**Roadmap and Gap Analysis for The Cognitive and Learning Disabilities Accessibility Task Force**

**Abstract**

To do:

1. Add abstract
2. Change formatting of h4 and h5
3. Add correct acknowledgments

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**1. Introduction**

*This section is non-normative.*

The Cognitive and Learning Disabilities Accessibility Task Force’s aim is to improve web accessibility for people with cognitive and learning disabilities. This is being done as part of the Web Content Accessibility Guidelines (WCAG) and Accessible Platform Architecture Working Group (APA WG), part of the Web Accessibility Initiative (WAI) of the W3C.  Challenges facing this work include:

* Lack of availability of open research: Research on this topic tends to be behind a “paywall” which means that developers and policy makers may be unable to find out what techniques are proven to work to address the needs of people with disabilities
* There is a wide range of cognitive disabilities; each type of impairment is different, with diverse symptoms and particular digital accessibility requirements. This adds to the complexity of knowing how to address user needs.
* The advice given in the research and available guidance is often vague and is not testable. So, even if developers read the research they would not know exactly what to do or when they have reached an acceptable level of accessibility.
* Some of the issues facing people using web technology are not simply about coding practices or code, but can include wider contexts, such as security concerns and personalization.
* Another major challenge is capturing difficulties related to cognitive disabilities that may be undeclared. People with cognitive disabilities may be embarrassed about their disabilities and may be less likely to request accommodations. They may be afraid of discrimination, especially in the work place. Others are not aware of their disability or of the impact it has on their functioning.
* Attitudes and misinformation can also become a barrier to inclusion for people with cognitive disabilities. For example, developers that may feel people with cognitive disabilities are not in their “target audience” and so have no interest in their inclusion. Also, studies of usability often over-sample college students. This can mean that the results work less well for those inadequately represented among sub-groups of college students (such the aging population).
* Accessibility has typically been based upon the assumption that any website can be designed to be usable by people with disabilities. However, when making a website usable for people with cognitive disabilities, the content itself may need to be changed (e.g. simplified), or support adaptability (e.g. multi-modal delivery).

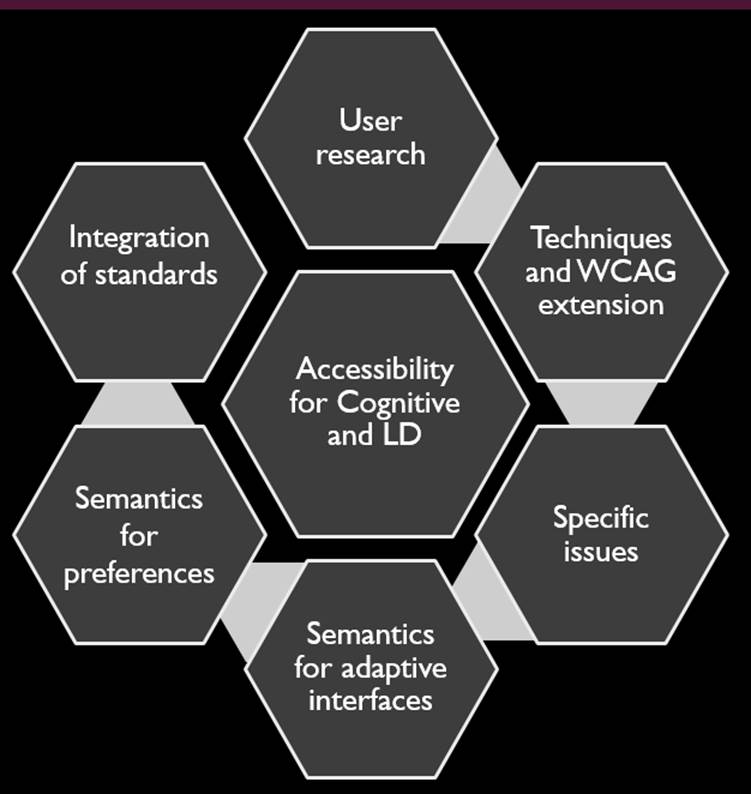
Addressing these issues requires us to make a broader view of solutions for accessibility, such as a content focused approach and to explore personalization solutions that incorporate inclusive design. To address these issues we have adopted the following strategies:

1. Select a **phased approach**. In our first phase we looked at eight different disabilities or categories that cut across types of cognitive impairment in terms of severity and brain function. Although some user needs might not have been identified in this phase, this approach made the work involved practical and it is likely that most key needs will have been identified. Other cognitive disabilities and emotional disabilities may be included in phase 2 and the current user groups may be re-examined.
2. Compile **user research** and literature reviews on the selected disability groups. These literature reviews mean that key findings are in the public domain and are easily available.
3. Compile a list of **authoring techniques** that include the most useful strategies from all the different user group research
4. Create testable and widely adoptable sets of **success criteria** that let authors know exactly what they need to do and when they have completed the task. (This will then become the basis for the extension to WCAG for cognitive disabilities)
5. Author a series of **issue papers** that explore topics beyond simple content such as security or personalization.
6. Review the techniques and issue papers to **identify the gaps** between what is currently supported in accessibility guidelines and in the web architecture and what is needed to enable accessibility for people with cognitive disabilities
7. **Create a roadmap** to show how we can fill these gaps.

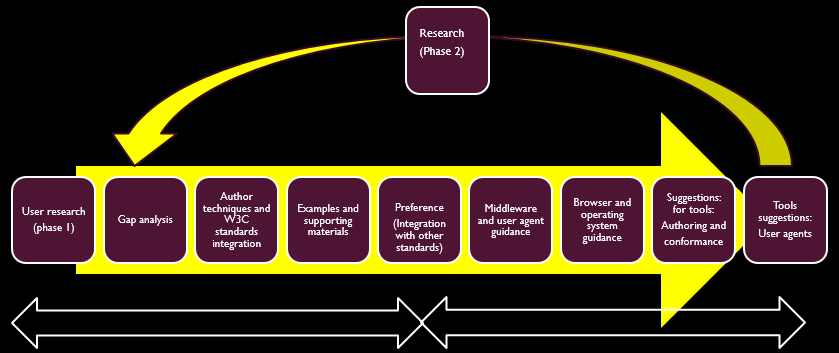
In addition to this gap analysis we have first drafts of the following accompanying documents: (Note they are works in progress and may change.)

* Background research document. See <https://w3c.github.io/wcag/coga/user-research.html>
* Issue papers on topics such as security, safety and how they are affected by cognitive disabilities. See [https://rawgit.com/w3c/coga/master/issue-papers/index.html](https://w3c.github.io/coga/issue-papers/links-buttons.html)
* An authoring techniques document, including
  + techniques that help all users and
  + techniques that help specific user groups. See <https://rawgit.com/w3c/coga/master/techniques/index.html>
* The techniques will also lead to a proposal for a WCAG 2.0 extension. See <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal_for_WCAG>
* Draft for a semantics for adaptive interfaces (that may become a WAI-ARIA extension) and personalization syntax to enable adaptable interfaces. See <https://w3c.github.io/coga/issue-papers/links-buttons.html>

The diagram shows how these need to be integrated to enable accessibility for people with cognitive disabilities



**Figure 1. Diagram showing user research leading to techniques & WCAG extension, specific issues, semantics for adaptive interfaces and preferences with integration of standards**

A roadmap must enable the integration of all the pieces that can make accessibility for people with cognitive disabilities workable. A roadmap must also address the author needs and issues that will help make this work practical. For example: Best practice documents and how to ensure that personalization is practical and testable.  


**Figure 2 Anticipated Roadmap**

The diagram shows what we are anticipating moving towards a roadmap. (Note that this work has yet to be completed.)

* User research (phase 1)
* Gap analysis
* Author techniques and W3C standards integration (such as WCAG and VOICE ML or ARIA)
* Support and possible standardization of preference (user settings) and metadata so that terms and setting are interoperable and user needs can be met across different Web applications. (Integration with other standards).
* Web semantics that enable personalization of content such that web authors can employ mechanisms that adapt Web content to meet the needs of the user according to the user preferences.
* Author support providing examples and supporting materials such as best practices and techniques. Test cases for personalization.
* Middleware and user agent guidance
* Browser and operating system guidance
* Suggestions for tools: For example guidance for authoring and conformance tools and user agents.

Then we can start the process again with phase 2 for additional research and new user groups, possibly including emotional disabilities.

**1.1 Importance of this Document**

This document is important because enabling people with learning and cognitive disabilities to use the Web and Web technologies is of critical importance to both individuals and society.

More and more, the Internet and the Web have become the main way people stay informed and current on news and health matters; keep in touch with friends and family; and it can provide independence such as convenient shopping etc. People who cannot use these interfaces will have an increased feeling of having a disability and of being alienated from society.

Further, with the advent of the Web of Things, everyday physical objects are connected to the Internet and have Web interfaces. Being able to use these interfaces now is an essential component of allowing people to maintain their independence, stay in the work force for longer, and stay safe.

Consider that the population is aging. The global share of population aged 60 years or over is expected to reach 21.1 per cent by 2050 and is typically higher in developed countries. A majority of people over 60 years old notice a decline in memory and executive function such as an Age Associated Memory Impairment (38.4%), Mild Cognitive Impairment (15.3%) or less frequently, dementia (8.8%). That means more and more people are dependent on others for things that they could do themselves, increasing the crippling cost of care and reducing human dignity.

We therefore invite you to review this draft; and comment and consider how your technologies and work may be affected by these issues.

**1.2 People with cognitive and learning disabilities and the Web**

People with cognitive and learning disabilities may be unable to use web content because of the design choices of the author. Examples include:

* People with impaired short term memory are unlikely to be able to remember passwords and access codes. They may have trouble or be unable to remember new symbols and interface paradigms.
* People with language related disabilities may need simple clear language and instructions. They may also need supporting graphics and familiar symbols
* People with communication disabilities may need clear literal language and may not understand metaphors or non-literal text and symbols.
* People with dyscalculia may not understand numerical references such as percentages.
* People who struggle with keeping and regaining focus, may be unable to focus on a task if there are lots of distractions and interruptions. They may need headers and signposts to help them regain the context after their attention has been lost (including in multi-media).
* Many groups will need support to minimize errors and complete their task. They will struggle with complex, multi-stage processes that were not necessary for the task at hand such as filling out forms or entering data correctly or finding the content or feature that they need.

**1.3 Assumptions**

There is a huge number of cognitive disabilities and variations of them. If we attempt an analysis of all the possibilities, the job will be too big, and nothing will be achieved. Therefore, we are adopting a phased approach, selecting in phase one a limited scope of eight diverse disabilities, and hope to achieve something useful within that scope. Also note that helping users improve skills, and emotional disabilities, are out of scope for phase one. We anticipate this analysis will continue to a second or third phase where more user groups are analyzed, and the existing analyses are updated with new research and with new technologies and scenarios.

**1.4 Comments**

This is an early and incomplete draft for review; and to help us get comments and early feedback. We are particularly interested in:

* omitted challenges, use cases, and issues;
* issues involving your technologies/work and people with learning and cognitive disabilities; and

We welcome comments and suggestions. Please send comments to pubic-coga-comments@w3.org. All comments will be reviewed and discussed by the task force. Although we cannot commit to formally responding to all comments on this draft, the discussions can be tracked in the task force minutes.

**1.5 Status of this document**

To do: Add that the gap analysis sections are mature and the roadmap is less mature

**2. Summary of issues and techniques**

As discussed above, the task force reviewed different disabilities to identify techniques that supported their using the web. The task force also reviewed issues that went beyond standard Web content, but affected the use of the Web for people with cognitive and learning disabilities.

This section is a summary of these findings. The full reports can be found at:

<https://rawgit.com/w3c/coga/master/techniques/index.html> and [https://rawgit.com/w3c/coga/master/issue-papers/](https://rawgit.com/w3c/coga/master/issue-papers/flat-design.html)

**Overview of techniques**

Most designers want people to be able to use their site. However designs that might be difficult for some people to use can actually bar people with cognitive and learning disabilities from using the content at all. Typically this happens because content providers may not be familiar with the needs of users having these impairments. We have reviewed multiple user groups as a first phase to identify user needs and challenges that are not fully included in WCAG. (See <https://w3c.github.io/wcag/coga/user-research.html>.) From this research we have identified techniques and themes though the techniques that authors need to be aware of (and are not full addressed in WCAG 2.0) The key themes are:

1. Help as many users as possible understand the site and know how to use it. This often involves using things that are clear and familiar to the user so that they do not have to learn new symbols, terms or design patters. Personalization based on user needs and markup properly annotated with cognitive semantics can help make the symbols and design as familiar to the user as possible.
2. Prevent the user from making mistakes and make it easy to correct mistakes when they do occur. A good design and use of proven scripts will make errors less likely, but when they do occur the user should know how to correct them, without having to render other data or start from the beginning.
3. Help the user to refocus and to restore context if attention is lost. Items like breadcrumbs can help orientate the user and help the user restore the context when it is lost. (Making breadcrumbs clickable can also help the user undo mistakes)

Main techniques include: (Taken from <https://rawgit.com/w3c/coga/master/techniques/index.html>)

* Use a clear structure with easy to follow sections short paragraphs manageable chunks
* Use an easy to follow writing style
* Provide rapid and direct feedback
* Help the user understand the content and orientate themselves in the content.
* Help users complete and check their work to make it less likely that the user will make mistakes and easier to undo mistakes when they occur
* Provide help
* Help the user focus and help restore the context if attention is lost
* Enable adaptability and personalization, so that symbols text and other features are familiar and helpful to the user
* Minimize the cognitive skills required to use the content and avoid barriers that stop people with cognitive disabilities from using content, such as hard to use security mechanisms.

A full list of the authoring techniques identified are at: <https://rawgit.com/w3c/coga/master/techniques/index.html>

**Summary of technique solutions**

To help bridge the gap we propose the following strategies:

1. Construct a full list of techniques: See <https://rawgit.com/w3c/coga/master/techniques/index.html>

2. Support an extension to WCAG that supports the techniques. This will include:

1. Writing new WCAG Success criteria and techniques
2. Suggesting changes to existing success criteria such as changing the text or the conformance level
3. Proposing new success criteria when necessary.

As part of this effort it is important to make this guidance as clear and prescriptive as possible, so that author knows what they need to do and when they have met the requirements. See <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal_for_WCAG>

3. Create a new semantics specification fog coga to define the associated semantics required for content adaptation.

1. This could be done via a WAI-ARIA module or a new Cognitive semantics specification
2. The techniques for adaptation *MUST* use these semantics
3. Specify concrete user settings to represent user preferences that can be used to direct a web application on how to modify the content

4. Define Testing criteria to ensure the authors know when they are done.

1. This may include new rule sets
2. This may require the creation of a test suite or specification.

5. Support, and when appropriate, enable better personalization and adaption of content to meet our users' needs. This has the following advantages:

1. It reduces the effort needed by the author. The author will just need to enable personalization, which is easier then working on issues such as simplification and clarity.
2. Enables author creativity. Ideally an author could create any interface that they wish, but by enabling API's and personalization, our user groups can receive an adapted interface that is suitable for their needs.
3. Better accessibility and inclusion. Sometimes, especially with these user groups, user needs can conflict. With adaptability and personalization the interface is personalized to the individuals user needs.

See the discussion on personalization below.

**Summary of Issues Papers**

The following sections provide a summary of the issues and solutions discussed at [https://rawgit.com/w3c/coga/master/issue-paper](https://rawgit.com/w3c/coga/master/issue-papers/flat-design.html)

**Issues with flat design**

**Taken from:** <https://rawgit.com/w3c/coga/master/issue-papers/flat-design.html>

**What it is:** Since 2013 Flat design has become a popular UI design pattern characterized by clean flat areas of color, clear typography and simply iconography.

**Summary of the problem with flat design:**

Many people can not learn easily new design metaphors (most coga groups) or remember things that they learned (such as people with a Mild Cognitive Impairment or dementia). Without these skills it can be much harder or impossible to:

* locate a desired items to interact with and
* know what interaction may do

**Summary of solutions for flat design**

1. In the authoring techniques and in proposal for WCAG we are recommending that content provide clear visual affordances
2. In personalization we are adding settings to allow buttons and controls to have clear affordances
3. In aria or in the native semantics all roles should be identified

**Further work for flat design**

How to recommend white spaces which can be confusing if over done for people with low visions? How to recommend clear groups

**Issues with web security and privacy technologies**

**Taken from:** <https://rawgit.com/w3c/coga/master/issue-papers/privacy-security.html>

**what it is:** For security purposes, introduction of intentional barriers to task completion.

**Summary of the problems with security and privacy**

Many people (most COGA groups) have memory issues that can make copying text, or remembering passwords, difficult or impossible. Other contributing issues include impaired executive function. Difficult security mechanisms often bar people with cognitive disabilities from accessing content or using a service at all.

**Summary of solutions for security and privacy**

We recommend a variety of solutions, which may work independently or jointly with others, such as:

* biometric devices, e.g., rings
* security tokens, e.g., keyfobs
* Keygen (see <http://www.w3.org/TR/html5/forms.html#the-keygen-element>)
* Fast IDentity Online (FIDO)
* CAPTCHA alternatives

**Further work for security and privacy**

Develop ease-of-use ideas, such as:

* alternative authentication factors
* consistent user interfaces
* plain-language instructions and feedback

**Issues with math**

**Taken from:** <https://rawgit.com/w3c/coga/master/issue-papers/math.html>

**Summary of the problems with math**

Numeracy issues can occur due to a range of difficulties, the most severe being the inability to read or understand numbers. It should be noted that different users may find math easer to understand than long text.

**Summary of solutions for math**

* Move towards digital math that can be extended (not numbers in images)
* Enable highlighting of sections as they are being discussed
* Link sections of numbers to extra help that can be read together
* Enable replacing math sections with words or summaries for users who prefer this.

**Issues with multi-modal content delivery**

**Taken from:** <https://rawgit.com/w3c/coga/master/issue-papers/multi-modal.html>

Text, which comprises the vast majority of content on the Web, is difficult to understand by many people (most COGA groups).

Also, use cases include:

1. Jumping to the relevant part of content (This is typically not supported, making content less usable.)
2. Finding pieces in the content once focus is lost
3. Going back a step when something was not understood
4. Going back and forth between where a term was explained and the content of focus
5. Multi-modal supplements can aid understanding - such as visual maps and spider diagrams
6. Too many multi-modal items on a page can make the page confusing or overwhelming

**Summary of solutions for multi-modal content delivery**

Text can be made easier to understand when delivered in different modes. Ideally, people should be able to choose that content is delivered in the mode they comprehend best, such as:

* Text To Speech
* Video
* Text With Contextually-Relevant Images
* Text with Consistent Icons and Graphics
* Text Replaced or Augmented by Symbol Sets

Further, video and audio should be navigable, such as:

1. Having the content structured such that it is clearly identified or signposted (e.g., with a slide that says "step two - remove the old washer" or "step three - put on the new washer")
2. The structure is navigable (e.g., a person can jump directly to step two)
3. Keywords are identified, and can be jumped to directly
4. Enabling bookmarks and annotations (that can be navigated)

**Further work for multi-modal content delivery**

Develop ease-of-use ideas, such as development and/or application of:

* plain-language standards
* visual and organizational structures
* font size and font type

**Issues with Personalization**

**Taken from:** This summary pulls together a few different issue papers and addresses them together

They are:

* User Preferences <https://rawgit.com/w3c/coga/master/issue-papers/preferences.html>
* Adaptable Links and Buttons <https://rawgit.com/w3c/coga/master/issue-papers/links-buttons.html>
* Symbols for Non-Verbal <https://rawgit.com/w3c/coga/master/issue-papers/symbols-non-verbal.html>
* Personalization <https://rawgit.com/w3c/coga/master/issue-papers/personalization.html>
* Providing graded help <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Providing_graded_help>
* Interoperable preference <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Interoperable_preference>
* (meta data support - to be added <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Meta_data_support>)

**What it is:** Personalization involves tailoring aspects of the user experience to meet the preferences or needs of the user. Technology holds the promise of being extremely flexible and the design of many systems includes the expectation that users will be able to optimize their interaction experience according to their personal preferences or accessibility requirements (needs).

We need personalization because:

1. Different user needs can conflict
2. Learning new design patterns (and widgets) can be confusing - we want to allow users to stick with what works for them
3. Extra support can be annoying to people who do not need it
4. Making content predictable is necessary for accessibility but can often be considered boring design
5. Ability to change levels of complexity (increase or decrease) - As the person’s skills improve or decrease over time or context.
6. Enable us to really meet the user needs

For example, using a familiar design, terms and symbols is key to being able to use the web for people who can not remember new symbols (such as some people with memory related impairments like dementia). However, what is familiar for one user may be new for another. Personalization could include loading a set of symbols that is appropriate for the specific user, ensuring that all users find the design and icons simple and familiar.

(See <http://www.w3.org/TR/coga-user-research/#aging-and-dementia> section 3.4.15.3 References from literature reviews on Dementia and ICT from Peter Cudd)

**Summary of the problems and Issues:**

**Summary of issues with preferences for cognitive disabilities**

Typical configurable features include adjustments such as colors, text and icon size, sounds or mouse double click speed. Current preferences tend to focus on physical needs that help the user use the content and not on cognitive needs and preferences that help the user understand the content. Meta data and ontologies for preferences also currently focus on physical accessibility needs. For our purposes we need the ontologies to support issues such as:

1. Types of Language support – such as non-literal language or simple language
2. Types of Help available
3. Types of graphics and symbols
4. API and add on compatibility, such as to help with filling forms or passwords
5. Adaptable controls for simple and know interfaces
6. Simplified content with less options
7. Features to help the user keep and restore context

**Summary of issues with setting and gathering preferences**

People with cognitive disabilities can be become daunted, or worse, completely unable to select their desired preferences. Indeed depending on the individual and the technology being used it may be impossible with a supporter's assistance.

So specific problems for people with cognitive disabilities include:

1. Too many settings and/or options for each
2. Not knowing what their preferences are in terms of the available technical solutions
3. Not being aware of possible solutions

Inferring Preferences is one solution but the technology is not yet mature. Another issue is **multiple devices and applications**.

**Interoperable personalization schemes**. Interoperable personalization schemes are where users want or need products and services to be personalized, they would prefer or need this to happen across the widest possible range of products or services. Personalization schemes that deliver this ideal will only succeed if they are standardized and if that standard is adopted by the widest range of product and service providers. However there are many critical issues for any personalization scheme to resolve such as funding and adoption.

Current works in progress are GPII (<http://gpii.net/> which is compatible with ISO/IEC 24751,) and ETSI (see <http://www.etsi.org/deliver/etsi_eg/202300_202399/202325/01.01.01_60/eg_202325v010101p.pdf>, <http://www.etsi.org/deliver/etsi_es/202600_202699/202642/01.01.01_60/es_202642v010101p.pdf> and <http://www.etsi.org/deliver/etsi_ts/102700_102799/102747/01.01.01_60/ts_102747v010101p.pdf> )

Another issue is **Contextual personalization** which includes optimizing the personalization of a product or service is to ensure that the personalization is appropriate for the current context of use. For example, settings that will suit the user of a mobile phone in their office or home will not be well suited to that user when they are driving a car.

Metadata is another related topic. Metadata allows the user to find content that they can use and suites their personal needs and preferences. A lot of work has been done for enabling metadata that helps people with physical disabilities find versions of content that they can use. However the semantics and terms do not support the specific requirements of people with different cognitive disabilities.

**Summary of solutions for personalization**

**Strategies**

1. Promote and support advancements in technologies in these area. For example, our recommending for WCAG will be along the lines of “Use semantics and standardized techniques and that enable the content to be adapted to the user scenario and enable additional support “
2. Enable compatibility with standards such as GPII but do not depend on them.
3. Develop the semantics and terms to support the specific requirements of people with different cognitive disabilities.
4. Enable simple solutions that are extendable - encouraging more complex solutions in the future, such as having preferences be easily cascaded to allow for contextual personalization and for portability in the future.

**Solutions and further work for personalization**

1. Support in WCAG that encourages support the features of the operating system or standards that enable adaption, such as adding additional success criteria.
2. Devolve supporting techniques so authors know exactly what to do
3. Encourage or develop the terms or ontology for support for cognitive disabilities so that projects like GPII and ETSI can use them.
4. Develop Semantics for the content so that personalization systems can know more about the content and enable adaptability of the content
5. Encourage development of at least one end-to-end solution (critical mass) that makes it practical to develop additional solutions that address specific points in the process.
6. Ensure any solutions architecture protects the user's privacy, such as client side adaptations and metadata that reflect functional requirements only. We also suggest an additional issue paper on related ethics.

**End to end basic solution**

We need standardized terms and supportive syntax that can be linked to associated symbols, terms, translations and explanations for the individual use, possibly via an aria attribute and personal preferences.

For example, assume an author can make it programmatically known that a button is used to send an email. At the user end, the button could be rendered with a symbol, term, and/or tooltips that are understandable for this particular user. It could automatically integrate with F1 help that explains the send function in simple terms. It could be identified with a keyboard short cut that will always be used for send. In addition it could be identified as important and always rendered, or rendered as a large button.

Working examples of how this could be used in practice with user preferences are available at <https://github.com/ayelet-seeman/coga.personalisation>. This is a project to help personalization for any use - including people with learning and memory issues. It is described more at: <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Easy_Personalization>.

It is made of 4 parts:

1. JSON files for user setting: <https://github.com/ayelet-seeman/coga.personalisation/tree/JSON-Script>
2. Aria proposal for new syntax: Adaptable Links and Buttons
3. An HTML page that uses some of the new aria syntax: <https://github.com/ayelet-seeman/coga.personalisation/tree/ExampleWebPage/>
4. Scripts that a web author can use or include that read the user settings in the JSON files and adapt the page for the user needs: <https://github.com/ayelet-seeman/coga.personalisation/tree/Script-Options>

This is only one example way to use the semantics. Others may follow. It is also worth noting that the GPII project is working on making user preferences portable which would also enhance this work.

**Special case**

Products for people who are non-verbal often use symbols to help users communicate. These symbols are in fact peoples' language. Unfortunately many of these symbols are both subject to copyright AND are not interoperable. That means end-users can only use one device, and cannot use apps or content from a different company. If we enabled mapping to open sets of symbol codes that, in turn, map to open or proprietary symbol sets, then they can be interoperable. At the user end, the user agent can load the symbols that the user knows. Symbol sets might still be proprietary but they would also be interoperable. That means the end user could use them across different devices, or any compatible content or applications.

Our members are working on projects to enable interoperable symbol sets and the semantics that would enable it. Such as (Pseudocode):

<img coga-concept="<http://symbo.arosac.org/somepage#girlnode>" scr="girlwithbow.gif" />

This will require

* incorporating this as a technique for WCAG and
* build the necessary semantic support, for web language such as aria.

**Issues with distractions**

**Taken from:** <https://rawgit.com/w3c/coga/master/issue-papers/distractions.html>

**Summary of the problems with distractions**

Distractions can cause people with cognitive disabilities to lose focus on the current action being performed or draw attention away from the primary content and can be difficult for some users to know how to understand, avoid and/or stop them. Distractions can come in the form of overlays, auto-playing content, animated side-bar content, advertisements, prompts, pop-ups, scrolling or auto-updating content and so on.

**Summary of solutions for distractions**

* Use personalization options to inform the content provider of accommodations required so the presentation of content can be modified.

For overlays, pop-up or pop-over windows:

* Avoid using overlays.
* Ensure overlays are easy to close.
* Ensure overlay content is accessible and doesn't interfere with other accommodations made for AT interoperability.
* Allow user to turn off overlays while still providing equivalent information and functionality.

For Advertisements:

* Animation, audio and video plays only on user request (not automatically).
* Clearly mark advertisements as such.
* Avoid overlaying content with advertisements, or auto-close the advertisement and return the user to the content when complete.
* Make advertisements easy to close.

Notifications:

* Make notifications easy to dismiss or opt out of.

Application installation prompts:

* Should be accessible, clear and easy to dismiss.
* Confirm with the user if user action would open an external website.
* Inform the user which is more accessible and customizable - the application or the website.

**Integrated solution for distractions**

Form a cross-application and cross-device distraction matrix that manages all distractions in one setting. In conjunction with this there could be a mechanism for the user to select or modify the distraction matrix to allow distractions only from certain users and/or applications.

**Issues with voice menu systems**

**Taken from:** <https://rawgit.com/w3c/coga/master/issue-papers/voice-menus.html>

**Summary of the problem**

Voice menu systems and Voice XML are used to develop audio and voice response applications similar to automated telephone menu systems. These systems can cause issues for people with cognitive disabilities who may not have the reasoning skills to understand the instructions or have trouble processing the instructions quickly enough while listening to an array of options to choose from. A person with a cognitive disability may have trouble with short-term memory resulting in the inability to remember the number or verbal response required by the application, or may take a longer period of time to verbalize or enter in a response.

**Summary of solutions for voice menu systems**

* Should have an easily remembered or standard instruction to reach a person for help, such as "0".
* Describe the option before giving the instruction of what information or option is used to select that option.
* Use simple terms or language for better comprehension.
* Pause between phrases, or options, to give time for the user to process the verbal information.
* Allow more time for the user to provide a response.
* Provide options for the user to slow down the speech, increase pauses, and allow the user to request more time to respond.
* Make it easy to go back to a previous menu item, preferably in a standard way, such as '9'.
* Make it easy to recover from errors, without hanging up on the user, causing them to start from the beginning, or giving even more complex instructions/menus.
* Avoid advertisements, as they are a distraction that can cause the user further confusion and difficulty remembering options.
* When designing a voice response system as a product, provide examples and advice that demonstrate how to reduce cognitive load.

**Issues with online payments**

**Taken from:** <https://rawgit.com/w3c/coga/master/issue-papers/payments.html>

**Summary of the problems with online payments**

People with various cognitive impairments can have a variety of difficulties with the online payment systems used in e-commerce. These difficulties range from having trouble understanding the instructions and process to be followed to complete a transaction to issues in providing the necessary personal and financial information to make an online payment. If an online payment system requires a lot of user input for required information, the presentation of the input fields could cause a cluttered look, which can be distracting and make it difficult for the user to process the steps to take to complete the transaction, adding to their frustration and stress. If the online payment system has voiced commands, persons with speech perception issues may not be able to fully understand the instructions to respond appropriately.

**Summary of solutions for online payments**

The solutions are split into five categories as follows:

* Navigation
  + Standardize any controls, features and navigation in the online payment system for consistency.
  + Keep menus short with clear labels and signs.
  + Provide ways to navigate back step-by-step or start over.
  + Provide prompts and feedback on the user's progress, give appropriate help when an error is encountered.
  + Limit the number of options to lower cognitive overload.
* Functionality
  + Use CSS to provide the user control of how information is presented, such as: font, font size, line height, spaces between lines of text, the size of click/touch areas, mouse-over highlighting of text, changes of background and text colors.
  + Provide user with list of information they need to have ready prior to using the web payment system.
  + Provide definitions and explanations for technical terms, acronyms, etc. used by the web payment system.
  + Keep alerts and feedback on the screen until the user explicitly dismisses them.
  + Provide search capabilities tolerant of misspellings and typos.
  + For users with low-literacy or processing impairments, include speaking text/narration.
* Content and Text
  + Use plain language and short, concise sentences.
  + Use appropriate graphics to enhance understanding.
  + Place critical content "above the fold" to avoid scrolling, if possible.
  + Use bulleted lists and a single idea per paragraph to make more digestible "chunks" of information.
  + Provide meaningful headings.
  + Avoid full justification of text (left and right margins) which can cause large white areas between words.
  + The line length of text should be less than 70-80 characters.
  + Avoid the use of non-literal text and colloquialisms in the text.
  + For people with memory limitations, reduce the standard 7 ± 2 elements per screen to 4 ± 2.
  + Provide the ability for the user to request longer or shorter content to either increase or decrease details provided.
* Layout
  + Use a consistent layout for each page or step in the web payment system.
  + Streamline the page and reduce any extra information not key to completing the web transaction.
  + Use plenty of white space for an uncluttered look
  + Highlight urgent or important information to be easier to find.
  + Avoid menus that appear or disappear with mouse hover and text that moves or changes.
  + Use high contrast between text and the background.
* Multimedia
  + As applicable, use typical accessibility techniques: captions, audio description, subtitles.
  + Use sounds to enhance the visual experience, such as auditory feedback to signal a change of state or completion of an action.
  + Avoid animated graphics which can be distracting, or provide controls to allow the user to adjust the speed of the motion.
  + Use graphics and icons as navigation aids, or to indicate progression through the steps for completing a web payment transaction.

**3. Roadmap - Tables of User Needs**

This section is work in progress for tables format for the coga roadmap and gap analysis. It identifies user needs that are not currently fully addressed by accessibility.

Each table addresses a group of user needs represented by a few related user stories of the form of "As a *<role>,* I want *<goal/desire>* so that *<benefit>*".

The tables show how related user needs can be met though:

* Authoring techniques for content using HTML,
* How this can be addressed in WCAG
* New semantics that may be required to address this user need, such as extra aria attributes
* Any personalization requirements
* Operating System support or other support that may be required to meet this user need

Note we also have the summary at https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Gap\_Analysis\_Summary#Summary\_of\_Issues

**Please note that this table is incomplete and is a work in progress. (We are publishing it early to solicit early feedback.**)

For a latest version see https://rawgit.com/w3c/coga/master/gap-analysis/table.html

**3.1 Table 1: Authentication**

**About the user:** Many people (most COGA groups) have memory issues that can make copying text, or remembering passwords, difficult or impossible. Other contributing issues include impaired executive function.

Sometimes security and authentication put a barrier between the user and the task that they are doing so that the user can not use the content or service. For example, difficult security mechanisms that require coping or remembering passwords often bar people with cognitive disabilities from accessing content or using a service at all.

This leads to following user stories:

1. As a user who has memory impairments and often forget passwords I need to be able to use a site without remembering or copying passwords and user names so that I can use this service.
2. As a user who has weak executive function I need the login process to be simple and not multi step so that I can use it.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **User Needs** | **Content and HTML** | **WCAG** | **New Semantics** | **Personalization** | **Operating System/ Other** | **Discussions** |
| **I need a method of secure website authentication that I find easy to use.** | NA | Propose a new Success criteria such as:  When there is a barrier between the content and the user that requires additional cognitive function an alternative is provided that does not require additional cognitive function  See https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal\_for\_WCAG#When\_there\_is\_a\_barrier\_between\_the\_content\_and\_the\_user\_that\_requires\_additional\_cognitive\_function\_an\_alternative\_is\_provided\_that\_does\_not\_require\_additional\_cognitive\_function  Techniques should include how to have security that does use passwords or copying such as biometrics and tokens | NA | We need to capture the type of security that this user can use | Hardware and operating systems could provide the authentication to websites and application - (needs further investigation and risk analysis) | <https://rawgit.com/w3c/coga/master/issue-papers/privacy-security.html> |
| **I need a safe ways to interact online** |  | As above |  |  |  |  |

**3.2 Table 2: Context and distractions**

**About the user:** Distractions can cause people with cognitive disabilities to lose focus on the current action being performed or draw attention away from the primary content and can be difficult for some users to know how to understand, avoid and/or stop them.

Once people have become distracted it can be difficult for them to remember what they were doing. This is especially problematic for people with both low attention and impaired memory such as people with dementia.

**This leads to following user stories: To do - fill in user stories**

**User needs**

* I need to consume content or complete a task without unnecessary distraction
* I need to turn off distractions 1) to be a default and 2) to be a trivial option in real time
* I need to know the context, were I am, and what I just did, or what happened to me
* I need to restore the context when I forget where I am or get distracted
* I need to restore the context in multi media. I need to go back to that bit I just missed, or re-orientate myself if I lost the context

**To do: Create table mapping user needs to solutions**

**3.3 Table 3: Entering data, error prevention & recovery**

About the user: Filling out forms and similar tasks can be overwhelming for most people with cognitive and learning disabilities. This includes relatively minor learning disabilities such as dyslexia or attention related disabilities. Many people (most COGA groups) have memory issues that can make copying text, difficult or impossible. Other contributing issues include impaired executive function.

Many people learning disability cannot remember numbers such as their post code, Social Security or Credit Card numbers. Many people even need to check their phone number. This makes entering information slow, and they may need to leave their desk or take a break.

Many users find it very difficult to copy information, due to low visual memory or impaired executive function.

This leads to the following user stories:

* As a user who needs to look up my postal code I do not want the session to time out while I try to find the information needed.
* As a user who needs to take breaks during tasks like filling in a form, I want to be sure all my work is saved automatically if my computer crashes so that I do not have to start over again, (which can create a cycle and each time I reenter my data I am more tired and more likely to make mistakes).
* As a user with difficulty typing numbers in the right order, I want an interface that makes mistakes less likely.
* As a user who finds entering information stressful, I want to enter as little information as I can so that it is manageable.

**User Needs**

* I need help avoiding mistakes - and minimize the mistakes I might make
* I need to know what mistake I made and how to correct a mistake. It does not scare me I need to make the correction easily
* I need enough time, and not lose my work
* I want to use applications or API's that remember a lot of my information so I do not need to enter it again
* I want to know were I am in the process
* I want to be able to check my work and go back without losing the work I have just done

**To do: Create table mapping user needs to solutions**

**3.4 Table 4: Help and support**

**About the user:** To be filled in

This leads to following user stories: To be filled in

**User needs:**

* I know how to find out more such as context sensitive help or tooltips
* I need to easily get human help
* I need symbols that help me understand
* I need graphs and pictures supplement text so that I can understand the point without a lot of reading
* I need speech support with synchronized highlighting so I can follow as I go I need rapid feedback
* I need reminders or I will forget appointments and when I was meant to do things
* I do not want too many reminders as they I will be distracted
* I want to be confident that I can manage my task

**To do: Create table mapping user needs to solutions**

**3.5 Table 6: Simple and clear interface**

**About the user:** Many people can not learn easily new design metaphors or remember things that they learned (such as people with Mild Cognitive Impairment (MCI) or dementia. Without these skills it can be much harder or impossible to locate a desired items to interact with and know what interaction may do. The user can feel lost or overwhelmed.

Many users can be overwhelmed by too many options, or too much information. If reading is slow then two much information mixed together will make it difficult or impossible to find the information you need.

This leads to the following user stories: To be filled in

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **User Needs** | **Content and HTML** | **WCAG** | **New Semantics** | **Personalization** | **Operating System/Other** | **Discussions** |
| **I need symbols that I understand strait away.** | The author will need to make sure the content adapts to user personalization settings to meet this need.  For example an open-source script could be included that would read user settings and import the correct symbol  such as used at http://rawgit.com/ayelet-seeman/coga.personalisation/demo/conactUs.html | The current proposal is to add a success criteria as follows:  Use semantics and standardized techniques and that enable the content to be adapted to the user scenario and enable additional support  See: https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal\_for\_WCAG  Techniques would and using the correct semantics and importing a script that adapts the page | In adding a semantic for the context (what the thing is for) such as  coga-action="undo"  or  coga-destination="home"  and additional landmarks or region such as  role="warning" | User setting will need to address how to handle different contexts such as coga-action="undo" , for example, which symbol to load for this setting.  A mechanism is needed to read the user setting and adapt the page. open source script is available/ being worked on at http://rawgit.com/ayelet-seeman/coga.personalisation/ | taxonomy will be needed of support end values  Taxonomy is needed for use preferences  GPII and ETSI and other standards will need to allow these preferences to be portable. | <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal_for_WCAG#Enable_adaptability>  <https://rawgit.com/w3c/coga/master/issue-papers/links-buttons.html> |
| **I need to understand the menu terms so that I know where to find things** | The author can use simple and well understood terms.  OR  The author will need to make sure the content adapts to user personalization settings to meet this need. |  | To be filled in | To be filled in | To be filled in | To be filled in |
| **I can find the controls that I need** | Do not rely on people remembering the scroll |  |  |  |  |  |
| **I know what are controls** | Use of clear affordances  Or use of the proper roles with adaptations according to standardized user preference | New success criteria required  **Interactive controls are visually clear or visually clear controls are easily available**  https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal\_for\_WCAG#Interactive\_controls\_are\_visually\_clear\_or\_visually\_clear\_controls\_are\_easily\_available: | new semantics are not needed but use of roles or native html are needed if presentational are used to meet this user need | Json easy personalization needs to allow for clear affordances- either setting individual styles for links buttons and other controls Or a universal setting for clear affordances | clear affordances and settings in the need to be read and interpreted either as at a website, or by the platform. If the platform is not supporting this option then the author needs to supply the option of clear affordances either in the content or as an automatic (reading the JSON for example) or easy to use setting. | [https://rawgit.com/w3c/coga/master/issue-papers/flat-design.html](https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal_for_WCAG#Enable_adaptability)  <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal_for_WCAG#Enable_adaptability>  <https://rawgit.com/w3c/coga/master/issue-papers/links-buttons.html> |

**To do: Clarify the following user needs and add them to the above table**

* I am familiar with the UI and I know how to work it and what will happen when I work it
* The content delivered in an easy-to-understand mode
* Simple content with few options and text consistent
* easy-to-use
* I find online payment systems understandable
* I find the structure easy follow
* I can easily find the content I need
* I need signposts so that I can find the information I need
* Multi media- understandable structure- I find it easy to find the content needed
* I can easily separate what I need and do not need and find what I need
* I know what is an advert or from a different site
* I know where to find things on a page
* I know the design patterns
* Jargon or other unambiguous affordances - I know what things are and what they do

**3.6 Table 7: Familiar interface**

**About the user:** Many people cannot learn easily new design metaphors or remember things that they learned (such as people with Mild Cognitive Impairment (MCI) or dementia. Without these skills it can be much harder or impossible to:

* locate desired items to interact with and
* know what the interaction may do

Using a familiar design, terms and symbols is key to being able to use the web for people who cannot remember new symbols (such as some people with memory related impairments like dementia). Therefore the user needs things to be familiar including:

* location of elements
* symbols
* text used
* how to get help

However what is familiar for one user may be new for another. So the interface needs to be familiar to the individual user.

This leads to the following user stories: To be filled in

Discussions

* User Preferences <https://rawgit.com/w3c/coga/master/issue-papers/preferences.html>
* Adaptable Links and Buttons <https://rawgit.com/w3c/coga/master/issue-papers/links-buttons.html>
* Symbols for Non-Verbal <https://rawgit.com/w3c/coga/master/issue-papers/symbols-non-verbal.html>
* Personalization <https://rawgit.com/w3c/coga/master/issue-papers/personalization.html>
* Providing graded help <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Providing_graded_help>
* Interoperable preference <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Interoperable_preference>
* (meta data support - to be added <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Meta_data_support>)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **User Needs** | **Content and HTML** | **WCAG** | **New Semantics** | **Personalization** | **Operating System/Other** | **Discussions** |
| **I need symbols that are familiar.** | The author will need to make sure the content adapts to user personalization settings to meet this need.  For example an open-source script could be included that would read user settings and import the correct symbol  such as used at http://rawgit.com/ayelet-seeman/coga.personalisation/demo/conactUs.html | The current proposal is to add a success criteria as follows:  Use semantics and standardized techniques and that enable the content to be adapted to the user scenario and enable additional support  see https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal\_for\_WCAG  Techniques would and using the correct semantics and importing a script that adapts the page | In adding a semantic for the context (what the thing is for) such as  coga-action="undo"  or  coga-destination="home"  and additional landmarks or region such as  role="warning" | User setting will need to address how to handle different contexts such as coga-action="undo" , for example, which symbol to load for this setting.  A mechanism is needed to read the user setting and adapt the page. open source script is available/ being worked on at http://rawgit.com/ayelet-seeman/coga.personalisation/ | taxonomy will be needed of support end values  Taxonomy is needed for use preferences  GPII and ETSI and other standards will need to allow these preferences to be portable. | <https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal_for_WCAG#Enable_adaptability>  <https://rawgit.com/w3c/coga/master/issue-papers/links-buttons.html> |

**To do: Clarify the following user needed and add them to the above table**

* I am familiar with the UI and I know how to work it and what will happen when I work it
* The content delivered in an easy-to-understand mode
* Simple content with few options and text customizable
* WOT interfaces (navigation, controls, features, text, help) consistent,
* I need easy-to-use online payment systems on different sites
* preferences can be set
* preferences are set for my current needs and context
* setting preferences for online interactions is fast easy or not noticed
* links and buttons that are context sensitive and localized
* deployment of familiar symbol sets capability to personalize websites (content, features, elements)

**To do: Add the above user needs to the table mapping user needs to solutions**

**3.7 Table 7: Clear and understandable text**

About the user: To be filled in

This leads to following user stories: To be filled in

User needs:

* understandable use of (familiar) language
* clear, unambiguous language
* to use the content without understanding of math concepts
* representation of math by words instead of number

To do: Make the above user needs into a table

**3.8 Table 8: Navigating the system**

About the user: Many people (most COGA groups) have memory issues and/or language issues that can make remembering numbers while processing words, difficult or impossible. Other contributing issues include impaired executive function.

Sometimes developers put a barrier between the user and the task that they are doing so that the user cannot use the content or service.

* Voice XML enable voice dialogs systems and voice browsers. Sometimes the user needs to hold multiple pieces of transitory information in their mind, such as the number that is being presented as an option, whilst processing the terms that follow.

This leads to following user stories:

1. As a user who has memory impairments and weak language processing skills, I want to be able to get help without going though a voiceML menu system so that I can set an appointment or find out some information.
2. As a user who has weak executive function. I need the process to get help to be simple and not multi step so that I can use it.
3. A user can have trouble identifying the right words to say in a voice menu.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **User Needs** | **Content and HTML** | **WCAG** | **New Semantics** | **Personalization** | **Operating System/**  **Other** | **Discussions** |
| **I need to find the information I need without deciphering a lot of text or symbols** | NA | Propose a new Success criteria such as  When there is a barrier between the content and the user that requires additional cognitive function an alternative is provided that does not require additional cognitive function  See https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal\_for\_WCAG#When\_there\_is\_a\_barrier\_between\_the\_content\_and\_the\_user\_that\_requires\_additional\_cognitive\_function\_an\_alternative\_is\_provided\_that\_does\_not\_require\_additional\_cognitive\_function  Techniques should include how to have security that does use passwords or copying such as biometrics and tokens | NA |  |  |  |
| **I need to identify the option I need quickly** | To be filled in | To be filled in | To be filled in | To be filled in | To be filled in | To be filled in |
| **I need simple-to-navigate menu systems** |  | needs further investigation |  |  |  |  |
| **I need simple-to-navigate voice-menu systems** | Use the standard 0 to reach a human operator  use best practices | Propose a new Success criteria such as  When there is a barrier between the content and the user that requires additional cognitive function an alternative is provided that does not require additional cognitive function  See https://www.w3.org/WAI/PF/cognitive-a11y-tf/wiki/Proposal\_for\_WCAG#When\_there\_is\_a\_barrier\_between\_the\_content\_and\_the\_user\_that\_requires\_additional\_cognitive\_function\_an\_alternative\_is\_provided\_that\_does\_not\_require\_additional\_cognitive\_function  alternatives for non vocal |  |  | Use of standard 0 to reach a human  understanding of different speech patterns | <https://rawgit.com/w3c/coga/master/issue-papers/voice-menus.html> |

Acknowledgements placeholder - Will include all active members of the task force.