March 12, 2014 9:30am PST: Version closed

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Preferences for Global Access

Institute for the Study of Knowledge Management in Education (ISKME)
Contract #ED-OSE-12-D-0013-0002

Deliverable Task 2.1 Requirements for First Discovery (Revised)

Cloud-Based Accessibility For Individuals with Disability

Tools for Creating Specifications of User Needs and Preferences for Online Interactions in Several Different Application Settings

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March 11, 2015

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1. Introduction

1.1 Overview

This specification is part of the Preferences for Global Access (PGA) project. The PGA project is funded by the National Institute on Disability and Rehabilitation Research (NIDRR), a component of the U.S. Department of Education's Office of Special Education and Rehabilitative Service, under Task Order 0002 of ED-OSE-12-D-0013 - *Tools for Creating Specifications of User Needs and Preferences for Online Interactions in Several Different Application Settings*. The purpose of Task Order 0002 is to develop and evaluate example First Discovery tool(s) that address the creation of user needs and preference specifications in the following four application settings, or areas:

1. Accessible Voting
2. Online Educational Assessment
3. Community-based Technology Support for Older Citizens
4. Open Educational Resources (OER)

This specification describes the requirements for tool(s) to quickly discover a user's needs and preferences in these application areas, to enable a user to personalize interfaces in order to allow the user to access Information and Communication Technology (ICT) available in the setting. The specification is designed to be a working specification: Although the fundamental requirements will not change, the specification may be enhanced as new requirements are discovered during the co-design process. The design approach for achieving the requirements may change considerably as the tool(s) are iteratively developed and evaluated through the co-design process (involving stakeholder and SME input); the fundamental requirements and their motivations will be examined and may be extended as necessary.

For each of the requirements discussed in this specification, background information is provided describing how the co-design team identified and refined the requirement; outstanding questions are also highlighted. The terminology used throughout is defined in Appendix A.

1.2 Global Public Inclusive Infrastructure (GPII)

The Task Order 0002 work is part of the Global Public Inclusive Infrastructure (GPII) – a cloud-based digital on-ramp to Information and Communication Technology. GPII is developing an architecture of flexible user interface (UI) component technologies and services. For Task Order 0002, the PGA project team will contribute a key component – First Discovery Tool(s) – to GPII. The tool(s) developed in this Task Order are building blocks toward the creation of a comprehensive set of GPII Need and Preferences editing tools for the Global Public Inclusive Infrastructure (GPII).

The preferences from First Discovery will lead to further discovery (beyond First Discovery) as to whether the user needs assistive technology (AT), and will allow them to leverage features of GPII such as online Shopping-Alerting Aid to choose from available AT.

The tool(s) developed in this Task Order will make use of technologies from GPII in their implementations. This will reduce the effort needed for the development of some parts of the First Discovery Tool(s), and enhance the tools' flexibility and extensibility. By using GPII

technologies, the First Discovery tool(s), though initially targeting the four application areas defined above, will be easily extensible to other application areas in future task orders of the PGA project.

1.3 Diverse Users of the First Discovery Tool(s)

Key to understanding this requirements document and the functionality described is understanding the range of users of the tool(s). In some cases, the end-user will use the tool(s) directly, without the involvement of an assistant, either because the end-user does not have an assistant to help or does not want assistance.

More often, however, the end-user will use the tool(s) with the assistance of another person. The assistant may be:

- a professional trained in both access technologies and the use of the First Discovery Tool(s)
- a professional trained in access technologies but not the use of the First Discovery Tool(s)
- a person trained in the use of the First Discovery Tool(s)
- a person with no training but interested in the user (family, friend, etc.)

The help of an assistant can greatly increase the probability of a successful First Discovery. It can be particularly helpful in recovering from problems that are caused by things that the tool(s) cannot detect, such as an interruption that could be misinterpreted by the tool as an inability to respond.

However, assistants can also complicate First Discovery, if they, for example, provide the wrong information based on incorrect assumptions about the end-user. If the tool(s) cannot detect and recover from misinformation or incorrect conclusions based on assistant input, the results may not be representative of the user.

2. First Discovery Process

Within the scope of this project, First Discovery tool(s) are defined as: *Tools used to find out what the basic needs of a person are, needs that, if they are not met, would prevent the person from using the Information Communication Technology (ICT) at all*. What it means to be “using the ICT at all” will be addressed in sections 2.1 and 2.2 of this document.

Figure 1 below provides a broad overview of the First Discovery process as we envision it at this time. The blocks in Figure 1 represent functions and flow, and do not necessarily represent modules or code blocks. Functionality may be implemented in different ways, iteratively or in parallel.

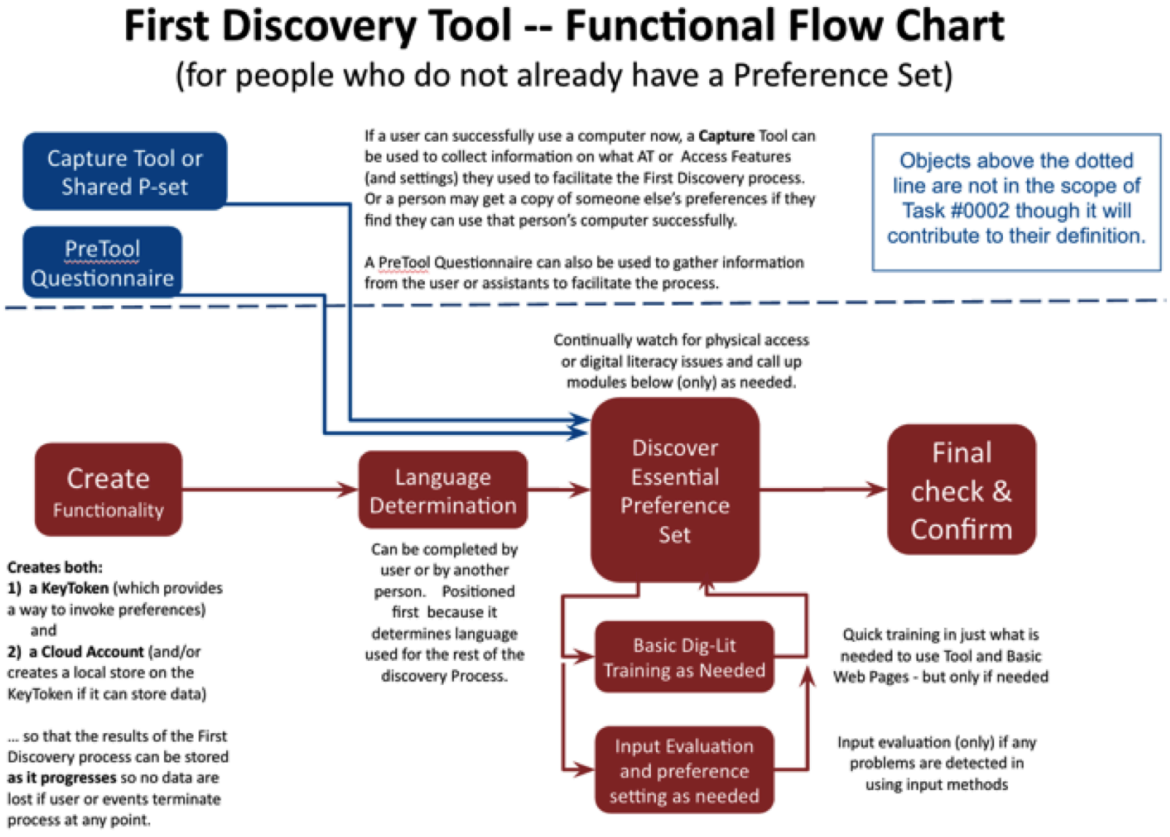

Figure 1. First Discovery Tool - Functional Flow Chart

In the process represented in the figure, First Discovery tool(s) are used by people who do not currently have a preference set. This includes both those who have never used a computer before, and those that have used a computer but do not yet have their preference set.

As First Discovery focuses on initial, minimal settings required for basic access and use, it does not include refinement of preferences or exploration of different preferences for different tasks or environments. The minimal settings for basic access and use are considered "essentials," or the ***essential preference set***.

First Discovery tool(s) start out assuming basic digital literacy and the ability to use the keyboard and/or touch screen. This allows the tool to be as efficient as possible for all those who do possess these skills. However, it is designed so that it will detect any lack of responsiveness or inaccurate use of keyboard, mouse, and/or touchscreen and immediately carry out a separate assessment (and training if necessary for essential digital literacy) of these skills in order to identify whether alternate means for access to the First Discovery tool(s) is possible, or if the person needs to be seen by a professional to set up access for them (i.e., the individual's needs are beyond the scope of what the First Discovery tool(s) can appropriately

handle).

> *Task Order 0002 Notes*:
> Acknowledging that certain extreme use cases cannot be handled by any automated tool, we still need to determine if a minimum digital literacy is required for a user to engage with the First Discovery process, and exactly what further digital literacy would be taught by the First Discovery tool(s).

Before preference discovery and saving can begin, the ***create functionality*** is initiated, which creates both a ***KeyToken*** for invoking preferences, and a ***Cloud Account*** so that the results of the FD process can be stored and data are not lost if the user or events terminate the process at any point. (If terminated by the user, the user is given the option to save or delete all of the information collected so far.) KeyTokens with blank accounts can also be generated in advance and just provided to the user at the start. They can be left anonymous or associated with a log-in or and identity later if desired.

Language determination, which can be completed by the user or by an assistant, is also done before preferences are determined, to identify the language used for the rest of the process.

Once the First Discovery process is complete, there is a final check to be sure that all the needs and preferences have been captured correctly and accurately. The functionality of these components may be implemented in different ways, iteratively or in parallel.

> *Task Order 0002 Notes*:
> It is understood that further adaptations designed to enhance the productivity of the user would require additional preference gathering tools to increase productivity in a given context. Although determining the requirements for additional tools is outside the scope of this task order, it is important to explicate where First Discovery ends for each application area being considered, and the implications of that endpoint for preference refinement. Section 2.1 of this report will address this.

Capturing, Sharing and Pre-Tool Questionnaire

There are three external actions that could speed up the First Discovery process by providing information on user needs and/or preferences: Capturing, Sharing, and providing a Pre-tool Questionnaire.

If an individual is already successfully using a computer, a "***Capture***" function (which is being developed separately outside of Task Order 0002) can be used to pull information on the assistive technologies and/or access features and the settings for this user. This can then be used to guide the First Discovery process, which can significantly reduce the time needed to gather and confirm the user's essential preference set by narrowing the options that need to be explored.

An individual may ask a friend to ***share*** his/her own setting set (all or some of it). This shared set can then be used in the same fashion as the captured settings, with or without further personalization. Users who bring captured or shared settings should have the option of bypassing the First Discovery process altogether if they choose, and taken to the "confirmation" stage.

For those who have not used a computer, or to accelerate First Discovery by skipping steps thought irrelevant, completion of a ***Pre-tool Questionnaire*** (see Requirement All-16 for a discussion of pre-tool support) by the user or an assistant could be used to achieve the same 'pre-information.' This may not provide as reliable information as a **"Capture"**, but can still help facilitate the entire First Discovery process by providing guidance that can be easily checked and used to eliminate more time-consuming discovery processes.

The creation of the *"**Capture**", **"share",** or "**Pre-tool Questionnaire**"* are not in the scope of Task Order 0002. The "short cutting" of the First Discovery process based on the different types of information from these functions is also not in the scope of Task Order 0002, although it will be kept in mind in building the architecture of the tool(s), so that it is not precluded at a later time.

2.1 The "Endpoint" of First Discovery

The "endpoint" of First Discovery occurs when the minimum set of adaptations needed to allow the user to "access ICT at all" for a given context have been discovered and stored. In this definition, across all application areas, the user must be able to interact with ICT effectively enough to a) use the rest of the FD tool, b) use other basic EXPLORE tools to further refine preferences, and c) use basic web pages.

The user's ability to interact with ICT "at all" is affected by the constraints and conditions of an application area (Voting, Online Assessment, Older Citizens, and OER), as well as situational factors (lighting, background noise, etc.). For example, the adaptations required to "access ICT at all" may be greater for OER than a voting poll-place environment (because ballots have very limited user interface controls). Tools designed for First Discovery need to account for these variations in the locations and applications in which they will be used.

The sections below discusses First Discovery endpoints for each application area.

Accessible Voting
In the Accessible Voting application area, the endpoint for First Discovery occurs when the end-user has the ability to interact with the jurisdiction's ICT effectively enough to vote at a polling station, and for some end-users, the ability to view candidates online and register online; end-users should also be able to interact with ICT effectively enough to use a more exploratory tool to further refine preferences for other voting-related activities. A breakdown of the voting-related activities that FD should support include:

- *Vote at a polling station* - Review a list of candidates; select choice(s); submit choices
- *View candidate information online* - Navigate candidate websites (links, menus); review the information (text, video, etc.) on candidates' websites

- *Register to vote online* - Fill in registration information; submit the information

Online Assessment
In the Online Assessment application area, the endpoint for First Discovery occurs when the user has reached the ability to interact with the ICT effectively enough to carry out assessments and achieve a score that is representative of the learner's abilities, or be able to use an exploratory tool to further refine preferences. For users who are able to move into assessment tasks after FD, below is a breakdown of those tasks:

- *Access the assessment* - Navigate to the assessment; read or listen to the questions; see, read, or listen to stimulus material included in an item, such as an image (with image description) or a passage; access tools included with an item, such as a calculator
- *Respond to assessment questions* - Fill in answers for a variety of item types (multiple choice, text entry, drag-and-drop, etc.); submit answers
- *End the assessment session* - Confirm completion of the assessment with a submit button or similar task

The possibility that for some users, the endpoint of First Discovery will *not be* the ability to move directly to an assessment task (i.e., read or listen to, and respond to test questions) is due to complexities in the assessment area. There are preferences that are used in assessment that are not part of FD, either because they are more detailed than a simple FD tool can determine (such as the need for extra time, keyword translation, auditory calming, or line reader tools), or because they are specific to education and assessment (such as masking answers or permission to use a calculator). For this reason, we expect that most students who are engaging in First Discovery in preparation for assessment will need to continue on to use an Explore tool to complete their set of preferences. As an example of the kinds of preferences common in assessment systems, there is a complete list of the assessment preferences included in the IMS Global Learning Consortium's APIP standard at: http://imsglobal.org/apip/ apipv1p0/APIP_CFC_v1p0.html (see the section of the table that begins with the row "Accessibility").

Older Citizens
In the Older Citizens application area, the endpoint for First Discovery would be when a user is able to interact with the ICT used for intake and basic digital literacy instruction, or at least effectively enough to use more exploratory tools to further refine preferences. A breakdown of the activities that FD should support for Older Citizens includes:

- *Fill out an intake form* - Review the form and understand the fields; fill in personal information; describe digital activity goals and technology experience; submit information
- *Participate in a digital literacy course* - Select course from a list; launch the course application

OER
In the OER application area, the endpoint for First Discovery occurs when the user is able to interact with the ICT well enough to engage with resources, or to use more exploratory tools to further refine preferences. Examples of resource engagement include logging into a school LMS, interacting with a PhET simulation, reading or listening to informational text, observing a video lecture, participating in an OER activity such as a set of math questions or a quiz, responding to a writing prompt, and submitting an assignment. A breakdown of the OER engagement activities that FD should support for end-users includes:

- *Log into/out of a Learning Management System* - Enter user ID and password, submit the information; navigate to logout page when done with session
- *Access course material/resources* - Navigate to page with course material/resource; read/listen to information that comprises the resource (video lecture, text, audio, etc.)
- *Submit an assignment or quiz answers* - Type text (e.g., an essay); fill in multiple choice answers; submit responses

2.2 Accessing ICT Across Application Areas

Below is an initial list of tasks that all users, across all application areas, must be able to understand and carry out at the end of First Discovery, in order to use and access basic ICT:

- Be able to access and exit a system using existing security mechanisms
    - Log into a system
    - Log out of a system
- Be able to Identify, understand the purpose of, and operate the following Interface Elements:
    - push buttons
    - toggle buttons
    - radio buttons
    - check boxes
    - sliders
    - links
    - scroll bars
    - back button
    - text field (editable text) - e.g., touching to direct one's typing
    - auto-submit-on-ENTERKEY behavior
    - toolbar
    - read text content
    - operate dropdown menus and menu bars
    - single keyboard key--i.e., controls should be operable without a modifier key
    - progress indicators (identify and understand the value they represent)
- Be able to move into more exploratory preference tools, through the following skills:
    - effectively use a keyboard--i.e., accurately activate desired keys without accidentally activating other keys, or without having unwanted key repeats
    - effectively use a touch screen interface, e.g., without accidentally activating adjacent controls
    - comprehend images with text
    - identify and comprehend cause and effects
    - identify lists
    - identify and comprehend alarms and warnings
    - identify the point in a process (context) that one is on at all times
    - identify video or audio clips and be able to control them (stop, pause, play, rewind, volume), and adjust the speed of play
    - identify and comprehend the words spoken in video and audio

It is understood that further adaptations designed to enhance the productivity of the user are likely necessary in each application area, and additional preference gathering tools are thus required.

3. Requirements

This section describes requirements that are specific to each application area, as well as requirements common across all areas, for the First Discovery Tool(s) prototype being developed for Task Order 0002. Additional features and capabilities deemed out of scope are described in Section 6 of this document.

3.1 Accessible Voting Requirements

Requirement AV-1: **All Stages**
The tool(s) must meet the needs of multiple interfaces and steps of the voting process.

> *Background*:
> The voting process often requires participation in numerous steps: voter registration, voter information, poll book and voting station. Not every voter will participate in all of these steps, but some will, so they are included in the scope/requirements here.

> *Task Order 0002 Note*:
> For this Task Order, we will choose a representative sample of the different technologies used in these steps to demonstrate the concept.

Requirement AV-2: **Machine Readable Output**
The tool(s) must allow preferences to be output as machine readable codes.

> *Background*:
> If the First Discovery is done in the polling place it is unlikely that systems will be connected to “the cloud” (where preferences would be saved). However, there are many voting activities before the polling place, and it is possible that end-users will carry out the First Discovery process at one location (e.g., voter registration) and will need to apply those preferences at another (e.g., the polling station). The PGA co-design team discussed possibilities for the tool to output the discovered preferences in some machine-readable form that could then be carried to subsequent locations and applied automatically. Possible formats discussed include electronically on a memory stick and on paper in some form of bar code, among others.

> *Task Order 0002 Note*: For this Task Order, we will demonstrate this using one standard format.

Requirement AV-3: **Time Limitations**
The version of the First Discovery Tool(s) used in a polling place must support the time limitations at the polling place.

Background:
At polling stations, there are frequently lines of people waiting to vote. This creates social pressures to minimize the time spent at the poll. Any preference-setting process will need to be fast or done on or on reserved equipment, including equipment that can simulate the voting technology interface for the purpose of collecting preferences, but not actually perform voting.

Requirement AV-4: **No Internet**
The version of the First Discovery Tool(s) used in a polling place must be able to function without any connection to the Internet.

Background:
At a minimum, it must support this while in the voting booth. But many precincts may not allow Internet connection– or it may not be reliable. Voting should not be prevented if this occurs.

Requirement AV-5: **Machine Preferences Only**
The tool(s) must be able to be customized to present only those preferences that represent functionality available on the voting machines at that location.

Background:
If a voting machine does not have certain capabilities, the tool(s) should not bother to present preferences related to those capabilities.

3.2 Online Assessment Requirements

In Online Assessment, most of the requirements identified are common to other application areas (see Section 3.5 for a list of common requirements); however, a unique requirement is that there may be individual accommodations that are required or restricted for different subject areas and for different students based on a student's Individualized Education Plan (IEP) or other educational documentation.

Addressing these variations in accommodations as outlined by the IEP for each student is out of scope for the time and resources available for this project. The FD tool(s) build the interface when the tool starts, based on configuration information recorded in a file (ranges, default values, etc.). To support customization based on an IEP, the IEP information would have to be encoded in a format the tool(s) could understand (such a format is not yet defined); the tool(s) would need to process that information and create new configuration information based on the IEP; the tool(s) would then be able to build the interface based on the new customized configuration information. IEP compatibility is discussed further in Section 6 of this report, "Requirements Out of Scope".

3.3 Technology Support for Older Citizens Requirements

In the Older Citizens application area, all of the requirements identified are also common to other application areas (see Section 3.5 for a list of common requirements). Worth noting, however, is that in this application area, there is likely a greater number of individuals coming to the FD process

with digital literacy constraints--thus elevating the importance of the “basic dig-lit training” function for end-users in this application area.

3.4 OER Requirements

In the OER application area, the end-user experience is likely to vary more than in other application areas. For example, students may be given a link and a prompt by a teacher to view a resource, or the resource might be embedded within other environments and resources (e.g., on a course webpage, within a learning management system, or coupled with questions as part of an in-class assessment). Additionally, the end-user is likely to encounter layered and embedded resources, resources with multiple media formats, and resources that vary by subject area – each of which may be associated with different preferences. This breadth of possible tasks and environments makes it particularly important that the First Discovery process prepares the end-user to use more exploratory preference editing tools, to further refine preferences. This is required in all application areas, but in the OER application area, it is highly likely that students will use additional preference editing tools before carrying out other activities.

3.5 Requirements Common to All Application Areas

Requirement All-1: **Flexible Content and Presentation**
The tool(s) must be created using technologies that provide developer-implementers with the ability to adapt the preferences that the tool(s) present to the end-user, the order in which those preferences are presented, and the visual design and presentation of those preferences in order to meet the needs of different application areas and organizational standards.

> *Background*:
> Different preferences will be relevant in the different application areas. For example, in the Voting area, different jurisdictions might use different voting technologies, making some preferences irrelevant. Even within a single application area, different preferences might be relevant in different organizations or contexts. In the Online Assessment area, preferences around supports for a mathematics test might include references to a calculator, but such preferences would be irrelevant for an English Literature test. Some applications may require that certain devices be used for the First Discovery so use of a flexible framework that allows the tools to be adapted as necessary for special applications is highly preferred.

> *Task Order 0002 Notes*:
> This will be accomplished by using the Infusion JavaScript Framework, which is designed to support flexibility in configuration and interfaces.

Requirement All-2: **KeyToken & Save**
The tool(s) must, at the start of the process, create a KeyToken (e.g., NFC, USB, etc.) – or work with a pre-created KeyToken – that can either a) store the discovered preferences internally (on the KeyToken) and/or b) be associated with a blank preference set on the GPII server so that the

discovered preferences can be stored for future use. The KeyToken can be anonymous.

Background:
In order to prevent loss of information gathered during the process—should it be interrupted for any reason (e.g. equipment failure, fatigue, etc.)—the storage medium or location should be set up first. To allow the user to continue the process on another device (see Requirement 15), the storage would have to be associated with a KeyToken, but would not need to be associated with the user in any way (unless the user chooses to associate the preference set with his/her identity).

In order for end-users to continue to use their discovered preferences, the preferences must be recorded in a way that they can be accessed at any time. The GPII infrastructure provides this functionality.

Task Order 0002 Notes:
This will be accomplished using existing GPII authentication and KeyToken support infrastructure.

We are exploring the use of both anonymous and ID related KeyTokens (e.g., a library card), the pros and cons, and the issue of user understanding of privacy implications of each. We do not seek to solve this, but are exploring it because it may have implications for the design of our tool(s).

Requirement All-3: **No Assumed Ability**
Until it has been established and verified by the tool(s) that a user has a given ability, the tool(s) must not require vision, hearing, ability to use a mouse, keyboard, or touchscreen, the ability to read printed text, or the ability to understand and use icons, on-screen controls and other digital metaphors.

Background:
At the start of the First Discovery process, the tool(s) will not know what the person can and cannot do. The first tasks will therefore be structure to carefully monitor and detect problems with ability to perceive, understand (including digital literacy) or operate the First Discovery tool(s) and their interfaces. As problems are detected, special screens will identify any problem in perceiving, understanding or operating and either adjust the First Discovery process -- or refer the person off to a professional for evaluation.

Task Order 0002 Notes:
This requirement one of the most challenging tasks of the project and one that has not been successfully done to date. A key result of this project will be significant progress on solving this problem.

Someone who has none or very few of the aforementioned abilities and who requires an assistive technology or access feature that cannot be simulated by the tool(s) would be beyond the scope of the tool(s). See the next requirement regarding “Failing Gracefully”

in a way that would help the user.

Requirement All-4: **Fail Gracefully**
In cases where the tool(s) are unable to interact with the user, the tool(s) must fail gracefully, providing the user with a recommendation that they be seen by a professional or that they try again with some assistance.

B*ackground:*
The tool(s) created for this task order it will not be able to determine the needs and preferences of *all* users. Even with an assistant, the tool(s) will have limitations (and these limitations will vary depending on the assistant). If the tool(s) fail, users should not be left feeling that they failed, nor should the program give up and leave them without any guidance as to what to do as an alternative to use of the tool(s) to figure out what they need.

Task Order 0002 Note:
We need to determine how to guide the user out of the tool(s) gracefully, or recommend an alternative to the user, given the fact that in some cases, the tool(s) may have difficulty communicating with the user and meeting the users' needs. This may involve communicating with a person near the user and conveying the information to them.

Requirement All-5: **Simple Navigation**
The tool(s) must support simple navigation between and within screens, including keyboard navigation. The user must be able to go back to review and change previous input. This may or may not be linear, but complexity and efficiency should both be considered, and the balance may be different based on what is discovered about user needs and preferences.

Background:
Many end-users – and their assistants – may have difficulty using the tool(s) if the navigation between or within screens is complex. Because some may need to navigate by keyboard, this navigation must be simple to understand and use.

Requirement All-6: **Diverse Assistants**
The tool(s) must support use/engagement by varied types of assistants (formal/informal, trained/untrained) through ease-of-use and intuitive interfaces, including being simple enough to be used by non-technical users and assistants.

Background:
As described in Section 1.3, there are many types of assistants with varying levels of technical knowledge and understanding of the First Discovery Tool(s) and of the end-user. The goal for each section within the tool(s) should be easily interpretable and quickly navigable by those in all assistant categories.

Some of the assistants (including sponsors or encouragers) that have been identified are: family members; community member assistants (such as found in senior centers, libraries, etc.); staff or volunteers at senior-oriented digital literacy programs; staff at government agency programs (office on aging); and clinicians at medical/clinical programs (low vision clinic). These assistants will represent a wide range of knowledge and skills with some having very little technical or disability skills or experience. Consequently tool(s) must be designed to be used easily with minimal knowledge or skills in order to be useable by all of the assistants.

Requirement All-7: Essential Preferences

The tool(s) must determine the basic settings (essential preferences) that the end-user needs in order to be able to use ICT in the application area (see section 2.1 for a description of what it means to use ICT in each application area). This process must be accomplished without requiring that the user have any knowledge of, or skills with, on-screen controls when they first begin (see Requirement All-8).

Background:
The First Discovery process must determine and meet the user's essential preferences for a particular setting so that the user may engage with ICT, or with additional preference setting tools, as required by the application setting. For example, if end-users cannot read and do not understand sign language, they may need any text to be read aloud to be able to perceive all text-based information presented to them. Another user may not need text to be read aloud, but they may need to specify which font size they prefer so that they can effectively read and comprehend written materials.

Task Order 0002 Note:
We will work with application area experts to determine what a minimal set of essential preferences will be. The initial list of essential preferences is presented in Section 5.

Requirement All-8: First Dig-Lit

The tool(s) must determine what digital literacy concepts the end-user needs to understand in order to use the interface elements in the First Discovery tool(s), and must offer sufficient digital literacy education to empower the user to use the tool(s).

Background:
Some users will have no prior knowledge of computers or how to use them; this requirement is necessary to ensure that the user can interact with the interface and move through the First Discovery process and also do something useful afterwards with simple ICT.

Task Order 0002 Note:
This is related to Requirement All-3, and is similarly challenging.

Requirement All-9: User Verification

The tool(s) must allow the end-user to verify that the preferences discovered by the tool(s) are the preferences they want. Verification should be easy.

B*ackground:*
The First Discovery process is an exploratory one and errors may be made by users and assistants along the way. Assistants might inadvertently make assumptions about the preferences of the end-user in their attempts to be helpful. It is important that end-users have the opportunity to confirm or correct any information that might have been provided by an assistant. Before exiting the tool(s), the preferences should be double checked and confirmed. This may take different forms for different users: asking the user for confirmation for some settings, or doing a final objective test for others (e.g., limits of vision).

Requirement All-10: **Preview**
The tool(s) must inform the user of the effect of any preference setting during the First Discovery process.

Background:
It is important that the end-user learn not just what preferences can be set but what the intended effect will look/act like with a given preference set in a particular way.

Requirement All-11: **Undo**
The tool(s) must allow users to undo the last preference setting at any instant in the process in a manner that will always be accessible to them.

Background:
Given the exploratory nature of First Discovery, end-users might try preference values and realize that they do not want them, perhaps because a chosen value makes the interface unusable, or because another preference makes another preference unnecessary. Users may accidentally or in error change a setting to one that puts the interface outside of their abilities, and therefore outside their ability to get it back to something they can use. During the exploration process, users must always be able to “back out“ of any change they make.

Requirement All-12: **No Disability Declaration**
The tool(s) must not ask end-users to declare they have a disability.

Background:
In many cases, older citizens may be unaware of their disability or may refuse to admit that they have an impairment. Consequently, the tool(s) must be designed to allow users to avoid declaring that they have a disability and instead focus on whether they are able to complete specific tasks.

Requirement All-13: **Auto-Save**
The tool(s) must save needs and preferences as they are discovered.

Background:
The results of the First Discovery process should be stored as it progresses so no data are lost if users or events terminate the process at any point. If the user terminates, they should be given the option to save or delete the data collected to that point.

Requirement All-14: **Restart In-Place**
The First Discovery process must be able to be completed over multiple sessions, and in

subsequent sessions users should be able to start where they left off.

> ***Task Order 0002 Note*:**
> **Restarting where the user left off at a different time or on a different system would require the user to identify the KeyToken associated with the intermediate preferences. We have not yet determined how this would be accomplished technically. If this specification requires association with the user, e.g., through the creation of an account, the user might be hesitant to create the account because they do not understand the implications. We will need to consider this and other factors.**

Requirement All-15: **Reusable Preference Format**
The tool(s) must save the end-user's needs and preferences in a way that allows the end-user to retrieve and use them in other GPII-compatible systems.

Background:
The GPII uses a standard and defined format. If the preferences from the First Discovery Tool(s) are saved in this format, they can not only be used by GPII infrastructure itself, but also by any other system that would like to make use of the needs and preferences.

> *Task Order 0002 Note*:
> We still need to determine whether or not a specific context (e.g. "desktop" vs. "tablet") will be associated with the outcome of the First Discovery Tool(s).

Requirement All-16: **Pre-Tool Support**
The tool(s) must be designed so that it can later support a pre-tool as a mechanism for assistants to seed the First Discovery process.

Background:
In the vast majority of use cases, an assistant will be available to provide the First Discovery Tool(s) with basic information about the end-user. This can help the tool(s) to more quickly determine what mechanisms can be used to communicate with the end-user (can the user see? read? hear? use a keyboard?). Without this minimal assistance, the process for an automated tool to discover the capabilities of the end-user may be onerous for many users.

> *Task Order 0002 Note*:
> For this Task Order, a pre-tool will cover language at a minimum. We will explore what other preferences might be included.

Requirement All-17: **Application Area/Context Configurable**
The tool(s) must flexible enough to be configured by integrators (see definition in Appendix A) in the future to accommodate different preferences for different contexts and user groups within each application area.

Background:

- In Online Assessment there may be different preferences related to specific testing areas
- In Accessible Voting, different tools are required:
    - At the voting place, a constrained set of preferences that matches the specific hardware and software used for voting is required
    - Voting preparation activities (registering, finding a voting place, reading about issues) requires a broader set of preferences (related to using the web)
- Tools aimed at Older Citizens may be more effective if they focus on the preferences most needed by this group
- In the OER application area, there may be the need for preferences tied specific topics, areas, or cognitive needs

Task Order 0002 Notes:
See the Note on Requirement All-1.

Although creating the data architecture so that the FD tool(s) can be configured later by integrators to handle a wide variety of specific contexts is within the scope of this task order, creating examples of those configurations and developing the user interface are not.

A subsequent document, submitted separately from this report, will outline the application area(s) that will be the focus of the Task Order 0002 prototype.

Requirement All-18: **Additional Tools Referral**
The tool(s) must inform the user that preferences can be further refined using other preference explore and management tools in the GPII ecosystem.

Background:
First Discovery tool(s) will only gather essential preferences. There are many other preferences that would be useful to different users, and users should not be left thinking that this is the only set of preferences there are. Nor should these new users be expected to be able to easily find intermediate and advanced tools for compatible preference gathering in the wide world of ICT/Web.

Requirement All-19: Device Support
The tool(s) must run on a device commonly found in the application areas.

Task Order 0002 Note:
We still need to determine what that device will be in each application area.

Background:
We expect that the First Discovery process will be carried out in environments that use different devices--e.g., desktop computers in some environments, tablets in others.

R**equirement All-20: Browser Support**
The tool(s) must run on accessible browsers.

> *Task Order 0002 Note*:
> In Task Order 0002, we will test against Chrome and Safari.

Requirement All-21: Privacy and Security
The tool(s) must ensure user's privacy while allowing transferability of the preference files between devices, contexts and locations.

Background
Across all application settings, privacy and security were recognized as key components of the tools. This general requirement was balanced against the desire to have transferability of the PNP files between devices, contexts and locations. Maintaining security and privacy while facilitating mobility of the PNP settings is key to a successful system. Within OER and Online Assessment, there are specific needs around integration with Learning Management Systems (LMS) and compatibility with standard forms and policies such as the Individual Education Program (IEP). It is important that the settings and terminology be compatible with those of the IEP.

4. Recommendations

The following recommendations and ideas are provided for consideration by the PGA co-design team. They are not requirements but rather further recommendations, or ideas for meeting one or more of the requirements above.

Recommendation 1: **Inference Use**
In all application areas, the tool(s) should support efficient use through inference wherever possible. For example, the tool(s) might prompt users to make preference settings based on their performance during the First Discovery process.

Background:
For example, if a user repeatedly has difficulty hitting a button accurately, the system can infer that buttons might need to be larger. Note that it will be important to allow the user to verify all preference settings as a final step, to guard against incorrect inferences drawn from incorrect information provided by an assistant.

Recommendation 2: **Motivating**
The tool(s) should be designed to motivate participation by end-users where that participation is voluntary through personalization of examples, rich media, gamification, etc.

Background:
In application areas where use of the tool(s) is voluntary, it is even more important for the

tool(s) to be engaging, easy to use, and fast to ensure end-users actually participate. In areas where the process is less voluntary, this requirement is less important.

Recommendation 3: **Progress Indicator**
The tool(s) should convey to the user how long the process will be how much left of it they have to go where possible.

Background:
One of the primary concerns that the co-design process identified is the need for the First Discovery process to avoid being lengthy or intrusive. A conversational style was discussed, for example, a sequence of questions or screens. The team discussed the concern that a one-at-a-time process might leave the user wondering how long the process was going to take, and felt that some form of status or progress indication would address this concern. However the fact that the answers to some sections may eliminate the need to carry out other sections means that it may not be possible to tell how much more is yet to be done.

Recommendation 4: **Embeddable**
The design should consider the fact that the tool(s) may be embedded in other applications.

Background:
In the discussions, it was mentioned that in some applications it may be desirable to embed the discovery process in another tool or process. Exactly what that process would look like is not known so it is not possible to ensure this. But during the design this type of implementation should be kept in mind.

Task Order 0002 Note:
This recommendation is facilitated by the open source nature of the software, and by its use of Infusion and the GPII architecture. This infrastructure is designed to support the creation of tools that are to be embedded in other applications.

Recommendation 5: **Embeddable First**
It should be possible to embed the tool(s) in an existing system such that it is the first thing that a user encounters.

Background:
Because the First Discovery process is, by nature, the first thing that some users will have to do, it must be possible for an integrator to add the First Discovery Tool(s) to a system as a first step.

Recommendation 6: **Security & Privacy**
The tool(s) should support the ability to add whatever privacy and security measures are employed by integrators in different environments.

Background:
Despite the need for transferability of PNP files between devices, contexts and locations, most contexts require some degree of security and privacy. Each application area has particular requirements.

Recommendation 7: **Documentation**
Documentation should be provided describing how to configure the tool(s) and how to use the interface.

Recommendation 8: **Stand Alone or Professional Use**
The tool(s) should be designed to work both stand alone and in conjunction with an evaluation by a trained professional.

> *Background*:
> In an assessment environment, an education professional may be present with a student to ensure that the student's mandated accommodations are provided. The educator should be *able* to monitor student progress and the settings the student is selecting. The educator should be able to assign some settings but allow the student to adjust them. For example, if a student has been approved to use text-to-speech, the teacher might enable that, while allowing the student to set a voice, speech rate, and volume. Depending on the context (high stakes assessment or assessment during learning) there may be some preferences the student is not permitted to select.
>
> One idea for making the tool easier to use by professional evaluators is to create the tool such that it supports multiple screens. The prompts (and navigation elements) could be presented on one screen to the professional (who could then present the tasks to the user in the proper form) and the second screen (where the user would respond) would face the user. This would allow professional skills to be added, reduce unnecessary screens, make the user screen simpler, and allow for professional intervention to handle failures.

5. Essential Preferences

The list below identifies the essential preferences that may be made available through the First Discovery tool(s). The tool(s) would capture, manipulate and apply these preferences, as applicable to the area they are designed for. The essential preferences listed include those identified in PGA Workshop 1 as well as others that have arisen in subsequent discussions. This list is still a work in progress, and the final list of essential preferences to be covered in the First Discovery tool(s) prototype will be determined though the co-design process and discussions by the team, the application area experts, and other stakeholders.

1. **Language** - the natural language that the content would be presented in
2. **Volume** - the auditory volume level
3. **Text size** - the size of the text on screen
4. **Text spacing and line spacing** - the space between characters and lines
5. **Color scheme** - what color combination the user needs/prefers for text and background
6. **Contrast level** - whether the user needs/prefers high or low contrast
7. **Read text** - whether **text** presented to the user will also be read aloud to them
8. **Read Screen** - whether all information presented visually should be read aloud /described (including icons, image, information conveyed through layout, etc.)
9. **Speech rate** - the rate at which speech is read aloud, expressed in WPM
10. **Show sounds/captions** - whether all speech and other important audio information should be presented as text and whether all alerts and sounds should be presented visually

11. **Sign language** - whether all text and audio should be presented using sign language
12. **Full keyboard control** - whether the person needs/prefers full control of the device using the keyboard only
13. **On-screen keyboard** - whether an on-screen keyboard should be provided to support text entry (or other keyboard-driven functions)
14. **Cursor speed** - the ratio between on-screen cursor movement and physical pointing device movement

Only shown if problem Is detected ??

1. **Key repeat delay** - the delay before a key starts to repeat when held down
2. **Key repeat rate** - the rate of repeat characters
3. **Bounce keys** - a function that applies a delay before accepting the same keystroke twice, which can remove keyboard errors due to tremor
4. **Sticky keys** - a function that enables modifier keys to remain active after being pressed, to support one-finger entry of modified characters

> *Task Order 0002 Note*:
> The interaction between preferences for text-to-speech and screen voicing will need to be investigated: For example, if a need for text-to-speech is identified, would a new user understand the different between text-to-speech and screen voicing?

6. Requirements Out of Scope for Task Order 0002

Task Order 0002 is limited in time and funding, and some desired features needed for First Discovery are not attainable. First Discovery requirements deemed out of scope for Task Order 0002 are listed here for implementation in future releases. These requirements are designate by OOS (Out of Scope) followed by a number representing the requirement number.

OOS 1: Assistance on Demand
The tool(s) must provide Assistance on Demand. Assistance on Demand (AoD) is a vehicle to provide remote assistance, with the intent of replacing or supplementing in-person assistance by a professional or non-professional. AoD offerings should be contextual in that they must be aware of where the user is in the First Discovery process.

While this is desirable, it is out of scope to provide it as part of this project. It is also hard to see how this would be prevented. It is listed here to be sure we do not do something accidentally to prevent this in the design of the tool(s).

OOS 2: **Dashboard**
The tool(s) must support a dashboard tool with settings and metrics about learner performance

that also enables user input on preferences.

> *Task Order-0002 Note*:
> This requirement needs further discussion. Does this relate to metrics for learning, or assessment? Or metrics regarding the First Discovery process?

OOS 3: **Authorization Model**
The tool(s) must provide an authorization model for preference tool configuration.

This refers to identifying preferences, and otherwise configuring the tool(s). Only an authorized person should be able to do this.

OOS 4: **Administrative Interface**
The tool(s) must provide administrative interface that allows assistants (professionals, teachers, etc.) to configure the tool(s) with respect to reading level, alternate presentation of preference choices, etc.

OOS 5: **Educational Data Import**
The tool(s) must collect data from other forms of educational assessments.

> *Task Order-0002 Note*:
> We need to determine if this is actually a within scope of First Discovery.

OOS 6: **APIP Verification**
The tool(s) must verify existing Needs and Preference statements as used in an APIP statement.

> *Task Order-0002 Note*:
> This will be supported so long as the GPII includes a translation for the APIP preference set.

OOS 7: Preference Import
The tool(s) must be capable of importing an initial GPII set of preferences (captured or shared) that can be used to speed up First Discovery. Because settings may not be appropriate or optimal for the user (they may be shared settings from another, or inappropriately selected or configured AT for the person), these preferences must be verified by the user through the use of the tool(s) before being relied upon.

In some cases, the user may have access to a set of preferences (perhaps shared by an assistant or a friend) that may be helpful in getting them started in the First Discovery process.

Note: According to this requirement, First Discovery tool(s) must ***support*** importing 'captured' or 'shared' preferences. It is not a requirement that the project develop such capture or sharing functionalities. These may be quite complex technically and developing the share or capture functions or tools themselves is beyond the scope of Task Order 0002.

Task Order 0002 Note:
The capture and sharing tools are still under development in other projects. The First Discovery tools(s) will not necessarily process all of the preferences in an imported set – only those dealt related to the First Discovery process (see note on Requirement 9). Preferences not used will be preserved.

OOS 8: IEP Compatibility
In Online Assessment, the tool(s) must be able to filter the preferences presented based on the content of a student's Individualized Education Plan (IEP). This requires that that the IEP be provided as an input to the FD tool and that the IEP input be encoded in a suitable format so that the FD tool can process the information. It might also be necessary to modify the interface templates based on the IEP (this would depend on what types of things can be specified by an IEP). The tool would then proceed to build its interface based on the new, customized configuration information.

7. Note on Universality

As part of the PGA co-design process, we frequently encounter an important issue in our design exploration regarding whether universal First Discovery Tool(s) are possible. That is, can we design a tool or tools such that any user, with any constellation of needs and preferences, can enter, use, and complete them? Assuming we can frame interface options in such a way that no unjustified assumptions are made, that we can create a flow that encompasses all possible user capabilities in a correct order, such a tool is theoretically feasible. For example, we could ask about the need for captioning before asking about audio volume preferences.

However, such a tool might be confusing, overwhelming, long, and thus daunting to most users, many of whom might abandon it if they could. This would be especially true for people with cognitive disabilities, those who are using the tool voluntarily, and those who are using it without assistance. That is a large enough segment to warrant concern.

We believe we have proposed requirements to address these issues: importing current device settings; using as much information about the user as possible; modularity and flexibility that reflect the use environment so that user experiences are manageable; allowing different versions to be created, etc.

In the end, only suitable user testing and expert walkthroughs in real environments of use will be able to provide answers to this design dilemma.

Appendix A: Glossary

This glossary defines various terms as used in this document and the project overall.

access (to ICT) The ability to perceive, understand and operate the ICT.

accessibility The degree to which something is perceivable, operable and understandable.

accessible (to a person) Perceivable, operable and understandable; (legal definition) Meeting a minimum standard for accessibility.

accessible portable item protocol (APIP) A standard protocol that provides assessment programs and question item developers with a data model for standardizing the interchange file format for digital test items and provides a test delivery interface with all the information and resources required to make a Test and an Item accessible for students with a variety of disabilities and special needs (Source: IMS).

assessment Academic tests and evaluation assessments, which are used to assess a student's progress in learning or to give feedback during learning.

assistant A person who helps the end-user in some capacity, either for the first discovery tool or the application setting tasks. There are different kinds of assistants, depending on the application area and specific context.

capture (functionality) Recording information about a person's needs and preferences by looking at the access tools and features that a person is currently using, along with his/her settings (see also Create, First Discovery, Explore, Manage, & Share Functionality)

context The surroundings, circumstances, environment, background, task, or other settings in which a preference is meant to apply. Examples include: When the environmental noise rises, raise the volume; when captions are on, and the environmental sound increases, do not raise volume; when I use my 'doing math' ContextToken, use the floating magnifier.

create (functionality) Setting up a new needs and preference storage location (account) and tying it to a KeyToken. NOTE: a person can have multiple needs and preference accounts, some of which are tied to an ID and some of which are anonymous. This is separate from the ability to have different preference sets within an account (see also First Discovery, Capture, Explore, Manage, & Share Functionality).

end-user A person who uses the First Discovery Tool(s) to discover and record their own personal preferences.

explore (functionality) Allowing a user to try out explore different settings and different features/technologies within a context where the user can immediately see the effect of the new solutions or settings (see also Create, First Discovery, Capture, Manage, & Share Functionality).

first discovery (functionality) Determining a person's essential needs and preferences for the first time
NOTE: This usually is for people who are not already using ICT successfully but could be used to confirm settings for a first time GPII user if they are not sure of their current settings or they are having trouble with them (see also Create, Capture, Explore, Manage, & Share Functionality).

individualized education program (IEP) A document that defines the individualized objectives of a child who has been found to have a disability, as defined by federal regulations (source: http://en.wikipedia.org/wiki/Individualized_Education_Program).

integrator A person with the authorization to add the First Discovery Tool(s) to the program for their organization; this person may also determine the allowable set of preferences to be changed. Examples include the chair of a county board of elections in the Accessible Voting area, and an educational technology coordinator of a school district and school district administrators in the Online Assessment area.

keytoken Anything that a person uses to identify which preference set should be applied to the current ICT device or environment meet his/her needs. Examples: The KeyToken could be a USB, a Smartcard, an NFC (near-field communication), a QR code, a password or anything else that can be used to indicate which preference set should be applied in a situation.

Note 1: KeyTokens can be associated with a person's identity, or they can be anonymous (e.g., users do not identify themselves, just identify which preferences should be applied); some KeyTokens can be used both ways.

Note 2: Some KeyTokens (USB, NFC, etc.) can actually store preference sets themselves. This can eliminate the need for an internet connection to fetch the preferences. It can be used by people who do not want their preferences stored in the cloud. It can be used as a back-up to allow some or all preferences to be available in case connection with the preference server is not working.

manage (functionality) Allowing a person to view and edit all of their current needs and preference set(s) (see also Preference Management Tool and Create, and First Discovery, Capture, Explore, & Share Functionality).

need (for a person) (as used in this document) A feature or feature-value that must be directly and continually available in an ICT interface or resource without which or a person cannot use the ICT or resource at all. Examples**:** a font must be above .1875 inch. (for someone who has low vision or they can't read it); all visual information must be provided in audio form (for a person who is blind and does not use/know braille).

Note 1: See also preference, preference set and preference profile

Note 2: In the First Discovery Tool(s), needs are not collected. Instead, the preferences are collected and used to guide the MatchMaking process. If preferences cannot be met, the limits of what a person can handle might need to be explored for that context through interaction with the user as part of finding a solution for them. This can then be recorded for that context is seen as helpful in future.

preference management tool (PMT) A tool that allows a person to view and/or edit the different preferences in their Needs and Preference sets, including different preferences or different preference sets that would be invoked in different contexts or by user choice. Usually a PMT will

provide access to all of the preferences and sets, but PMTs could be designed that would provide more limited views or editing capabilities to meet the needs and or preferences of different users.

preference (for a person) Features or feature-values that what a person would prefer in general or for a particular context, for reasons of comfort, convenience, or productivity. Examples: the person prefers the AcmeMag magnifier; the person prefers fonts larger than .5 inch; the person prefers magnifier with enlarged view anchored to top of screen; the person prefers 200 % magnification. NOTE: the term **preferences** is often used as an abbreviation for **needs & preferences (**see also **Need)**

preference set Any defined collection of needs and preferences. This may be: the whole preference set for an individual (see preference profile); a subset of a person's preferences (e.g. a preference set they use for math); a generic set of preferences that many people may use (e.g. a typical or example or starter preference set for people with low vision).

preference profile A set of preferences belonging to a person, that refers to characteristics of interfaces, materials, processes etc. A preference profile does not describe the user, but rather the user's needs and preferences with regard to interfaces, materials, processes that they encounter. NOTE: a preference profile is also a preference set but usually refers to the whole of a person's preferences rather than just a subset of it.

share (functionality) Providing the ability for a person to share some or all of their needs and preference profile with another person or persons, usually to help that second person get started developing their own preference profile (see also Create, First Discovery, Capture, Explore, & Manage Functionality).

stacked (preferences) Layered in a cascading fashion where the latest set of preferences overlays the previous sets such that new preferences override lower ones where they are the same, but lower level preferences stay in effect if there is no upper level preference that overrides it.

Appendix B: Considerations When Designing for People with Disabilities

- Never automatically advance in a presentation or webpage.
    - It might take some users longer than the allotted time to read and comprehend the material.

- Avoid using a first-person perspective for the computer.
    - The user might try communicating with the computer as if it is a human.

- Higher contrast is not always better.
    - Some users have difficulty reading text with extremely high contrast and require alternative text and background colors.

- Never rely on “No Response” as a response option.
    - Similar to automatically advancing a presentation, the response may not be what the user intended if it takes a user longer than the allotted timeframe to process the information.

- When repeating a message in sign language, always include motions to get the user’s attention.
    - We cannot assume that a user is looking at the screen at all times, so starting with “Let me say it again…” or something similar can be used to draw the user’s attention to the screen.

- Talking very slowly is actually counterproductive.
    - When someone talks slower, users could forget what was said earlier in the sentence.

- Tell a user what to do rather than what not do to.
    - If a sentence is in the format “Don’t do _____,” the user might hear the last part of the sentence and simply do it. (e.g. “Don’t press the red button” ---> User might only hear or remember “Press the red button”)

- Always provide instructions with the Available Option first and Action Required second.
    - If the required action is described before the user is told the outcome, the user might perform the action before hearing what the action does. (e.g. “For English, press 1” rather than “Press 1 for English”)

- To understand how a screen might be viewed by someone with low vision, try looking at the screen through a “soda straw”.
    - When only a small portion of the screen is visible at one time, a layout that otherwise seems intuitive can be confusing.
- Use 1.5 line spacing when possible.

    - White space between lines prevents users from rereading or skipping sentences.

- Minimum of 18 point font preferred when possible.
    - Larger text is easier to read for everyone.

- Break up multiple-step tutorials so only one step occurs at a time.
    - Reduces mental load. Some users have difficulty remembering several things at once.

- Remove screen clutter when possible.
    - Reduces mental load. Presenting multiple elements on the screen can be distracting.

- Use plain language whenever possible.
    - Reduces mental load. Some users have limited vocabulary. Some users aren't able to understand metaphors or new definitions for common terms. Some users take things literally.

- Provide direct and immediate feedback when possible.
    - Explaining mistakes immediately can help users learn concepts faster.

- Encode information in several formats (location, shape, color, etc.)
    - Users might not be able to understand or perceive one of the formats, so having multiple increases the likelihood that they will be able to receive the information.