



**Research Report** | Aaron Crosby, Amberly Riegler, Fiona Kuipers  
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# Executive Summary

## Overview

Synapse is one of multiple tools created by Sage Bionetworks to help advance biomedicine by making science more open, collaborative, and inclusive. An open source platform, Synapse is used to carry out, track, and communicate research. Synapse enables co-location of scientific content (data, code, results) and hosts a growing number of living research projects and resources.

Synapse allows users the ability to download multiple datasets at once through the use of a bulk data download feature. Users can search for datasets, add them to a download list, and package up as a compressed .zip file to download. The purpose of this usability study was to investigate the user experience surrounding this feature.

## Participants & Methodology

The research team worked with Sage Bionetworks to recruit scientists and bioinformaticians that were existing Synapse users. Through the use of remote interviews conducted online, the study measured user ability to complete tasks. Qualitative data surrounding user insights was gathered via think aloud protocol and pre-/post-test questionnaires conducted before, during, and after the user tasks.

## Results & Recommendations

Regardless of a user's likelihood to use the feature, and despite multiple points of confusion that were uncovered over the course of the study, users generally appreciate the functionality of the bulk download feature. Multiple opportunities for improvement were identified in the areas of search, iconography, and process flow, and the study also makes recommendations to improve the effectiveness of future research.

## Study Objectives

The main goal of the study was to uncover pain points associated with tasks required from project search and discovery to bulk download using the Synapse.org website UI. Additional goals included determining the perceived value of the bulk download feature, evaluating how errors are addressed by users, and identifying interactions ripe with areas of opportunity for improvement.

## Description of Study

Testing sessions were conducted back to back between March 8, 2019 to March 9, 2019. Each session lasted approximately 45 minutes. Consent for participation was conducted online and consent forms were returned prior to beginning each study session.

### Participants

Due to the targeted user population for Synapse, recruitment for participants relied upon convenience sampling from sponsor and personal contacts. A total of 5 participants were recruited; 3 bench scientists and 2 bioinformaticians. Previous experience using Synapse not required for participation and most participants had little to no experience using the online interface. A complete overview of participants can be found in Appendix B: Results.

### Protocol

Each session began by asking participants to complete a pre-task questionnaire via Google Form, which collected personal information and details about Synapse use (see Appendix A: Facilitation Script & Questionnaires). Once their responses were submitted, participants were asked to begin sharing their screens in order to observe a series of scenarios while thinking aloud.

Users were first asked how they might begin searching for data and were prompted to search for "TCGA adenocarcinoma". Next, users thoughts were collected on search results and how they would identify items of interest and were then prompted to select the folder "TCGA Lung Adenocarcinoma - Consolidated". Upon opening this folder, users were asked how they might go about downloading all of the visible files. Users were then given two more search terms "MICMA data for use in independent research" and "GSE10433 raw data layer" and prompted to download these as well. After all items were added to the download list, users were asked how they'd go about downloading the items from the list. When eligible files were zipped, downloaded, and removed from cart, users were asked to explore how to go about downloading the remaining files in the list. After each individual task was completed, users were provided with a post-task questionnaire to gauge opinions on Synapse (see Appendix A: Facilitation Script & Questionnaires). After this segment, the session ended with a post-study questionnaire.

## Testing Environment and Setup

Testing sessions were conducted remotely using Zoom, an online meeting platform. Participants, facilitator, and note takers provided their own laptop, headphones, and internet connection. Allowing users to complete the study on their own computer in a familiar environment reduced the likelihood of deviation from their natural behavior.

This method of usability test was chosen based on the lack of physical proximity to participants, the ease of joining an online meeting for all parties, and the ability to capture high quality documentation of each session.

## Data Collection and Analysis

Qualitative measurements include interactions, thoughts, feelings, reactions, and comments made by users during testing and captured in a standardized note taking form during each session (see Appendix C: Notes and Recordings). This data was analyzed by identifying themes and recurring problems across participants.

Google Forms was used to capture quantitative data from pre- and post-task questionnaires. Analyzed results from this data can be found in Appendix B: Results.

## Findings and Recommendations

### Successes

All users were able to complete the tasks within a few minutes and with minimal help from the moderator. Users who had never used the online interface before recognized familiar elements of the design, interpreted them correctly, and were able to navigate successfully. Informational pop-ups were helpful to all participants and prevented them from taking unnecessary steps to achieve tasks. Overall, users had a positive impression of the bulk download feature. Participant 2 and 3 were particularly excited to use the feature to expedite their work processes.

### Opportunities

Four major areas of opportunity became apparent through user testing. These themes were consistent throughout all tests, and each participant presented valuable insight as to how their expectations and understanding of the interface was inconsistent with the actual design. The first three areas of opportunity should be considered major pain points in need of immediate action.

## Iconography



Participants consistently misinterpreted two icons in the user interface: the blue icon for adding an item to the download list, and the green icon symbolizing an item with external links. All five participants imagined that the blue icon would trigger an immediate download of an item in Synapse.

Participant 1 said: *"...it will open the save dialogue box in the browser"*

Participant 2 said: *"I'd probably expect it to start downloading immediately."*

Participant 3 said: *"...the download button would download both of them."*

Participant 4 said: *"You obviously download here,"* and *"It would be more directly downloading."*

Participant 5 said in response to a question: *"...an immediate download"*

When participants added items to their download list by clicking the blue icon, reactions ranged from confused to surprised and mildly annoyed.

All five participants also needed help to understand the green icon and relied upon the pop-up to guide their next steps. Participant 1 interpreted the color of the green icon to signify the downloadability of the item and was confused when Synapse would not allow a download directly from the download list. He remarked, *"I don't understand why this remained... it's green."* While the four of the five participants recognized the link symbol, the green icon itself did not convey the need to download the item manually. Participant 5 seemed completely unfamiliar with the link symbol inside the green icon at first, but after some time, remembered its meaning.

## Troubleshooting List Items

In the fourth and final task, participants were asked to troubleshoot the list items that did not download. Three items remained; the first contained an external link and needed to be downloaded manually, and the second and third items required a request for access. All participants rated the difficulty of this task between 3 and 6 on a 7 point scale (with 1 being very easy and 7 being very difficult).

Participants struggled most with the item containing an external link. They did not understand why Synapse would allow a file to be added to the download list if it could only be downloaded directly from the item page. Participant 3 said, *"If there was a path to download the file through Synapse... then the download list should be smart enough to be able to link it,"* and *"There's no explanation for why you can't download from the download list."* Although participants were able to successfully download the first item, it took them considerably longer to troubleshoot the problem than the second and third items.

Most participants attempted to troubleshoot the second and third items *before* the first item. Participants seemed to favor these items because the yellow icon for access-restricted data drew their attention, and because the words “Request Access” clearly described the problem and encouraged action. Participants were also unified in their expectations regarding the “Request Action” link; an automatic request through the Synapse platform or via email was reported to be the preferred interaction.

Participant 1 said: *“I would probably click request access... I would expect to just click it, and make me request access.”*

Participant 2 said: *“I would expect it to... hopefully... click a button to request and it would just send it...”*

Participant 3 said: *“I would expect it to make an automatic email to a person.”*

Participant 5 said: *“I would assume like an email of some sort... I would more prefer it to be through this website.”*

### Multi-Step Download

Participants assumed that downloading their items from the download list would be a one-step process and two expressed frustration with the number of clicks it took to download their items.

Participant 1 said: *“You have to do four different things to do what you want,”* and *“Why wouldn’t I just be able to create and download at the same time?”*

Participant 3 said: *“Oh, now it’s ready to download... it was just zipping before... I’d be pretty pissed... if it took 20 minutes, and then I’d be like, oh it has to download again?”*

Participant 5 said: *“Oh, NOW I have to download the package”*

In addition, participants did not understand the term “create package” and some participants first looked for a download button. Participant 1 commented that he disliked having to name files and would rather have a generic name such as “Synapse package *time-stamp*” automatically populated.

Participant 1 said: *“Create package was confusing, I would expect something like ‘download’”*

Participant 4 said: *“I don’t see a download-all button.”*

Participant 5 said: *“Create package doesn’t really mean anything to me, it’s zip that means something to me.”*

Despite being slightly frustrated with the multi-step download process, participants genuinely seemed to appreciate the bulk-download feature overall and would likely respond well to continued improvements.

## Search Results

Participants, particularly the lab users, had trouble distinguishing the difference between folders and files. They were also unsure of how items with the same name were different from one another. Upon closer inspection, more experienced participants were able to discern that repeated search results were actually the same sets of data that had been updated or created by different Synapse users.

Participant 2 said: *"I'm not immediately sure what the results all are."*

Participant 3 said: *"I don't know why I have six results of the same thing."*

Participant 4 said: *"It's just not as descriptive as it could be."*

Participant 5 said: *"I don't know if they're all the same, they look kind of the same."*

## Recommendations

### Iconography

More research should be done to determine whether different icons or links (in lieu of the blue and green icons in this study) would provide more clarity and decrease user frustration. The use of links should be explored since participants in this research study responded positively to the "Request Access" link.

### Troubleshooting List Items

Requesting access to data should be automated if possible. Users should be prohibited from adding items requiring manual download to their download list unless the site functionality is updated to allow packaging of files regardless of where they are hosted. Additionally, further research on using color to signify a file's ability to be downloaded in the list could be explored.

### Multi-Step Download

Creating a zip file to download should be a one-click process. Users should be able to take a single action to "download" the files that they want to package and download, with UI guidance on time remaining and current action being taken on their behalf.

## Limitations & Future Research

### In-Person Task Facilitation

Were this study to be repeated, it would be ideal to conduct research sessions in person rather than remote. This study was unable to gather any qualitative data on the body language or attentiveness of participants (beyond what could be perceived over audio), the benefits of which would likely outweigh the benefits of facilitating remotely over the web.

## **More Specific Participant Recruitment**

Had time been less of a constraint, consensus is that a more defined and targeted user base could have yielded deeper and more meaningful insights. Recruiting users that are already experts in using the features would lead to insights that may not have surfaced due to limited experience of participants of this study. Prior to running future usability studies, Sage Bionetworks should implement mechanisms (eg. website telemetry) to allow recruitment of participants in a more targeted manner.

## **Account Creation**

This study did not address the scenario of a new user going through account creation. Recommendation is to consider a usability study on this specific scenario as a component of the end-to-end user experience.

## **Request Access**

This study did not address the scenario of an existing user requesting access to project files that are currently blocked from download. Recommendation is to consider a usability study on this specific scenario as a component of the end-to-end user experience.

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# Appendix A: Facilitation Script & Questionnaires

## Introduction

How are you today? My name is \_\_\_\_\_ and I'm a student researcher from UW. Also on the call are my group counterparts \_\_\_\_\_ and \_\_\_\_\_ to help capture notes and insights. The goal of today is to get your feedback on the Synapse website, so we'll be asking you to perform some tasks on the website and answer questions about how you feel during and afterwards.

For some of the tasks we will need you to share your desktop, so perhaps begin by closing any windows or applications you currently have open, especially if you'd prefer they not be seen by us. We'll also be recording this session, but it will only be shared with development to improve the website. Is that ok?

Also keep in mind that we are not affiliated with the website or company, and won't be offended by any criticism or negative feedback. We're looking for your honest thoughts and feelings. Make sense? Do you have any questions before we begin?

## Pre-Test Questionnaire:

So first thing, if you could click on the link in the IM window ([https://docs.google.com/forms/d/199gZ\\_ae093IEQNTSQTk5F6Qk3-Xx2p4DVUeWABUjPbg/edit?usp=sharing](https://docs.google.com/forms/d/199gZ_ae093IEQNTSQTk5F6Qk3-Xx2p4DVUeWABUjPbg/edit?usp=sharing)), a brief pre-test questionnaire should open in your browser. Please take a moment to fill that out, and let me know if you have any questions along the way.

1. You use Synapse most often to (check all that apply):

- To search for files
- Download files
- Upload files
- Read and review data
- Collaborate with colleagues
- Other

2. The last time you downloaded files using synapse was

- 0-7 days ago
- 1-3 weeks ago
- 2-6 months ago
- Longer than 6 months ago

3. The last time you searched for files using Synapse was:

- 0-7 days ago
- 1-3 weeks ago
- 2-6 months ago
- Longer than 6 months ago

4. How many files do you usually download at a time:

- 1-5
- 5-25
- 25-50
- 50 or more

Please let me know when you've finished.

## Task(s) Setup

For the next few tasks, we'd like to follow along as you navigate the website, so can you please turn on screen sharing by selecting "share screen" in the bottom navigation area in the Zoom application?

For the following tasks, and throughout the remainder of the study, do your best to think out loud and provide commentary on what you're thinking as you go through the tasks. For example, read out loud anything you focus on, and explain the actions you're taking.

### Task 1 - Locate a data set

Scenario: This first task is in regards to locating a set of data.

<open browser>

<navigate to synapse.org>

<login>

Now that you're logged in, what would you do to find a set of data about lung cancer?

Search for the following: TCGA Lung Adenocarcinoma - Consolidated

On a scale of 1 to 7, with 1 being easy and 7 being difficult, how easy or difficult was it to complete this task? Any other thoughts or feelings about this task?

### Task 2 - Add files to your download list

Scenario: Now that you've found the project you were looking for, we're going to try and find the relevant files.

What would you do first from this page?

What does the icon under the column "Download" mean to you?

What do you expect to happen when you click on the name of the file?

What do you expect to happen when you click on the icon?

What do you expect to be able to do when you click on "Download Options"?

Go ahead and click on the arrow+ icon for each file.

What happened? How do you feel about that?

Now, we're going to search for and download a couple other files.

Search for "MicMa Data For Use in Independent Research" and add all the available files  
Search for "GSE10433 Raw Data Layer from NCBI GEO" and add all the available files

How would you verify that you've prepared all the files for download?

On a scale of 1 to 7, with 1 being easy and 7 being difficult, how easy or difficult was it to complete this task? Any other thoughts or feelings about this task?

### **Task 3 - Download Files**

Scenario: For this task, you'll be downloading the files you've search for and found.

Where would you go to see all of the files you are planning to download? Can you explain your thought process?

<navigate to download list>

How would you go about downloading all of the files now that you're ready?

On a scale of 1 to 7, with 1 being easy and 7 being difficult, how easy or difficult was it to complete this task? Any other thoughts or feelings about this task?

### **Task 4 - Troubleshoot problem files**

Scenario: Now let's take a look and see if everything we were trying to download actually downloaded.

Where would you go to look?  
Explain your thought process.

What would you do about any files that require additional access?  
How would you remove any files that require additional access?

<remove files that require additional access>

Why do you think this file didn't download?  
How would you go about downloading it?

<download remaining file>

On a scale of 1 to 7, with 1 being easy and 7 being difficult, how easy or difficult was it to complete this task? Any other thoughts or feelings about this task?

## Post-Test Questionnaire:

Alright, you've completed all the tasks. You can turn off screen sharing if you'd like. The last portion is a post-test questionnaire which I will paste a link into the IM window ([https://docs.google.com/forms/d/1jHBTN\\_6qnAvlo7TGFRpZnok6Ggve-xs\\_Lc6SSOZO8IA/edit?usp=sharing](https://docs.google.com/forms/d/1jHBTN_6qnAvlo7TGFRpZnok6Ggve-xs_Lc6SSOZO8IA/edit?usp=sharing)).

1. Please rate how easy it is to use Synapse:  
Easy (1) to Difficult (5)
2. Please rate how much you like using Synapse  
Like(1) to Dislike (5)
3. Please indicate the degree to which you agree with the statement: Synapse helps me do my job efficiently.  
Agree (1) to Disagree (5)
4. Please indicate the degree to which you agree with the statement: I understand what icons mean in Synapse.  
Agree (1) to Disagree (5)
5. Please indicate the degree to which you agree with the statement: I use the bulk downloading feature more often than I manually download individual files.  
Agree (1) to Disagree (5)
6. Please indicate the degree to which you agree with the statement: I use the bulk downloading feature more often than I manually download individual files.  
Agree (1) to Disagree (5)
7. Please indicate the degree to which you agree with the statement: Synapse help tools and error messages are useful and assist me in using the platform.  
Agree (1) to Disagree (5)

Take a moment and fill this out and let me know when you've completed. At this moment I'd like to open it up to my colleagues for any questions they'd like clarification on.

Do you have any questions for us?

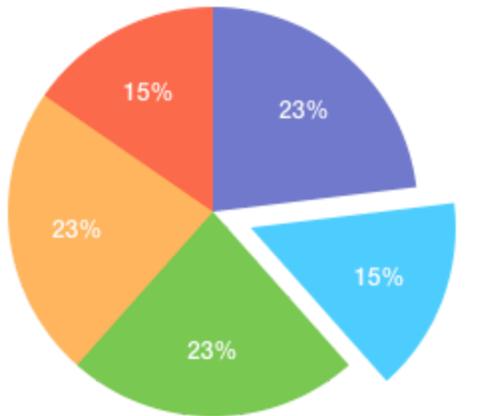
Thank you very much for your time. Contacts from Sage Bionetworks will follow up with you via email for the \$25 Amazon gift card as a gratuity. We really appreciate your help with our research! Cheers!

# Appendix B: Results

## Pre-Test Questionnaire Data

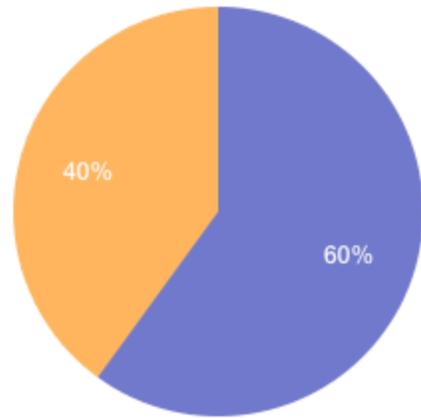
There was a general divide between our two user groups. The bioinformaticians tended to use Synapse for all of the listed functions (these were our active users, downloading and searching for files within the past 7 days) and tended to download in bulk. Our wet lab biologists were more likely to use Synapse to search and review data and are more likely to download individual files (this could be attributed to our lab users lack of current involvement with a project).

You use Synapse most often to:



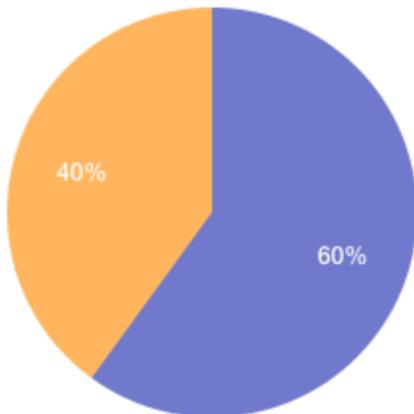
- Search for files
- Upload files
- Collaborate with colleagues
- Download files
- Read and review data

The last time you downloaded files using Synapse:



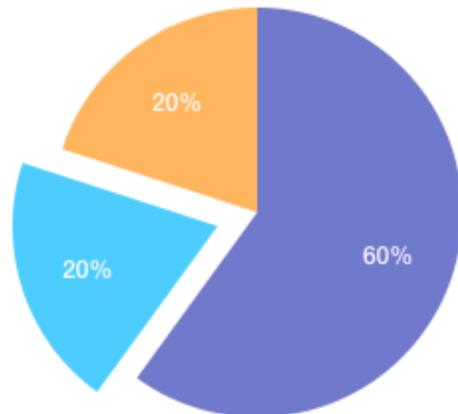
- 0-7 days ago
- 2-6 months ago
- 1-3 weeks ago
- Longer than 6 months ago

The last time you searched for files using Synapse:



- 0-7 days ago
- 2-6 months ago
- 1-3 weeks ago
- Longer than 6 months ago

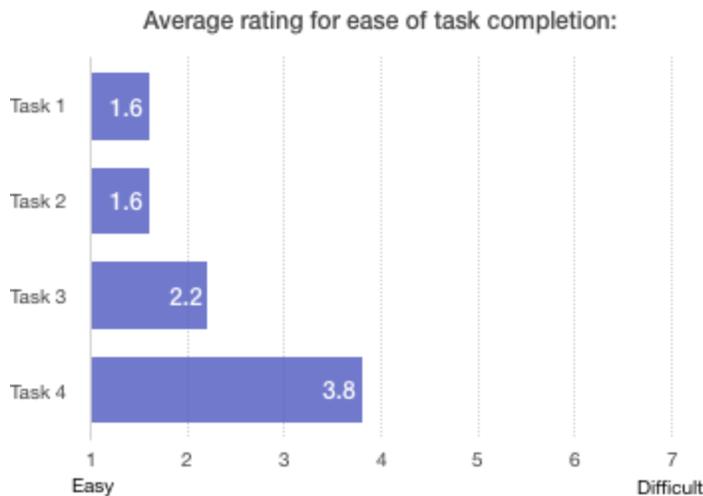
How many files do you usually download at a time?



- 1-5
- 5-25
- 25-50
- 50 or more

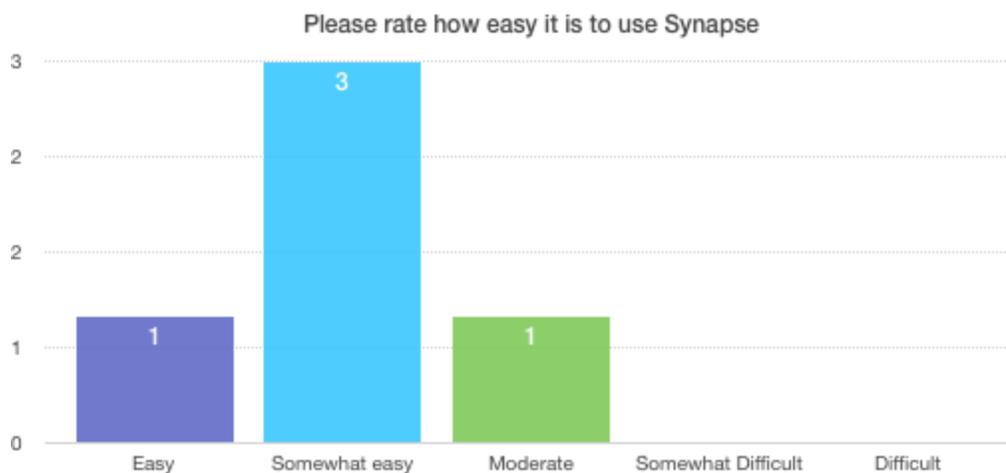
## In-task Questionnaire Data

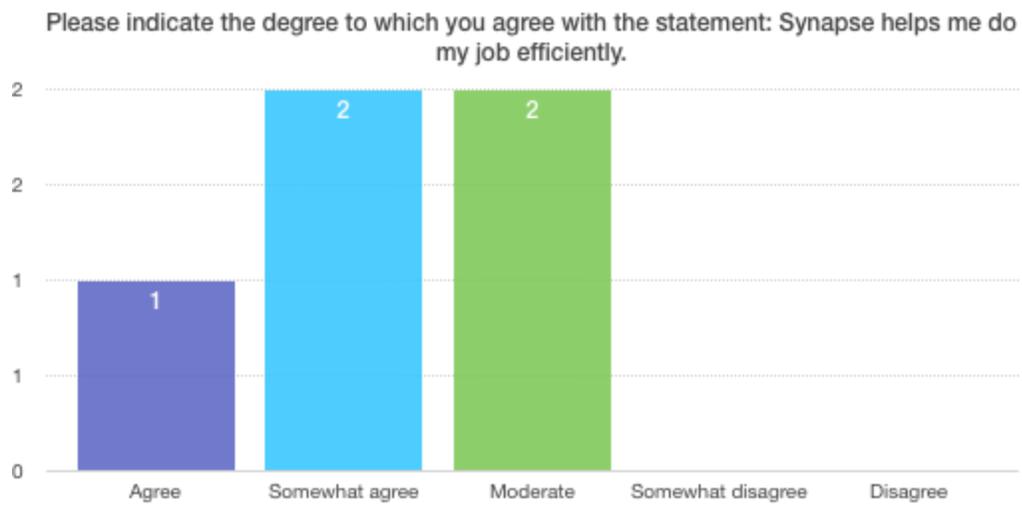
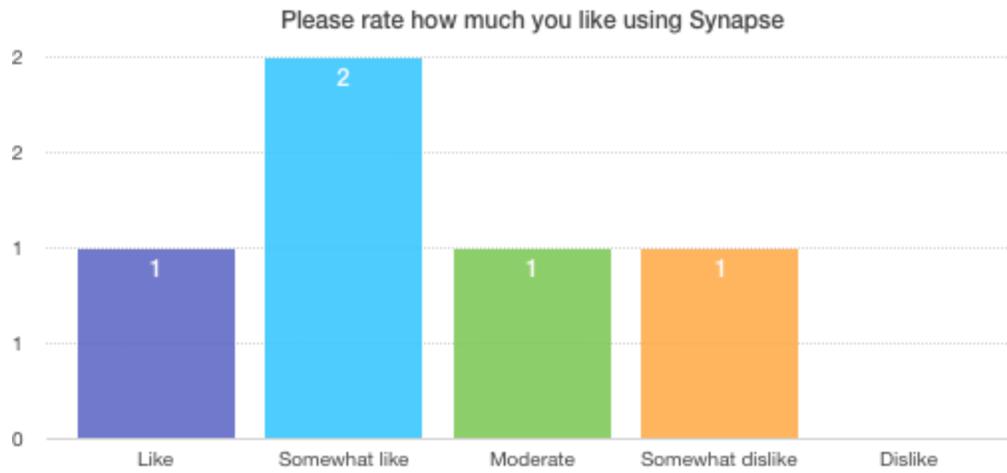
Participants ratings appear to be at odds with their verbal feedback during task completion. It appears that despite facing challenges within each step, the overall process felt intuitive. Troubleshooting files posed the biggest challenge, however, the issues experienced can likely be attributed to new users, as experienced users would already recognize what to expect to happen



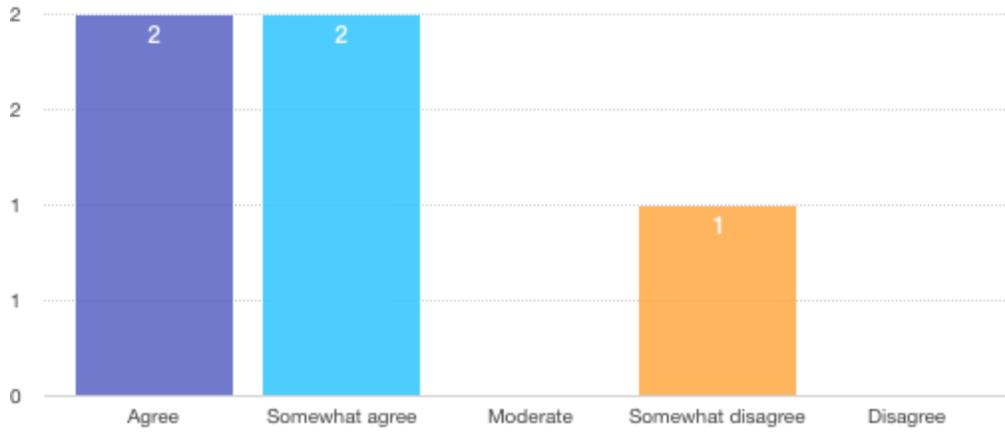
## Post-Test Questionnaire Data

Overall users rated Synapse as relatively easy to use and helpful with efficiency and site navigation. Ratings for iconography seem to contradict data gathered from the interview session - it's possible that users response to this question is complicated by having the icons clarified during testing.

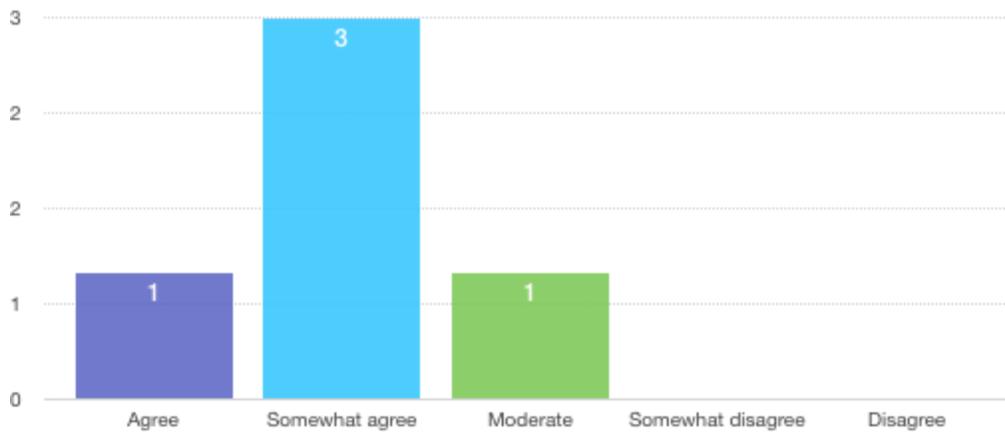




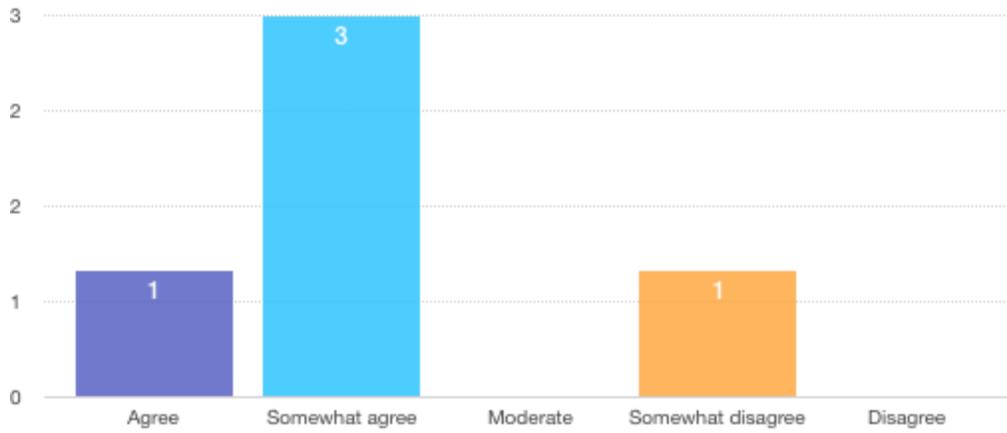
Please indicate the degree to which you agree with the statement: I understand what icons mean in Synapse.



Please indicate the degree to which you agree with the statement: I use the bulk downloading feature more often than I manually download individual files



Please indicate the degree to which you agree with the statement: Synapse help tools and error messages are useful and assist me in using the platform.



**Is there anything that you feel is missing on this site?**

1 participant - Nope

4 participants - no response

**Do you have any other final comments or questions?**

1 participant - Synapse is great!

4 participants - no response

# Appendix C: Notes and Recordings

## Participant Session Recordings

Zoom application was used to record online sessions, capturing facilitator and participant audio and screen capture. Due to default settings on Zoom, facilitator and participant faces were also captured intermittently. Due to the sensitive nature of research material including personally identifiable information (PII), recordings will not be shared publicly, and will be shared with Sage Bionetworks (physically via USB flash drive) to use for development purposes only.

## Note-Taking Form

Participant #:

Date:

Time:

### TASK ONE: Locate Data Set

Pathway(s)	Notes/Observations
Projects Tab→ Search bar→ Intended data set  Or  Projects Tab→ Sort tabs→ Intended data set	(Note why was the user successful or not successful, e.g., wrong pathways, confusing page layout, navigation issues, terminology)
<p><b>Score (circle one):</b>    Success                      Partial Success                      Fail</p> <p>Skipped</p> <p><b>NOTES</b></p> <p><i>Participant's answer to the post-task question:</i></p>	

**TASK TWO: Add file types to download list**

Pathway(s)	Notes/Observations
Data Set page→ File selection→ Download List page	Errors:  Time to complete task:  Notes:
<p><b>Score (circle one):</b> Success                  Partial Success                  Fail</p> <p>Skipped</p> <p><b>NOTES</b></p> <p><i>Participant's answer to the post-task question:</i></p>	

**TASK THREE: Create Package and initiate download**

Pathway(s)	Notes/Observations
Download list page→ Selects files→ Creates zip package→ initiate download	Errors:  Time to complete task:  Notes:

<p><b>Score (circle one):</b> Success                  Partial Success                  Fail</p> <p>Skipped</p> <p><b>NOTES</b></p> <p><i>Participant's answer to the post-task question:</i></p>
---

**TASK FOUR: Troubleshoot downloads**

Pathway(s)	Notes/Observations
Download list page→ Files that didn't download→ Create new zip→ Initiate download	Identify reason for failed download:    Yes                  No  Time to complete task:  Notes:
<p><b>Score (circle one):</b> Success                  Partial Success                  Fail</p> <p>Skipped</p> <p><b>NOTES</b></p> <p><i>Participant's answer to the post-task question:</i></p>	