

Affordance Analysis of Goblin Tools

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EDIT 802: Cognition and Technology

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September 30, 2024

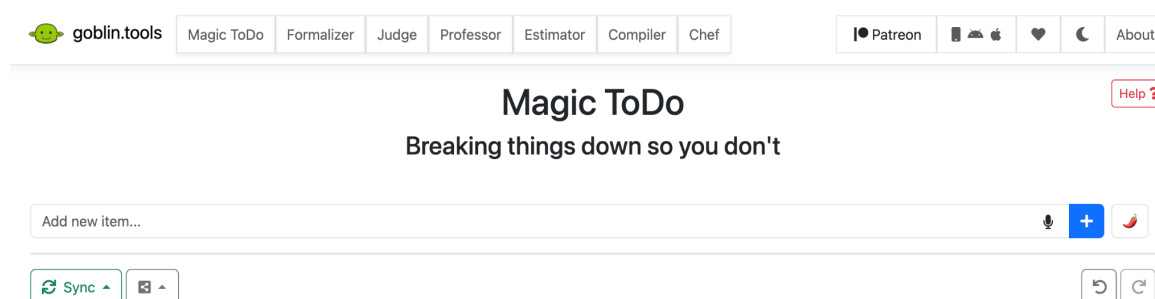
Affordance Analysis of Goblin Tools

Many individuals with neurodivergence encounter challenges with executive functioning tasks in their everyday lives. Regardless of their daily environment or situational contexts, many neurodivergent individuals benefit from strategies or tools that facilitate tasks like establishing routines, planning and prioritizing, and controlling emotions. Goblin Tools uses OpenAI to assist users in accomplishing these tasks they may typically find overwhelming or challenging to initiate.

To minimize distractions and facilitate focus, Goblin Tools is a group of seven single-task tools with a simple user interface to aid executive functioning tasks integral to planning, prioritizing, and communicating. Due to its intentional design, each page of Goblin Tools offers only one role to the user and performs only one common task, such as breaking down tasks into smaller concrete steps or understanding the tone of written text. To facilitate accessibility, Goblin Tools is available in two formats: a free website and a low-cost mobile app that is available for download on Android or Apple devices. The only apparent differences between the website and the app are the cost and convenience since the app permits users to engage with Goblin Tools on their phone or tablet. Both versions of Goblin Tools offer the same engagement opportunities for users. For this analysis, we will focus on the web-based interface. Figure 1 below shows the web-based interface landing page for Goblin Tools.

Figure 1

Web-Based User Interface Landing Page



As explained on the About page, Goblin Tools uses models from the AI-based service OpenAI to analyze and respond to user inputs (De Buyser, 2024). The user enters information based on the provided writing prompt and then clicks a button to execute the necessary actions for the response. For example, if a user selects the Chef tool, they will enter ingredients they have access to and then click the blue “suggest” button to generate a suggested cooking recipe. Some tools allow users to select a complexity level or tailor the response to a particular recipient. The website features seven tabs, each representing a tool, allowing users to choose the tool they need for a specific task. The tools in Goblin Tools are categorized as “roles” to accomplish the following overall purposes: task initiation and completion, communication, and comprehension. Table 1 below summarizes the overall intention behind the seven roles and their specific functions.

Table 1

Summary of Goblin Tool Purpose

Purpose	Role	Specific Function for User
Task Initiation and Completion	Magic ToDo	Breaks down tasks in a to-do list into smaller steps
	Estimator	Estimates how long the task will take
	Compiler	Turns a brain dump into a list of tasks
	Chef	Creates a recipe based on available resources
Communication	Formalizer	Transforms text into different tones
	Judge	Reads text to judge tone
Comprehension	Professor	Provides a quick explanation and example of concepts

The Goblin Tools user interface is different for each of the seven roles. Table 2 presents each role, function, and user engagement. In this table, the user engagement describes the necessary user inputs for each role and the generated outputs.

Table 2

User Interface

Roles & Functions	User Engagement
User Role: <i>Magic ToDo</i> Breaks down tasks into smaller steps and stores them as a to-do list	User Inputs: Goal or task Generated Outputs: A breakdown and estimated time of smaller subtasks to accomplish a goal

 goblin.tools

Magic ToDo

Formalizer

Judge

Professor

Estimator

Compiler

Chef

Patreon









About

Magic ToDo

Breaking things down so you don't

Help ?

Add new item...







Sync







User Role: <i>Formalizer</i> Transforms the text's tone	User Inputs: Text, email, or other written communication Generated Outputs: Rewritten text of user-selected tone or register
---	---

Formalizer

Turn the spicy thoughts into classy ones, or vice versa

Enter your text here...



Make my text:

More professional



Convert



Your converted text will appear here...



User Role: *Judge*

Reads text to judge tone

User Inputs: Text, email, or other written communication**Generated Outputs:** Evaluation of the tone of the text and a suggested response

The Judge

Am I misreading the tone of this?

Enter your text here...



Judge

Suggest a response



Your text comes across as...

User Role: *Professor*

Provides a quick explanation and example of concepts

User Inputs: A topic or complex text**Generated Outputs:** An explanation and example of the concept

The Professor

Give me the crash course

Enter something here...



Explain



An explanation here...

With an example here...

User Role: *Estimator*

Estimates how long
tasks will take

User Inputs: An activity or task

Generated Outputs: A time estimation

Estimator

Just tell me how long this is probably gonna take

Now also available on [Magic Todo](#) items!

Enter an activity here...



Estimate



This will take roughly...

User Role: *Compiler*

Turns a brain dump into
list of tasks and sub-tasks

User Inputs: List of worries, ideas, or goals

Generated Outputs: List of tasks to accomplish goals

Compiler

Compile my braindump into a list of tasks

Enter your braindump here...



Turn into tasks

User Role: <i>Chef</i> Creates a recipe based on ingredients entered	User Inputs: Ingredients, dietary preferences, cooking constraints	Generated Outputs: A step-by-step recipe
--	--	--

The Chef

What am I having for lunch?

Write what ingredients you have here! You can also write down dietary constraints, serving sizes, equipment, time, or anything else you want the Chef to take into account.



Suggest

You could cook...



Target Audience

While many users may find Goblin Tools valuable for everyday tasks, it was primarily designed and developed to assist neurodivergent learners. The design keeps the user interface simple, assigns only one tool for each role, places only one role on each page, and keeps the interactions consistent across all pages. These decisions are particularly beneficial for users with executive function challenges. Users with ADHD or on the Autism spectrum may receive a sense of confidence and assurance.

For this affordance analysis, we will use Brown's (2005) clusters to inform how we organize Goblin Tools' support for executive function management, given the overlap and integrated nature of many of the skills:

1. Task Planning: organization, prioritization, timing, and activation
2. Task Engagement: initiation, focus, sustainment, and attention shifts

3. Mental Regulation: alertness, sustained effort, flexibility, and processing speed
4. Emotion Regulation: modulation and frustration management
5. Working Memory: recall, verbal memory, and non-verbal memory
6. Self-Awareness: actions, thoughts, impulses, and communications

These skills are not just theoretical concepts but are required for every aspect of one's health, success, and development (Diamond, 2013). The executive functions can be broken into three categories: Inhibition and interference control, cognitive flexibility, and working memory. Table 3 shows each Goblin Tools role and the corresponding supported executive functions organized by these categories.

Table 3

Executive Functional Management Support by Role

Roles in Goblin Tools	Supported Executive Functions		
	Inhibition and Interference Control	Cognitive Flexibility	Working Memory
Magic ToDo	Task Planning Task Engagement	Emotion Regulation Mental Regulation	Working Memory Self-Awareness
Formalizer	Task Planning Task Engagement	Mental Regulation Emotion Regulation	Working Memory Self-Awareness
Judge		Mental Regulation Emotion Regulation	Self-Awareness
Professor		Mental Regulation Emotion Regulation	Working Memory Self-Awareness
Estimator	Task Planning Task Engagement	Mental Regulation Emotion Regulation	Self-Awareness
Compiler	Task Planning Task Engagement	Mental Regulation Emotion Regulation	Working Memory Self-Awareness
Chef	Task Planning Task Engagement	Mental Regulation Emotion Regulation	Working Memory Self-Awareness

Objective of Affordance Analysis

This affordance analysis will explore the cognitive, physical, sensory, and functional affordances of Goblin Tools and examine ways to implement them to support learning goals. Rooted in the research on affordances by Hartson and Pyla (2012) and Bower (2008), we seek to answer the following questions with this affordance analysis:

1. Following Hartson and Pyla (2012), what cognitive, physical, sensory, and functional affordances do Goblin Tools provide?
2. Following Bower (2008), what e-learning technology affordances are provided?
3. How usable is Goblin Tools as a digital technology?
4. Which affordances can be improved or addressed to better support neurodivergent learning needs?
5. What learning interactions, activities, or tasks can be developed for digital tools?

Affordance Frameworks

For user experience design, affordances are evaluated to determine the perceived or actual properties, features, and aspects of a design that suggest how the digital tool should be used. Norman (1999) emphasizes that perceived affordances are essential to consider because they guide the user's perception of the proper operation of a tool, which is more important than the features intended by a designer. Hartson (2003) expanded the concept of affordances by breaking them into four categories for classification: cognitive, physical, sensory, and functional. Hartson and Pyla (2012) interpolated how the four concepts of affordance extend to interaction design. Table 4 provides an overview of each category type.

Table 4*Overview of Affordance Classifications (Hartson & Pyla, 2012)*

Category of Affordance	Description	Examples
Cognitive	Aids in understanding and interaction with an object	Clear instructions Logical layout
Physical	Helps the user do something physical	Clicking items Moving objects
Sensory	Uses senses to help convey understanding	Sound when clicked Color change
Functional	Helps the user to achieve tasks	Browsability Data manipulation

Bower (2008) expanded this framework to include E-learning technologies. Functional affordances are essential for these technologies to help users navigate and use digital tools. This framework breaks functional affordances into smaller subcategories to allow for a detailed evaluation of the educational potentials or utility of the digital tool and the evaluation of the digital tool system. Table 5 below provides a breakdown of the functional categories proposed for E-learning.

Table 5*Overview of E-Learning Technology Affordances (Bower, 2008)*

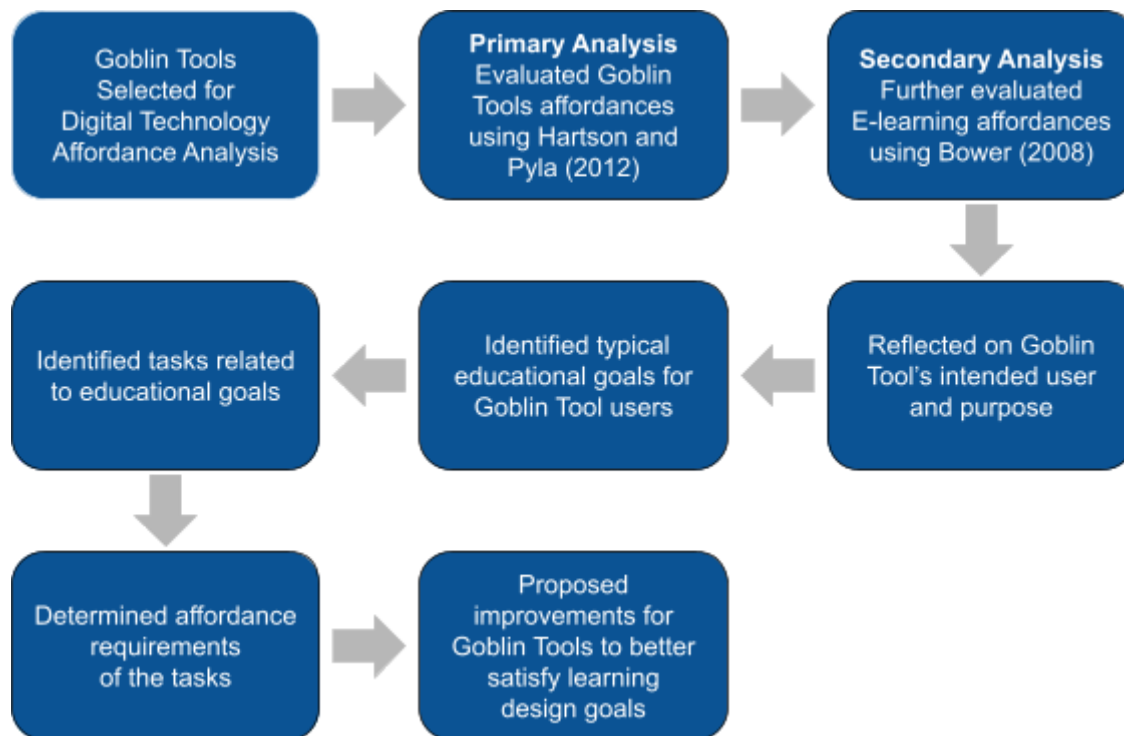
Emphasis	Affordance	Description	Examples (Ability to...)
Educational Potentials of Digital Tool Focuses on Utility	Media	Input and output forms	Read text, write, view images, listen, speak, watch video
	Spatial	Manipulation of physical elements	Resize elements, move and place elements
	Temporal	Access to information	On-demand access, record and play information, types of digital access
	Navigation	Locate within and between resources Manipulate data	Browse, links, and search text; Sort and order data
	Emphasis	Direct user attention	Draw attention and highlight items

Evaluation of the Digital Tool System	Synthesis	Integration of resources and functions	Combine tools, functions, content, and resources
	Access- Control	User access	Controls permissions and abilities to share
	Technical	Efficient, effective, and ubiquitous support	Sufficient support and infrastructure to facilitate connection
	Usability	Intuitive use	Easy use and manipulation
Focuses on Usability	Aesthetics	Appearance	Appearance and engagement hold the attention
	Reliability	Dependable	Consistent system performance

Analysis of Goblin Tools

Our Analysis Process

For our affordance analysis, we used Hartson and Pyla's (2012) framework to analyze the cognitive, physical, sensory, and functional affordances of our digital tool, Goblin Tools. This classification provided a solid primary foundation for evaluating our digital tool's distinct features and affordances. However, given Goblin Tools' intentional design to aid neurodiverse individuals, we found that many features successfully met at least three of the four categories. We then chose Bower's (2008) framework as a secondary tool to provide a more nuanced and tool-specific evaluation. This aimed to delve deeper into the functional affordance categories of Goblin Tools, as presented in Table 4 previously. Figure 2 provides an overview of our analysis process, including future steps that will be discussed later in this report.

Figure 2*Overview of the Analysis Process***Primary Framework: Hartson and Pyla, Affordances in UX Design (2012)*****Cognitive Affordances***

Cognitive affordances offer an essential aid to assist users with understanding how to use Goblin Tools and how to engage in decision-making. Goblin Tools effectively utilizes these features to guide users through the web interface, providing a clear understanding of their current position and how to navigate. The interface includes a navigation bar with seven roles (e.g., Magic ToDo, Judge), a help button, icons, and submission buttons for text inputs. These features are instrumental in enabling users to interact with the tool and provide the necessary information.

The Goblin Tools interface provides clear labels for each page, buttons, and text boxes with writing prompts. These aids are strategically placed to assist users in understanding how to interact with each page. The *Help?* button, a critical feature, is significant in guiding users

through the tool's features and functions. It provides step-by-step instructions for the current page to ensure the user understands how to engage with the tool.

Goblin Tools' mindful use of icons is crucial in categorizing information, providing additional interaction options, and offering accommodation options. They enhance the user's ability to navigate and interact with the tool. Depending on the user's role, they can speak instead of type, sort and clear data, filter information, change the complexity and vocabulary displayed, and move items within lists. This flexibility in interaction is a key feature of Goblin Tools.

The user will also find cognitive affordances in how the interface minimizes distractions by using a simple design and presenting information only required for the current page. Figures 3 and 4 show several examples of cognitive affordances.

Figure 3

Cognitive Affordances: Descriptions of Tools and Submission Button

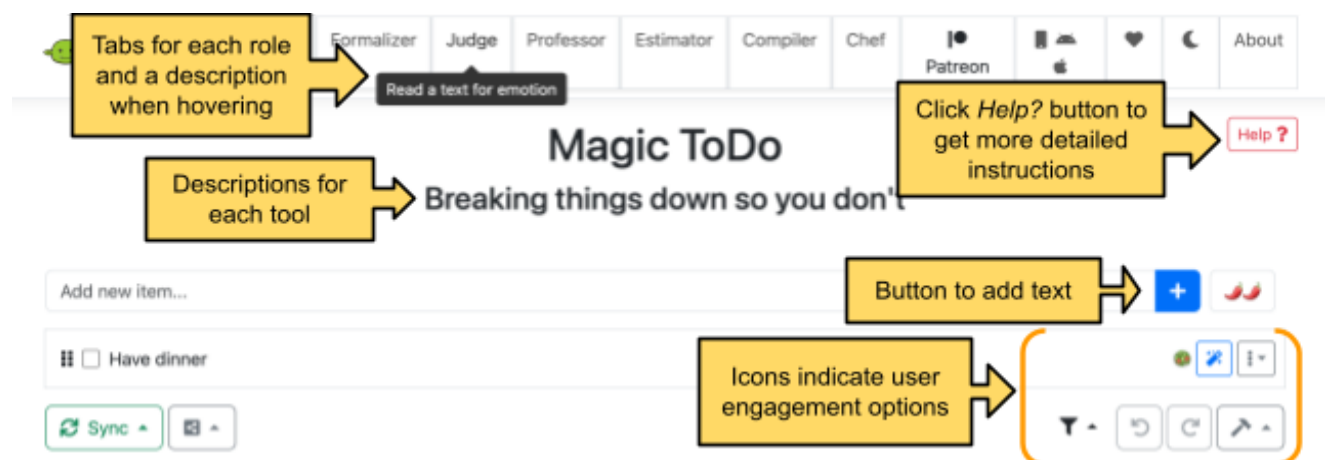
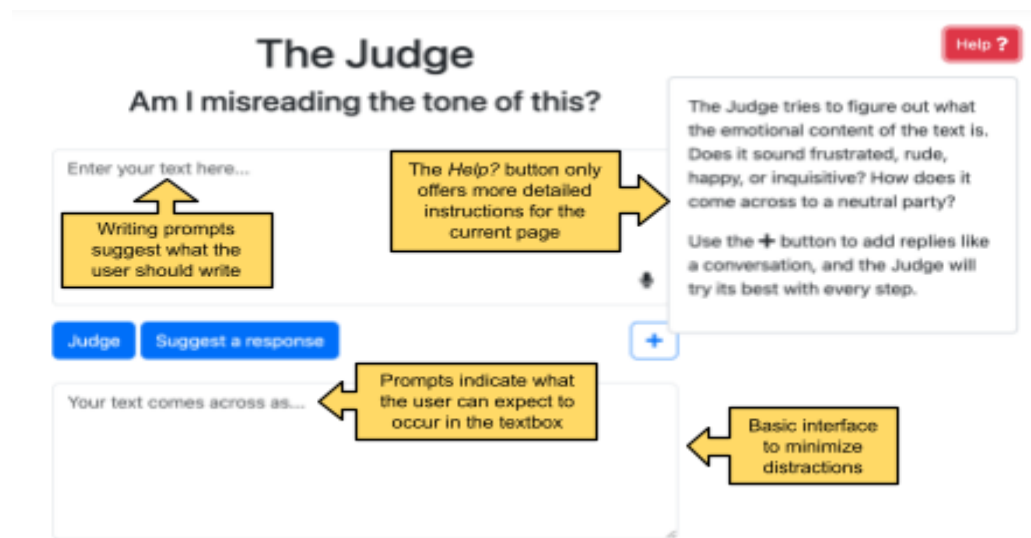
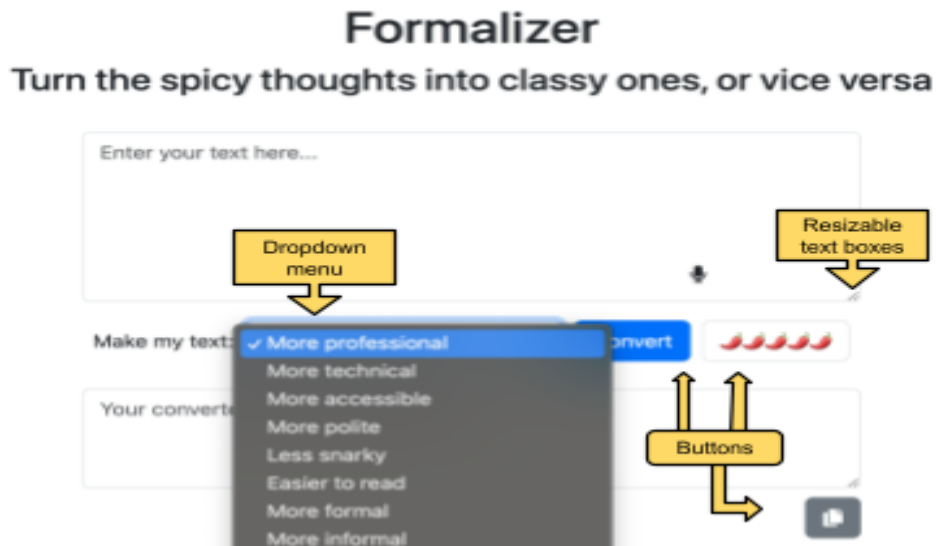


Figure 4*Cognitive Affordances: Basic Interface to Reduce Distractions****Physical Affordances***

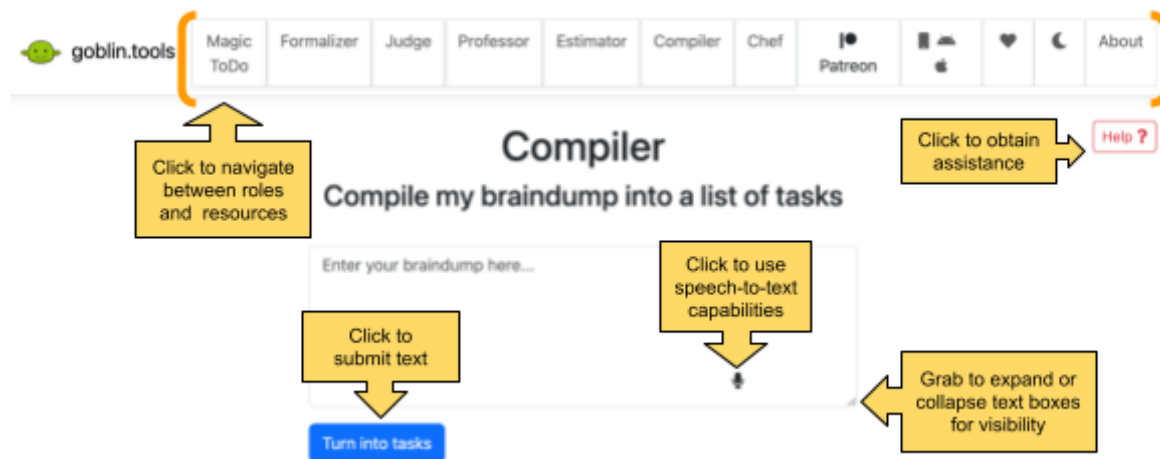
Given that Goblin Tools is a digital technology, its physical affordances primarily focus on the user's interactions with the digital interface. The user-friendly website interface features a few buttons and checkboxes for users to click. These elements are large enough to manipulate the cursor arrow easily. The Magic ToDo and Formalizer roles stand out with their dropdown menus, which offer users a range of options. Additionally, most roles come with resizable text boxes, allowing users to adjust the text window as they type. Figure 5 provides a visual representation of these features.

Figure 5*Physical Affordances: Clearly Defined Actions****Sensory Affordances***

Sensory Affordances leverage the user's senses to assist them in interacting, observing, and understanding the digital tool – especially with cognitive and physical affordances. Goblin Tools uses a straightforward user interface with clear features that pop on the all-white background. The tool clearly outlines textboxes to differentiate between textboxes and background space. There is also a consistent use of color for submission buttons, help buttons, and other interactive features. Goblin Tools uses blue for buttons where the user submits a response, red for help buttons, and white for other interactive features or dropdown menus. Goblin Tools also uses a sans-serif font to aid in reading. Figure 6 displays these features for easy reference.

Figure 6*Sensory Affordances: Intuitive Engagement and Appearance***Functional Affordances**

Functional affordances help users accomplish tasks in Goblin Tools. The site uses a consistent design across each page to indicate where and how the user can take action. Users can click buttons to submit text, obtain assistance, and navigate between each role. They can also enter text by typing or speaking and then collapse or expand the text boxes to accommodate the text visually.

Figure 7*Functional Affordances:***Secondary Framework: Bower, E-learning Technology Affordances (2008)**

To analyze functional affordances, we used Bower's E-learning framework (Bower, 2008) to analyze specific categories. As shown in Table 5, Bower's list of affordances can be categorized as either utility affordances related to the educational potential of the digital tool or usability affordances related to the evaluation of the digital tool. There are seven sub-categories related to utility affordances and four sub-categories related to usability affordances.

Utility Affordances

Media Affordances. Media affordances relate to the digital tool's text, images, audio, and video features. Goblin Tools had many media affordances related to text, with a few options for images and audio. Table 6 organizes these findings.

Table 6*E-learning Technology Affordances: Media*

Abilities	Actions	Instances
Text	Easy to Read	Yes! Black text, white background
		Larger headings
		Few words
		Callout boxes have white text on a black background
		Blue buttons have white text
		Option to switch between light and dark modes for easy reading in different settings
	Easy to Write/Type	Adequate space for responses
		Resize text box
		Easy-to-read sans-serif font
		Defined areas to enter text
Images	Easy to View	Purposefully used
		Leverages icons to communicate purpose
		Explanation appears when the cursor hovers over icons
		Graphics appeal to targeted users
	Easy to Draw	none
Audio	Easy to Listen	none
	Easy to Speak	Clicking on the input textbox microphone icon to use the speech-to-text capability
Video	Easy to Watch	none
	Easy to Produce	none

Spatial Affordances. Spatial affordances relate to the digital tool's ability to resize and move elements. While there are few options for spatial affordances, they were intentionally selected to support user engagement. Table 7 organizes the spatial affordances.

Table 7

E-learning Technology Affordances: Spatial

Abilities	Actions	Instances
Resize	Easy to Resize Elements	Text boxes can be expanded or collapsed
		Elements dynamically adjust when changing screen size
		Text boxes automatically adjust to make the text visible
Placement	Easy to Move Elements	Can move and reorder items only in the Magic ToDo list
		Can move sub-tasks to and from the primary task list

Temporal Affordances. Temporal affordances relate to the digital tool's accessibility. Accessibility addresses the on-demand ability to access the software. While there are minimal and straightforward instances of accessibility, they are purposefully used to assist the user. Table 8 organizes these findings.

Table 8

E-learning Technology Affordances: Temporal

Abilities	Actions	Instances
Accessibility	Easy to Access	Easy to access on app or via the web-based site
		Must be connected to the internet to use
Record	Easy to Record	Records data only for the Magic ToDo list
		No ability for media recording
Playback	Easy to Playback	None
Synchronous/ Asynchronous	Easy to Sync Across Devices	Permits the user to synchronize their ToDo list across devices

Navigation Affordances. Navigation affordances relate to the digital tool's ability to move within and externally to the software and search, sort, and sequence the data. A few options exist to navigate within the software via the navigation bar and link to external resources applicable to the user. Outside of the navigation bar, the only links between tools are for the Estimator, Compiler, and Chef roles to send their output to the Magic ToDo list to create a checklist. Due to the developer's privacy protection, only the data entered into the Magic ToDo list can be retained, sorted, and cleared on demand. Table 9 organizes the findings for Navigational affordances.

Table 9*E-learning Technology Affordances: Navigational*

Abilities	Actions	Instances
Browse	Easy to Browse Sections	Can click between pages using the navigation buttons
		Back button returns to the former page but without the data
Link	Easy to Link to Other Resources	Navigation bar links to other pages within the software
		The Estimator, Compiler, and Chef roles link to the Magic ToDo role to create a corresponding list
Search	Easy to Search	None
Manipulation	Easy to Sort and Sequence Data	Can sort Magic ToDo items based on the icons
		Clicking the hammer icon presents options to clear archived data, clear/display time estimations by task, and clear task completion indicators

Emphasis Affordances. Emphasis affordances relate to the digital tool's ability to draw focus to a particular area or field. This creates an opportunity for the design to draw attention to certain features that are relevant to the user. Goblin Tools uses particular features to promote the user's focus and productivity. Table 10 organizes these findings.

Table 10*E-learning Technology Affordances: Emphasis*

Abilities	Actions	Instances
Highlight	Easy to Highlight Aspects	None
Focus	Easy to Direct Attention to Particular Areas	The tool for each role is centered on the screen Specific use of color, icons, and buttons draws the user's attention to productive areas that encourage focus

Synthesis Affordances. Synthesis affordances relate to the digital tool's ability to integrate resources and functions. This creates an opportunity for the design to combine tools, functions, content, and resources. Goblin Tools offers a few features that allow for combining and integrating tools and functions. However, the three roles that accommodate this feature work only with the Magic ToDo List. Table 11 organizes these findings.

Table 11*E-learning Technology Affordances: Synthesis*

Abilities	Actions	Instances
Combine	Easy to Combine Tools Together	None
Integrate	Easy to Integrate Tool Functions and Content	Tasks can be sent from the Estimator, Compiler, and Chef to the Magic ToDo to create a checklist Specific use of color, icons, and buttons draws the user's attention to productive areas that encourage focus Clicking the share icon will present a brief list of integrated options to share information

Access-Control Affordances. Access-control affordances relate to the digital tool's ability to facilitate user access. This creates an opportunity to control permissions and the ability to support collaboration. Goblin Tools uses particular features to facilitate the user's focus and productivity. Table 12 organizes these findings.

Table 12*E-learning Technology Affordances: Access-Control*

Abilities	Actions	Instances
Permissions	Easy to Manage Permissions	No account is required to use Goblin Tools.
		User can create an account to sync the Magic ToDo
Sharing	Easy to Facilitate Collaboration	None

Usability Affordances

Technical Affordances. Technical affordances relate to the digital tool's efficient, effective, and ubiquitous support across various platforms, including internet connections. Goblin Tools must have an internet connection but uses minimal underlying technology. Table 13 organizes these findings.

Table 13*E-learning Technology Affordances: Technical*

Abilities	Actions	Instances
Ubiquity	Easy to Use on All Devices	Goblin Tools offers a paid-for app for both Apple and Android devices at a low cost.
		The web-based option is not system-dependent.
Connection	Easy to Adapt to Bandwidth	No, but it is not needed due to its simplicity
Speed/ Efficiency	Easy to Quickly Process	Generates fast responses with OpenAI
		Does not generate images, diagrams, etc
		Only generates simple text that can be copied or exported

Usability Affordances. Usability affordances relate to the digital tool's intuitive use.

Goblin Tools is easy to use and manipulate by the user. This is a prized affordance for the target audience since they value consistency and ease of use. Table 14 organizes these findings.

Table 14

E-learning Technology Affordances: Usability

Abilities	Actions	Instances
Intuitive	Easy Engagement	Each tool has minimal interaction
		Each tool is has a simple user interface
		Clear use of buttons, icons, text boxes, and options
Manipulate	Easy Operation	Easy to navigate between roles and make a selection
		Specific use of color, icons, and buttons draws the user's attention to productive areas that encourage focus
Efficiency	Easy to Build Skills	User quickly builds proficiency in using the software

Aesthetics Affordances. Aesthetics affordances relate to the digital tool's appearance.

Goblin Tools has been designed to use appearance and engagement to hold the user's attention. Goblin Tools leverages simplicity as an aesthetic component, as shown in Table 15.

Table 15

E-learning Technology Affordances: Aesthetics

Abilities	Actions	Instances
Appeal	Easy to View	Appeals to the intended user
		Intentionally designed for the intended user
Appearance	Easy to Understand the Layout	Free of unnecessary information
		Free of distractions such as excessive colors, movement, ads, videos, and options
Satisfaction	Easy to Use	Holds the attention of the intended audience
Focus	Easy to Maintain Attention	No competing features to distract the user

Reliability Affordances. Reliability affordances relate to the digital tool's ability to perform as intended. Goblin Tools offers minimal options and does not need a significant support infrastructure to support its operation. Table 16 organizes these findings.

Table 16

E-learning Technology Affordances: Reliability

Abilities	Actions	Instances
Robust	Easily Supports the software	Minimal platform requirements are required due to the simplicity of the software
		No current need for collaboration, video, or excessive archived data
		Performs specific tasks without options to add additional ones
Performance	Easily Performs as Expected	Consistent system performance that is dependable, stable, predictable, and operates without issues

Negative and False Cognitive Affordances

In addition to many positive affordances, Goblin Tools has several notable false cognitive affordances. False cognitive affordances mislead users and confuse how the user would understand or interact with the digital tool. Goblin Tools has several false cognitive affordances related to buttons. Goblin Tools uses a “spiciness” meter to give the user some say in the complexity and specifics of the output from the different roles. The meter, ranging from 1 to 5, is intended to reference how neurodivergent-friendly or “neuro-spicy” the user needs the provided information. However, as seen in the steps produced by Magic ToDo, this meter can confuse users because sometimes a higher spiciness correlates to more detail and more straightforward vocabulary. Other times, a higher spiciness correlates to less detailed information, as is the case for the Professor role. Figure 8 shows a comparison in spiciness level for Magic ToDo, and Figure 9 shows an example comparison for the Professor.

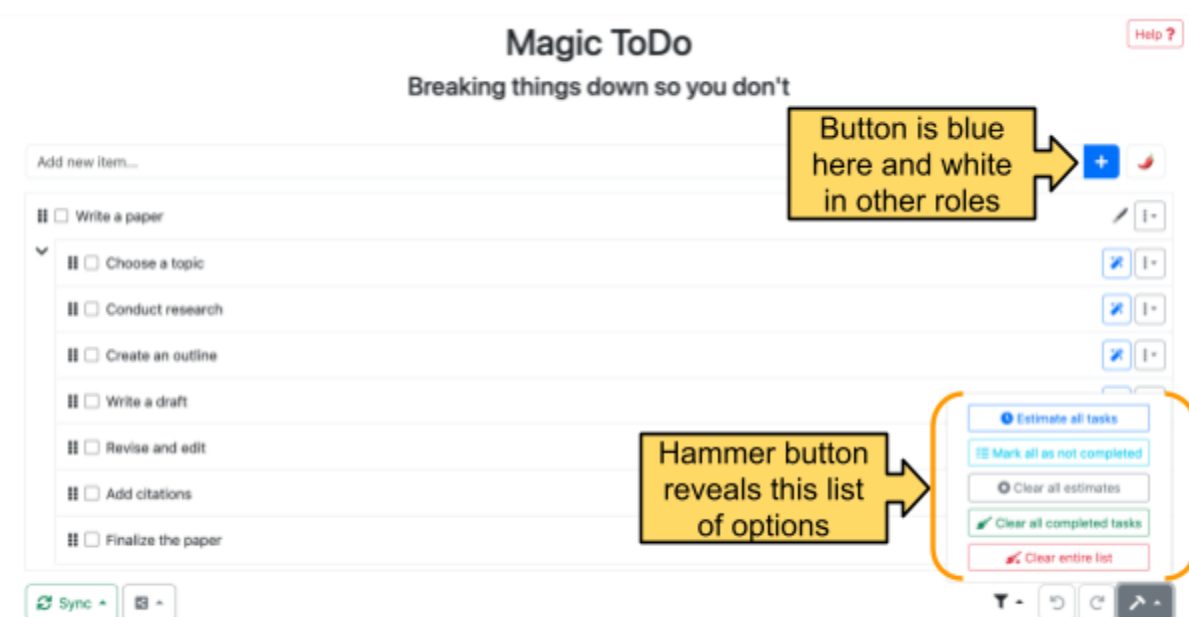
Figure 8*Comparison of Magic ToDo Output by Spiciness Level***Figure 9***Comparison of The Professor Output by Spiciness Level*

Another false cognitive affordance for buttons relates to the add button, signified by a plus sign. Unlike the consistency of most button colors, the plus sign changes color between Judge and Magic ToDo. In Magic ToDo, there is also confusion for some users on the hammer

tool. This tool is designed to perform bulk functions with options such as marking all as complete, estimating all, or deleting all. The hammer is not a logical tool icon for bulk actions and can confuse users, especially in juxtaposition to the very clear user interface. It also does not appear on the screen until you leave and return to the to-do list function. Figure 10 below shows the add and hammer buttons in Magic ToDo.

Figure 10

False Cognitive Affordances: Hammer and Add Buttons



For negative affordances, we noted that the font will increase and decrease in size when the screen is resized, but the user cannot selectively increase or decrease the font's pitch. Adding this functionality would improve the accessibility of the Goblin Tools interface.

Iteration and Feedback Process

For the first iteration of our affordance analysis, we developed a list of every cognitive, physical, sensory, and functional affordance of Goblin Tools using the Hartson and Pyla (2012)

and Bower (2008) frameworks. After submitting it to peer feedback and faculty review, we received feedback to display our findings in a spreadsheet and prioritize the affordances.

For the second iteration, we created a spreadsheet to display our findings. However, after submitting the prioritized spreadsheet for faculty review, we were advised to revise our spreadsheet's format and streamline our data due to the vast quantity of data displayed.

For the final iteration, we eliminated redundancies in our table and combined similar items to present a clearer table. We also sorted the list of affordances topically by the type of interaction with the user interface. For this, we developed four main groups: buttons, text/textboxes, icons, and indicators/features. This allowed us to display the information in a more usable format for viewers. Appendix A shows our final iteration presented topically.

User Experience Assessment

Analysis of User Reviews

From an evaluation of user reviews on Google Play, we developed a summary of users' positive and negative feedback (Google Play, 2024). Table 17 below displays the positive reviews. As seen in the table, it was evident that many users appreciated the simple nature of Goblin Tools and found it helpful to facilitate everyday life tasks. Many users expressed feeling more competent and less anxious or overwhelmed when using Goblin Tools as an aid to craft emails or plan their tasks.

Table 17

Summary of Positive User Feedback from Reviews

Category	Summary of Positive User Feedback
Learning Features and Personal Benefits	Teaches how to better breakdown and prioritize tasks
	Shows how to craft better responses to tricky emails or respond to HR/work items
	Frees up the mind for other tasks and thoughts
	Helps overcome decision-making paralysis by giving concrete steps

	Provides one option for a recipe without needing decisions from the user
	Helps organize time and activities
	Lessens anxiety related to email responses or overwhelming tasks
Accessibility	Love to use the microphone feature to brain-dump ideas or enter information
Navigation	Easy to navigate and select the tools to use
	Simple interface

Many of the positive reviews highlighted features we evaluated in our affordance analysis, such as the simplicity of the user interface. We found it interesting that many personal accounts for how Goblin Tools had changed the user's life correlated with the learning design tasks we developed from our affordances analysis. Many Goblin Tools users expressed that the developer was hearing their needs as ADHD and Autistic individuals. However, some reviews suggested ways the app or website could be improved to facilitate better task completion or integration of the app with their everyday life. Table 18 summarizes the negative feedback and recommendations compiled from the user reviews.

Table 18

Summary of Negative User Feedback and Recommendations from Reviews

Category	Summary of User Negative Feedback and Recommendations
Navigation	No undo button
	Does not retain the memory of typed responses when switching between views
Accessibility Features	Cannot increase text size
	No option to change the color of the text
Organization & Functionality of Magic ToDo	Hard to move and reorganize tasks in to-do list
	Want to change the relationship between parent and child elements in to-do list

	Confusing to turn off setting that deletes items from to do list when checked complete
	Want to put in recurring tasks at specific time intervals
	Want to manually enter time estimates and have system adjust other times accordingly
	No due date for tasks
AI Functionality	AI feature provides detail on current step but not required steps before and after (such as tidying room before vacuuming)
	AI can give general picture (like steps to make a workout plan) but does not provide specifics (like actual workout plan components)
	Combines strange ingredients in recipe that would not be appetizing
	Want to save data (such as floor data) so AI would generate a better response for tasks (such as steps for cleaning house)
	Want to present options and AI helps select best one based on input data
Icons	Icons and emojis confusing to some
Collaboration/ Multi-User	Want to be able to share and edit to do list as a family
	Want multiple save files or user profiles to separate to do lists or have a work and a home to do list
Integration	Challenging to send tasks to iCal
	Want grocery shopping list generated from recipes or ingredients listed
	Want widget for easy view and interaction on computer
App Functionality	Slow to load
	Crashes frequently with long to do lists
	Deletes to do list when updating app

Based on our analysis of affordances and the negative feedback provided by users, here are our top 3 recommendations for ways the developers of Goblin Tools could improve the digital tool accessibility and easy comprehension:

1. Provide options for increasing text size and changing color options for on-screen text.

2. Include a how-to video/gif inside the current “help” button text that shows users how to interact with each role and the different button options and actions available for that role.
3. Better define or label emojis such as the spiciness meter.

As shown in Table 18, some feedback focused on additional features and functionality the users wanted from Goblin Tools. Most of the requested features help users organize their thoughts, coordinate with their calendars and families, and access the information they input into the system. If the developers would like to increase the functionality of Goblin Tools to better meet the user’s expressed needs, we recommend the following options based on our affordance analysis:

1. Create a setting in Magic ToDo that allows users to reorganize tasks more efficiently, set personal time estimates, and use AI to adjust the other times according to user-inputted time constraints.
2. Add more integration with the user’s calendar so tasks can be assigned to specific due dates and set at recurring intervals.
3. Allow users to select a profile under the Magic ToDo list to store multiple “save” files or user info for the to-do lists.
4. Add navigation options for “back” and “undo” so users can easily navigate between information entered previously and return to previous settings without the data being erased.

We also recommend that the developers explore some concerns with the app crashing or deleting data.

How the Readings Supported Analysis

The assigned reading supported our analysis in several ways. Norman (2023) introduced us to affordances and challenged us to consider the importance of our interactions with objects around us. Hartson and Pyla (2012) extended our thinking of affordances into four areas: cognitive, physical, sensory, and functional. By adding these categorizations to our

thinking, we considered the interaction and the type of interaction these affordances provided. Moving from the physical world to the digital one, Bower (2008) takes the aspect of functional affordances and expands them into 11 actions with corresponding abilities.

As a result of our studies, we identified a digital technology and then analyzed its affordances. Using Hartson and Pyla (2012) and Bower (2028), we identified the affordances, categorized them, prioritized them, and analyzed them. In doing so, we could determine a list of limitations, areas of improvement, and strengths of the tool.

Learning Interactions, Activities, and Tasks from Affordance Analysis

Goblin Tools provides an aid that assists users in executive functioning skills and effective communication and collaboration. Unlike some digital tools, Goblin Tools is not designed for full-class implementation as an explicit learning tool. Instead, Goblin Tools has many features and affordances that can assist individual users in learning interactions, activities, and tasks to fully participate in classroom and learning opportunities. We have developed a list of 10 learning principles derived from Goblin Tools features and affordances. With each learning principle, we describe the principle and present an idea for how it could be implemented for a user in a learning setting, such as a classroom.

Table 19

10 Learning Principles from Goblin Tools Affordances Analysis

Learning Principle	Description	Implementation
Pedagogical Flexibility	Utilizes AI-Assisted Constructivist Learning Theory to tutor students	Framework for using an AI-tutor. Students can interact in real-time with AI features to submit responses before sharing with their group or explaining a concept aloud
Provide Access	Provides easy access to online tools from multiple devices	Easy for students to access by apps on hand-held devices and a web-based interface on a laptop for on-demand assistance in the classroom.

Facilitate Communication	Typically around artifacts	Aids the student in understanding text and decoding tone within the text by creating explanations and alternative suggestions. This can help when students are learning to craft written text in the classroom. Produces a checklist for students to ensure they can accomplish tasks assigned by the teacher.
Enhance Collaboration	Understand and craft written communication	Promotes confidence in student responses and shows how to craft better responses to tricky emails or respond to teachers or other peers
Identity & Presence	Transient Accounts	Permits an on-demand experience to assist with in-the-moment engagement
Represent & Share Content	Enables text manipulation and creation to facilitate communication, creating procedures, and simplify tasks	Helps students overcome decision-making paralysis by giving concrete steps to accomplish assignments with the option to specify a timeframe Helps students estimate time for in class activities or take home assignments such as a report. Students can adjust the complexity of the instructions and create a to do list to facilitate turning in assignments on time. Can facilitate real-life decision making such as the Chef feature which provides one option for a recipe without needing decisions from user
Easy Contribution	Familiar digital engagement patterns and use of digital tools	A simple user interface aids students in focusing on the task at hand. Using features that students are familiar with makes the cognitive load minimal for students. This aids in easier adoption and repetitive use by students.
Enhance Motivation & Engagement	Assists with task simplification, tone and communication refinement, and personalization.	Teaches how to break down better and prioritize tasks through repeated student input of in-class or at-home learning activities and goals Helps organize time and activities by providing estimates for completion of time and providing an easy checklist to support student-initiated completion of work
Vicarious Learning & Reflection	Connect and share thoughts through engagement with AI Reflection from AI-generated feedback.	Teachers can help students build executive function skills to lessen anxiety on multi-step tasks. Students can reflect on feedback from AI and implement suggestions in responses or classwork opportunities

Develop Digital Capabilities	Communicating Self-Directed Learning	Fosters independent engagement. Students can use tools during individual work time to better plan processes or organize work. This also improves digital competencies or helps students phrase and organize thoughts in digital space.
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Conclusions

The affordance analysis of Goblin Tools was essential in identifying the positive and negative features of the digital tool and the ways in which the user interface and functionality afford the user understanding and interaction. Through our analysis, it was evident that Goblin Tools was designed to thoughtfully leverage minimally distracting user interfaces with consistent text and button options. Despite having seven unique roles, Goblin Tools provides simple instructions and a user-friendly output intended to support the learning and everyday functions of its neurodivergent target audience.

Our evaluation also presented a review of negative feedback from users and other false cognitive affordances that we recommend the developers consider in future versions of the website. Through our report, we narrowed our focus to seven main improvements that would improve the affordances of the tool and allow the users to interact and navigate the tool with ease. Given the use of AI in the tool, we also recommend that the developers continue to investigate user reviews and recommendations, and make changes to their user interface as the functionality of open AI expands.

From our analysis, we also developed a list of learning principles that can be leveraged in the classroom with individual learners or in informal learning settings to ensure neurodivergent students can participate in all learning activities with confidence. Goblin Tools provides tools and aids supporting communication, collaboration, and executive functions like task initiation and completion. We recommend that teachers and special educators evaluate the usefulness of Goblin Tools for their specific populations. Depending on their students' unique needs and ages, Goblin Tools might be a great digital tool to recommend to users who could

benefit from an extra support system for on-demand learning. The overwhelmingly positive user reviews hint at this new digital tool's potential to support learning tasks using AI.

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Appendix A - Topical Organization of Goblin Tools Affordance Analysis

AFFORDANCE ANALYSIS						
						
AFFORDANCE	PRIMARY FRAMEWORK	SECONDARY FRAMEWORK	POSITIVE or NEGATIVE	REASON for +/- DECISION	DESCRIPTION	LOCATION
Harrison & Pyla Four Basic Types of Affordances		Bower E-Learning Technology				KEY: dark green background = specific pages light green background = specific page area
BUTTONS						
Button - Navigation with Embedded Hyperlinks	Cognitive Functional Physical Sensory	Media Navigation Usability Aesthetics Reliability	Positive	Clear signifier of available options	Links the user to internal pages within the software	Navigation Bar - Every Page
Button - Help	Cognitive Functional Physical Sensory	Media Emphasis Usability	Positive	Clear signifier with text, icon, and color usage	Opens a pop-up window to explain how to use items on that webpage	Header Area - Every Page
Button - Blue with white text	Cognitive Functional Physical Sensory	Media Emphasis Usability Aesthetics	Positive	Clear signifier	Indicates the user will be requesting an action to be executed. Is always located after the text box	Formalizer Judge Professor Estimator Compiler Chef
Button with icon - Plus sign, "+"	Cognitive Functional Physical Sensory	Media Usability Aesthetics	False Cognitive	Clear signifier, but has inconsistent use of color	Indicates the user will be adding an item to the list below the button.	Magic ToDo Judge
Button with icon - Chili Peppers	Cognitive Functional Physical Sensory	Media Usability Aesthetics	Positive	Signifies the level can be changed	Popup window appears with a slider to change the reading level and the number of subtasks	Magic ToDo Formalizer Professor Estimator
Button with icon - Vertical 3-dots	Cognitive Functional Physical Sensory	Media Navigation Emphasis Usability Aesthetics	Positive	Clear signifier	Indicated there is a collapsed menu with four additional options	Magic ToDo
Button with icon - Magic wand	Cognitive Functional Physical Sensory	Media Navigation Emphasis Usability Aesthetics	Positive	Clear signifier	Indicated the task can be broken down into smaller steps	Magic ToDo
Button with icon - Trash Can	Cognitive Functional Physical Sensory	Media Usability	Positive	Clear signifier	Appears when the task has been checked as complete to offer the option to delete the finished item	Magic ToDo
Button - Switch Light/Dark Mode	Cognitive Functional Physical Sensory	Media Usability Aesthetics	Positive	Clear signifier with light or dark mode icon	Permits the user to choose what mode works best for them by changing the background between light and dark. Icon changes based on mode - shows moon icon to change to dark mode and sun icon to change to light mode	Navigation Bar - Every Page
Button - Feedback	Cognitive Functional Physical Sensory	Navigation Media	Positive	Clear signifier with emotion icon	Opens a pop-up window for the user to provide feedback via two options: by email or by clicking on 1 of 3 options that use both an icon and text	Navigation Bar - Every Page

AFFORDANCE ANALYSIS						
						
AFFORDANCE	PRIMARY FRAMEWORK Harrison & Pyla Four Basic Types of Affordances	SECONDARY FRAMEWORK Bower E-Learning Technology KEY: dark blue background = functional light blue background = non-functional	POSITIVE or NEGATIVE	REASON for +/- DECISION	DESCRIPTION	LOCATION
Button - Patron & Icon with Embedded Hyperlink	Cognitive Functional Physical Sensory	Media Navigation Usability Temporal Usability Aesthetics	Positive	Clear signifier in the form of software icon and text	Links the user to an external page that supports membership, pricing, and announcements	Navigation Bar - Every Page
Button - Apps & Icons with Embedded Hyperlink	Physical Functional Cognitive	Media Navigation Usability Technical Aesthetics Reliability	Positive	Clear signifier in the form of device icons	Links to external sites to download the user apps as indicated by the icon: Apple, Android, and web app.	Navigation Bar - Every Page
Button - About	Cognitive Functional Physical Sensory	Media Navigation Usability	Positive	Clear signifier	Links to an internal page that explains information about the software written in easy-to-understand language and contains easily identifiable hyperlinks	Navigation Bar - Every Page
Button with Icon - Copy	Cognitive Functional Physical Sensory	Media Usability	Positive	Clear signifier	Permits the user to copy the text response for usage elsewhere	Formalizer Chef
Button with Icon - Hammer	Cognitive Functional Physical Sensory	Media Navigation Usability	False Cognitive	Clear signifier	The purpose of this icon is not clearly identified by the user until the cursor hovers over it and indicates it is for bulk changes. It is also offers a dropdown menu with options to apply to all tasks in the list	Magic ToDo
Button with Icon - Reverse	Cognitive Functional Physical Sensory	Media Usability	Positive	Clear signifier	Undoes the last action taken	Magic ToDo
Button with Icon - Forward	Cognitive Functional Physical Sensory	Media Usability	Positive	Clear signifier	Redoes the last action taken if the user wants the action to reappear	Magic ToDo
Button with Icon - Share	Cognitive Functional Physical Sensory	Media Access-Control Technical Usability Aesthetics	Positive	Clear signifier	Commonly used icon to indicate the options available on the dropdown list that include saving, copying, printing, exporting and uploading	Magic ToDo
Button with Icon & Text - Sync	Cognitive Functional Physical Sensory	Media Access-Control Technical Usability	False Cognitive	Signifier	Experimental feature offering the ability to sync ONLY the Magic ToDo list across devices; does not sync any other pages.	Magic ToDo
TEXT BOXES & TEXT						
Text Box - Fixed size	Cognitive Functional Physical Sensory	Media Usability Aesthetics	False Cognitive	Limited space for text to be entered	The text field is only large enough for one task and will not expand if there is a lot of text	Magic ToDo

goblin.tools		AFFORDANCE ANALYSIS			
PRIMARY FRAMEWORK		SECONDARY FRAMEWORK	POSITIVE or NEGATIVE	REASON for +/- DECISION	LOCATION
AFFORDANCE		Harrison & Pyla Four Basic Types of Affordances			
		Bower E-Learning Technology			
		KEY: dark blue background = functional light blue background = non-functional			
Text Box - Resizable	Cognitive Functional Physical Sensory	Media Spatial Usability Aesthetics	Positive	Large enough space for text to be entered	All textboxes have the ability to be resized so the user can see all of the text Formalizer Judge Professor Estimator Compiler Chef
Text Box - Writing Prompt	Cognitive Sensory Functional	Media Emphasis Usability	Positive	Clearly expressed directions for text entry	Assists the user in two ways: (1) provides writing suggestions to the user, and (2) offers context if there is a response Magic ToDo Formalizer Judge Professor Estimator Compiler Chef
Cursor Hover	Functional Sensory Physical Cognitive	Media Emphasis Usability	Positive	Offers additional information	When hovering over a button, an text explanation in contrasting colors appears. When hovering over dropdown menus, the options appear. Magic ToDo Formalizer Judge Professor Estimator Compiler Chef About Navigation Bar - Every Page
Title	Cognitive Sensory Functional	Media Emphasis Usability	Positive	Clear signifier	Labels the page with a job role so the user knows what they can do on the page Header Area - Every Page
Sub-title	Cognitive Sensory Functional	Media Emphasis Usability	Positive	Clear signifier	Explains what will happen on the page Header Area - Every Page
Font	Cognitive Sensory Functional	Media Usability Aesthetics	Negative	Font used for text	Provides accessibility by using a sans serif font, the user cannot change the font's pitch Magic ToDo Formalizer Judge Professor Estimator Compiler Chef
ICONS					
Icon - Microphone	Cognitive Physical Sensory Functional	Media Temporal Usability Aesthetics	Positive	Clear signifier	Indicates where a user can use the speak-to-text accessibility feature and is only located in each text box where the user is to input text. Magic ToDo Formalizer Judge Professor Estimator Compiler Chef
Icon - Task Categorization	Cognitive Sensory Functional	Media Usability	Positive	Clear signifier	Visually indicated a category for each item in the task list Magic ToDo

AFFORDANCE ANALYSIS						
goblin.tools						
AFFORDANCE	PRIMARY FRAMEWORK	SECONDARY FRAMEWORK	POSITIVE or NEGATIVE	REASON for +/- DECISION	DESCRIPTION	LOCATION
	Harrison & Pyla Four Basic Types of Affordances	Bower E-Learning Technology				KEY: dark green background = specific pages light green background = specific page areas
	KEY: dark blue background = functional light blue background = non-functional					
Icon - Chili Pepper	Cognitive Physical Sensory Functional	Media Usability Aesthetics	False Cognitive	Signifier	A common term used by neurodivergent learners but may not be easily understood by all users. Here, "spiciness" refers to how hard the user thinks the task will be to accomplish. This may be confusing to the user since it normally refers to the user's neurodivergent level and not task difficulty level.	Magic ToDo Formalizer Professor Estimator
Icon - Menu	Cognitive Physical Sensory Functional	Media Usability Aesthetics	Positive	Clear signifier	Uses an industry standard practice to indicate the menu bar has been collapsed into a popup window if there is not enough viewable area on the current screen	Magic ToDo Navigation Bar - Every Page
Icon - Move and sort items	Cognitive Physical Sensory Functional	Media Spatial Usability	Positive	Clear signifier the list order can be moved	Allows the user to change the order of the items on the ToDo list	Magic ToDo
Icon - Filter	Cognitive Physical Sensory Functional	Media Navigation Usability Aesthetics	Positive	Clear signifier	Displays the option for the user to sort the tasks according to their category icon	Magic ToDo
INDICATORS & FEATURES						
Dropdown Menu	Cognitive Physical Sensory Functional	Media Navigation Usability	Positive	Provides additional options	Magic ToDo: Provides additional options for multiple buttons to display, sort, manipulate, share, change, or sync Formalizer: Provides additional options for communication tone when writing	Magic ToDo Formalizer
Checkbox	Physical Functional Cognitive	Media Usability Aesthetics	Positive	Clear signifier	Indicated the task has been accomplished.	Magic ToDo
Specific Color - Blue	Cognitive Sensory Functional	Media Temporal Emphasis Usability Aesthetics	Positive	Clear signifier	The color blue is only offered when the user has the option to submit a request via a hyperlink or button.	Magic ToDo Formalizer Judge Professor Estimator Compiler Chef
Specific Color - Red	Cognitive Sensory Functional	Media Temporal Emphasis Usability Aesthetics	Positive	Clear signifier	The color red is only offered when the user needs assistance	Magic ToDo Formalizer Professor Estimator Header Area - Every Page