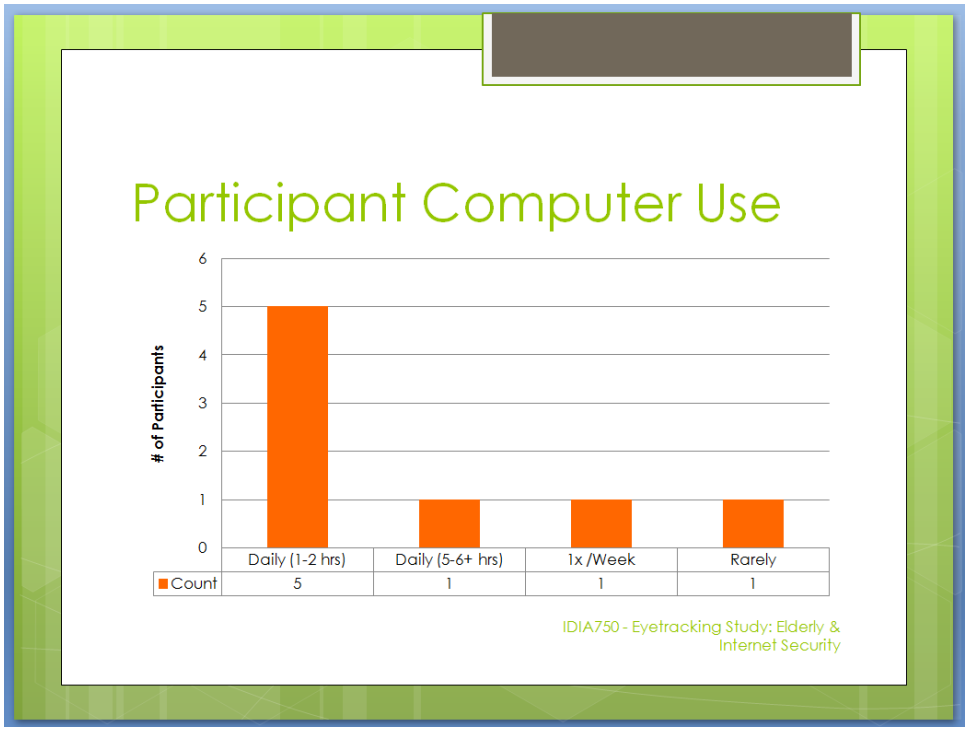

Figure 4. Participant Computer Use – Eye-tracking Pilot Study

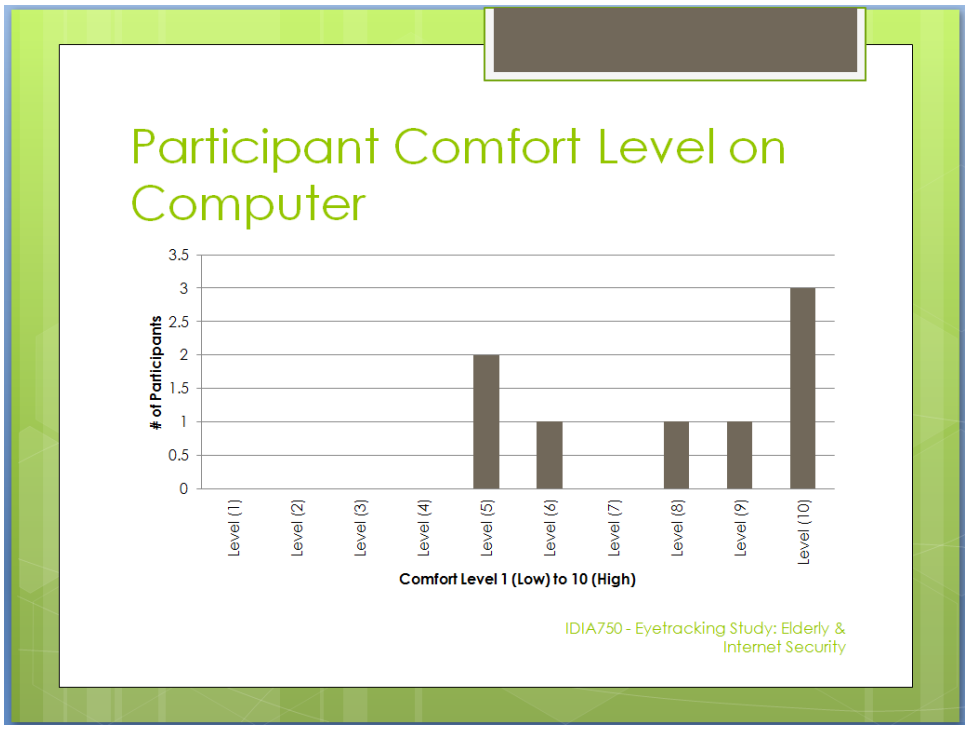

Figure 5. Participant Comfort Level – Eye-tracking Pilot Study

None of the participants reported having been the victim of an Internet scam, but they did report several fears about using the Internet, including identity theft, information theft, and viruses/malware (see Figure 6). The participants reported a number of precautions they take while online, including the following:

- Never give out personal information.
- Implement workplace information assurance training.
- Use virus scanners – keep them up to date, scan regularly.
- Avoid questionable sites.
- Do not open any unknown emails or messages/inputs.

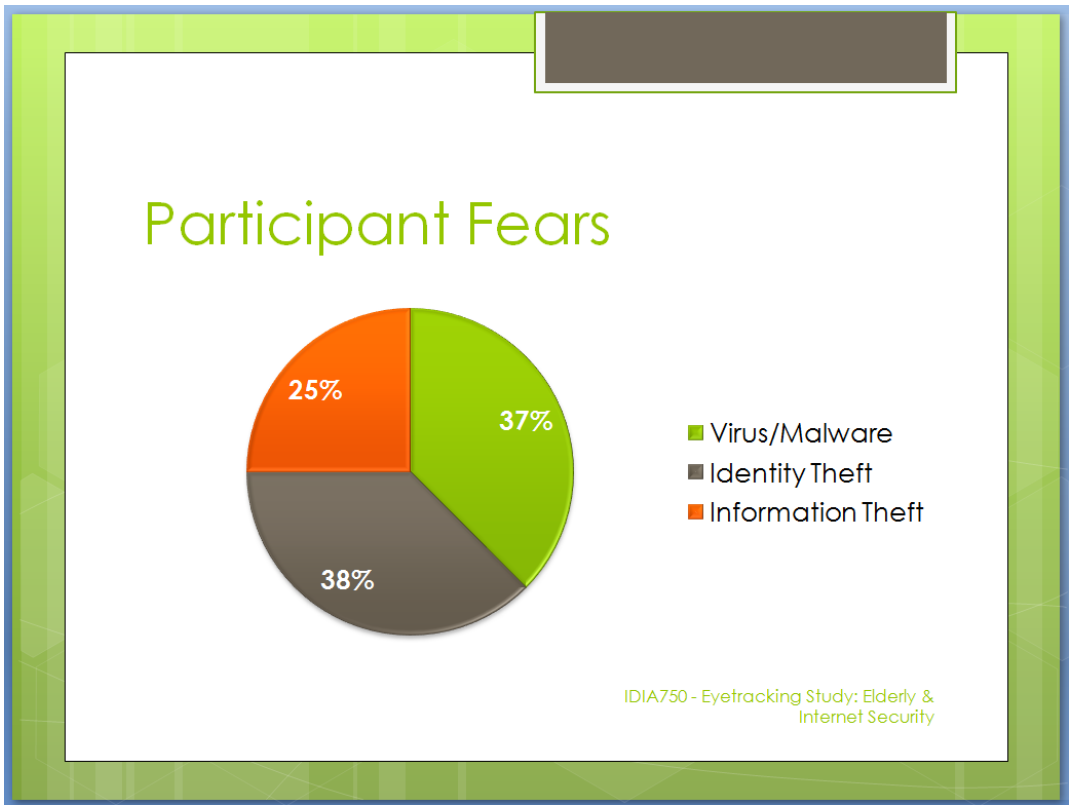

Figure 6. Participant Fears Online – Eye-tracking Pilot Study

Internet Safety Training – Usability Study

Utilizing the information gathered from the initial eye-tracking pilot study, a usability study for a custom-made training tutorial on Internet safety for elderly computer users was designed. The tutorial and the study design incorporated the testing practice/procedure findings from the pilot study, as well as the findings regarding content. Qualitative testing sessions included a combination of individual interviews, task analysis, and scenarios to determine the participants' general ideas about Internet safety, as well as specific areas of concern. Both the content and design efficacy of the training module were subjects of analysis as part of the study.

Employing the RITE method.

The Rapid Iterative Testing and Evaluation (RITE) method was chosen for this study, as it has been shown to be highly effective for finding and fixing problems, while requiring a relatively small number of participants. The theory behind this approach is a

question of diminishing returns: the more participants that are used, the fewer new problems are discovered (Medlock, Wixson, Terrano, Romero, & Fulton, 2002). The RITE method involves defining a target population for testing, scheduling participants, determining how user behaviors will be measured, constructing a test script, and having participants engage in a verbal protocol such as 'think aloud' (Medlock et al., 2002). The difference between this method and a traditional usability test is the focus on rapid changes and the verification of the effectiveness of those changes. The ability to make such rapid changes improves the final product as quickly and efficiently as possible.

The study had a total of 16 participants. Four individual sessions were held over a period of two days using a paper prototype. Twelve individual sessions were held over a period of four days using the digital prototype. Changes to the prototypes were made between the paper and digital prototype as needed.

The paper prototype testing occurred at the participants' homes. These sessions were independently led, with a concentration on the 'think aloud' protocol, which asks users to narrate their interaction with the prototype as they go. Participants provided feedback regarding the content of the Internet safety training. Paper prototype tests were not audio/video recorded because the emphasis at this stage was directed to the training content rather than interaction with the prototype. Therefore, it was determined that little of value would be gleaned from video observation.

Digital tests, using the Internet Safety Tutorial prototype (based on the paper prototype) were conducted, for the most part, at the respective participants' homes (The Woods Community, in Hedgesville, West Virginia) to ensure comfort and to replicate a real-life online training scenario. Two of the participants did request to have their session at the moderator's home (also in The Woods Community), but the environment was similar in comfort and style to the other test locations. Audio/video recording was employed for each session, as well as direct observation. A digital camcorder was used to capture the user's screen as well as any audio interaction with the tutorial and questions/comments to the moderator. Each participant used his/her own computer equipment to interact with the digital prototype, with the exception of the two participants

who had their sessions at the moderator's home. Those two participants used a 17" Macbook Pro with built-in speakers.

Participants.

Participants in this study were recruited via a community-wide email to The Woods, a housing and cabin population in Hedgesville, West Virginia. The email described the study and asked for volunteers over the age of 65 who used the internet regularly (3-5 hours per week). Volunteers were offered a $25 Gift Card and were asked to contact the tester via email for scheduling and basic arrangements (location, equipment availability, etc.). The participants consisted of ten women and six men over the age of 65, representing a variety of computer literacy levels and educational backgrounds. Although the number of subjects was relatively small, valuable and reliable conclusions were drawn regarding user behavior and comprehension of the material presented. Participant characteristics are summarized in Table 1.

Table 1

Participant Data

Participant #	Age	Gender	Ethnicity	Education	Own computer	Computer Use	Paper/Digital Prototype
1	74	F	Caucasian	High school	Yes	Daily	Paper
2	78	M	Caucasian	High school	Yes	Daily	Paper
3	76	F	Caucasian	High school	Yes	1/Week	Paper
4	75	F	Caucasian	Bachelors	Yes	Daily	Paper
5	67	F	African American	Masters	Yes	Daily	Digital
6	77	F	Caucasian	Masters	Yes	Daily	Digital
7	67	M	Caucasian	Masters	Yes	Daily	Digital
8	74	M	Caucasian	Bachelors	Yes	Daily	Digital
9	74	F	Caucasian	Bachelors	Yes	Daily	Digital
10	74	F	Caucasian	High School	Yes	Daily	Digital
11	85	F	Caucasian	Bachelors	Yes	Daily	Digital
12	79	M	Caucasian	Masters	Yes	Daily	Digital
13	72	M	Caucasian	J.D.	Yes	Daily	Digital
14	68	M	Caucasian	Doctorate	Yes	Daily	Digital

Materials.

Paper prototype participants used the Microsoft PowerPoint version of the Internet Safety Tutorial, consisting of 35 pages printed in color. Digital prototype participants accessed a web-based tutorial (see Figure 7) on individual laptops and computers using Google Chrome or Mozilla Firefox browsers. The digital prototype provided a hypothetical design for an Internet training module.

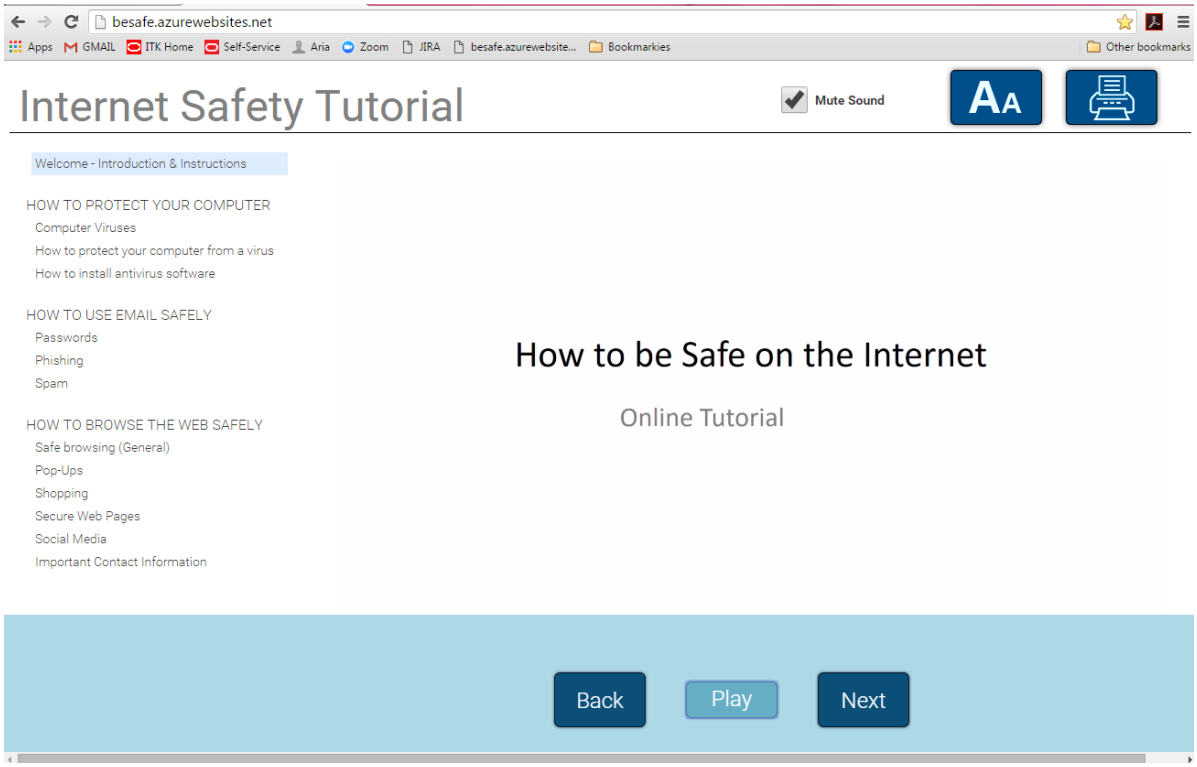

Figure 7. Screen Shot of Internet Safety Tutorial - Welcome Page

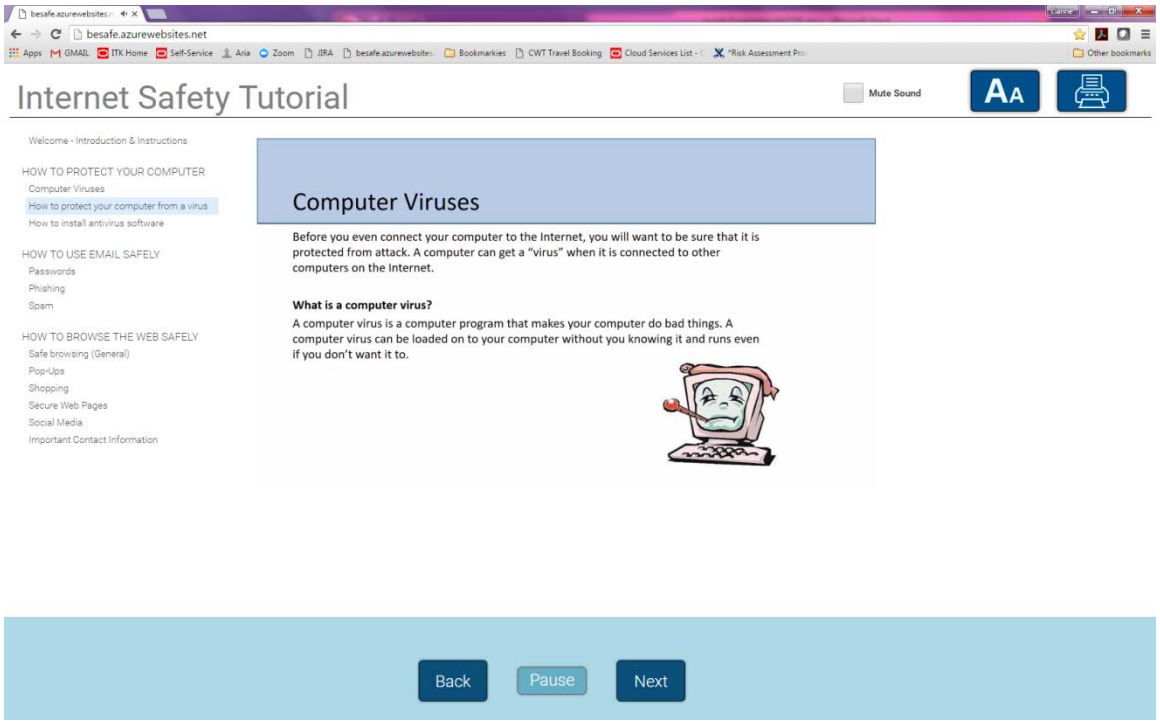

Figure 8. Screen Shot of Internet Safety Tutorial – Computer Viruses

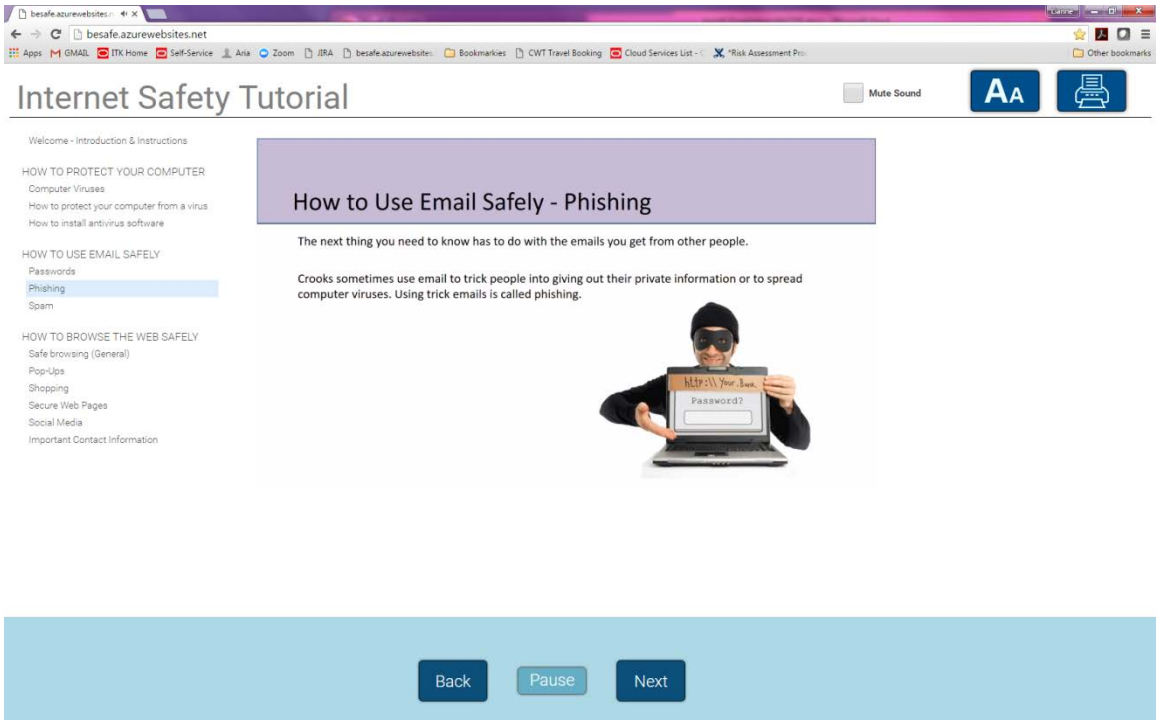

Figure 9. Screen Shot of Internet Safety Tutorial – Phishing

See Appendix F for screen shots of the complete prototype.

Test tasks.

Participant tasks for the paper prototype involved reading the material in order, while providing 'think aloud' feedback and questions. Participant tasks for the digital prototype included interaction with the web-based training module, utilizing the tutorial's built-in navigation. Sections of the digital tutorial included self-check quiz questions to confirm learned concepts in various areas of Internet security/safety. Regardless of prototype type, participants were asked a series of pre- and post-session questions, shown in Figures 8 and 9.

SURVEY

Thank you for your participation in this study. Please take a few minutes and answer the following questions to the best of your ability.

Name: Participant Number:

Age: Gender: Ethnicity:

Household Income:

Highest Level of Education:

Do you have regular (daily) access to a computer or laptop?

Do you currently own a computer or laptop?

How often do you use the Internet?

How many hours per week do you spend on the Internet?

What are your typical Internet activities? Please check all that apply.

- Email
- General Browsing
- Searching/Browsing Medical Information
- Searching/Booking Travel
- News
- Shopping
- Games
- Social Media (Facebook, Online Communities, Chat Rooms, etc.)
- Other (Please specify): _____

On a scale of 1 (least comfortable) to 10 (most comfortable), how comfortable are you with sharing your personal or financial information online?

What was your reasoning for the number you chose above?

What concerns do you have (if any) regarding safety when you go online?

What do you hope to learn from the Internet Safety Training tutorial?

Figure 10. Pre-assessment Survey

POST-OBSERVATION QUESTIONS

Thank you for completing the Internet Safety Training tutorial! Please take a few moments to answer the following questions.

What was your overall impression of the training?

What did you like about the training?

What (specifically) did you learn that you didn't know before from the training? Did anything surprise you?

What suggestions would you make for improvement of the training? Feel free to include both content and design characteristics in your suggestions.

What will you take away from the training and apply to your online activities (if anything)?

Please answer **Strongly Agree, Agree, Disagree, Strongly Disagree or Unknown** to the following statements, and include comments if desired:

The course content was simple and understandable.

The illustrations, audio, and interactive features were helpful.

I could navigate the course very easily.

I liked the look and feel of the course.

The course has improved my knowledge on the subject.

The duration of the course was just right.

Thank you!

Figure 11. Post-observation Questionnaire

Procedure.

The paper prototype participants were recruited via friends and family of the tester and within the local area of Bel Air, Maryland. Three females and one male who claimed to be avid computer users (internet activity 3-5 hours minimum per week) volunteered to participate. All paper prototype participants were over the age of 70, between 74 and 78 years of age.

Paper prototype sessions involved participants sitting comfortably wherever they liked at their homes, reading through the 35-page printed training document and answering quiz questions with a pen or pencil. Content and general layout of the training document mirrored that of the digital prototype. Direct observation and post-observation questioning was used to determine the efficacy of the training content and training design. Paper prototype sessions were not audio/video recorded.

Digital prototype sessions were held individually in a comfortable environment, either in participants' actual homes or a setting meant to replicate the participant's home (the moderator's home). Participants sat at their home workstations or in a comfortable chair at the moderator's home. Participants used either a home laptop or desktop computer. No tablets or mobile devices were used. Digital prototype sessions were audio/video recorded via a digital camcorder mounted on a tripod and focused over the participant's shoulder on their workstation/monitor. Participants' faces/body language were obscured during the sessions for privacy/anonymity purposes.

The moderator interacted extensively with participants in both paper and digital prototype sessions, as the testing was meant to be iterative. For three of the sessions, the moderator included an additional observer via a GoToMeeting screen share and audio phone conference. During sessions, the moderator took extensive notes on the participants' reactions, body language, questions, and other interactions with the prototype. Between the paper prototype sessions and the digital sessions, several design and content-related edits were incorporated, based on feedback from participants. Between the first and second rounds of the digital prototype sessions, design and content-

related changes were also made on the basis of feedback from the participants and other observers.

Usability Goals:

Completion rate – the percentage of test participants who successfully complete the task without critical errors. A critical error is defined as an error that results in an incorrect or incomplete outcome. In other words, the completion rate represents the percentage of participants who, when they are finished with the specified task, have an "output" that is correct. Note: If a participant requires assistance in order to achieve a correct output then the task will be scored as a critical error and the overall completion rate for the task will be affected.

A completion rate of 100% was the goal for each task in this usability test.

Error-free rate – the percentage of test participants who complete the task without any errors (critical or non-critical errors). A non-critical error is an error that would not have an impact on the final output of the task but would result in the task being completed less efficiently.

An error-free rate of 80% was the goal for the task in this usability test.

Time on Task (TOT) – The time to complete a scenario is referred to as "time on task". It is measured from the time the person begins the scenario to the time he/she signals completion.

Completion of the tutorial should not exceed one hour.

Subjective measures – Subjective opinions about specific tasks, time to perform each task, features, and functionality will be surveyed. At the end of the test, participants rated their satisfaction with the overall system. Combined with the interview/debriefing session, these data are used to assess attitudes of the participants.

General Questions to be Addressed by the Study:

- Are the researched principles regarding elderly users and interactive design confirmed in testing?
- What activities do elderly users typically engage in online?
- Is the Internet Safety Tutorial prototype appropriate in both content and design?
- Is the length of the digital prototype appropriate for elderly users?
- Do elderly users find value in online tutorials?

Results and Analysis

Pilot Study – Usability Testing of GCF Online Training

Observations.

The eye-tracking pilot test uncovered a number of problems that the participants encountered while trying to complete the tasks, despite their high level of comfort on the computer and high levels of Internet usage. The most significant of these was the fact that the 'Next' and 'Back' navigation buttons were located below the fold. Eye-tracking information showed that all of the participants were lost or confused until they were prompted to scroll down (see Figure 12). Eye-tracking graphics in Figure 12 depict the various eye movements and areas of focus among users in the training. It is clear by the scattered data points that once users read the content on the page, they were unable to determine what to do next. Additionally, once they did find the 'Next' button, they had a tendency to double-click on it, which resulted in skipping over pages of the tutorial.

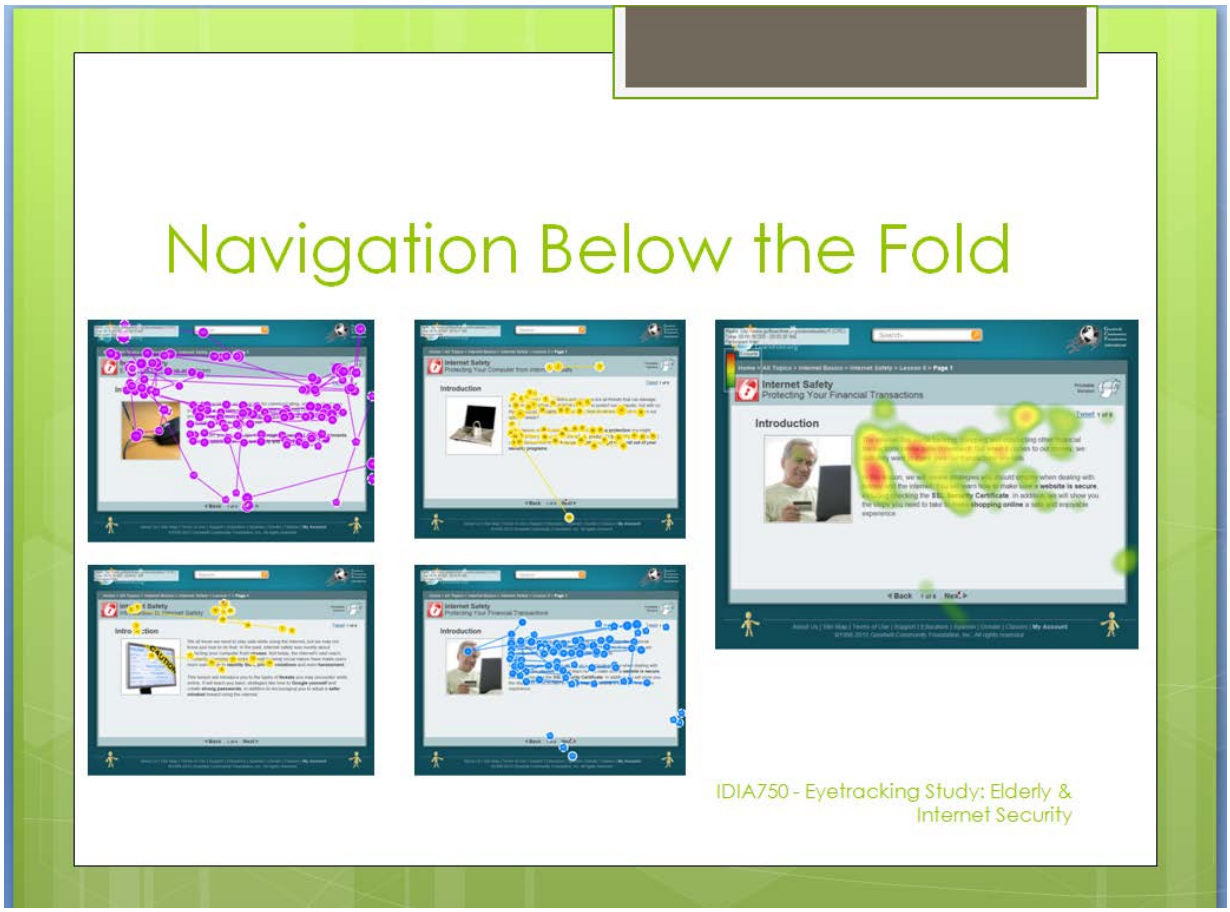

Figure 12. Eye-tracking Data

Another problem that emerged was the difficulty that participants had in discerning the interactive portions of the pages and recognizing the fact that these areas were clickable. Because they didn't know where to click, they were not able interact with this material. Another navigation issue that was noted was the tendency of the participants to become 'lost' if a link opened a new window. When this happened, participants could not find their way back to the tutorial. In spite of these observed navigation issues, most of the participants reported that they had little difficulty with navigation (see Figure 13).

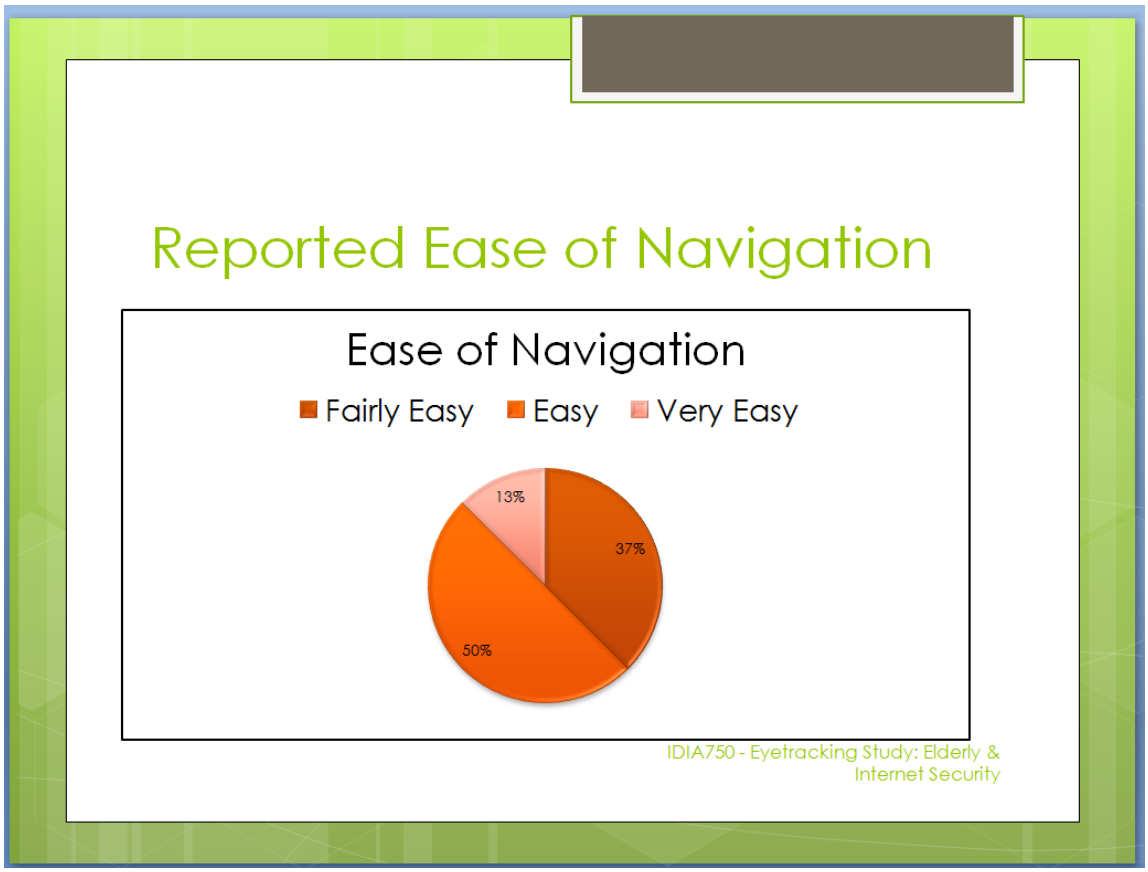

Figure 13. Reported Ease of Navigation

While most of the reported problems were associated with navigation, some of the participants had difficulty with the computer jargon, and would have preferred that it be explained or simplified. In one case, a participant said that the tutorial did not apply to him and that he didn't want to read it. Other feedback from the participants included the following requests:

- Frame important information with graphic element(s).
- Provide more highlighting/emphasis on callouts.
- Provide more opportunities for interactivity.
- Provide more word definitions for laymen.
- Position "Next" button in a clear, prominent area.
- Explain how to turn off 'display' function in email.

- Provide supplemental information in pamphlet form.
- Provide more advanced topics where appropriate.
- Provide more information on identifying real vs. fake security warnings/info.
- Chunk information to be less wordy/text heavy in parts.

The point of designing an Internet safety tutorial for the elderly is to effectively educate them on the specific dangers and threats online. To evaluate the efficacy of the training, the participants were asked what new information they learned from the tutorial. They reported learning the following:

- The importance of, and how to back up data
- The importance of being courteous online
- How to create complex passwords
- Various options for protecting themselves from threats
- The availability and purpose of a product called MicroCleaner
- The number of threats online
- Terms, descriptions, and types of attacks

Recommendations.

Based on the findings of the eye-tracking pilot study, the online training used in the test could have been improved in a number of ways. Recommendations for improvement, to be considered when creating the tutorial for the usability study, were as follows:

- Move navigation buttons to the top/above the fold
- Simplify language/lessen computer expert jargon
- Improve organization of topics
- Add leveling for basic, medium, and advanced users
- Include more interactivity
- Break up text-heavy sections with photos, interactivity, case studies
- Provide step-by-step instructions on how to set up protection measures

- Incorporate self-check quizzes

Internet Safety Training Usability Study

Paper Prototype Observations

Prior to engaging in the paper prototype of the Internet Safety Tutorial, participants were asked about their online activity in order to assess the adequacy of the topic areas covered in the tutorial. The results are shown in Table 2. All four participants reported using the internet for email, and all but one participant reported using the internet to book travel. No participants reported reading/accessing the news online, and only one reported utilizing social media.

Table 2

Online Activity – Paper Prototype

	Participant 1	Participant 2	Participant 3	Participant 4
Email				
General Browsing				
Medical Information				
Booking Travel				
News				
Shopping				
Games				
Social Media				

Participants were also asked how comfortable they were sharing personal or financial information online on a scale of 1-10, 1 being least comfortable, and 10 being most comfortable. Two of the participants chose 2, one chose a range from 1-5 depending on the circumstances, and one participant chose 5. Generally speaking, these numbers seemed to indicate that the group of participants was wary of sharing personal information online. When asked for the reasoning behind the number they chose, participants had varied answers. One claimed that privacy was the reasoning, two stated that they don't like to share personal information and that it's no one's business, and the fourth was "just being careful."

Participants were asked what specific concerns they have about using the Internet safely. One said protecting personal information, one said scams, and the remaining two participants didn't answer. It is possible that participants were not sure what concerns they should have and were afraid to answer incorrectly, as opposed to not having any concerns. Based on the answers to the prior question about their comfort in sharing information online, it certainly appears as though they knew to be cautious.

The final pre-session question asked what the participant hoped to get out of the training. One participant said "security," one said "awareness of pitfalls," one said to be aware of emails from people they don't know, and the fourth participant did not answer.

All participants were given a 30-page color printout of the Microsoft PowerPoint slides that contained the Internet Safety Tutorial and were asked to read through the content and answer the quiz questions after each section while the moderator observed, took notes, and answered questions. The font and graphics of the printout were large and very clear to see/read, as it was printed directly from PowerPoint (as opposed to the varied/limited space online/on a monitor), which was an advantage to using paper as opposed to viewing the training online. The tactile nature of the paper prototype allowed participants to both feel the girth of the material (and likely estimate the length of the training) and manually navigate through the pages easily. The complexity of online navigation and the lack of knowing visually/physically how long the training was that would be present in the online version were also advantages to interaction with the paper

prototype. It took participants between 35-45 minutes to read through the tutorial and answer the questions. The participants then answered a post-session survey. The results are shown in Table 3.

Table 3
Post-Session Survey Questions – Paper Prototype

	Strongly Agree	**Agree**	**Unknown**	**Disagree**	**Strongly Disagree**
The tutorial content was simple and understandable	1	3			
The illustrations and interactive features were helpful	1	3			
I could navigate the tutorial very easily		2	2		
I liked the look and feel of the tutorial		2	2		
The tutorial has improved my knowledge on the subject	1	2	1		
The duration of the tutorial was just right		3	1		

The survey questions were difficult to parse, as some participants simply said 'yes,' rather than indicating how strongly they agreed; in some cases, they did not answer the question at all. However, in general, the feedback was very positive. No participants disagreed with any of the statements, which seems to indicate that the content, design, and interactivity were adequate.

When prompted with open-ended questions, participants unanimously were pleased with the tutorial and thought it had good information. The only suggestion given by one of the participants was to include more visuals; specifically, actual scenarios regarding Internet safety.

Most participants answered all of the self-check questions correctly. One participant had some trouble, but was able to talk through the correct answers with the moderator and understand the reasoning. One question that generally seemed to cause some confusion was this: "True or False: Spam is a virus that you get in your email." Although some spam emails can *carry* viruses, spam in itself is not considered a virus.

Improvement of the definition or repetition of this terminology may be useful in future testing.

Based on the feedback from the paper prototype, it was clear that the language was just right for the demographic, the text size was adequate, and the quiz questions reiterated the training content in a helpful way. The improvements noted were to add more visuals and examples, and to incorporate more interactivity. Obviously, interactivity was inherently limited with a paper prototype, but the point was still relevant. More images and examples were incorporated into the digital training.

The Internet Safety Tutorial was designed to focus primarily on the activities in which elderly individuals engage most: email, web browsing, shopping, and social media. Based on the feedback from the participants, these activity areas were appropriate, with the exception of social media; only one of the four participants claimed to engage in social media. However, because the social media section of the training is relatively short, and because the cautions can be applied to other Internet activities, such as email, it remained intact for the digital prototype.

Usability Results (Paper Prototype):

Completion rate - the percentage of test participants who successfully complete the task without critical errors. A critical error is defined as an error that results in an incorrect or incomplete outcome. In other words, the completion rate represents the percentage of participants who, when they are finished with the specified task, have an "output" that is correct. Note: If a participant requires assistance in order to achieve a correct output then the task will be scored as a critical error and the overall completion rate for the task will be affected.

100% of participants completed the Paper Prototype training activity.

Error-free rate – the percentage of test participants who complete the task without any errors (critical or non-critical errors). A non-critical error is an error that would not have

an impact on the final output of the task but would result in the task being completed less efficiently.

An error-free rate of 95% was attained for the Paper Prototype training activity (goal was 80%).

Time on Task (TOT) - The time to complete a scenario is referred to as "time on task". It is measured from the time the person begins the scenario to the time he/she signals completion.

Completion of the tutorial did not exceed one hour.

Digital Prototype Observations

The idea behind the digital prototype was to test and/or confirm research regarding the usability and interactivity of Internet-based training for the elderly. Ultimately, the goal is to have an online tutorial available for seniors that addresses specific Internet safety topics and threats to help this age group avoid some of the more common scams targeted at them.

As in the paper prototype tests, the digital prototype participants were asked about their typical online activities to confirm the comprehensiveness of the topics in the training. The results of this questionnaire are shown in Table 4.

Table 4

Online Activity – Digital Prototype

(Participant #)	5	6	7	8	9	10	11	12	13	14	%
Email	■	■	■	■	■	■	■	■	■		90%
General Browsing	■	■	■	■	■	■	■	■	■		90%
Medical Information	■	■	■	■	■		■	■	■	■	90%
Booking Travel				■	■	■					30%
News	■		■	■	■	■		■	■	■	80%
Shopping	■	■	■	■	■	■	■	■			80%
Games				■	■				■		30%
Social Media	■	■	■	■				■	■	■	70%

In addition to the online activities listed above, participants were able to write in specific activities under the category 'Other.' Those activities included searching for graphics for secondary school, maintaining Facebook pages for several organizations and businesses, paying bills, and publishing on Amazon Kindle. Overall, the activities participants engage in online were in alignment with the tutorial material. One topic area that might potentially be added to future iterations is online prescription scams, since the majority of participants claimed to use the Internet to look up medical information.

Participants were asked what safety concerns they currently have online. Those concerns included avoiding having accounts hacked because they have been in the past, identity theft, disclosure of information online, financial loss associated with identity theft, keeping information safe, going online 'blindly,' general awareness, and fraudsters. When asked what participants hoped to learn from the tutorial, they said they wanted to fill in gaps in their knowledge ("more than I already know"), as well as knowing the best practices to adopt, how to better secure personal information, how to travel around the Internet more safely, how to be more secure online, how to avoid fraud, and any easy

ways to stay safe. Participants of the paper prototype echoed similar concerns, specifically around identity theft and wanting to increase their general knowledge.

After incorporating the changes from the paper prototype, the digital prototype was developed using Microsoft Azure training software, in which the frame of the tutorial consists of PowerPoint content playing as 'video' sections with corresponding audio. Users were able to see the topic hierarchy on the left of the screen, jump to specific sections if desired, go forward and backward by section using 'Next' and 'Back' buttons, change the font size to be larger if needed, and to print the training (PDF) at any point. Aside from those interactions, the content sections were played primarily at a set speed (how long the narration on each slide takes) without the user being able to skip ahead to the next full section. Despite the observations in the Pilot Study, and research indicating that older adults prefer activities to be self-paced, it was unfortunately not possible to break the training down into individual slides for the user to click through due to development time and inherent limitations with Azure. Between sections, self-check quizzes gave the user a number of True/False questions and asked the user to click on a selection circle based on their answer. After answering, a text box appeared, letting the user know whether he/she was correct and providing an explanation of the answer.

Testing of participants occurred in two rounds, with an iterative period in between to make high-priority changes. The first round elicited the largest number of issues identified; these were observed by the moderator and also noted by participants. Generally speaking, the tutorial operated as intended, with no technical issues/glitches that interrupted the flow or integrity of the training. One potential technical issue was noted that *could* have occurred, but didn't: a participant not having speakers attached to his/her computer or laptop. Participants were not asked ahead of time whether or not they had speakers, so the fact that they all did was fortuitous. The audio narration was intended to supplement the text, allowing for visually impaired seniors to have a secondary option for receiving the information. A mute button was incorporated for those who did not want audio narration. However, because the sections were broken down into video chunks, rather than individual slides, the movement between pages depended on

the length of each narration/audio file. For a fast reader or a user without speakers connected, the timing of the page changes could potentially be annoyingly slow or seem erratic. The only way to correct this potential problem would be to break the entire training up into slides and allow users to click through each page at his/her own pace, which would be a priority for a fully implemented training module.

Below is a summary of the findings from the first round of testing, followed by the changes implemented as a result.

First round of testing.

Issues/Suggestions Identified:

- Text was too small on smaller laptops; increasing text size made video extend beyond the screen.
- Pauses between slides were too long in many sections.
- Need descriptions of the various antivirus options.
- 'Next' button turned green in some cases, but not in others; nearly all participants had issues knowing when to click 'Next.'
- Need to include more examples of each issue with illustrations (e.g., data breaches).
- Need natural breaks in the training; too much content at once.
- Supplementary pamphlet or documentation that outlines top tips and/or contact information would be good to provide as reference.
- Audio/voice was boring/monotone; need to liven up the audio.
- Audio was too quiet even on loudest volume setting.
- Lack of access to links in the training without printing was inconvenient.
- Images were too small to read/be seen well.
- Training was visually boring; in need of more color.

What Users Liked:

- Easy to understand definitions of common terms.

- The idea of having a secondary email account for businesses/lesser known individuals.
- Illustration and information about secure browsers for shopping/entering personal or financial information online.

Changes Implemented:

After the first round of testing, it was clear that some modifications were needed. Given the short timing between rounds, however, only the most important changes could be implemented. First, the colors of the headings were too faint, so those were brightened. Each heading had a specific color as a navigation cue to let the user know which section they were in. Second, images that were clearer, larger, and more colorful replaced some of the images that did not work as well in the first iteration. In the quiz sections, the color of 'correct answer' pop-up boxes was changed from a faint blue color to green, and 'incorrect answer' boxes were changed from white to purple. These color changes allowed for a more visual cue about the answers. The text of the quiz answers was also updated to reflect accurate explanations of the answers, and instead of simply saying 'correct' or 'incorrect,' the correct answer boxes said 'YES!!!' and incorrect answer boxes said 'Please try again.' This change in language provided positive reinforcement to keep the user engaged and motivated. Additionally, at the end of each major section, a 'Congratulations' page (Figure 14) was added, which let the user know that the section had ended, and gave him/her the option of continuing or coming back later. These pages offered a natural break between sections and let the user know when a section was complete.

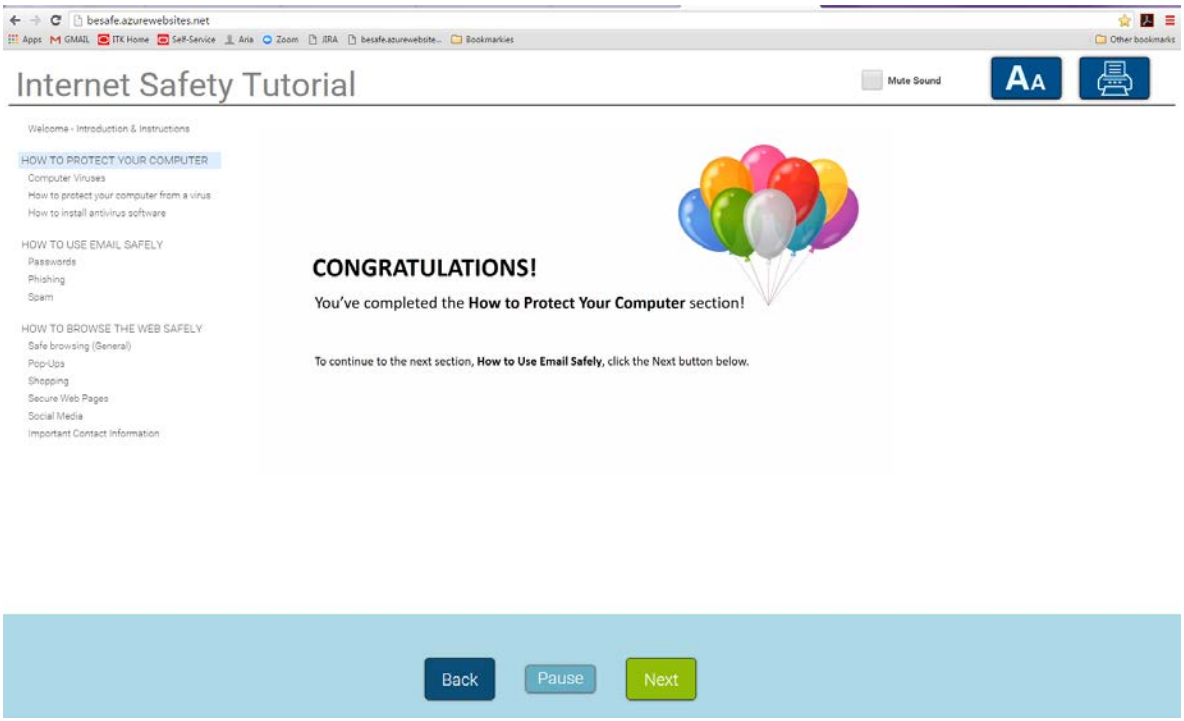

Figure 14. Congratulations Page

In areas where the pause between pages was too long or the audio was too low, the sections were re-recorded. Finally, a change was made to the phrasing of one of the quiz questions. The question originally said, "True or False: I can use the same password for multiple accounts to make things easier"; it was changed to say "I *should* use the same password for multiple accounts to make things easier." One of the participants in the first round of digital testing correctly pointed out that because it was *possible* for people to use the same password for multiple accounts, the question could be answered 'True' when the point was supposed to be that it is best practice to use unique passwords for each account.

Second round of testing.

Issues/Suggestions Identified:

- Left navigation text is too small.
- When text size button is clicked, the main content goes off screen.
- Participants were unsure when to click 'Next.'

- Long pauses between pages were confusing.
- Double-clicking on the "Next" button skips content/sections.
- Audio/sound is too soft to be heard well.
- Some participants had trouble clicking 'Next' button; target was too small.
- If participant had slow Internet connection, videos cut off or wouldn't display properly.
- Language was considered patronizing to some participants.

What Users Liked:

- 'Congratulations' pages; very positive responses.
- Interactivity (navigation, quizzes, graphics).
- Repetition of concepts through quizzes and audio.
- Definitions of terms.
- Breakdown of sections and topics laid out.
- Clear presentation of information.

Evaluation:

In the second round of testing, many of the issues identified in the first round that were not changed came up again. The main issue was with navigation, as clicking 'Next' tended to be troublesome for various reasons: 1) it only turned green at the end of major sections, rather than every spot where a user could move forward; 2) double-clicking happened often, resulting in the skipping of sections rather than going to the next sequential section; 3) the long pauses between slides made users think they should click 'Next'; 4) it was clear that users would have liked to move forward at their own pace rather than waiting for the audio narration to end. Many participants stated that they already knew much of the content of the training, but that it was a good refresher. Some suggested having training levels, so that more advanced users could dig into topics that interested them or were more pertinent to them. All participants commented on the

importance of such a tutorial, and stated that they would recommend the training to others.

As in the paper prototype, after the digital tutorial, participants were asked to rate their experiences as outlined in Table 5.

Table 5

Post-Session Survey Questions – Digital Prototype

	Strongly Agree	**Agree**	**Unknown**	**Disagree**	**Strongly Disagree**
The tutorial content was simple and understandable	8	2			
The illustrations and interactive features were helpful	6	4			
I could navigate the tutorial very easily	8	2			
I liked the look and feel of the tutorial	6	4			
The tutorial has improved my knowledge on the subject	6	4			
The duration of the tutorial was just right	5	5			

The results were overwhelmingly positive, and many participants were excited to have a copy of the training to share with friends and family. If any conclusions were to be drawn from the above responses, one could consider that the duration of the tutorial was possibly too long. The researcher observed many times during the testing that it appeared that participants were bored, fidgety, yawning, and generally not fully engaged. However, the issue of navigation discussed earlier could likely address the duration of the tutorial if users were able to click through the pages one at a time at his/her own pace.

Usability Results (Digital Prototype):

Completion rate - the percentage of test participants who successfully complete the task without critical errors. A critical error is defined as an error that results in an incorrect or incomplete outcome. In other words, the completion rate represents the percentage of participants who, when they are finished with the specified task, have an "output" that is correct. Note: If a participant requires assistance in order to achieve a correct output then

the task will be scored as a critical error and the overall completion rate for the task will be affected.

100% of participants completed the Digital Prototype training activity (goal was 100%).

Error-free rate - the percentage of test participants who complete the task without any errors (critical or non-critical errors). A non-critical error is an error that would not have an impact on the final output of the task but would result in the task being completed less efficiently.

An error-free rate of 98% was attained for the Digital Prototype training activity (goal was 80%).

Time on Task (TOT) - The time to complete a scenario is referred to as "time on task". It is measured from the time the person begins the scenario to the time he/she signals completion.

Completion of the tutorial did not exceed one hour.

Longitudinal Observations

After roughly five months for paper prototype participants, and four months for digital participants of the Internet Safety Training Usability study, participants were contacted again to determine the retention of knowledge from the training. In order to determine what participants retained, the embedded self-check questions peppered throughout the training were extracted and given to participants again, either in person via Adobe PDF screen shots, or remotely, using Zoom Conferencing to screen-share the questions.

Questions were as follows:

1. True or False: Without an anti-virus program installed on my computer, I am at risk of my computer getting a virus and sending the virus to my friends or damaging my computer.

2. True or False: A good password combines numbers, letters, and symbols, and doesn't have dictionary words.
3. True or False: If someone calls me on the phone and says they are from my bank and need the password to my online account, I should give it to them.
4. True or False: I should use the same passwords for all of my accounts to make things easier to remember.
5. True or False: An email that asks you to click on a link or enter financial information or passwords is probably a trick email.
6. True or False: An email with an attachment with the file name ending in .exe or .zip may give my computer a virus.
7. True or False: Spam is a computer virus that you get in your email.
8. True or False: I can protect my computer and myself from most email threats by never opening an email, link, or attachment from someone I don't know.
9. True or False: Malware refers to any bad computer programs that try to harm your computer or steal your information.
10. True or False: Pop-Up ads are annoying but not harmful.
11. True or False: Shopping online can be convenient and safe if you are careful about how and where you share your personal and financial information.
12. True or False: It is important when you use social web sites (Social Media) to not share your personal information with people you do not know.

Below are the quiz results from Dec/Jan 2015/2016 to April/May 2016:

	Prototype	**Quiz Date**	**Score**	**%**	**Quiz Date**	**Score**	**%**	**Difference**
Participant 1	Digital	Jan-16	11/12	92%	April-16	10/12	83%	Worse
Participant 2	Digital	Jan-16	12/12	100%	May-16	8/12	67%	Worse
Participant 3	Digital	Jan-16	12/12	100%	April-16	12/12	100%	Same
Participant 4	Digital	Jan-16	12/12	100%	May-16	12/12	100%	Same
Participant 5	Digital	Jan-16	12/12	100%	May-16	11/12	92%	Worse
Participant 6	Paper	Dec-15	12/12	100%	May-16	10/12	83%	Worse
Participant 7	Paper	Dec-15	12/12	100%	May-16	11/12	92%	Worse

The most missed True/False questions were the following:

1. *Pop-Up Ads are annoying but not harmful.* Participants likely agreed that pop-ups were indeed annoying, and went with "True," despite the fact that Pop-Up Ads can be both annoying and harmful.
2. *Spam is a computer virus that you get in your email.* The connection between Spam and viruses is relatively significant, which likely caused many participants to answer "True," when Spam in itself is not a virus.

Commensurate with the research on aging and memory challenges, participants either retained the same score, or did slightly worse after the 4-5-month period. While the results didn't decline dramatically, they seem to indicate a need for regular "refreshing" of the training content. Recommended frequency of the training would be about every 6 months.

Alignment with Researched Design Principles

As mentioned in the Literature Review, there are many design principles that can be applied when designing for senior users. The table below (Table outlines which of those guidelines were observed in the Internet Safety training usability study, and also calls out original principles observed in testing.

Table 6

Confirmed and New Design Principles for Senior Users

Principle	Reference	Confirmed (Y/N)	Notes
GENERAL			
Emphasize the benefits of technology to increase adoption, and leverage users' familiarity of other technologies	Pernice, Estes, & Nielsen, 2013	Y	
Avoid jargon, marketing/technical terms, and complex language	Pernice et al., 2013; National Institute on Aging, 2009; Newell et al., 2006	Y	
Where possible, ensure that there is only one way to complete a given task	Pernice, Estes, & Nielsen, 2013	Y	
Provide a guide, either in print or displayed prominently on the site, for basic actions	Pernice, Estes, & Nielsen, 2013	Y	Internet Safety training tutorial could have done a better job of this; users

			were often confused as to what to do next in certain areas
Provide ample and adequate feedback. Display clear feedback during any process or workflow	Pernice, Estes, & Nielsen, 2013	Y	When there was a pause in audio, it caused a lot of confusion with users; lack of feedback as to what was happening was problematic
Ensure that the home page/landing page loads quickly	Pernice, Estes, & Nielsen, 2013	Y	
Internet connectivity and speed are factors in feedback; slower Internet speeds can further increase memory impairments/issues and cause the user to lose focus	Pernice, Estes, & Nielsen, 2013	Y	Users with slower internet speeds had issues with the way the training would load, and interrupted the flow of the training
Offer closed-captioning and a transcript for videos; seniors often prefer reading text over watching a video, or will watch a video at extremely loud volumes in order to hear	Pernice, Estes, & Nielsen, 2013	Y	Users appreciated having audio and text to supply the training content
Offer voice augmentation to support text where possible	Sato, Kobayashi, Takagi, Asakawa, Tanaka, 2011; National Institute on Aging, 2009	Y	Users appreciated having audio and text to supply the training content
Use precise, informative wording on error messages and prompts that is clear and non-threatening; describe the problem and how to fix it	Pernice, Estes, & Nielsen, 2013	Y	Quiz answers in the training lacked in this area in the first round of testing, as they did not adequately explain why answers were right or wrong.
Use a pleasant, relaxed atmosphere for testing to elicit the best results and feedback. Manage the environment to reduce the number of distractions	Pernice, Estes, & Nielsen, 2013	Y	Testing in user's homes was invaluable in terms of comfort of participants and observation of participants in their natural environment
TEXT			
Use at least a 12-point font	Githens, 2007; National Institute on Aging, 2009; Newell et al., 2006	Y	14+ is ideal; the larger the better. Many users were squinting on small monitors.
Use a sans serif font	Githens, 2007; National Institute on Aging, 2009	Y	
Use medium or boldface typeface	National Institute on Aging, 2009	Y	
Never use all capital letters; it is very difficult to read	National Institute on Aging, 2009	Y	
Avoid using italics, which are hard to read, especially online	National Institute on Aging, 2009	Y	

Provide strong contrast between text and background color	Pernice et al., 2013; National Institute on Aging, 2009; Newell et al., 2006	Y	Backgrounds were intentionally white on all pages of the training for this reason.
Use scalable text	Githens, 2007; National Institute on Aging, 2009	Y	Despite the ability to click a button to make text larger, most users didn't engage that functionality. Scalable, large, text is much more effective.
Use left justification	Githens, 2007; National Institute on Aging, 2009	Y	
Differentiate hyperlinks from regular text	Pernice et al., 2013	Y	
Change the color of links/pages that have been visited to avoid confusion	Pernice et al., 2013	Y	
Do not use automatically scrolling text	National Institute on Aging, 2009	Y	
CONTENT			
Do not stereotype or generalize about seniors; do not assume all seniors are interested in the same or limited topics	Pernice et al., 2013	Y	The terms "elderly" and "senior" were intentionally omitted in the training to avoid offending users.
Do not patronize seniors; write factually	Pernice et al., 2013	Y	This is a challenge when users have a high level of educational background, especially when writing to an 8th grade reading level. One participant (a PhD) was especially offended by the "patronizing language."
Arrange content by topics, not ages; aging affects everyone differently	Pernice et al., 2013	Y	This is another reason why leveling content is so important (novice, intermediate, expert users)
Use tables for information that is commonly compared	Pernice et al., 2013	Y	
Prioritize content on pages	Pernice et al., 2013	Y	
Separate information directed at different audiences (professional vs. general)	Pernice et al., 2013	Y	
Write at 8th grade reading level or lower	Pernice et al., 2013	Y	Most users were pleased at how clear and easy to understand the content was of the training.
Use only well-organized material that avoids unnecessary complexity.	Pernice et al., 2013	Y	
Define terms that may be unfamiliar in the context; avoid using them if not	Githens, 2007; Pernice et al., 2013; National	Y	Users identified unfamiliar terms very

necessary.	Institute on Aging, 2009		quickly and expected them to be defined immediately.
Use descriptive terms instead of marketing terms for products, descriptions, and links	Pernice et al., 2013	Y	
Use common social networking terms cautiously	Pernice et al., 2013	Y	
Focus information by addressing users' top tasks and top questions first	Pernice et al., 2013	Y	The content was determined by understanding the activities that seniors engage in most when they go online for this reason.
Chunk information into easy-to-scan formats	Pernice et al., 2013; National Institute on Aging, 2009	Y	
Use clear headings and descriptions	Pernice et al., 2013	Y	
Use information-layering techniques to present long or complex content	Pernice et al., 2013	Y	The training could have even gone a step further in this respect, by illustrating specific security issues or going into case study narratives.
Display pagination links in the top right or bottom center of pages, above or below the content; ensure consistency throughout		Y	
Avoid the need for excessive scrolling	Pernice et al., 2013; National Institute on Aging, 2009; Newell et al., 2006	Y	No scrolling was required for the training unless users had an exceptionally small monitor/screen.
Put key information first, typically at the top of the page	National Institute on Aging, 2009	Y	
Write in the active voice, which puts the focus on people and actions	National Institute on Aging, 2009	Y	
Write in the positive	National Institute on Aging, 2009	Y	
Provide summary information to reinforce and aid in recall	National Institute on Aging, 2009	Y	Review sections were helpful at achieving this reinforcement of information.
NAVIGATION			
Use a consistent layout throughout	Githens, 2007; National Institute on Aging, 2009	Y	
Provide a clear path to commonly accessed content	Pernice et al., 2013	Y	
Use clear navigation with mutually exclusive categories	Pernice et al., 2013	Y	

Clearly display the user's location in the interface or process	Pernice et al., 2013	Y	The left navigation would highlight where the user was in the training, but had some functionality loss at the sub-heading level. This could be improved in future iterations.
Expose subcategories upon hover where possible	Pernice et al., 2013	Y	
Thoroughly test timing of opening menus on hover	Pernice et al., 2013	Y	
Provide instructions where possible (keep a navigation key on all pages, for instance)	Pernice et al., 2013	Y	
Avoid changes to overall navigation designs; seniors use lists of instructions about how to perform tasks and can be caught off guard by design changes to their method	Pernice et al., 2013	Y	
Ensure main navigation menus are clearly visible at all times	Pernice et al., 2013	Y	
Structure navigation to ensure the fewest number of clicks is needed to achieve a given task	National Institute on Aging, 2009	Y	
Use signposts (page titles, breadcrumbs, etc.) to help users understand where they are on the site and where they can go	Pernice et al., 2013	Y	
Use static navigation elements; avoid moving menus or click targets	Pernice et al., 2013; National Institute on Aging, 2009	Y	With the exception of varied content, the training essentially stayed the same static navigational elements throughout.
Do not use menus that require users to slide the mouse and click in one movement	National Institute on Aging, 2009	Y	
Ensure the main logo links to the home page		N/A	No logo was used
Do not use color, underlining, or bolded text that looks the same as link formatting		Y	
Provide adequate space between links and other click targets	Pernice et al., 2013; National Institute on Aging, 2009	Y	
Do not use pop-up windows.	Pernice et al., 2013; National Institute on Aging, 2009	N	Pop-ups were used to provide quiz answer responses; users had no problem navigating back to the training.
Treat double-clicks as single clicks. Ignore subsequent clicks on a single target	National Institute on Aging, 2009	Y	This was definitely a problem with our navigation buttons. Users

			who double-clicked ended up skipping whole sections of the training.
GRAPHICS			
Avoid patterned backgrounds	Githens, 2007; National Institute on Aging, 2009	N/A	No patterned backgrounds were used
Use only images that add value and support the content; use text alternatives where possible	Githens, 2007; National Institute on Aging, 2009	Y	
Ensure images are easy to see	Pernice et al., 2013	Y	This was a challenge with the training; fitting content and images so both were large enough
Avoid abstract symbols (for example, use an arrow with words rather than the 'play' symbol common on remotes, DVD players, etc.)	Pernice et al., 2013	Y	Action words were used in lieu of common symbols (Next, Back, Pause); the print, mute, and text size buttons were symbols and users rarely used them. Future iterations could add tool tips to define the buttons, or use words instead of images.
Use graphical elements to enhance text, not replace it	Pernice et al., 2013; National Institute on Aging, 2009	Y	
Avoid using rotating images on main page (or any page) due to the level of distraction	Pernice et al., 2013	N/A	No rotating images were used.
Make sure pictures of people reflect the diversity of the intended audience	Pernice et al., 2013	Y	
Keep the number of actions or buttons per screen to a minimum (below 10)	Newell et al., 2006	Y	
When graphical elements appear close to a text link, make those elements part of the working link	Pernice et al., 2013	Y	
Avoid presenting important text as part of an image	Pernice et al., 2013	Y	
Offer large click targets and provide adequate space between them	Pernice et al., 2013; National Institute on Aging, 2009	Y	Despite the large navigational buttons, one user still had trouble clicking with the mouse. A touch screen may have been more useful in her case.
Use videos to supplement text, not replace it	Pernice et al., 2013	Y	
Use large buttons that do not require precise movements to activate; make buttons and icons stand out	National Institute on Aging, 2009	Y	
Make buttons obviously clickable	National Institute on Aging, 2009	Y	

Avoid the use of yellow, blue, or green in close proximity	Githens, 2007; National Institute on Aging, 2009	Y	
Use ALT tags and text where possible	Pernice et al., 2013; National Institute on Aging, 2009	Y	This would have been helpful with the print, mute, and text size buttons.
Clearly label links that are videos using a video icon or the word 'video' along with the topic's description	Pernice et al., 2013	N/A	No videos were used in the training.
Keep videos short and to the point	Pernice et al., 2013	N/A	No videos were used in the training.
Provide closed captioning and/or transcripts of video content	Pernice et al., 2013	N/A	No videos were used in the training.
NEW OBSERVATIONS			
Provide detailed instructions (preferably in writing) for all tasks to be completed	Internet Safety Usability Study (Digital Prototype), 2016	N/A	Older individuals like having a clear set of instructions or directions to feel in control, or like they are doing things "right"
Provide several examples and illustrations to reiterate new concepts	Internet Safety Usability Study (Digital Prototype), 2016	N/A	Repetition is important to get new concepts across; examples and illustrations are useful
Pair digital information with hardcopy to reiterate key points and provide visual/tactile reminder	Internet Safety Usability Study (Digital Prototype), 2016	N/A	Several users suggested a pamphlet or hardcopy of key security tips and contact information
Avoid long pauses in video or audio	Internet Safety Usability Study (Digital Prototype), 2016	N/A	Users were confused by long pauses in audio; weren't sure what to do next
Make interactive features straightforward; do not try to trick users with quiz questions; keep it simple	Internet Safety Usability Study (Digital Prototype), 2016	N/A	Users anticipated being tricked by the quiz sections of the training, but were encouraged by getting most answers right
Provide levels of information based on computer/internet experience of users (novice, intermediate, expert)	Internet Safety Usability Study (Digital Prototype), 2016	N/A	Users had varied experience levels on the computer/internet; would have benefitted from more customized information based on experience
Ensure that links clicked do not open new browser windows	Internet Safety Usability Study (Digital Prototype), 2016	N/A	Users tend to get lost and unable to return to immediate task after clicking links
Enable touch-screen ability where possible	Internet Safety Usability Study (Digital Prototype), 2016	N/A	Users with dexterity issues could benefit from using touch screen technology; many users

			accustomed to using touch screens and expect it
Incorporate positive feedback where possible	Internet Safety Usability Study (Digital Prototype), 2016	N/A	Users were very excited by "Congratulations page" after completing major sections of the training

General Observations

The Nielsen/Norman Group was completely accurate in its suggestions about conducting usability tests with seniors: researchers should build in extra time before and after sessions, and be willing to help after the session (Pernice et al., 2013). The senior participants were extremely hospitable, offering drinks and snacks, and seemed to truly appreciate the experience. Most of the participants enjoyed engaging in conversation and questions with the moderator during testing and asked several specific questions about Internet safety. Some asked if it was a problem to have more than one antivirus software on the computer at a time. Others asked for a quick demonstration of how to increase privacy security on Facebook, or how to modify their security options on Facebook. It was clear that participants were engaged in the topic area and keen to learn as much as possible about the topic of Internet safety. In most cases, participants wanted more from the tutorial, either to dig into specific topic areas or to introduce new topics altogether. Several suggested the idea of having different levels of training based on the user's knowledge on the subject, and/or making certain topics more accessible. One interesting observation was that the participants would often refer to 'the elderly' or 'seniors' as if they weren't in the demographic themselves, saying something along the lines of: "this would be extremely beneficial for old people." In the design process, it was important that the terms 'elderly' and 'seniors' explicitly were not used for the reason that these terms have the potential to offend older individuals or put them into a stigmatized category which they may not want to be a part of. Instead, the language was modified and written in such a way that any layperson would be able to easily follow and understand it.

One participant was impressed with the language, stating that he had written for the newspaper years back, and that he had become an expert at writing at a sixth grade

reading level. He thought the training could be well suited for both elderly individuals and possibly children. However, another participant—a well-educated PhD—was very put off by the tone and the language of the training. She found it extremely condescending and patronizing. Specifically, she said that using the term 'crook' was "quaint" and "not sinister enough." She also thought the phrase "[viruses] make your computer do bad things" was patronizing, especially since it was stated twice. She said that she had just read another publication aimed at seniors, and she found the language there to be patronizing as well. It may simply be that material written at an eighth-grade reading level (as this tutorial was) is inherently problematic for individuals of the highest education levels. However, given the fact that seniors in America account for the lowest rates of literacy among adults, with 64 percent performing in the Basic and Below Basic levels, the language in the training is likely to be appropriate (Brown, H., Prisuta, R., Jacobs, B., & Campbell, A., 1997).

Another interesting observation was that at least half of the participants tried to interact with the training as if it were a touch screen, touching the monitor on the 'Next' button. Perhaps in future iterations, the training could be customized for elderly using tablets and mobile devices since those devices can be easier for those with dexterity challenges. One of the most interesting observations was that participants were very interested in talking about passwords and very willing to show the moderator where and how they stored their passwords. One participant said he had a folder on his computer called something vague/misleading (not 'passwords') in which there was a document that seemed to relate to that vague topic, but below it contained his lists of passwords. Another participant went under her desk and pulled out a binder that she handed to the moderator that contained all of her passwords, written down. Yet another participant also had an unmarked binder of passwords that he kept 'hidden' on his bookshelf. The fact that these participants were so open and willing to share this information with a relative stranger was supportive of the idea that seniors are more likely to be trusting of strangers than younger individuals would be.

Usability Study General Questions Addressed:

- Are the researched principles regarding elderly users and interactive design confirmed in testing?
    - *Yes, see table 6 for detailed results.*
- What activities do elderly users typically engage in online?
    - *As the research indicated, elderly users engage in email and web browsing as their main activities online. Detailed results of user activity can be found in tables 2 and 4.*
- Is the Internet Safety Tutorial prototype appropriate in both content and design?
    - *With some minor adjustments, the prototype would be significantly useful to this age group. Improvements to design have been discussed in the above results; future iterations will be detailed in the Discussion Section.*
- Is the length of the digital prototype appropriate for elderly users?
    - *One of the adjustments to be made to the training is for it to be completely self-paced via clickable Next and Back buttons throughout the training per content slide. This will significantly contribute to an appropriate length of time for this age group. The section chunks also make it easy for users to stop and come back after required breaks.*
- Do elderly users find value in online tutorials?
    - *Per the follow-up questions to participants, elderly users do find value in tutorials such as the one tested in this study. However, because the data is subjective, and older users tend to be overly positive, it is difficult to determine definitively.*

Conclusion

This study was intended to explore the design, content, and interactivity of an Internet Safety Training module for elderly adults (age 65+), with the purpose of effectively conveying valuable, pertinent information regarding both the general risks and age-specific scams targeted at older individuals online. After in-depth research examining the Internet activity of older adults, age-related differences and their effects on computer use, senior vulnerability to scams, online trainings currently available to seniors, and effective principles for design, a custom training module on Internet safety was designed, developed, and user-tested for this demographic.

Previous to the research referenced above, a pilot study was conducted in 2012 that tested the efficacy of an existing Internet safety training module, the Goodwill Community Foundation (GCF) Internet Safety Tutorial suite (located at http://www.gcflearnfree.org/internetsafety), utilizing eye-tracking software in a lab setting with six senior participants. Eye-tracking technology allowed the tester to observe and explore the specific fixations older individuals had when completing the tutorial task, and led to understanding how the mental models for information-seeking behavior affected the overall experience. One of the major observations was that older participants expected the content of each page of the tutorial to be on the screen, and were not accustomed to scrolling down the page. The major design flaw of the GCF tutorial was having the navigation buttons 'below the fold,' or outside of the viewable area of the screen, which meant that users were required to scroll down in order to click 'Next' and move forward. All of the findings and age-specific observations were interpreted and incorporated into the 2016 custom Internet Safety Training module developed for this study.

The Internet Safety Training tutorial developed in Azure (besafe.azurewebsites.net) was tested in two parts: a paper prototype, analyzing primarily the content, diction, and organization of the training; and a digital prototype, incorporating the research, findings from the pilot study, and findings from the paper

prototype, examining the user interaction and efficacy of all content and design elements. Four seniors participated in the paper prototype, and ten seniors participated in the digital prototype. All but two participants interacted with the training in the comfort of their own home environment, which was planned intentionally so that testing would occur in as close to a real-life scenario as possible and to make participants feel more at ease.

Results of the testing confirmed much of the established research on elderly computer users, especially the prescriptive guidelines to designing for seniors, and also brought to light questions and issues not considered. For example, the idea of the terms 'elderly' and 'senior' seem to require further examination to determine 1) what they imply, 2) what ages they include, and 3) whether the terms adequately account for the drastic variants between individuals on the lower end of the age bracket and those at the top. Participants on the lower end of the age bracket (65-70) were commonly still working or just recently retired, and were well-versed in the content of the training, whereas participants over 80 seemed to find the most value in the training; these older participants aligned more closely with the idea of 'elderly' in the research, and their age-related limitations were most apparent. Despite these variations, all 14 of the participants unanimously reported finding immense value in the training and stated that they would recommend the training to others.

Limitations

There were several limitations to this study that could be addressed in future iterations or studies on the subject. First, the development of the training itself was hindered by a very low budget, which meant that certain features and functionality were not possible. For example, use of narration by a senior-looking avatar, professional voice-over, dynamic editing, and advanced interactive modules would have been preferable, but could not be implemented with the available resources.

Second, the number of participants was too small to be statistically significant. While the information gathered from the current study was valuable and led to greater

insight and understanding of the online senior demographic, further large-scale quantitative studies would be beneficial in verifying these findings.

Third, the elderly users who participated in the study were all in the same relative geographic location, had a high level of income and education, and were all in good physical and mental health. Consequently, the efficacy of the training may not have been as thoroughly tested as it could have been with a more diverse population (i.e., lower income, less educated, diverse regional dialects, different regional job market, etc.).

Fourth , the 'positivity bias' phenomenon noted in the literature review made it exceptionally important to observe users' actions and responses as opposed to asking them for feedback directly. The subjects of the study indeed exhibited tendencies of politeness and positivity, regardless of their interaction with the prototype(s). Subjective results obtained via post-questionnaire were overwhelmingly positive, which may or may not indicate success of the design.

Finally, time was a limitation in this study. More rounds of testing could have helped improve the results. Time to create more iterations of the training would have eliminated some of the more troublesome findings.

Research Contribution

The research contribution of this study consists primarily of the prototype for an Internet Safety Training tutorial/module, along with the results of the pilot eye-tracking study, paper prototype, and digital prototype usability testing. The training module incorporates established principles regarding designing for seniors as well as content specific to the Internet activities engaged in most by this population: computer ownership, email, web browsing, shopping, and social media. Because free, accessible, online training about Internet security is not generally designed for, or available to, seniors, this training and the associated research contribute something unique to both the online senior community and researchers alike.

The significance of the study is that it 1) examines the elements of successful design via research, observation, and interaction with seniors, 2) contributes original findings through usability testing and analysis, 3) challenges stereotypes related to seniors with respect to technology, 4) provides customized internet safety training for seniors at no cost, and 4) recommends future path of research and development opportunity for the implementation of further training tailored to seniors.

Suggestions for Future Iterations

For the Internet Safety Tutorial to be effective, several improvements would need to be made, based on the feedback and input from users in testing. Most importantly, the tutorial should be broken down into individual slides so that users can click through at their own pace. The original intent was to avoid having the user clicking 30+ times, but having the tutorial broken down into sections this way caused a lot of confusion about how to interact with the 'Next' button and when to move forward. Giving the user more control over the slides would definitely improve the user experience.

Another important change would be to ensure that the 'Next' button could be double-clicked, as that is a common practice among elderly individuals. In the current prototype, double-clicking would move the user forward two sections rather than just one. The pilot study elicited the same issue with double-clicking, which supports the consensus in research that elderly individuals have difficulty clicking and double-clicking on targets using a cursor/mouse (National Institute on Aging, 2009; Smith, Sharit, & Czaja, 1999).

In the second iteration, the colors of the pop-up boxes showing self-check results were changed to a lime/neon green and a neon purple color (Figure 15). These colors were a little too vibrant/ distracting, so they should be changed to a more subdued green and purple color. There were also some wording and spacing issues in the text of the self-check result boxes. These should clearly say 'Yes!!!' or 'Please Try Again' so that the user knows whether or not they got the question right. The word 'True' or 'False' in the pop-up box is unnecessary, and it has the potential to confuse the user by insinuating that the answer *should be* 'True'/'False' as opposed to the answer they chose. Below that should be the explanation of why the answer was correct or incorrect. The 'Okay' button (to continue on) should be at the bottom right of the box.

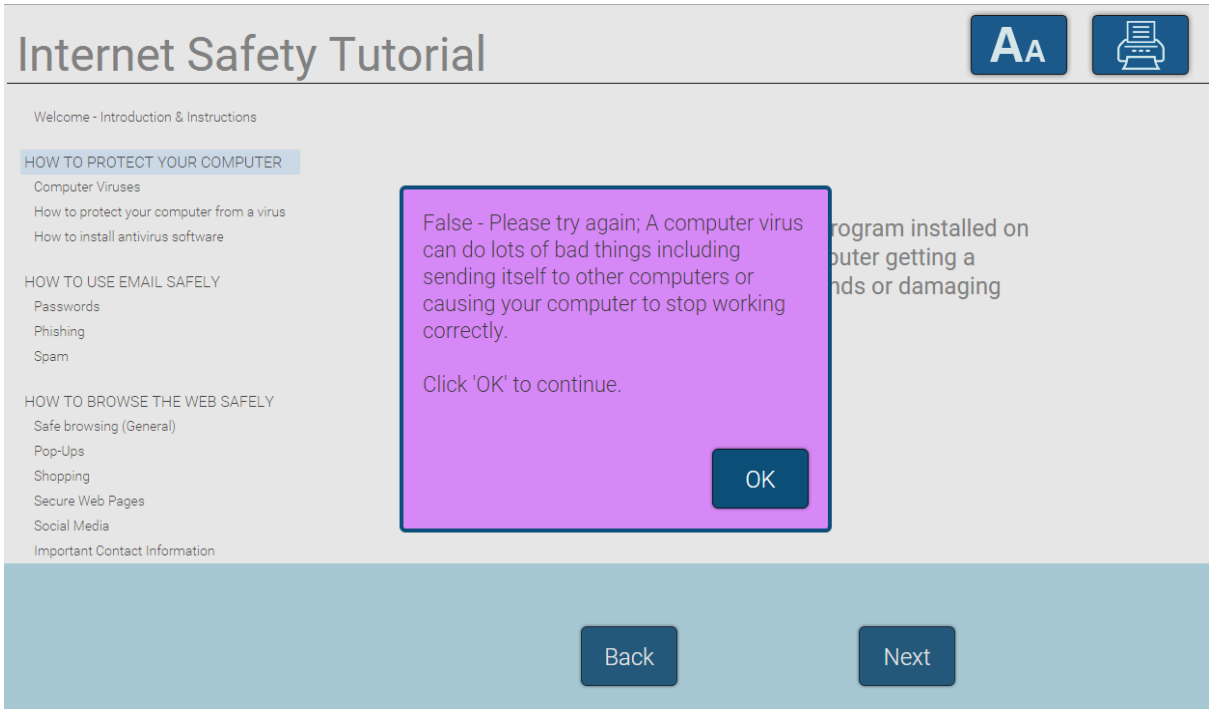

Figure 15. Self-Check Pop-Up Box

Additionally, it might be helpful to have a description of the size of monitor that best displays the training. Users with very small laptops had trouble reading all of the text on the screen. The larger text sizes were definitely appreciated by users, and on smaller screens it was clear that users were leaning in or squinting to read the page. The ability

to use at least a 14-point font, with an option to increase to 16-point or 18-point, was quite a challenge on small screens. Another solution could include developing the training on another platform, where the content of the page sizes itself based on the size of the screen so that the integrity of the design is not lost. Another issue that could be easily fixed was the audio volume. It was too quiet to hear very well, even at the loudest speaker setting. Older users need to be able to hear the narration (if they choose to listen to it) in spite of age-related hearing loss, and consequently they should have the ability to adjust the volume to whatever level is appropriate for them.

Based on the observation that most participants did not consider themselves to be 'seniors' or 'elderly,' it might be beneficial in future iterations for there to be one or several avatars of older adults talking about specific Internet safety issues or video segments of actual seniors providing anecdotes to support the content. This may help the user relate to the training in a meaningful way, as opposed to listening to a 'lecture' on Internet safety. Something else that might add to the value of the training would be a printable summary of safety tips and contact information for reporting scams/fraud. This quick reference page could stay on the user's desk as a reminder of the most important tips to stay safe.

Future versions of the training should also incorporate user feedback by adding layering for a range of users. It was clear after observing many participants in the digital prototype that much of the basic internet safety material was already known. Participants stated after going through the training that they "knew most of it already" either from job training or personal experience. Therefore, accommodating two to three levels of computer experience would be useful; for example, 'Novice,' 'Intermediate,' and 'Advanced.' Another option would be to create a hierarchy of topic areas, starting at the most general and then digging into the specifics of each section, giving the user the ability to choose how in-depth to go.

Finally, as mentioned earlier, it is crucial to have the training available on mobile devices and tablets in addition to laptops and computers. It was clear that participants expected to be able to interact with the tutorial by way of touch screen. That format

would also be beneficial in scaling the text size, depending on how large or small of a screen is used.

Further Research and Development

There are a number of ways this study could be applied to further research and development. With the growing number of older adults going online, there are many opportunities for developing senior-specific training courses related to online security; for example, online banking tutorials, online shopping tutorials, computer/technology tutorials, etc. Future online training opportunities for seniors could also include other areas of scams/fraud, such as phone, door-to-door, friends/family/caretakers, etc.

The Internet Safety digital prototype could also be developed on a larger scale, using more advanced technology to accommodate mobile devices and tablets, as well as scaling to individual screen sizes on computers. In a more robust version, more interactivity could be introduced by way of avatars or video clips (e.g., anecdotal lessons with senior representatives), and additional features could be introduced, such as the ability to click/touch key terms to see their definitions. More in-depth self-check/quiz sections could involve more than just True/False questions; for example, users could be asked to match terms to pictorial representations by dragging and dropping. Many of the e-learning and Learning Management Software (LMS) offerings include similar features and would likely incorporate many of the suggested improvements. Once developed, the training could then be widely available on either computers/devices targeted to older adults, or on web pages most often used/visited by seniors, such as AARP.

In terms of research, there is much to be discovered about the elderly population. The most prevalent gap in research observed was that of eLearning usability involving seniors. Most usability research performed on eLearning with elderly persons is centered on teaching basic computer skills, rather than moving on to more expansive topics. Seniors have a desire to learn, and lack the opportunity to do so on thoroughly-tested eLearning/online platforms. Additionally, this study addressed a number of design elements and content development/ organizational principles, but further analysis of age-

specific characteristics and limitations by age bracket is required. There can often be a significant difference between a 65-year-old and an 85-year-old, both physically and mentally, and more research on those differences would aid in developing levels of online training or adjusting design elements for any web-based media. However, age alone may not be the primary indicator when it comes to creating distinctive categories, as there can also be dramatic differences between elder individuals of similar age, depending on health, mobility, education, occupation, and the like. Several theories exist on the categorization of aging adults – ranging from the young-old, categorized by those 55-75 who are relatively healthy, educated, have high purchasing power, enjoy more free time, and are politically active; and the old-old, including those 75 and older who are less healthy overall, in need of assisted housing and transportation, and are less productive by comparison (Neugarten, 1974). Some delineations include a category called the "middle-old" which breaks the ages down further and includes those aged 75-84 (OpenStax CNX, 2016), but the point to keep in mind is that chronological age is really not a definitive marker when it comes to health and cognitive ability.

Additionally, delving further into the specific vulnerabilities of older individuals, when it comes to scams and fraud, would be hugely beneficial to the development of further training material. Knowing how seniors can reduce their vulnerability based on this research would be hugely beneficial.

There will always be an opportunity for further study when it comes to technology. As technology changes, the need to adjust the target of study and development is inevitable. Therefore, a reevaluation of the concepts and design principles will have to happen regularly. Content specific to scams online (and offline) will also change frequently, as the methods and execution of scams are constantly evolving.

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Appendices

Appendix A: Participant Recruitment

PARTICIPANT RECRUITMENT

UNIVERSITY OF BALTIMORE SCHOOL OF INFORMATION ARTS AND TECHNOLOGIES

The Study – The researcher is observing 10-15 individuals **over 65 years of age who use the Internet 3+ hours per week** in order to determine the efficacy of Internet safety training designed for this age group. The results will help establish a deeper understanding of design factors, comfort level, and content associated with Internet training modules and general Internet safety.

Process – You were selected as a possible participant due to your age and level of Internet usage. If you decide to participate, you will be asked to complete a brief training tutorial at a location of your choice (typically your home/institution) and then asked a series of questions about your experience. The researcher will observe you, take notes, and your session may be video or audio recorded. The process should take no longer than 60-90 minutes.

Confidentiality – Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Participants will be assigned a subject number in order to remain anonymous.

Compensation – Participants will receive a $25 Gift Card as a thank-you for helping with the study.

Questions – If you have any questions about this study, please feel free to contact Lianne Appelt at 240-446-2292 or via email at liannecatherine@gmail.com

Appendix B: Participant Documents

STAYING SAFE ON THE INTERNET

CONSENT & SURVEY

Thank you for your participation in this study. The following document contains the consent form and a brief survey prior to completion of the course.

PARTICIPANT CONSENT

University of Baltimore School of Information Arts and Technologies

The Study – The researcher is observing 10-15 individuals over 65 years of age in order to determine the efficacy of Internet safety training designed for this age group. The results will help establish a deeper understanding of design factors, comfort level, and content associated with Internet training modules.

Process – You were selected as a possible participant due to your age and level of Internet usage. If you decide to participate, you will be asked to complete a brief training tutorial at a location of your choice (typically your home/institution) and then asked a series of questions about your experience. The researcher will observe you, take notes, and your session may be audio and screen activity recorded. The process should take no longer than 60-90 minutes.

Confidentiality – Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Participants will be assigned a subject number in order to remain anonymous.

Questions – If you have any questions about this study, please feel free to contact Lianne Appelt at 240-446-2292 or via email at liannecatherine@gmail.com

Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, and that you are not waiving any legal claims.

_____ _____

Participant Signature Date

SURVEY

Thank you for your participation in this study. Please take a few minutes and answer the following questions to the best of your ability.

Name: Participant Number:

Age: Gender: Ethnicity:

Household Income:

Highest Level of Education:

Do you have regular (daily) access to a computer or laptop?

Do you currently own a computer or laptop?

How often do you use the Internet?

How many hours per week do you spend on the Internet?

What are your typical Internet activities? Please check all that apply.

- Email
- General Browsing
- Searching/Browsing Medical Information
- Searching/Booking Travel
- News
- Shopping
- Games
- Social Media (Facebook, Online Communities, Chat Rooms, etc.)
- Other (Please specify): _____

On a scale of 1 (least comfortable) to 10 (most comfortable), how comfortable are you with sharing your personal or financial information online?

What was your reasoning for the number you chose above?

What concerns do you have (if any) regarding safety when you go online?

What do you hope to learn from the Internet Safety Training tutorial?

POST-OBSERVATION QUESTIONS

Thank you for completing the Internet Safety Training tutorial! Please take a few moments to answer the following questions.

What was your overall impression of the training?

What did you like about the training?

What (specifically) did you learn that you didn't know before from the training? Did anything surprise you?

What suggestions would you make for improvement of the training? Feel free to include both content and design characteristics in your suggestions.

What will you take away from the training and apply to your online activities (if anything)?

Please answer **Strongly Agree, Agree, Disagree, Strongly Disagree or Unknown** to the following statements, and include comments if desired:

The course content was simple and understandable.

The illustrations, audio, and interactive features were helpful.

I could navigate the course very easily.

I liked the look and feel of the course.

The course has improved my knowledge on the subject.

The duration of the course was just right.

Thank you!

Appendix C: Test Protocol

TEST PROTOCOL – INTERNET SAFETY TRAINING

Document overview – this document details the test plan for conducting a usability test in the development of eLearning/onlineLearning modules and for greater understanding of the participant demographic. The goals of this test include establishing a baseline of user performance, evaluating the content requirements for elderly users on Internet security/safety, and identifying potential design concerns to be addressed in order to improve the efficiency, productivity, and end-user satisfaction.

The usability test objectives are:

- To determine design inconsistencies and usability problem areas within the user interface and content areas. Potential sources of error may include:
  - Navigation errors – failure to locate functions, excessive keystrokes to complete a function, failure to follow recommended screen flow.
  - Presentation errors – failure to locate and properly act upon desired information in screens, selection errors due to labeling ambiguities.
  - Audio/Technology errors – failure to provide appropriate technology for the intended course
  - Content mismatch – failure to address topic areas appropriate to the demographic, failure to provide understandable material, etc.
- Exercise the training tutorial under controlled test conditions with representative users. Data will be used to access whether usability goals regarding an effective, efficient, and well-received user interface have been achieved.
- Establish baseline user performance and user-satisfaction levels of the user interface for future usability evaluations.

Participants – subjects of this study will be chosen based on the following criteria: 1) age over 65 years, 2) Internet use more than 3 hours per week, and 3) regular access to the Internet/computer.

10-15 participants will be chosen based on the above criteria and sessions will be held at their home or community computer/laptop. Testing will occur between 04/2015-06/2015 provided the number of participants can be attained.

Methodology - participants will be recruited via word of mouth, cold calling independent living facilities locally, via social media, friends and family, and via sign up sheet at senior centers. Ten to fifteen participants will be selected based on their age and experience with the Internet. Participants who use the Internet more than 3 hours per week and have regular access to a computer connected to the internet will be qualified to complete the study.

The participants' responsibilities will be to first complete a short survey that establishes their demographic and current level of comfort using the Internet and sharing sensitive information online. Participants will then be asked to complete a high-level Internet security training module intended to provide the basics of navigating the Internet safely. The training itself should take no longer than 30 minutes. The facilitator will be observing and taking notes during the training to capture any pertinent information related to the participant's experience. The participant will then be asked to complete another brief survey asking their opinion on the training, including both content and design attributes.

Procedure - Participants will take part in the usability test at their home or at a designated computer lab where he/she feels most comfortable. The purpose of performing the testing in their home environment is to gain a keen understanding of how the participant interacts normally with their own computer. It also provides a level of comfort that a usability lab or unfamiliar computer may not. The type of computer participants use is irrelevant as long as they are able to access the Internet, although the type will be noted by the facilitator for research purposes.

The participant's interaction with the training tutorial will be monitored by the facilitator seated in the same area/room. The facilitator will be taking notes, and may record (audio) and capture screen activity from the session. Audio and/or screen activity will be captured via GoToMeeting or the like.

The facilitator will brief the participants on the tutorial and instruct the participant that they are evaluating the training, rather than the facilitator evaluating the participant. Participants will sign an informed consent that acknowledges: the participation is voluntary, that participation can cease at any time, and that the session will be audio/screen activity recorded but their privacy of identification will be safeguarded. The facilitator will ask the participant if he/she has any questions.

Participants will complete a pre-survey establishing background information and demographics. The facilitator will explain that the amount of time taken to complete the task will be measured and that exploratory behavior outside the test task should not occur until after completion of the task.

The facilitator will encourage the participant to "think aloud" so that a verbal record exists of their interaction with the tutorial. The facilitator will observe and enter user behavior, user comments, and system actions in a note pad or the like.

After the training, the participant will be asked to complete a short post-survey and elaborate on the task session.

Ethics -

All persons involved with the usability test are required to adhere to the following ethical guidelines:

- The performance of any test participant must not be individually attributable. Individual participant's name should not be used in reference outside the testing session.
- A description of the participant's performance should not be reported to his or her manager.

Usability Metrics -

Usability metrics refers to user performance measured against specific performance goals necessary to satisfy usability requirements. Scenario completion success rates, adherence to dialog scripts, error rates, and subjective evaluations will be used. Time-to-completion of scenarios will also be collected.

Scenario Completion

The facilitator will require, or request, that the participant obtains or inputs specific data that would be used in course of a typical task. The scenario is completed when the participant indicates the scenario's goal has been obtained (whether successfully or unsuccessfully) or the participant requests and receives sufficient guidance as to warrant scoring the scenario as a critical error.

Critical Errors

Critical errors are deviations at completion from the targets of the scenario. Obtaining or otherwise reporting of the wrong data value due to participant workflow is a critical error. Participants may or may not be aware that the task goal is incorrect or incomplete.

Independent completion of the scenario is a universal goal; help obtained from the other usability test roles is cause to score the scenario a critical error. Critical errors can also be assigned when the participant initiates (or attempts to initiate) and action that will result in the goal state becoming unobtainable. In general, critical errors are unresolved errors during the process of completing the task or errors that produce an incorrect outcome.

Non-critical Errors

Non-critical errors are errors that are recovered from by the participant or, if not detected, do not result in processing problems or unexpected results. Although non-critical errors can be undetected by the participant, when they are detected they are generally frustrating to the participant.

These errors may be procedural, in which the participant does not complete a scenario in the most optimal means (e.g., excessive steps and keystrokes). These errors may also be errors of confusion (ex. initially selecting the wrong function, using a user-interface control incorrectly such as attempting to edit an un-editable field).

Noncritical errors can always be recovered from during the process of completing the scenario. Exploratory behavior, such as opening the wrong menu while searching for a function, will be coded as a non-critical error.

Subjective Evaluations

Subjective evaluations regarding ease of use and satisfaction will be collected via questionnaire, and during debriefing at the conclusion of the session. The questionnaire will utilize free-form responses and rating scales.

Scenario Completion Time (time on task)

The time to complete each scenario, not including subjective evaluation durations, will be recorded.

Usability Goals -

The next section describes the usability goals for The Internet Safety Training.

Completion Rate

Completion rate is the percentage of test participants who successfully complete the task without critical errors. A critical error is defined as an error that results in an incorrect or incomplete outcome. In other words, the completion rate represents the percentage of participants who, when they are finished with the specified task, have an "output" that is correct. Note: If a participant requires assistance in order to achieve a correct output then the task will be scored as a critical error and the overall completion rate for the task will be affected.

A completion rate of 100% is the goal for each task in this usability test.

Error-free rate

Error-free rate is the percentage of test participants who complete the task without any errors (critical or non-critical errors). A non-critical error is an error that would not have an impact on the final output of the task but would result in the task being completed less efficiently.

An error-free rate of 80% is the goal for the task in this usability test.

Time on Task (TOT)

The time to complete a scenario is referred to as "time on task". It is measured from the time the person begins the scenario to the time he/she signals completion.

Subjective Measures

Subjective opinions about specific tasks, time to perform each task, features, and functionality will be surveyed. At the end of the test, participants will rate their satisfaction with the overall system. Combined with the interview/debriefing session, these data are used to assess attitudes of the participants.

Reporting Results –

The Usability Test Report will be provided at the conclusion of the usability test. It will consist of a report and/or a presentation of the results; evaluate the usability metrics against the pre-approved goals, subjective evaluations, and specific usability problems and recommendations for resolution. The recommendations will be categorically sized by development to aid in implementation strategy.

Appendix D: IRB Approval Letter

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UNIVERSITY OF BALTIMORE

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Research

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April 16, 2015

Lianne C, Appelt
College of Arts and Science
University of Baltimore
1420 N. Charles Street
Baltimore, MD 21201

Dear Ms. Applet:

This letter serves as official confirmation of the Institutional Review Board's review of your protocol for a study entitled "Designing for the Elderly user: Internet Safety Training," submitted for review on March 18, 2015.

The Institutional Review Board considered your request and concluded that your protocol poses no more than minimal risk to participants. In addition, research involving the use of widely acceptable survey/interview procedures where the results are kept confidential and the questions pose minimal discomfort to participants is exempt from IRB full-committee review per 45 CFR 46.101 (b) (2). As a result, the Institutional Review Board has designated your proposal as exempt.

Investigators are responsible for reporting in writing to the IRB any changes to the human subject research protocol, measures, or in the informed consent documents. This includes changes to the research design or procedures that could introduce new or increased risks to human subjects and thereby change the nature of the research. In addition, you must report any adverse events or unanticipated problems to the IRB for review.

If you have any questions, please do not hesitate to contact me directly by phone or via email.

As authorized by P. Ann Cotten, C.P.A., D.P.A.
Chair, Institutional Review Board

Jocelyn L. Klucar, CRA
Coordinator, Institutional Review Board

cc: K. Summers

Appendix E: Eye-Tracking Pilot Study

Lianne Appelt
Advanced Eyetracking, K. Summers
University of Baltimore

Individual Project – Test Plan

Description: The purpose of the test plan is to test the design, layout, content, and overall ease of use of the GCF Free online Internet Safety tutorial for elderly users (65+).

Tutorial : http://www.gcflearnfree.org/internetsafety

Participants: 6-8

Pre-Questionnaire

1. How often do you use the internet in any given week?
2. On a scale of 1-10 (1 low, 10 high) how comfortable are you on the computer?
3. Have you ever been a victim of an (attempted) internet scam?
4. What precautions, if any, do you take when using the internet to avoid identity theft, scamming, etc.?
5. Do you ever shop online?
6. What is your biggest fear about using the internet?

Task 1: Introduction to Internet Safety

Participants will go through the first, second, or third of 8 modules on Internet Safety on the web page, including interactions with interactive portions of the media.

Internet Safety

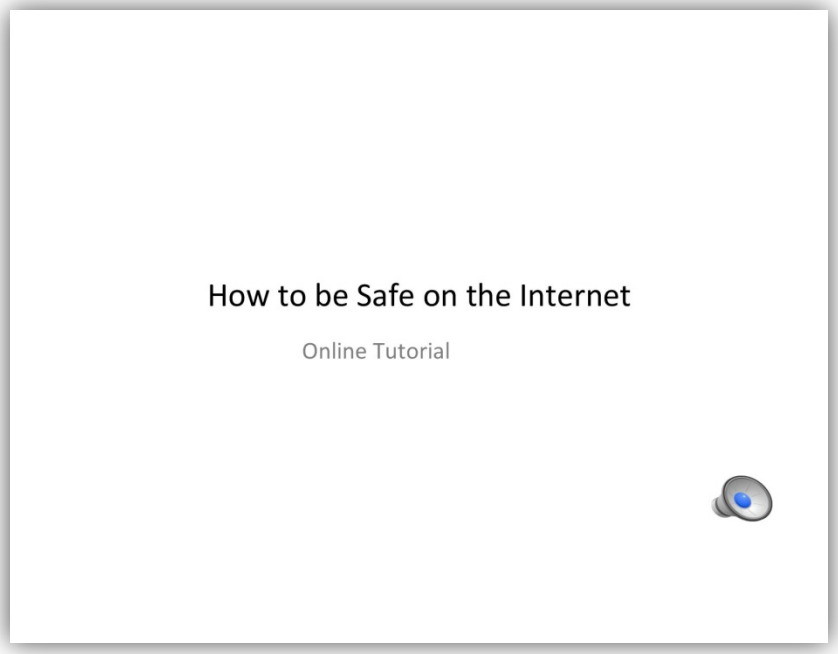
- 1: Introduction to Internet Safety
- 2: Protecting Your Computer from Internet Threats
- 3: Email Tips for Scams and Spam

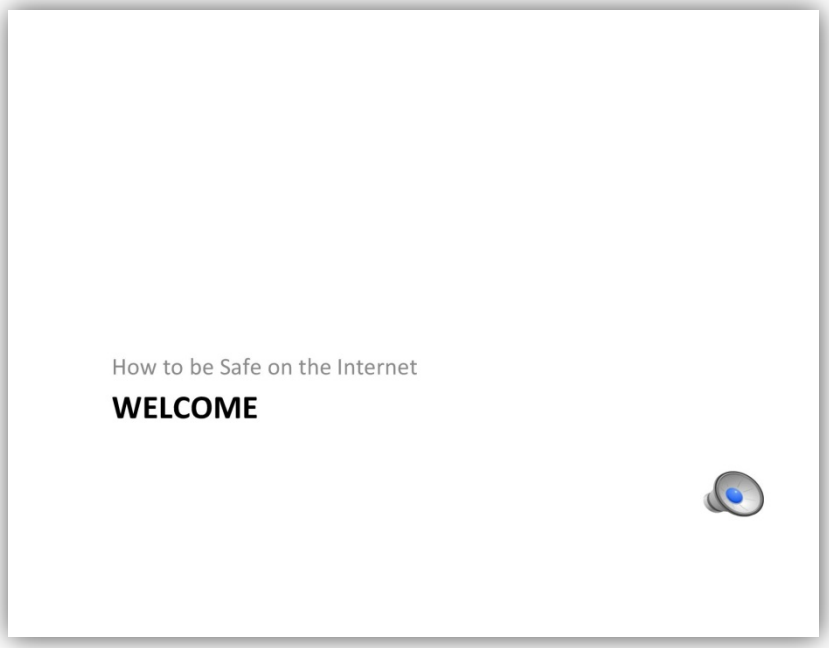
Time/Duration – 20 minutes

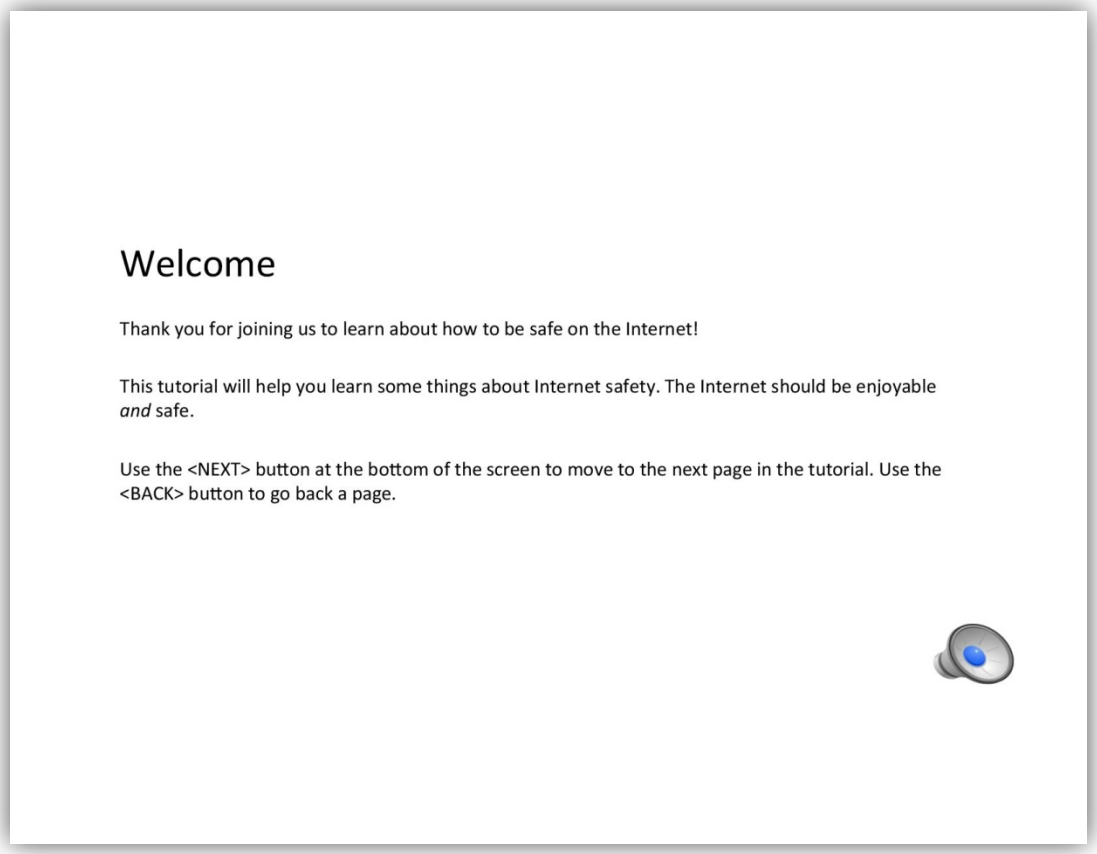
Follow up questions:

1. Was it easy or difficult to navigate the tutorial on Internet safety/other modules?
2. What did you learn that you didn't know about internet safety?
3. What was your overall impression of this tutorial?
4. What would you have liked to learn more about?
5. What improvements would you suggest for this tutorial, if any?

Appendix F: Internet Safety Training Storyboard







How to use the tutorial

The <TEXT SIZE> button allows you to change the words on the page to be bigger or smaller based on your preference.

If you'd like to print a page (or pages) of the program for reference, use the <PRINT> button at any time.

To turn sounds off, click the <MUTE> button. Click it again to turn sounds back on.

The <HOME> button will take you to the main menu where you can choose a section or topic to learn more about.

When you're ready, click <NEXT> to start the tutorial!

Introduction

As you know, the Internet is an exciting tool that allows you to do many things.

You can:

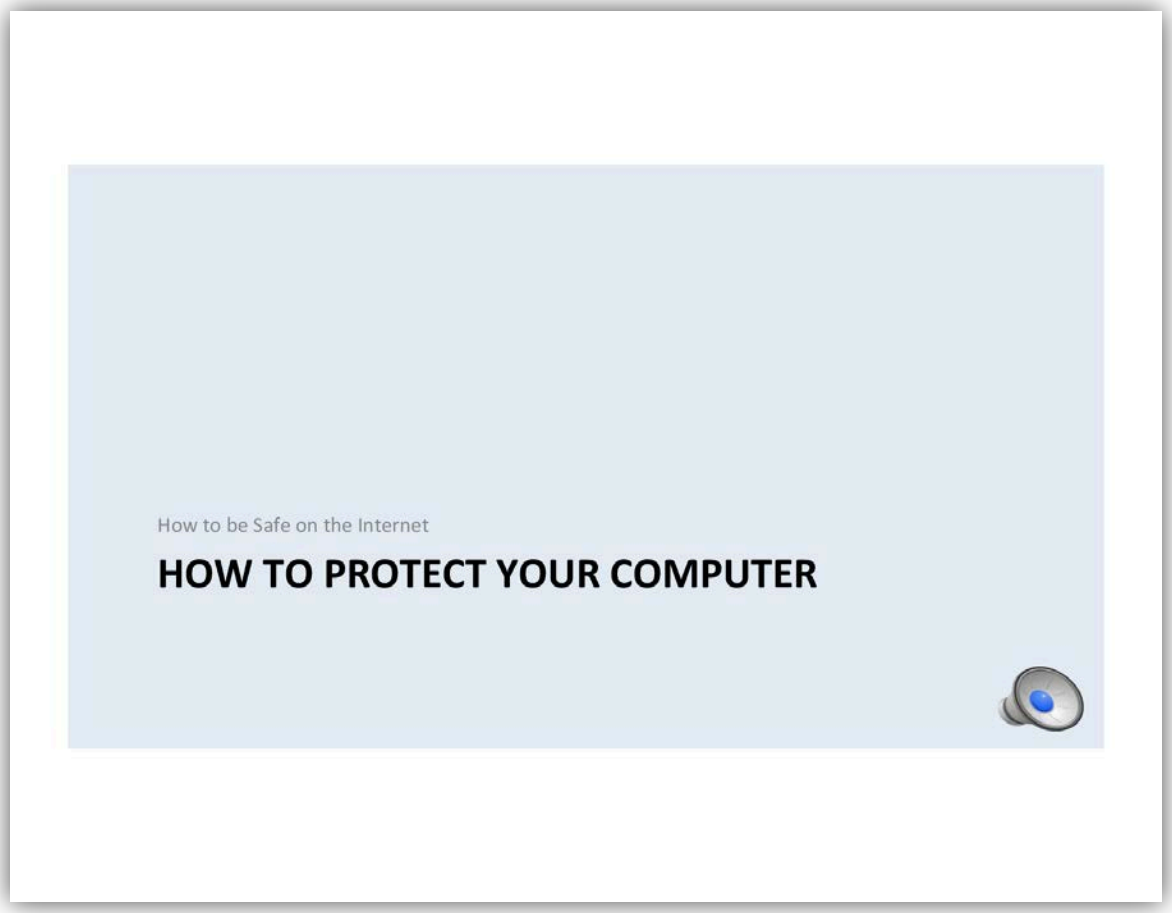
- Find information
- Send email
- Chat with friends
- Shop
- Do your banking
- Read the news
- Check the weather
- Plan a vacation

However, you do have to be careful when you go on the Internet. Sometimes people use the Internet to do bad things, like try to steal your money.

Topics

To learn how to protect yourself and your computer, this tutorial is broken down into the following sections:

- How to protect your computer
- How to use email safely
- How to browse the web safely



Computer Viruses

Before you even connect your computer to the Internet, you will want to be sure that it is protected from attack. A computer can get a "virus" when it is connected to other computers on the Internet.

What is a computer virus?

A computer virus is a computer program that makes your computer do bad things. A computer virus can be loaded on to your computer without you knowing it and runs even if you don't want it to.

Computer Viruses

What do computer viruses do?
Computer viruses can make your computer do lots of bad things like:

- Delete your data
- Use your email program to send the virus to your friends
- Make your computer stop working
- Send your bank or personal information to crooks

How do you know if you have a computer virus?
You can have a computer virus and not even know it. However, some viruses cause your computer to behave strangely. If your computer is doing any of these things, you might have a virus:

- Messages or pop-ups that cannot be closed
- Programs cannot be opened
- You're locked out of your computer
- Messages are sent from your email that you did not send
- Your computer stops working altogether

How to Protect Your Computer

Just like you can protect your body from getting the flu with a flu shot, computers can be protected by what is called an anti-virus program.

An anti-virus program routinely checks your computer for known viruses and keeps them from getting onto your computer.

In the same way you need a new flu shot every year because the flu viruses change, you need anti-virus protection that stays up-to-date. Crooks keep writing new bad programs, so the anti-virus software has to guard against new computer viruses all the time.

How to Protect Your Computer

The best anti-virus software costs between $25-60 per year. Some of the top products include:

- McAfee Anti-Virus – www.mcafee.com
- Trend Micro Anti-Virus – www.trendmicro.com
- Norton Anti-Virus – www.norton.com

You can also get anti-virus software for free. These free ones aren't quite as powerful, but they still provide pretty good protection. Some free options include:

- Avast Free Anti-Virus – www.avast.com
- Panda Free Anti-Virus – www.pandasecurity.com
- Bitdefender Anti-Virus Free Edition – www.bitdefender.com

Installing Anti-Virus Software

You can buy discs at a computer store to install anti-virus software. Or, you can download it on the Internet and install it. The discs or the download will come with some instructions for installing the software.

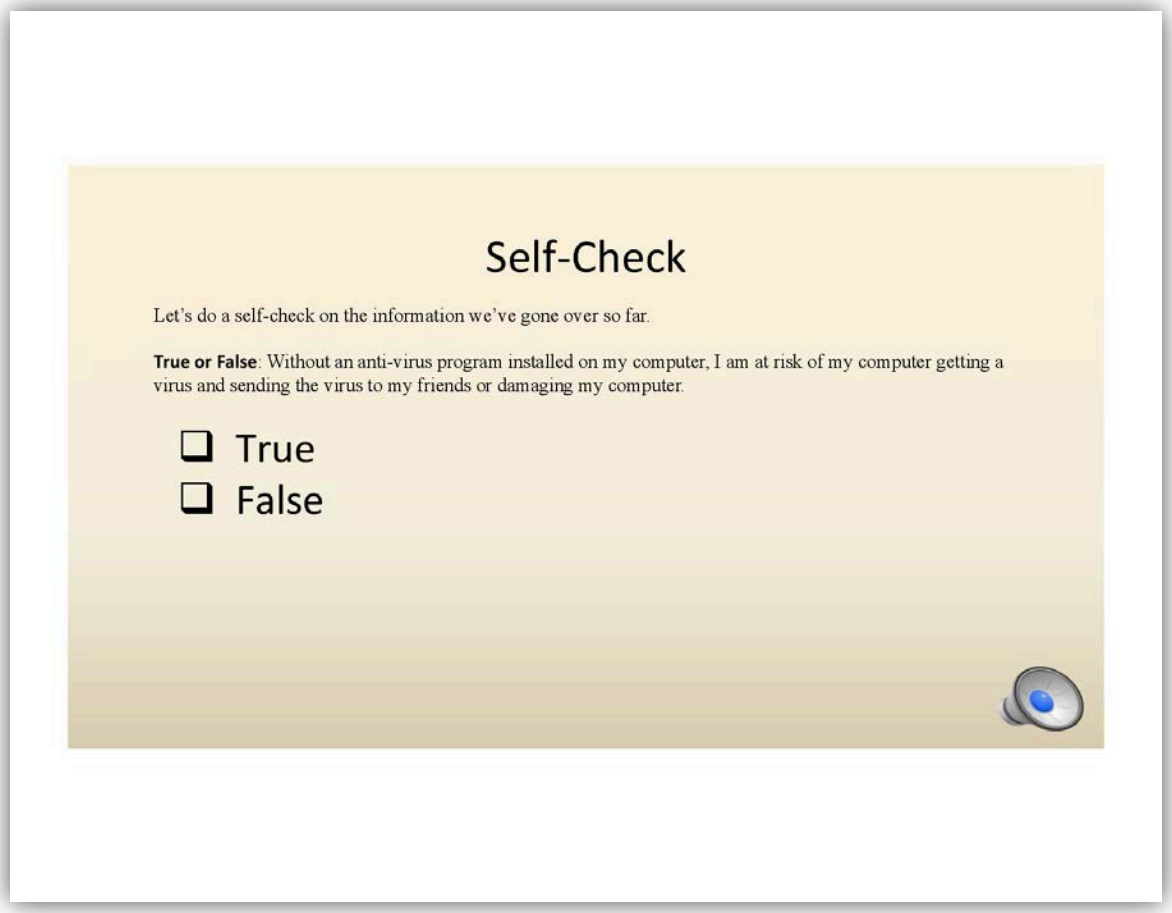
If you are not comfortable with installing the anti-virus software yourself, try to find someone who can help you. Once installed, the software will mostly run by itself.

If you buy your anti-virus software, companies often set up an automatic renewal. Your credit card will be billed once a year, and your anti-virus software will just keep protecting you.

Review

Let's review what we've learned about computer viruses…

- ✓ Before you start using the Internet you need to make sure that your computer is protected against computer viruses
- ✓ A computer virus is a program that makes your computer do things you don't want it to do
- ✓ You can choose anti-virus software that is free or that has a yearly fee
- ✓ Anti-virus software will help to keep your computer and your information safe



How to Use Email Safely - Passwords

A password is like a "key" that opens the door to your email. You should be the only one who has the "key" to your email.

The first thing you will need to do is to choose a good password.

Because passwords can be hard to remember, you may want to choose something like your name, date of birth, pet's name, children's birth dates, or something else easy for you to remember. **But don't do it.**

The problem with picking something easy for you to remember is that people looking to steal your "keys" will have a much easier time unlocking your account by guessing your password.

How to Use Email Safely - Passwords

Someone who knows you may be able to make guesses until they find the right password. Or, someone who doesn't know you might do some research about you, and then be able to guess the right thing. Worst of all, some crooks use computers to try lots of names and words and dates until they find one that works. A crook might try every word in the dictionary to find your password.

Crooks can also break into the computers used by a website to store information about its users. If a crook steals your password from the email company, then they don't need to guess it!

How to Use Email Safely - Passwords

Some people want to use the same password for all their accounts. This might make your life easier, but it also makes it easier for crooks. If they get your password for one account, they have your password for other accounts too!

So, you need different passwords for different things. If the account isn't very important, you can probably use an easier password. But if the password is for your bank, you should use a really hard password!

How to Use Email Safely - Passwords

So, how do you create a password that is hard to guess? Here are some tips:

Things you should **NOT** do:

- -Don't use your name, or the name of anyone in your family, or your pet's name
- -Don't use anyone's birthday, anniversary, or other important date
- -Don't use any words that can be found in a dictionary

Things you should do:

- -Include numbers or symbols
- -Include both upper case and lower case letters
- -Make your password 8 or more characters long

How to Use Email Safely - Passwords

You can also use a program called Norton IdentitySafe. This free program will keep track of all your passwords and also keep them safe.

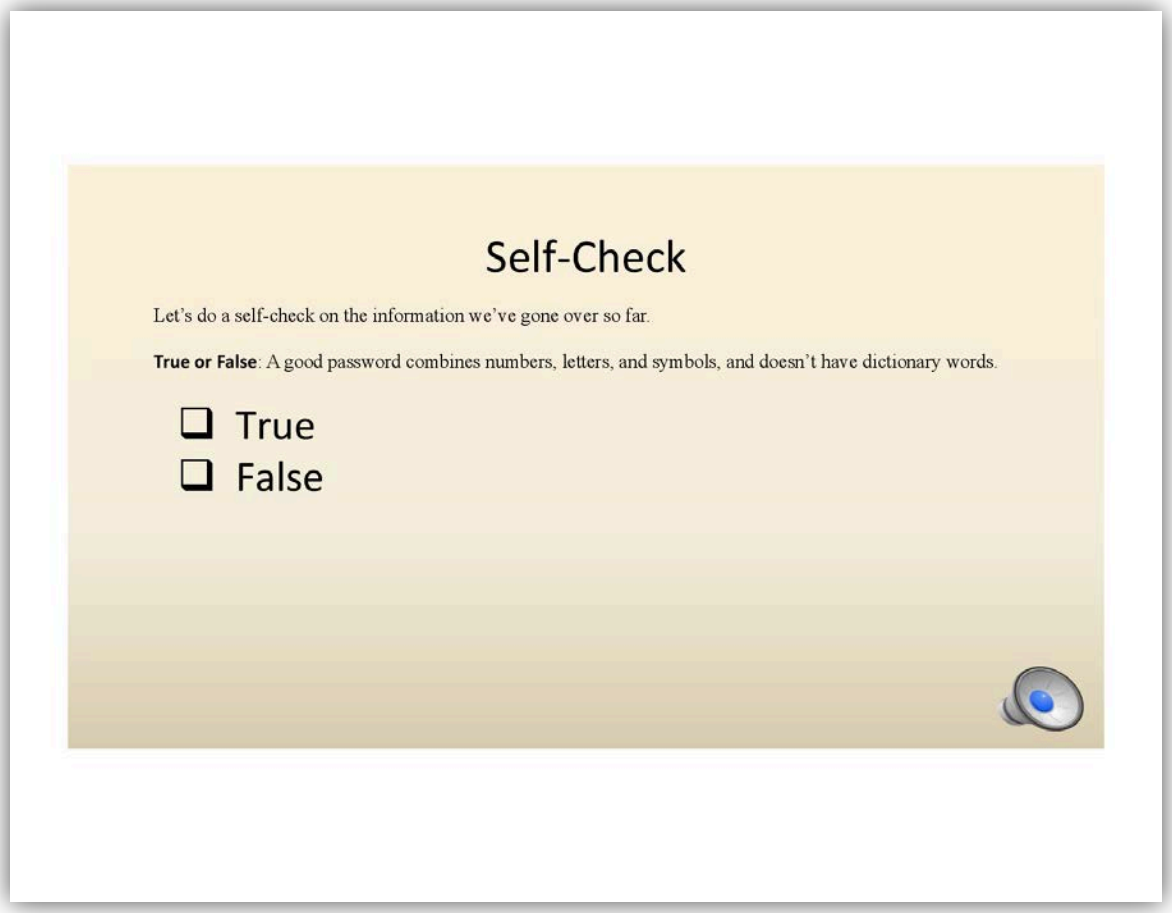
Norton IdentitySafe Details and Download: https://identitysafe.norton.com/

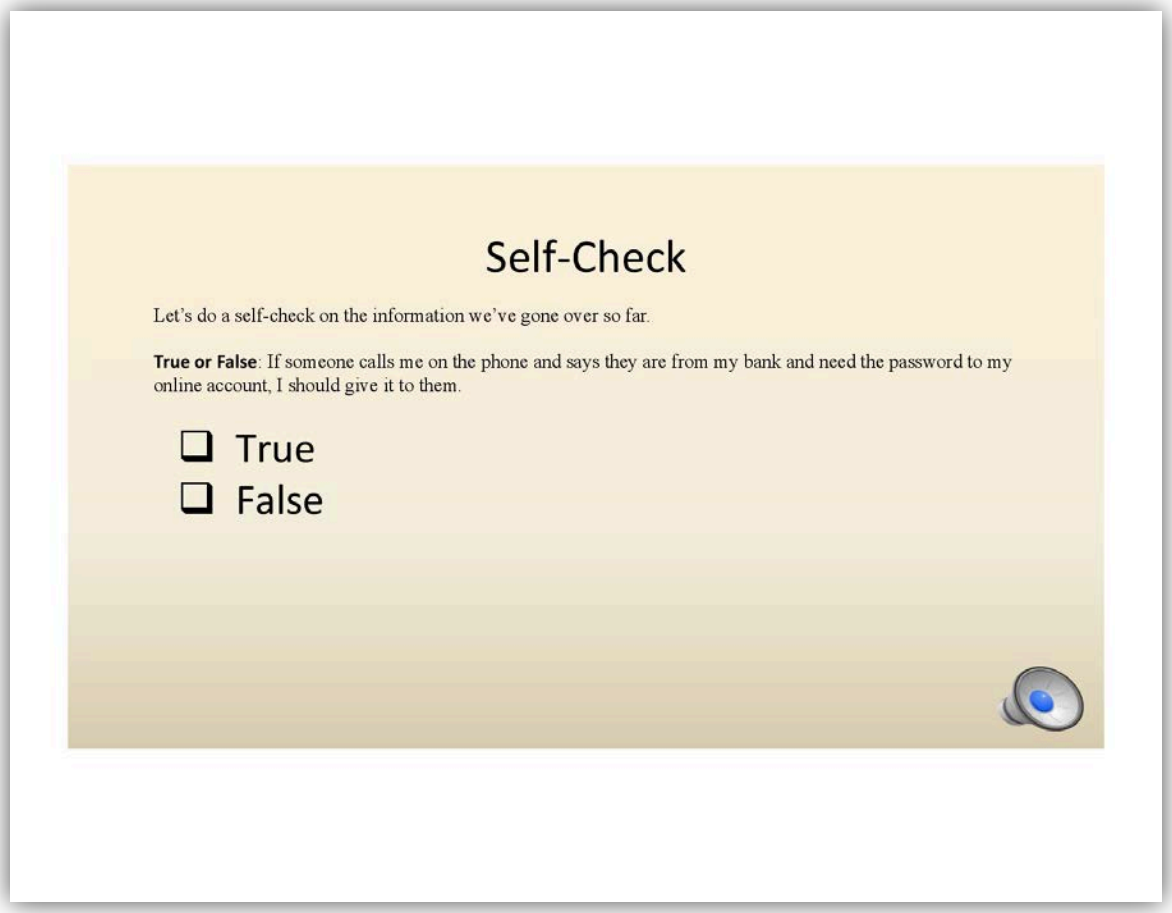
Pro Tip – no legitimate company, email technician, or administrator will EVER ask you for your password. If anyone emails you or calls asking that you provide your password for any account DO NOT GIVE IT TO THEM. There is a good chance the person asking for it is not who you think they are.

Review

Let's review what we've learned about passwords.

- ✓ A good password can help keep your information safe from crooks
  - A good password doesn't use names, dates or words.
  - A good password uses numbers or symbols.
  - A good password has both upper-case and lower-case letters.
- ✓ Using the same password for every Internet account means crooks only need to guess your password once
- ✓ If you write your passwords down, make sure you keep the paper safe or lock it up
- ✓ No real company will ever ask you for your password. Never give your password to someone who asks for it!





How to Use Email Safely - Phishing

The next thing you need to know has to do with the emails you get from other people.

Crooks sometimes use email to trick people into giving out their private information or to spread computer viruses. Using trick emails is called phishing.

How to Use Email Safely - Phishing

If you click on a link from a trick email, it will take you to a fake webpage that might even look real. When you sign in on the fake webpage, the crook will steal your username and password. Or, they might ask for money. Then crooks can use your information to access your real accounts, steal money, or pretend to be you so they can buy things.

Trick emails often have subjects like...

- •Wow, you won't believe this!
- •Your bank account is suspended
- •You've won a prize!
- •You won't believe what they said about you.
- •Your account has been closed

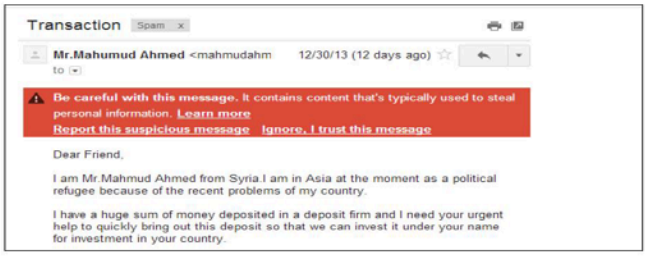
How to Use Email Safely - Phishing

- Never open an email that has an attachment if you do not know the sender, especially if the attachment has ".exe" or ".zip" at the end of the file name.

- A trick email greeting is often non-personalized or generic, such as "Dear Client" or "Dear Customer." (As in the example above)

How to Use Email Safely - Phishing

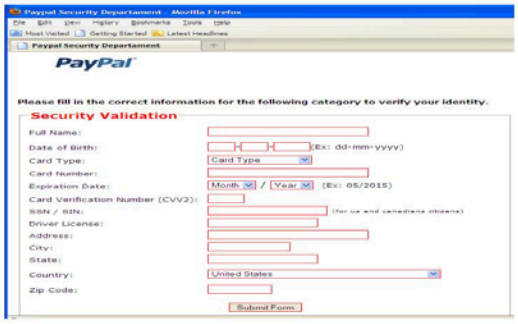
- Trick emails are often full of mistakes, and may be written in other languages.



- If you get a trick email from someone you really do know, then maybe your friend has a virus. You might want to warn them so they can check their computer.

How to Use Email Safely - Phishing

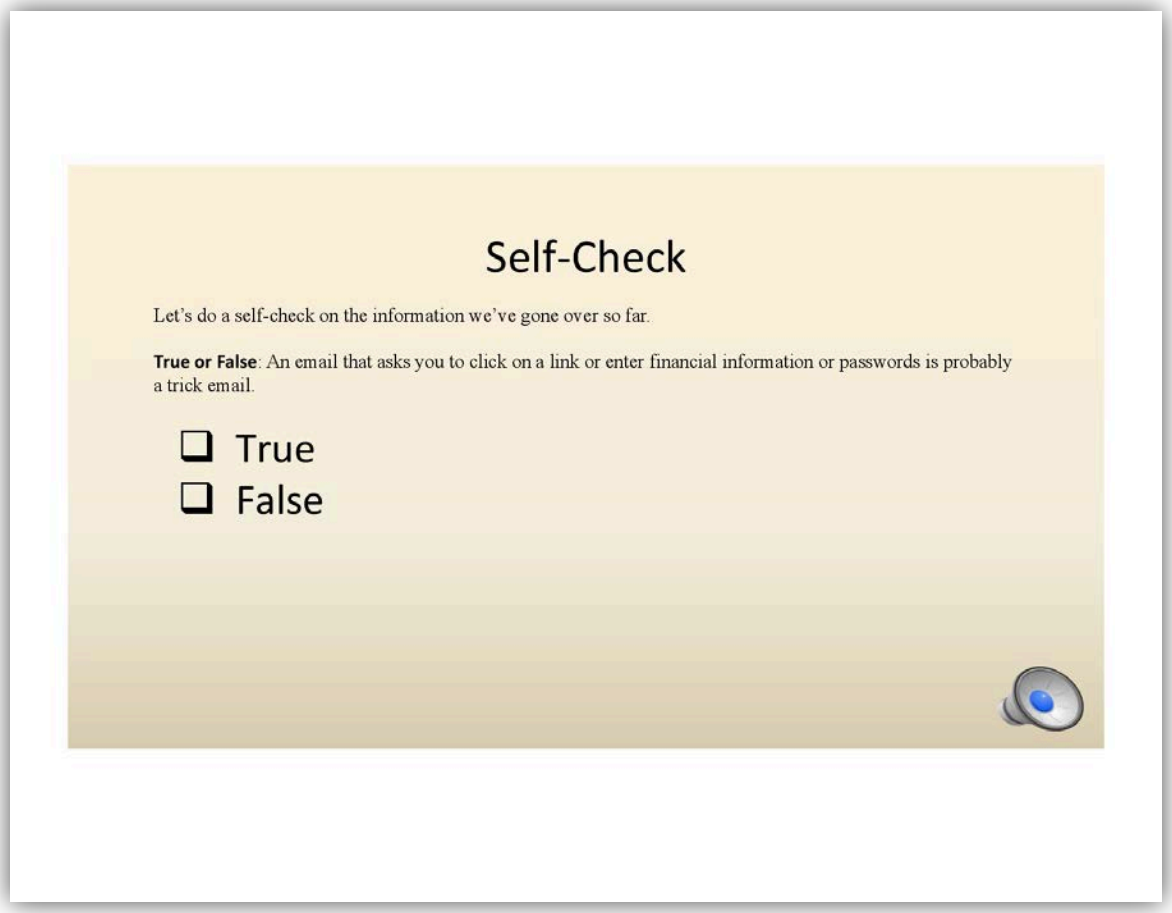
- Any email that asks you to click on a link to "confirm your identity" or "provide additional information" is probably trick. If you're not sure, contact the business directly without using any phone numbers or links provided in the email.

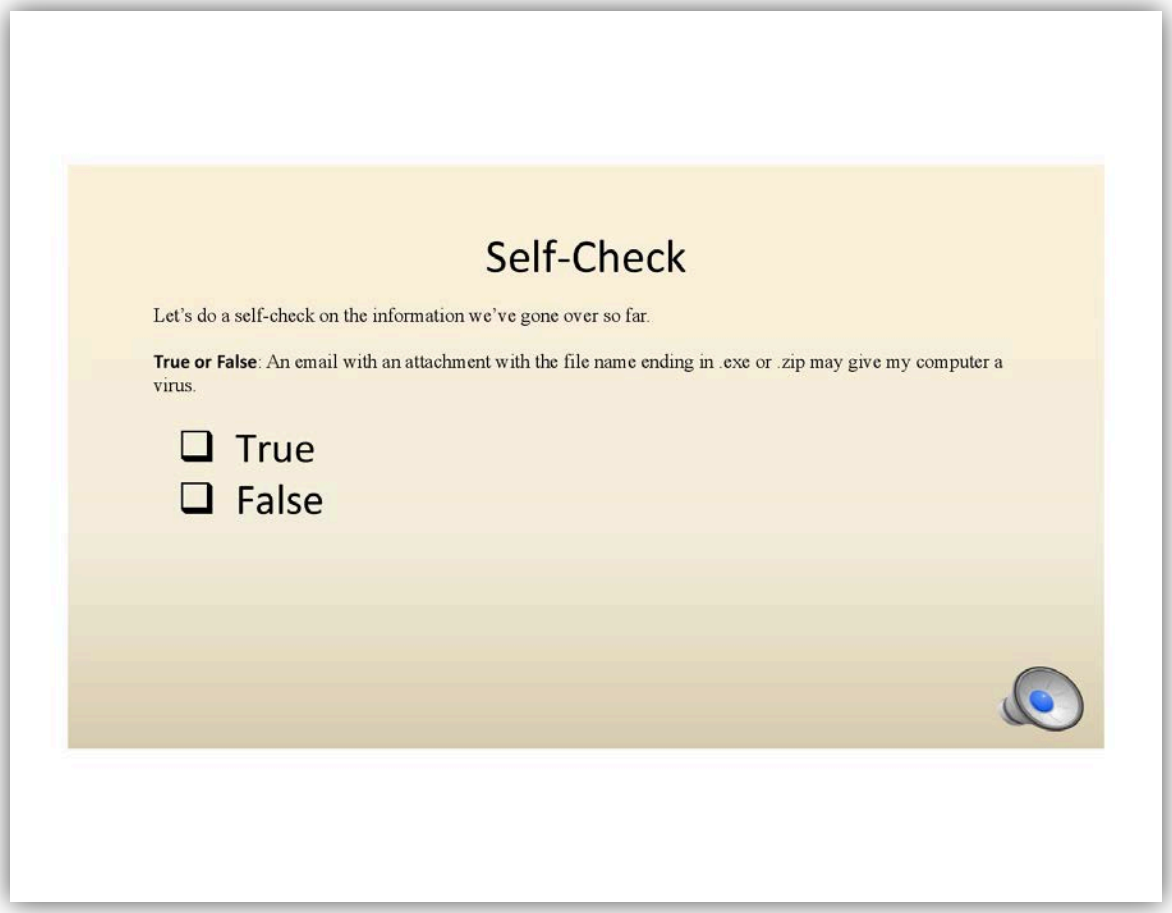


Review:

Let's review what we've learned about phishing…

- ✓ Crooks often use email as a way to trick people into spreading viruses or giving out personal information.
- ✓ Trick emails use words that make you want to open the email, like "You won't believe this!" or "Your account is now closed"
- ✓ Clicking links or opening attachments in trick emails can install a virus on your computer
- ✓ Clicking links from a trick email can trick you into giving away your private information
- ✓ When in doubt, DELETE IT! Never open an email that seems suspicious or is from someone you don't know.





How to Use Email Safely - Spam

You may have heard the term “Spam” before. Spam in email refers to "junk” emails that are sent to a lot of people at once.

Sometimes when you use a website and enter your email address, that company will send you newsletters, coupons, and other information.

Those are typically not harmful, but if you get a lot of them they can be annoying. And when you really get a lot of them, they can fill up your inbox. When your inbox is really full, you might not be able to send new emails. Or you might miss emails that you care more about.

How to Use Email Safely - Spam

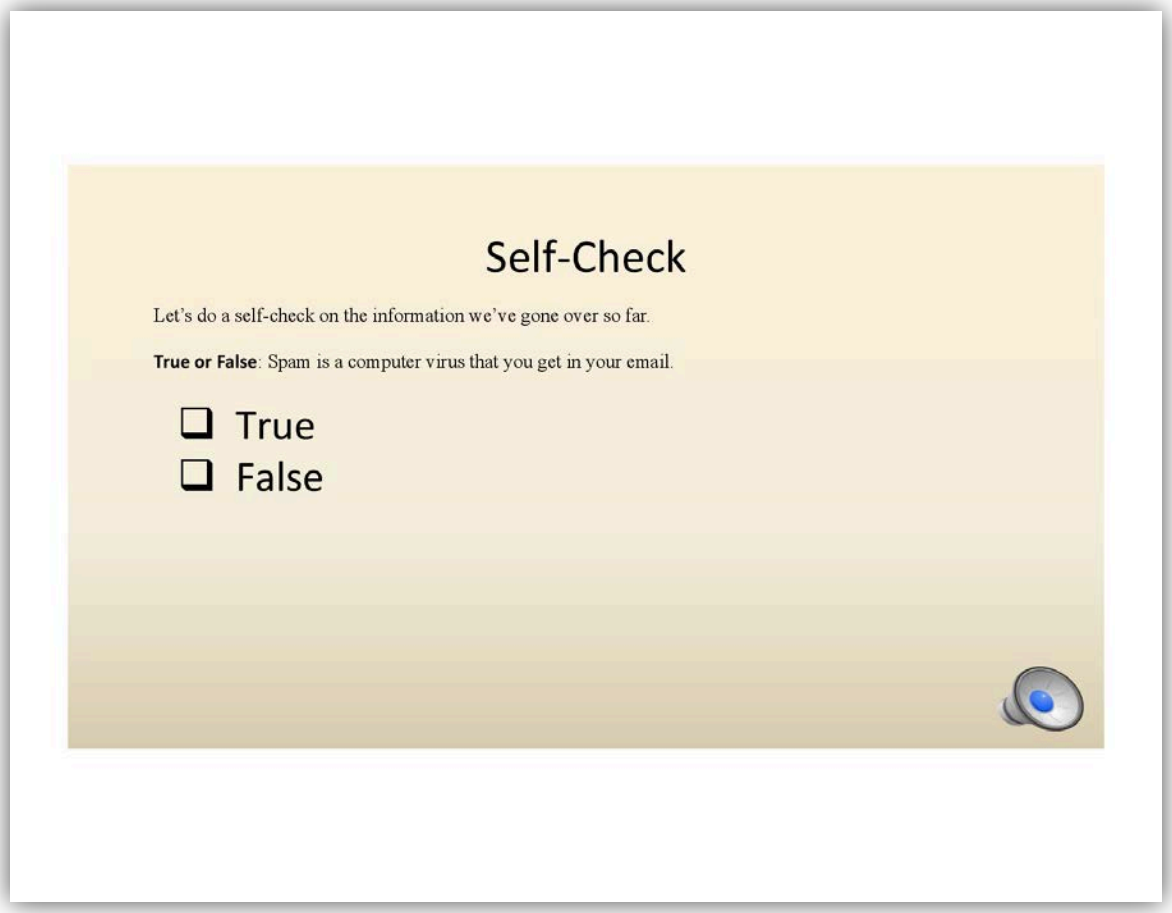
Some email providers will try to remove spam emails from your inbox for you.

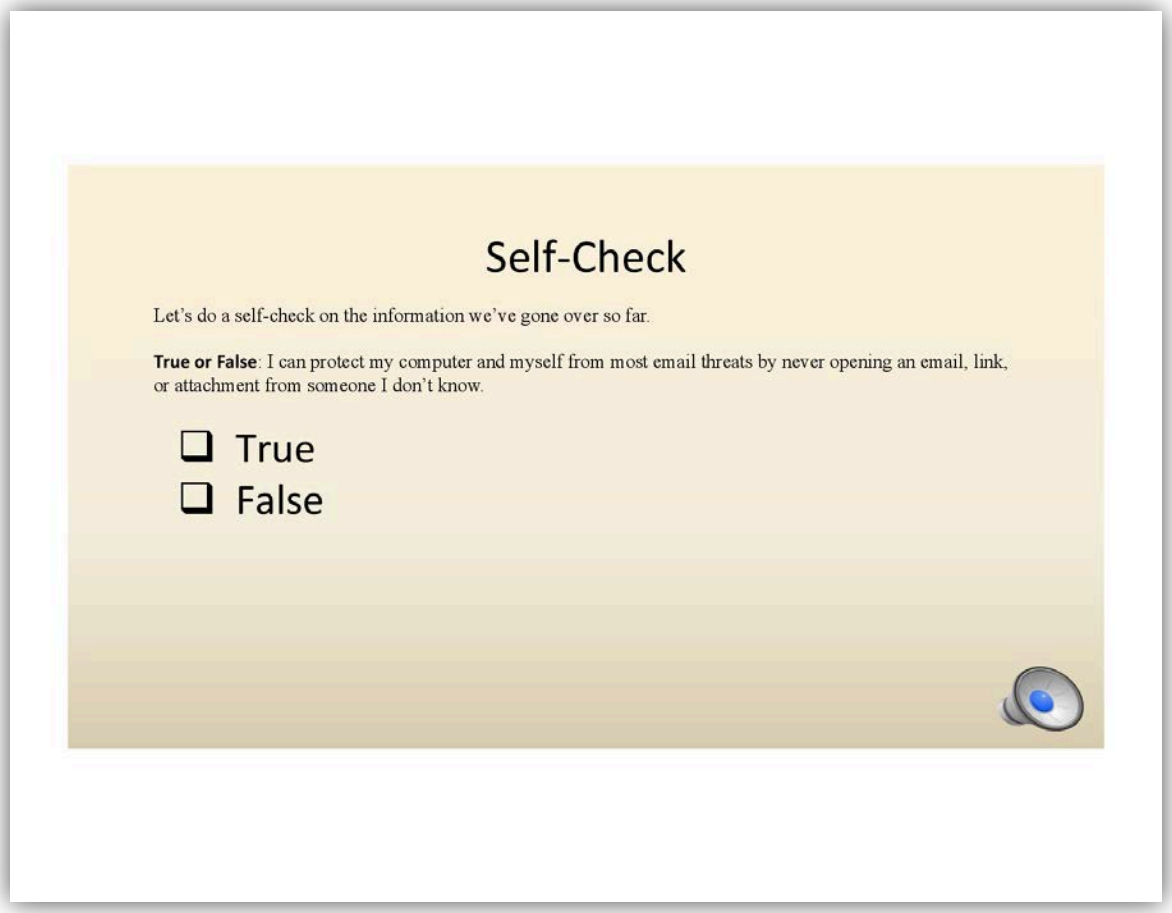
Email programs also let you mark emails as spam yourself. If you get an email that you don't want to get again, you can mark it as spam. Then your email provider won't let that kind of email into your inbox again.

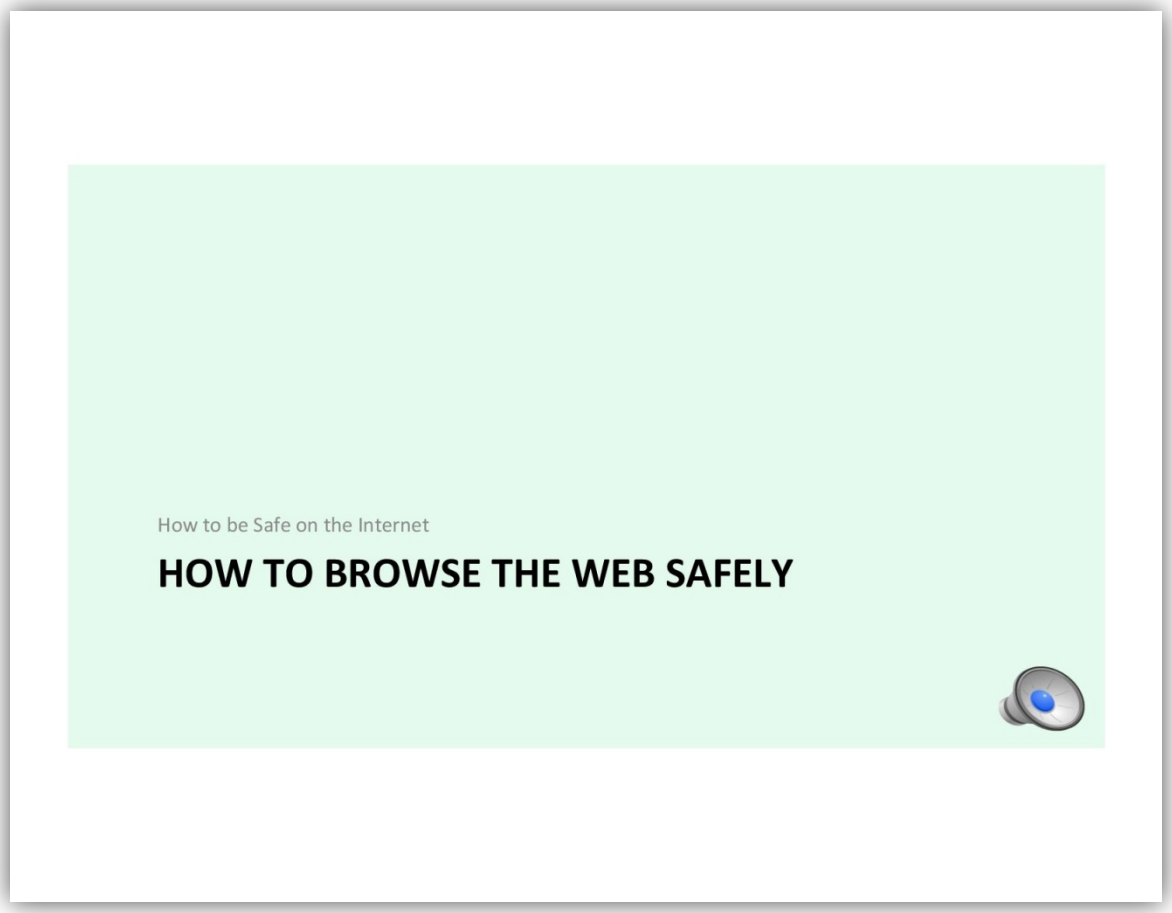
Review:

Let's review what we've learned about spam…

- ✓ Spam is another word for "junk" email, typically trying to get you to buy something
- ✓ Your email provider can help you find and block spam email
- ✓ Spam emails are not always harmful, but they can be annoying
- ✓ Spam emails should usually be deleted immediately
- ✓ Too much spam email can make your email inbox so full that you are unable to send or receive regular emails
- ✓ You will get less spam email if you only give your email address to friends



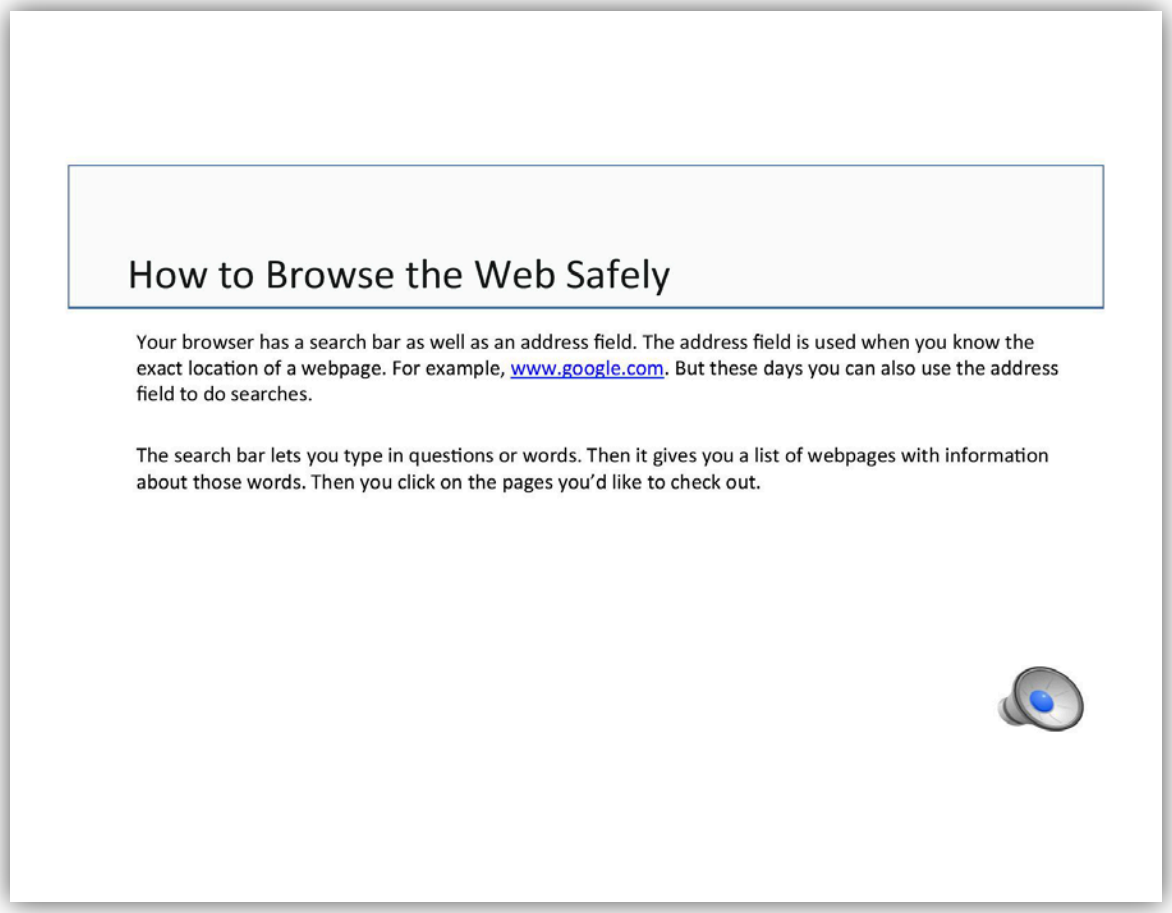


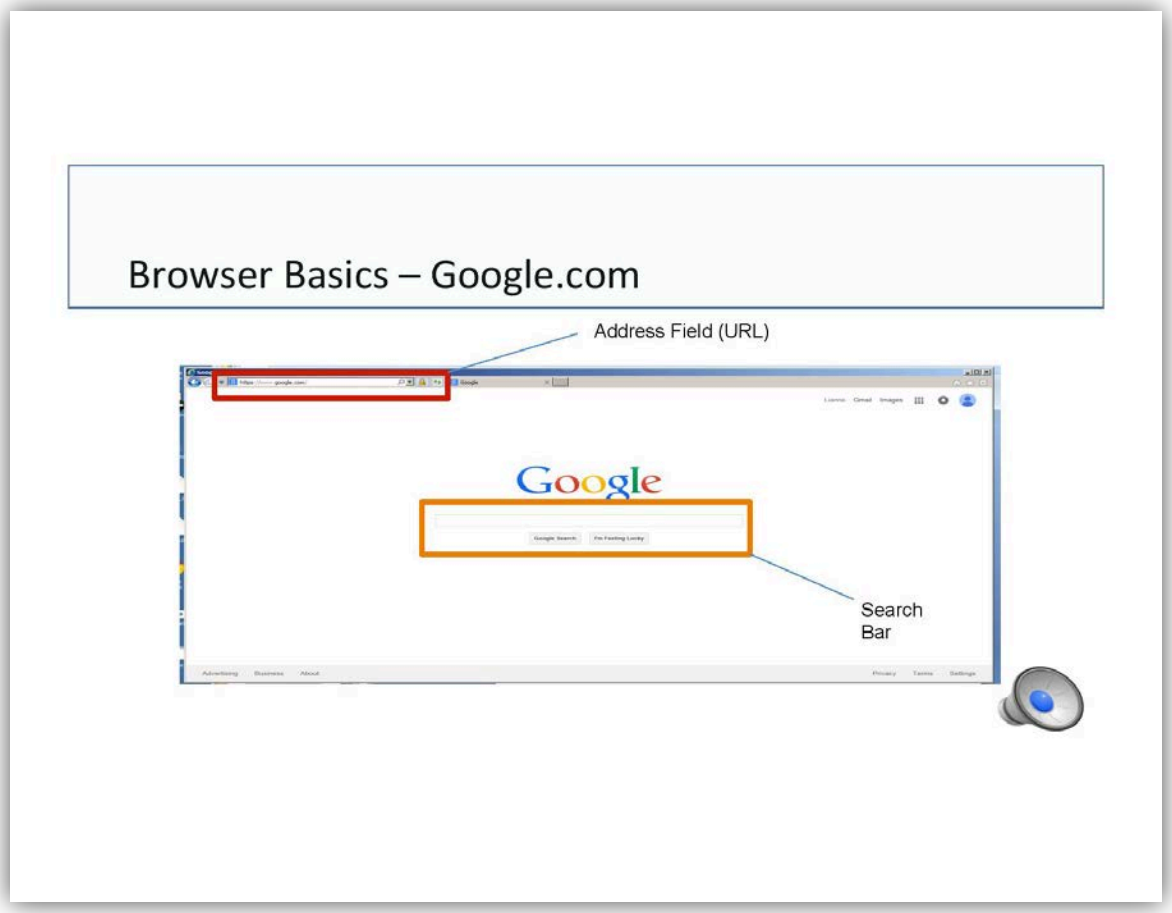


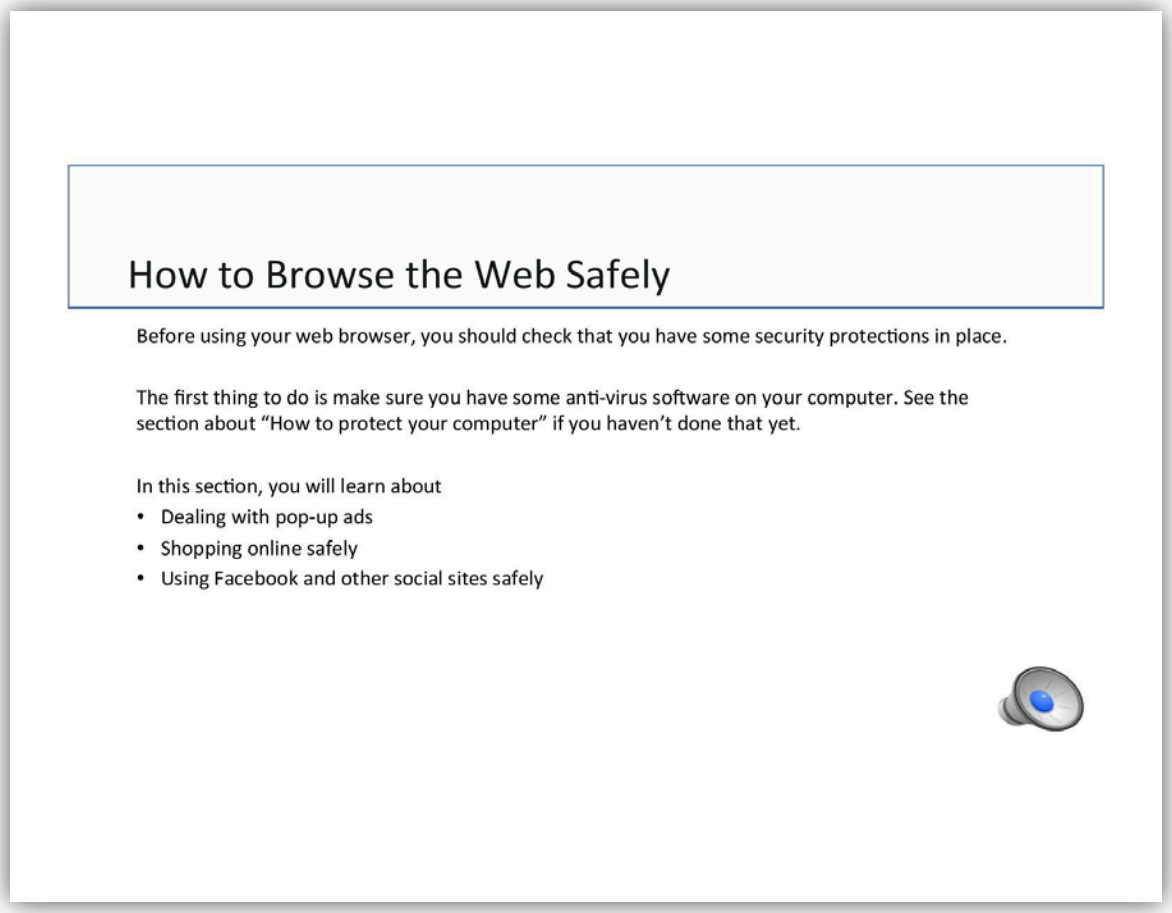
How to Browse the Web Safely

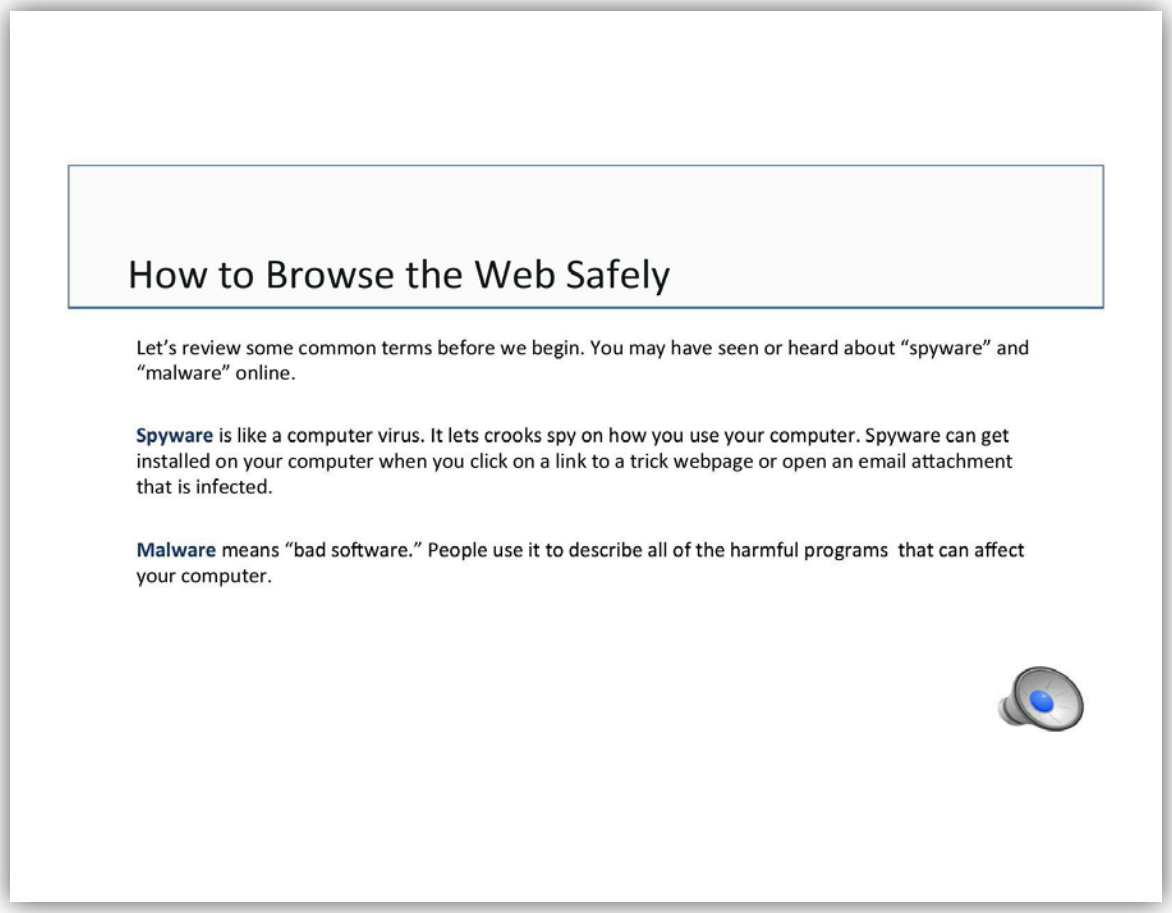
You can find all kinds of helpful and interesting information on the Web. But you do need to be careful. We will talk about some of the risks. And we'll talk about ways that you can protect yourself and your computer.

A **web browser** is the application you use to look at webpages. Some browsers include Internet Explorer, Mozilla Firefox, Google Chrome, and Safari.





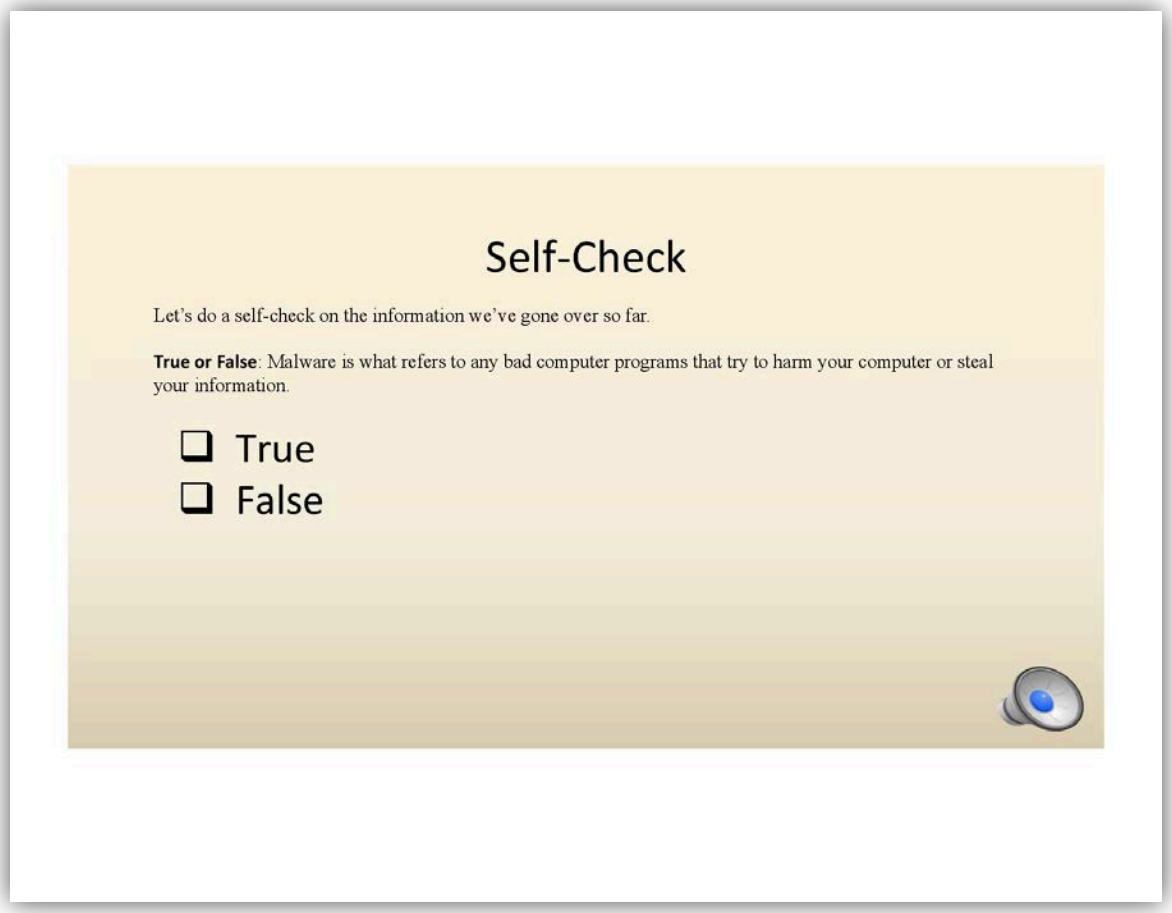




Review:

Let's review what we've learned about safe browsing…

- ✓ Browsing the Internet can be fun and informative
- ✓ Common browsers include Internet Explorer, Firefox, Chrome, and Safari
- ✓ Spyware is a specific program aimed at spying on your Internet activity and stealing your personal information
- ✓ Malware is a blanket term used to describe all programs that can negatively affect your computer



How to Browse the Web Safely- Pop-Ups

Sometimes when you are looking at webpages, you will start to see pop-up ads. Pop-up ads are small browser screens that pop up when you're on a webpage. Often these pop-up ads will also include clickable links.

Pop-up ads can be confusing and annoying. Even worse, sometimes they are dangerous. Just like trick emails that try to trick you into clicking on a link, these pop-ups will try to trick you into clicking on their links.

How to Browse the Web Safely- Pop-Ups

Sometimes the pop-ups try to scare you into clicking on a link.

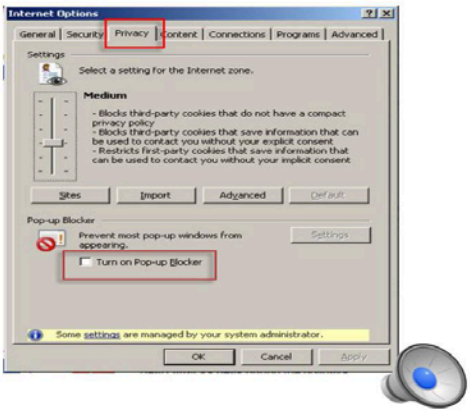
One common trick is a pop-up that tells you that you have a virus on your computer. The pop-up will tell you that clicking on its link will help you remove the virus.

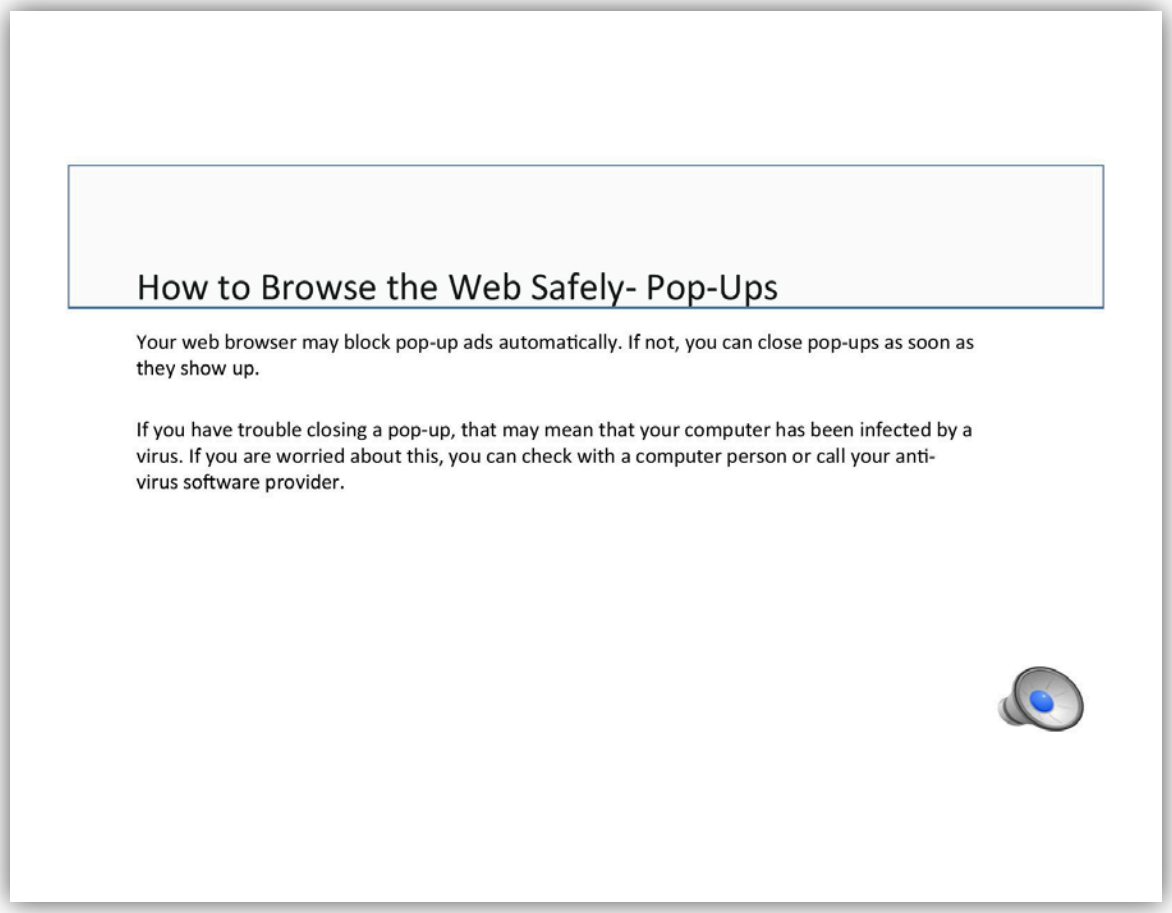
But when you click on the pop-up, it takes you to a trick site. The site asks you to pay money or install trick software to fix your computer. Or the pop-up might ask you to call a phone number and then they ask for your bank or credit card information.

How to Browse the Web Safely- Pop-Ups

If pop-ups bother you, you can also go into your browser settings to turn on a "pop-up blocker." You can do a search for "how to turn on the pop-up blocker" for the web browser that you use.

Example Google Search: **Turn on Pop-Up Blocker for Internet Explorer**

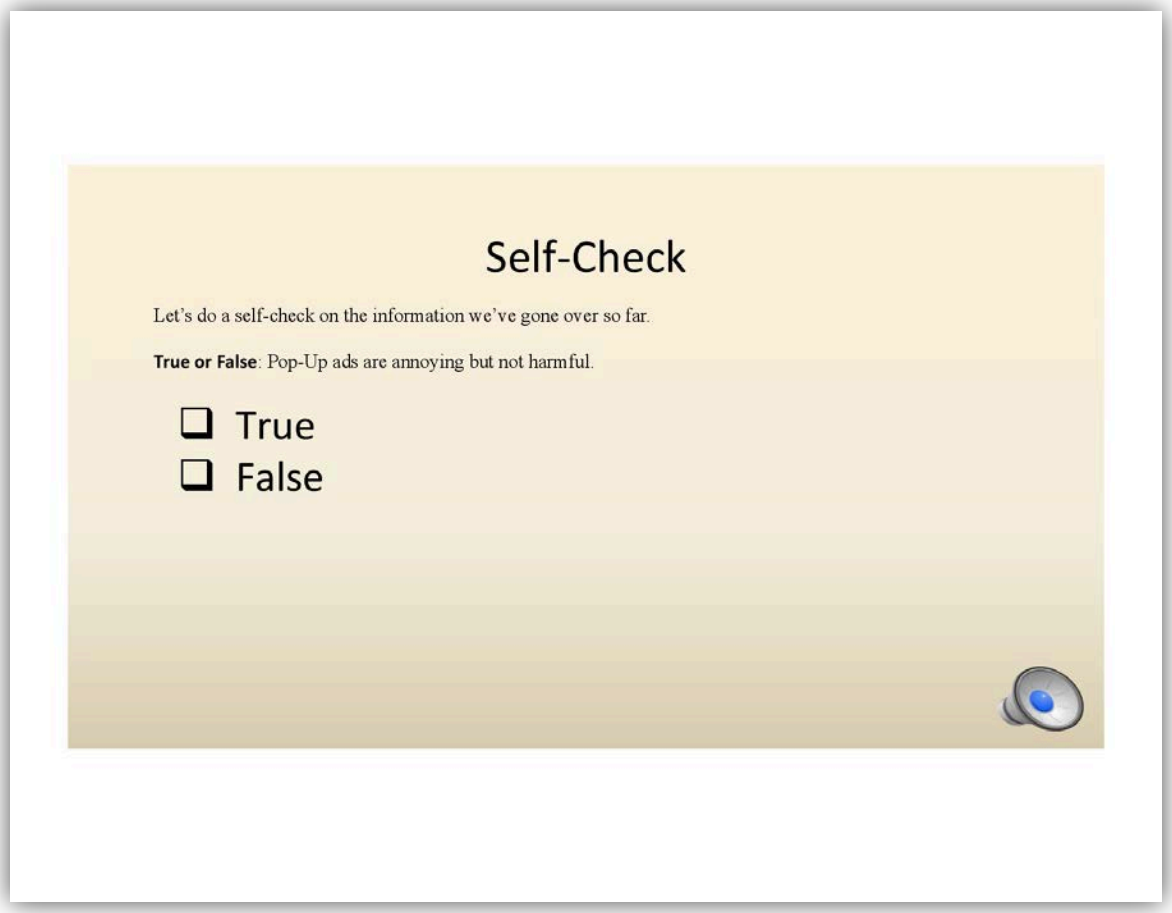




Review:

Let's review what we've learned about Pop-Ups…

- ✓ Pop-ups are small browser windows that appear on certain websites
- ✓ Pop-Ups often want you to click on them
- ✓ Some pop-ups will take you to trick web pages and may steal your information
- ✓ Some pop-ups can give your computer a virus
- ✓ You can block pop-ups through your browser

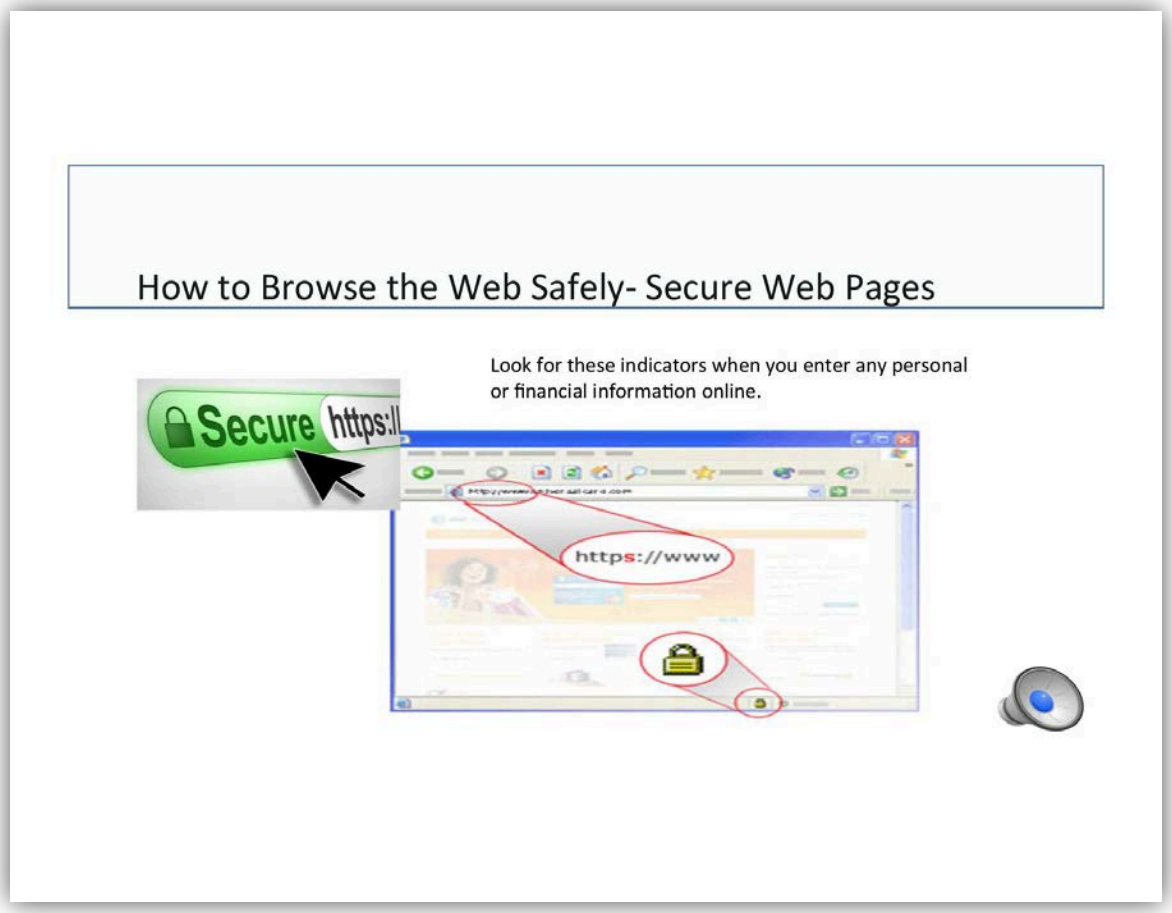


How to Browse the Web Safely- Shopping

Shopping online can be fun and convenient. But to buy things, you have to share your personal and financial information.

When a site asks for your personal information or your financial information, check to make sure that the site is using extra security. Look for "https" in the browser's URL and a lock icon at the bottom right of your browser or in the address bar. (Illustration on next page)

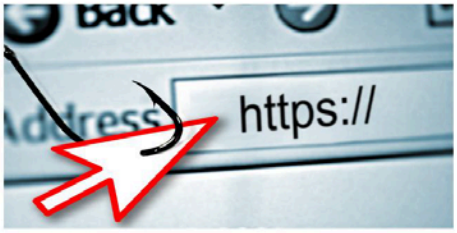
You also need to make sure you are buying from a site you can trust. You should only buy things from sites that you know. If you never heard of a site, you should probably be careful.



How to Browse the Web Safely- Shopping

You also need to make sure you are on real websites, not trick websites.

The best way to do that is to get to the site by typing in the address bar. If you click on a link in an email or an ad to get to a site, you might end up on a trick version of that site.



How to Browse the Web Safely- Shopping

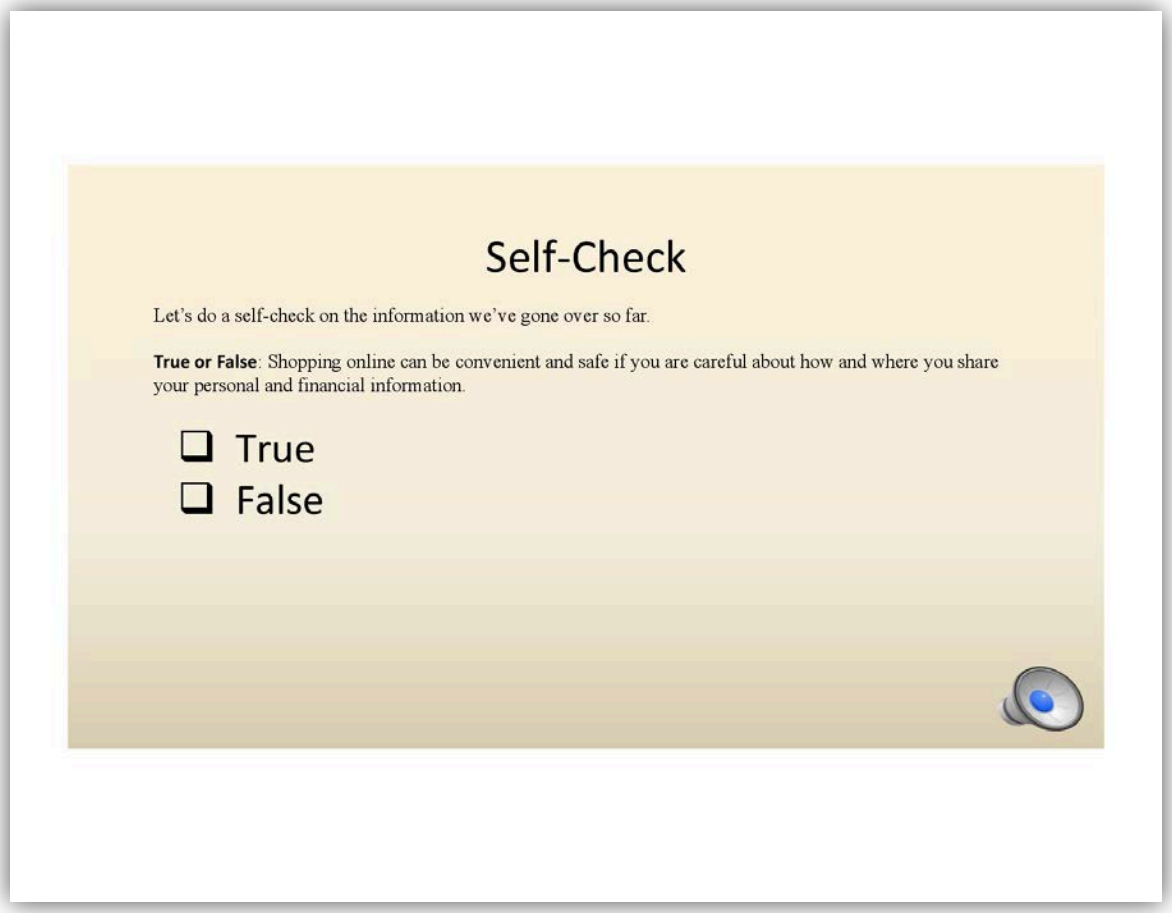
You can also use a service like Paypal to buy things online. That way you only have to give your financial information to one website, instead of giving your information to a lot of websites.

You pay Paypal, and they pay the other websites for what you want to buy. (For more information visit https://www.paypal.com/us/webapps/mpp/home)

Review:

Let's review what we've learned about shopping online…

- ✓ Shopping online can be easy and convenient
- ✓ In order to buy things, you have to provide personal and financial information to web pages
- ✓ Look for signs of a safe web page – like https in the address bar and a lock symbol on the browser
- ✓ Get to shopping sites by typing the name directly into the address bar to avoid trick web pages (eg. www.amazon.com, www.walmart.com, www.target.com)
- ✓ Consider using services like Paypal to pay securely online



How to Browse the Web Safely- Social Media

The Web can be a great way to stay in touch with friends, or even meet new friends. You can use sites like Facebook, Twitter, LinkedIn, Instagram, and Dating Sites to share news or pictures. These kinds of sites are often called **social media.**

While these sites can be fun, there are a few things to keep in mind so you can stay safe:

1. **People online may not be who they say they are.** Don't share your personal information with strangers. For example, don't share your full name, home address, zip code, phone number, birthday, or other private information. If crooks get your private information, they can steal your identity. Or they can come to your house.

How to Browse the Web Safely- Social Media

2. **Don't let social media sites tell everyone where you are. And don't post too much information about where you are.** For example Facebook has a "check-in" function that will tell everyone where you are when you make a post. Or if you are using Facebook Messenger it will tell the person where you are. If crooks find out where you are, they might be able to harm you or rob you.

3. **Don't accept friend requests from people you don't know.** Crooks want information about you to plan an attack or a scam. Remember, people online may not be who they say they are.

How to Browse the Web Safely- Social Media

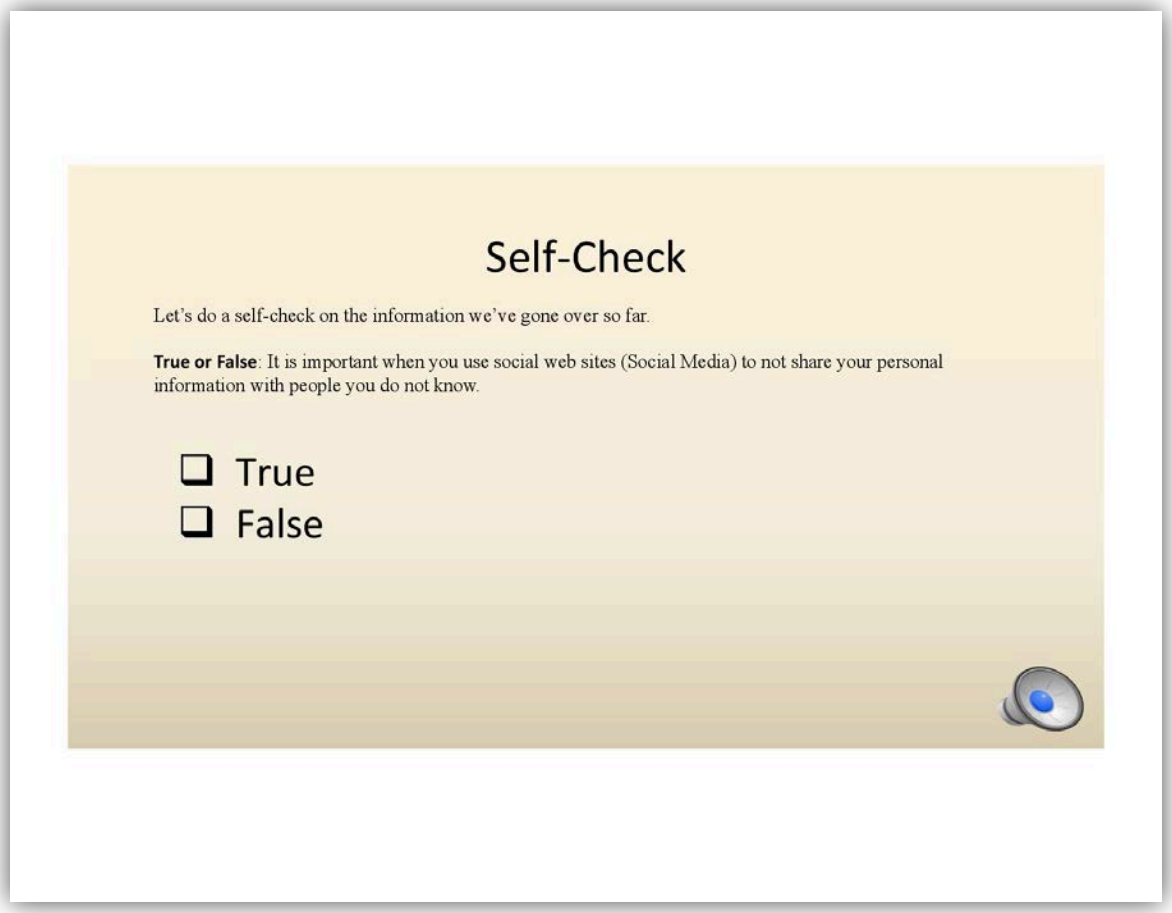
4. **Think twice before posting photos** – make sure the photo doesn't tell people where you are, and do not post photos of other people without asking them first.

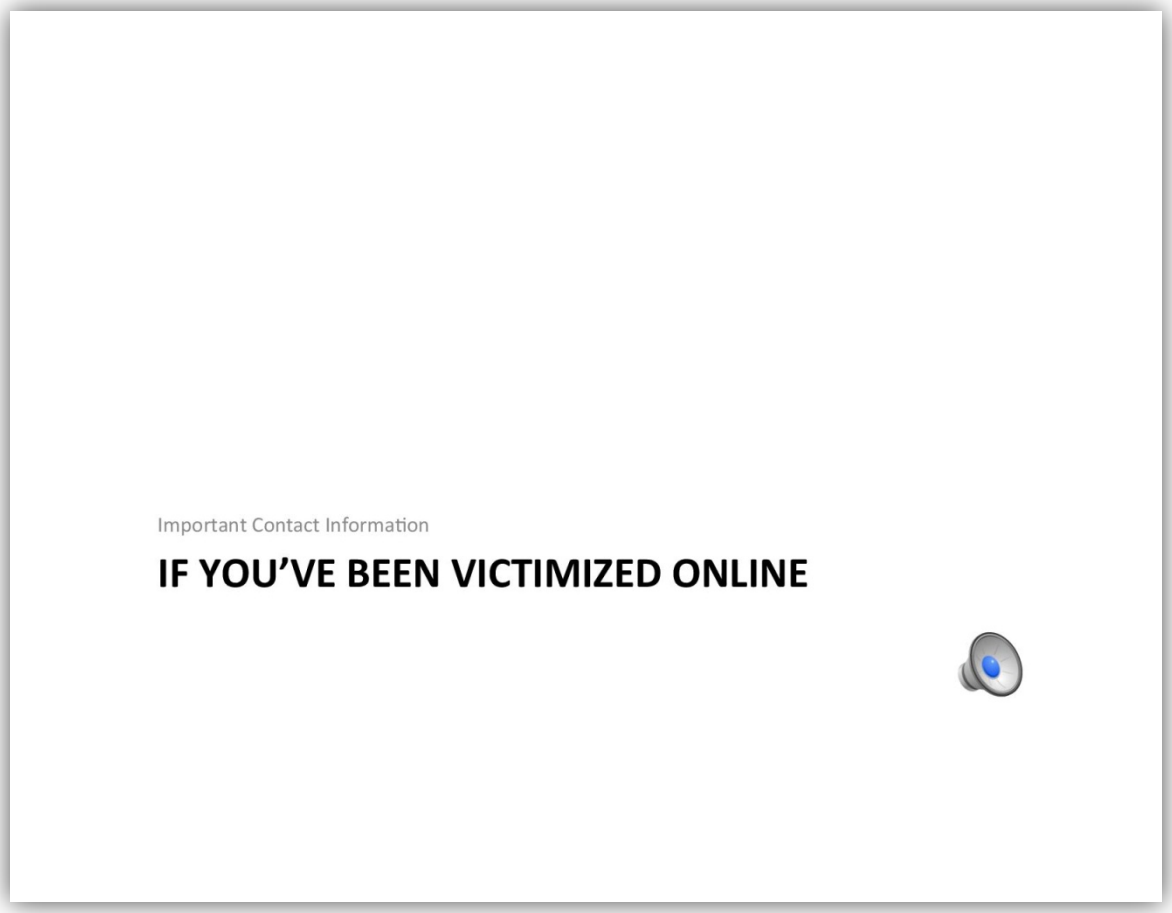
5. **Don't say anything online that you would not say out loud or in person.** Help make the online world a polite and friendly place. Also, if you offend others, you could end up making yourself a target for anger or abuse.

Review:

Let's review what we've learned about social media…

- ✓ Social media can be fun, but stay safe by keeping your personal information secret
- ✓ Remember these tips when you go on social web sites:
  - People online may not be who they say they are.
  - Don't let social media sites tell everyone where you are. And don't post too much information about where you are.
  - Think twice before posting photos – don't give away your location or post photos of others without their permission
  - Don't accept friend requests from people you don't know.
  - Don't say anything online that you would not say out loud or in person.





If you've been victimized online

It is VERY important to report Internet crimes when they happen - not only for you, but for potential future victims.

1. If you feel like you might be in physical danger, call 911 and report your concern to the police.

2. For computer hacking, fraud, and Internet-related crimes, visit this site to report your issue to the appropriate enforcement agency: http://www.justice.gov/criminal-ccips/reporting-computer-internet-related-or-intellectual-property-crime

3. You can also file a complaint at the FBI Internet Crime Complaint Center here: http://www.ic3.gov/default.aspx