

Methodology for a Space Assessment

Introduction

A space assessment can be broken into four main stages: planning, execution, analysis, and recommendations. Depending on the situation and your goals, “acting” or “application” can be a fifth step. While in some situations the data itself is the desired result, and action will come later, sometimes using the information to make changes is the goal of a project. Either decision is fine: luckily, the information from a space assessment will continue to be relevant unless or until the storage conditions of the collection change.

Your assessment should be tailored to your institution. From the beginning it is important to remember that there is no one way to do a space assessment. **While there are many models for an assessment, none are inherently better or worse.** Different approaches all have their own strengths and limitations; an institution should evaluate various approaches in terms of their needs and resources before making a decision on how to structure their space assessment.

The methodology presented here is tailored toward item-level assessments. This method provides detailed information about the space needs of the collections, however it is not the correct choice for every institution or every situation. While this guide is intended to help you design your own item-level assessment, the process can also be extrapolated to inform space assessments based on larger profiling units. For the purposes of most examples I will tend toward 3D objects on shelves because of their ubiquity in museum collections, but you may need to think about other types, such as 2D art and rolled textiles; these will have different space needs and require different fixture types.

Blank copies of the noted forms are available in Appendix D as well as online at:

<https://drive.google.com/drive/folders/1k2t9NALIeJQ3UD1r7doyAmVN3TM9tLjY>

Defining Goals

If your institution is considering a space assessment, the first step is to define the project’s goals. What are you trying to accomplish with this project? What are the end goals of the assessment? Develop clear answers to these questions before you begin any other planning for the assessment. Articulating the goal of an assessment is important to not only planning an effective assessment, but also for staying on track during the project. Defining this goal requires support and input from those with a stake in the project; depending on the institution, this may include curators, directors, or even board members. Ensure that everyone involved agrees on the goals now to prevent misunderstandings later.

You can express the goals of the project as answers to direct questions, such as:

- What is the current footprint of the collection?
- How many new fixtures do we need to purchase?
- How overcrowded is the collection currently?
- What would the footprint of the collection be if stored properly?

Phrased as desired outcomes of a project, you can express an assessment's goals as:

- We want to determine how many new fixtures to purchase.
- We want to know the required cubic footprint for our collection to plan for a new storage space.
- We want to know how compressed our collections are to advocate for increased funding.

Stage One: Planning the Assessment

Planning is the most important part of any assessment. By properly preparing and planning ahead before diving in, you minimize unexpected problems and roadblocks later and ultimately save time.

Planning a space assessment is a balancing act. It is based on the goals of the assessment as well as the resources available. In the following discussion of what to plan for and consider, remember that all planning is holistic; decisions about scope cannot be made outside of decisions regarding time and staffing, for example.

Scope: Strictly and clearly define the breadth of the assessment.

Scope defines what will and will not be covered in this project. This includes actions as well as physical spaces and collections. Clearly articulating the scope of the assessment will help keep the project on track. Record which rooms, fixtures, shelves, and items will be assessed in this project. This is particularly useful when the items you are assessing are mixed with other collections.

Your scope defines what sort of situation you will slow down to correct. In any assessment you will encounter situations you didn't anticipate beforehand. Before beginning, determine if you will do something about those issues when you encounter them or note it and move on. Will you stop to pad a shelf? To reorganize a drawer? When discussing these questions, keep the end-goal in mind. If the ultimate goal is to move the collection, stopping to make changes now may not be an effective use of time. If the project is tailored to gaining advocacy data and there are no immediate plans to rehouse items, stopping to add foam may be recommended. It is important to make sure

that everyone involved agrees with the determination of the project’s scope at the outset; this creates a framework for decisions later.

Assess the Space: Document fixtures and floorplans.

Inspect and document the fixtures and space of your assessment. Calculate the cubic footprint of your current fixtures by measuring each type’s exterior dimensions and multiplying by how many are in the space (cubic footprint includes the amount of floor space as well as vertical space). This will not represent the “size of the collection” but rather “the space the collection currently occupies.” Having the current footprint gives you a number to compare your assessment results to. Record the measurements or floor plans of the space; this will be useful for collections planning (see Table 1 for example).

Fixture Type	Number of Fixtures	Exterior Dimensions (in)	Cubic footprint, Single Fixture	Cubic Footprint, Total Fixtures
All-Steel (1)	66	36 x 18 x 78	29.25	1930.5
All-Steel (2)	3	36 x 24 x 78	39	117
Open Shelving	14	18 x 36 x 84	31.5	441
Open Shelving (#68)	1	36 x 36 x 76	57	57
Open Shelving (#69)	1	36 x 36 x 86	64.5	64.5
Open Shelving	11	18 x 36 x 59.5	22.313	245.443
Open Shelving	8	18 x 36 x 58.5	21.983	175.864
Drawer Unit (Sherds)	1	18 x 36 x 85	31.875	31.875
Lane Cabinet	1	32 x 29 x 37	19.875	19.875
Totals	106			3083.057

Table 1: Example of how to record the dimension of fixtures

Document detailed measurements of the fixtures you are planning for, whether they are new or your current fixtures. Know what aspects of the fixtures themselves will take up space; think of the upper lip of a cabinet, the 6 inches items need to be from the floor, or the thickness of shelves. Remember to think about the space needed for access; cabinet doors need to swing open, textile racks need to pull out; how much space will need to be added to account for this? If you are using shelving units, determine the available surface area of shelves for each type of fixture you will utilize, and at what intervals your fixtures will allow you to set your shelves.

Think about how the type of fixtures you are planning for will impact how you design the assessment. Generally, museum collections storage fixtures need to be considerate of:

- 3D items like pottery, baskets, and sculpture which usually sit on shelving or drawers
- textiles like clothing, rugs, or tapestries that can be stored hanging or rolled on tubes
- 2D art, such as paintings, which can either be stored in art bins or on hanging racks.

Each style of storage will need different consideration and calculations during an assessment.

Survey the Collection: Know what you have.

Visually survey the collections that will be part of your assessment so you have a sense of what atypical items or situations you will encounter during the physical assessment. For example, are there items that are a very different size or shape relative to the majority of the collection? Perhaps there are boxes of archives stored with items that will also need to be documented and accounted for in some way. How will you account for broken pieces of larger items? Is the collection too mixed to accurately sort into organizational sections? Don't let yourself be surprised mid-assessment by atypical items or situations that will throw off your consistency. These concerns can be discussed with the team and resolved before the assessment is executed, saving time later.

Profiling Unit: Select the appropriate profile unit for the assessment.

Selecting a profile unit is one of the most important decisions to make when planning an assessment. The execution and analysis information presented here is based on an item-level assessment; however, this is a decision that should be carefully considered with the assessment stakeholders.

An institution should select the smallest profiling unit that accommodates their resources and needs of the project. The smaller the unit, the more data will be generated, the more time the assessment will take, and the longer analysis will take. For example, an item-level assessment may produce 3000 pieces of data, while a fixture-level assessment might generate only 60. However, smaller profiling units produce more detailed results. Your profiling unit should be small enough to produce the data needed for specific goals and large enough to avoid becoming overly cumbersome (trying to collection 500,000 pieces of data, for example).

Whichever profiling unit you chose to use, it is important that it incorporate height so you can determine the true space needs of the collection and understand how it fits into your three-dimensional space. In an item-level assessment, knowing objects' heights allows you to accurately set the shelving in a unit before you begin rehousing, reducing object handling. This model expresses space in cubic feet. There are other ways to capture three-dimensional data. For example, you could assess the collection in terms of the two-dimensional floor space occupied and try out multiple variables for the height dimension: the taller the fixture, the less floor space required for the same amount of storage space. This allows you try out multiple collections plans, depending on the height of the room, helping you design new space or inform how you might retrofit existing space.

Organization: Plan how the collection will be organized at project's end.

This, along with profile unit, is one of the most important decisions to be made when planning a space assessment. Before beginning an assessment you must determine how the collections will be ultimately organized. This must be considered with all the stakeholders, including the collections manager and curators who understand how the collections are utilized and which organizing structure best suits this use. Consider: should the items be stored geographically? By type? By culture group? You might store all the baskets together, or all the Apache material together, for example.

Organizational schemes will have a large impact on collections planning; items like textiles and paintings need specific storage fixtures and usually must be stored together to accommodate this. Within these type groups, other schemes can be employed. There can also be overlapping organization schemes, for example by geographic region and by culture groups within each region.

When considering an organization plan, collections staff have to balance an efficient use of the available space with the ability to efficiently access the items in useful ways. For example, most researchers and tribal representatives want to see items from a particular region or culture, so storing these together will make accessing the collection more efficient. On the other hand, consider storage like art racks: while art racks may themselves be space efficient, they require almost double their own footprint so they can be pulled out and the art accessed. Based on your institution's use of art, would these pieces be better stored in art bins? This is an opportunity to reflect on how the collection is used, and what makes sense for this collection's access and preservation.

The organization of the assessment will ultimately influence how the data is gathered during the execution of the assessment; data will be gathered in groups based on your planned organization. Be sure this is clearly outlined and agreed to.

Collection Sections: Develop organizational sections for the collection

Your organization scheme will define the sections you divide the collection into for the assessment. For example, if you decide to store baskets by culture group, you will have a section for each group represented in the collection: Navajo, Hopi, Apache, Pomo, etc. It is important to remember that **this is a space assessment, not an inventory**. When possible, group fixtures together into sections: for example, if you are organizing by culture group, shelving units 1-6 may be generally Apache, 7-10 generally Comanche, and so on. This may not be perfect, but on the whole it should balance out in the end, and is more efficient for large assessments than determining one at a time which section an item fits into. It may be useful to write on or color code a collections map to

visualize sections and plan a path for the assessment (if you don't already have a map, make a simple one which includes all the fixtures in the room). This map will also be very useful for keeping track of your progress, and making notes later if needed.

You can use a collections management software to summarize locations of groups of items based on the attributes of your organization and create a list to help guide your assessment, if needed. If you have planned for multiple sections within an organization, for example storing all the paintings by artist, then you may need a report to guide you to all the Monets during the assessment. This is particularly useful if items are being organized by attributes other than size or type. If the plan is simply to place all the textiles together, then you only need to ensure you know where all the textiles currently are.

Growth: Plan for expected growth of the collection

Under some goals and projects it is viable and useful to include space planning for future growth of the collection. Growth is calculated on a year-based horizon, usually ten years although you can choose to plan for more or less. Calculating for a ten-year horizon means planning for ten years of expected growth of the collections. Your time horizon is also the useful life of your assessment results, barring any unexpected changes to the collection. After this, a new assessment will be needed.

Calculations for expected growth can be based on several metrics, including: percentages of the collection, such as an expected growth of 5% every five years; by space, such as one cabinet every two years; or by looking at the average number of items offered for donation to the museum for the last number of years and assessing their average needed space.

Think strategically about the type and scale of growth that can be expected; can you reasonably use your past accessions as a model, or should you turn to other institutions for advice? Is it reasonable to plan for the contingency of large-scale donations? Collections staff and curators should discuss this and develop shared future growth expectations.

Growth space can be planned for in specific places based on your organization. During collections planning, space can be placed at the end of organizational sections, or placed in strategic places throughout the collection. Based on the knowledge of the curators, growth space can be placed with the fastest growing section of the collection, or the area that is targeted for growth in the Collections Plan.¹

¹¹ Collections Plan: a statement of the institution's considerations regarding future collecting activities and desired growth; defines areas of collection the institution plans to grow. (AAM, *Standards and Best Practices*; Collections Stewardship)

Time frame: Outline a realistic time frame for the project.

Determine the timeframe for the project. The timeframe is a statement of the overall time available for the assessment. When does the assessment have to be completed? Do you have a hard deadline, or is it more open-ended? Be sure to be realistic and flexible in your assumptions. Consider any deadline you may need to meet for funding or other outside concerns. The time frame for the project at this stage does not need to be stated as detailed timeline; that can be done later. It should be a statement of how long all you have to complete the project, all things considered. This makes everyone aware of the how long they actually have to accomplish all the tasks. When defining your timeframe, keep in mind that a more detailed space assessment, such as an item-level assessment, will take more time than a cabinet or room-level assessment. If you have a firm deadline that must be met, let this help guide your design of the project to ensure it can be completed on time.

Staff: Assign roles and responsibilities for the assessment.

Based on the scope and the time resources available to you, evaluate your staffing needs for the assessment. Consider the staff you have available and whether you will need to ask for help from volunteers, students, or interns. You may also need to consider training for project staff.

Space assessments are best executed with at least two people. Having one person physically assessing the collection and another documenting the measurements streamlines the process by a large degree. This also creates an immediate quality spot-check on data, by having two sets of eyes on the assessment. Having two people assigned to the project also means no one will get pulled away from other work to do two-person tasks like moving large items.

Clearly articulate everyone's role in the assessment, from the collections manager oversight to the daily tasks of the assessment. Make sure everyone with a role understands what it is, and when in the process it needs to be accomplished.

Space Standards: Determine what standards for space are expected.

Before a space assessment, decide what "correct" storage will look like. How much buffer space is required around and above each item? This will vary by the type of object, the type of fixture, and the way the collections are utilized. It is also dependent on what the goal of the project is: is this a move where everything can be decompressed as much as needed, or is this a project aimed at reorganizing existing space to use it more effectively? Be realistic in your considerations of how much expansion is achievable before you begin the assessment. Consider how many rows of

items you are willing to have on a shelf, and how many items per shelf is acceptable. You may also need to consider the amount of weight your fixtures can accommodate; your art racks may have enough space to accommodate 15 pieces, but will this overburden the fixture?

It is important to acknowledge how the type of item you are assessing will impact your standards and process. Will you have to plan a scheme for oversized items? These items will need special accommodation outside your standard fixtures. Do the items need mounts to support them? If so, the space these take up will need to be included. Decide what a best-case scenario for this collection looks like, and build your space standards around this.

Data Categories: Define the categories of space data you will group items into.

Using what you know about the needs of the collection, the visual survey you performed, and your understanding of the desired fixtures' abilities, select how you will define and group the space data you are recording. You cannot record the exact measurement of every item in the collection; instead generalize slightly and define size groups that will accommodate this collection. In an item-level assessment, you will be recording the space needed for each item in terms of height, width, and depth to capture the three-dimensional footprint of the collection. Measuring height is part of the additional detail innate to an item level assessment; this information allows you to more precisely plan storage layouts and shelving in fixtures. Consider what measurements are needed to accurately assess your collection: textiles may only need length and diameter; symmetrical pots can use one measurement for width and depth.

Example data categories may be:

- Textiles: 4'x4", 4'6", 4'x8", 5'x4", 5'x6", 5'x8"
- Pottery: 6x6x6", 6x6x8", 6x6x10", 8x8x6", 8x8x8", 8x8x10"

You might standardize everything to within two inches, or one inch. If the collection is composed of oversized items, you may want to go even larger.

Data categories are used to lump items together so they can be analyzed. The number of data categories impacts the resolution of your assessment data: too many categories may make the data difficult and time consuming to analyze. Too few and the results lose their accuracy.

Make sure that your measurement categories are consistent with what your fixtures can do; if shelves can only be set two inches apart, there's no reason to measure height in one inch increments. If your shelves are only 18 inches wide, don't set a width category for 20 inches. Define your data categories to the best of your ability; these can be refined later.

Documentation: Plan a documentation strategy.

Decide how you will record data in a consistent way. Your documentation should be simple and straightforward, easy to implement during the assessment; designing a tracking matrix one way to do this. A tracking matrix includes all of your predetermined data categories, so objects can be added to the appropriate category during the assessment (see Table 2). If necessary, you can tailor a matrix to each section of the collection or unique fixture type to capture the appropriate data. For example, you might need larger data categories for a particular artist’s paintings, or need smaller increments of size to accurately capture data for archaeological items.

W/D -> Height	4	6	8	10
4				
5				
6				
7				
8				

Table 2: Example Tracking Matrix capturing width and depth on one axis and height on the other. Ticks count the items for each category.

While using a clipboard and paper matrix is simpler and more efficient during the physical assessment, you will also need to record the data into a digital format; this not only backs-up the raw data, but allows you to easily aggregate all the data from the multiple sections so it can be analyzed individually and as a whole. I recommend a simple digital spreadsheet for recording this data; you can easily set-up a sheet that captures all of your data. Enter columns of data for each section of the collection you assessed: the data categories, the number of items in each category, and the space required for the number of items from each data category (see Table 3 for an example).

DxWxH	Apache Creek			Greater Mogollon			Mixed Mogollon		
Object Measurements	Absolute Number	Cubic Feet Total	Square Feet Total	Absolute Number	Cubic Feet Total	Square Feet Total	Absolute Number	Cubic Feet Total	Square Feet Total
4x4x4	2	0.07	0.22	8	0.296	0.889	4	0.148	0.444
6x6x4	1	0.08	0.25	3	0.250	0.750		0.000	0.000
8x8x4	1	0.15	0.44		0.000	0.000		0.000	0.000
10x10x4		0.00	0.00		0.000	0.000		0.000	0.000
12x12x4		0.00	0.00		0.000	0.000		0.000	0.000
14x14x4		0.00	0.00		0.000	0.000		0.000	0.000
16x16x4		0.00	0.00		0.000	0.000		0.000	0.000
18x18x4		0.00	0.00		0.000	0.000		0.000	0.000
4x4x5		0.00	0.00		0.000	0.000		0.000	0.000
6x6x5		0.00	0.00	8	0.833	2.000		0.000	0.000
8x8x5		0.00	0.00	4	0.741	1.778		0.000	0.000
10x10x5		0.00	0.00		0.000	0.000		0.000	0.000
12x12x5		0.00	0.00		0.000	0.000		0.000	0.000
14x14x5		0.00	0.00		0.000	0.000		0.000	0.000
16x16x5		0.00	0.00		0.000	0.000		0.000	0.000
18x18x5		0.00	0.00		0.000	0.000		0.000	0.000
4x4x6	2	0.11	0.22	2	0.111	0.222	1	0.056	0.111
6x6x6	6	0.75	1.50	12	1.500	3.000	9	1.125	2.250
8x8x6	23	5.11	10.22	17	3.778	7.556	3	0.667	1.333
10x10x6	13	4.51	9.03	3	1.042	2.083		0.000	0.000
12x12x6	2	1.00	2.00	1	0.500	1.000		0.000	0.000

Table 3: Example of space data categories (left column) and entry of data

Practice: Perform a practice run on a small representative sample of the collection.

Performing a trial of your assessment is useful for several reasons: it will help the assessment team develop a communication strategy before getting fully under way; it will allow you to determine how long assessing each section collection should take; it will let you test the effectiveness of your documentation strategy and allow you to refine it; it can illuminate atypical items or fixtures that you may have overlooked that you should address before beginning the full-scale assessment; and most importantly, it will help you refine your data categories. The trial run will help you see patterns in the sizes of items; use this to reconfigure any of your data categories that don't seem useful. Maybe you need to increase the increments of size you record; maybe you've realized you set too many categories to be manageable. Use information from this trial run to inform any necessary updates to decisions you've made thus far.

Timeline: Build a detailed, flexible timeline for the project.

The timeline is different than the timeframe you defined previously. The timeframe set the parameter of the time you have available for the project; the timeline, informed by all the decisions you've made to this point and your time trial, is a more detailed document. It should define time allocated to planning, and how much time will now be allocated for the physical assessment. Rely on your trial to inform this but be flexible with yourself; assume that you will become quicker as you go, but also will most likely encounter at least one unforeseen roadblock. Think about how many hours a week will be able to be devoted to the project, and how many people will be working on it. You should establish milestones to help keep you on track, and check-in points for the team, to

keep everyone apprised to progress and to discuss any questions that have arisen. The timeline will also help establish how much time will be available for analysis of the data.

Project Guide: Build a Project Guide document to organize all your plans.

A project guide is a succinct document that captures all the decisions made in the planning process. It should be a document you can refer to so you know what you were thinking and how you arrived your outcome, weeks or years down the road. This document is intended to provide consistency and clarity for this and future assessments. Include things like your timeline, your organization structure, your preset standards, and your data categories. It should also have space for added notes from the assessment; there will be things that need to be recorded as you go, decisions you make during the assessment. If many people were involved in the planning process, it may be a good idea to have those involved sign off on the final guide, for accountability down the line.

Supplies: Gather or purchase the supplies you will need.

Gather the supplies the assessment will need: soft tape measure (avoid any with metal), clipboard, pencils, cart, stool and ladder, and gloves. Find a place to store these items for the duration of the assessment.

Stage Two: Executing the Space Assessment

Execution should follow the planned organization of the collection. Be sure that you keep track of your progress. As you go, take notes of any questions or concerns you may have about specific situations, and return to these when you have time or after you have consulted with the larger team.

Measuring Space

Pick one of your organizational sections and start to measure! Using your soft measuring tape, measure items at the largest point on the required dimensions, and then add your established standards for required buffer space. **Remember: you are not measuring the item, but the space each item needs.** At the beginning of an item-level assessment, you will need to measure each item; however, as you go you will be able eyeball items and count them off into the appropriate data categories and move much quicker through the collection. For example, you might be able to look at a shelf and quickly see that there are four 10x10x12" items, or look at an unfolded textile and know

it is about four feet wide. If an item is in a mount, include the mount when measuring, and remember to include any foam an item is sitting on. If an item falls between two of your data categories, place it in the larger; this will ensure you do not come up short on space later. However, sometimes you will have to make a judgment call. For example, when measuring 3D items, if you have rounded up for several items of the same height, maybe one gets rounded down to balance it out. Alternatively, if many items fall very tightly into categories, you can add an imaginary item of the same height for “breathing room.” Remember, this is not about being getting an exact measurement for each item, it is about arriving at the required space for the collection.

Tick off items into your predetermined categories and record this on your tracking matrix. For example, if a shelf has four 8x8x8” items, put four ticks in that size category (see Table 4). This is where having two people is very effective; one to measure and count items, another with a clipboard, ticking off data categories as the first calls out numbers. Each section of the collection under your organization scheme should use its own tracking matrix so you can analyze how much space or how many fixtures each section needs; if you accidentally record Plains items in the Great Basin section, this will throw off your analysis of both sections’ data. If you need to make changes to some of the decisions made in the planning stage, make sure to record these in the Project Guide. If it impacts the collection of data you may have to go back and remeasure some sections.

W/D -> Height	4	6	8	10
4				
5				
6				
7				
8				

Table 4: Example Tracking Matrix modelling how to check off items into the appropriate size category.

Make sure you are keeping track of any of the atypical items you identified in your initial assessment of the collection. It is much more efficient to already know how you plan to measure and record things like mini items, broken items, or things you want to ultimately move out of this space. Otherwise, you may have to move through the collections multiple times to make sure you have all the data. Keep track of these items in consistent ways. If you come across something that

you did not plan for, take the time to pause and develop a plan for it; if you decide to skip and come back to too many situations like this, you may begin to lose track of what still needs assessed and you will have to go back through the collection multiple times.

Oversized items are any items that will not fit onto your standard fixture, shelf, or drawer. Your tracking matrix should acknowledge this by not having space categories larger than your fixtures. Instead, record the exact size of each of these oversized items on a separate sheet; these will need their own storage designed for their size. Some of these items might be currently stored on your standard fixtures, but still be technically too large, up against a wall or too near the edge. Depending on the goals of your project, these may need to go on a larger fixture, or may need to be considered oversized.

Digital Data Aggregation

Enter data from your matrix into your digital spread sheet as you finish each section. You have the option to do all the data entry at the end of the measuring, if you feel there are areas you may have to return to and update your counts for a particular section.

In your digital spread sheet, record the number of items from each data category from each of your collection sections. In an item-level assessment, think about the most useful way to group and enter the data: if you are planning for shelves, group data categories by height so you can calculate shelf heights; if you are planning textile racks, enter by length so you can see how many four-foot tubes you need. In a computerized spread sheet program, such as Excel or GoogleSheets, you can embed equations into the cells which will account for the data you enter and automatically make calculations for you, such as cubic needed for the items in that data category. Building these equations into the cells so they auto-fill as you enter data will be a timesaver, and will ensure that no human error is made during these calculations. For example:

- To calculate cubic feet from inches, embed " $((L*W*H)/1728)*\text{number of items}$ "
- To calculate surface area in square feet from inches, embed " $((L*W)/144)*\text{number of items}$ "

Using a program like Excel is useful because you can add multiple pages to your calculations; this allows you to keep all your work together. Add a page for your calculation of the current footprint of the collections, with the dimensions of the fixtures, as well as data needed to calculate how many fixtures you will need, such as the thickness of shelves and how close together

the cabinet will allow them to be spaced, the max length of tubes a textile rack can accommodate. You can add a page to contain the data for the oversized items, or any other items that did not fit into your tracking matrix and any other space data you accumulated during the execution of the assessment. Keeping all the data in one place ensures it will all be included in the final calculations and analysis.

Stage Three: Analysis

Calculating Needed Space

Analysis uses the data gathered to determine how much space is needed for the existing collection. While you could quickly tally up the cubic space (or surface area) needed for the items in each section, this does not include the space the fixtures themselves occupy, and so is not directly comparable to the current footprint you calculated previously. By analyzing the data more intently, you can determine how many fixtures would be needed to appropriately house the collection.

One section at a time, calculate the required number of fixtures. This will depend on what type and size of fixture you are planning for and how items can be stored on it. For example, if you are working with hanging art, this will be a function of the area of the art and the dimensions of your racks. Textiles racks will be based on the number of tubes needed at each size. For 3D items on shelves, determine how many shelves you need for each of the heights included in your data categories.

Calculate the number of needed shelves from tallest items to shortest, as shorter items can fill gaps on taller shelves. Using the amount of surface area required for the group of items in each height group, and the available surface area of a shelf, determine how many shelves are needed at each height. For example, imagine one of your collections sections of 3D items returned this data set when you are planning for shelving units with 17.5x35.5" shelves:

Data Category (LxWxH")	Absolute Number	Cubic Feet Total	Square Feet Total
8x8x10	4	1.481	1.778
10x10x10	9	5.208	6.250
12x12x10	1	0.833	1.000
8x8x11	1	0.407	0.444
10x10x11	6	3.819	4.167
12x12x11	1	0.917	1.000
10x10x12	5	3.472	3.472
12x12x12	5	5.000	5.000
14x14x12	2	2.722	2.722
10x10x13	2	1.505	1.389
14x14x13	1	1.475	1.361

Table 5: Example data for 3D symmetrical objects

Starting from the bottom, the three 13" tall items only need one shelf: together they take up 14x34", less than the area of a shelf but very close. Moving up the data set, the two 14x14x12" items will fit onto one shelf, but not much else. Looking at the 12x12x12" category, the assessor will have to decide how many items of this size will fit on single shelf; the shelf is only 35.5" in length and three items of this size would technically need 36". However, part of that space is the buffer space and the missing half an inch could be made up by moving the items a fraction of an inch closer together. This is where personal judgement and a balance of space efficiency and preservation come into the calculations. If you decide three of these will fit onto a shelf, then you will need two shelves for these items, and one of these would have room left over. One of the 10x10" items will also fit, and the remaining four of these will fit three to a shelf, meaning two more shelves. Next up the data set is a 12x12x11", which can go on the leftover space of your last 12" shelf, as can one of the 10x10x11" items. The next shelf will be 11". This may seem tedious, but as you go through the data you will become more adept at visualizing space and calculating how many items can realistically fit. At the end, you will have something that looks like this:

Data Category (LxWxH")	Absolute Number	Cubic Feet Total	Square Feet Total	# of shelves	Shelf Height
8x8x10	4	1.481	1.778		
10x10x10	9	5.208	6.250		
12x12x10	1	0.833	1.000		
8x8x11	1	0.407	0.444	4	10
10x10x11	6	3.819	4.167		
12x12x11	1	0.917	1.000	3	11
10x10x12	5	3.472	3.472		
12x12x12	5	5.000	5.000		
14x14x12	2	2.722	2.722	5	12
10x10x13	2	1.505	1.389		
14x14x13	1	1.475	1.361	1	13

Table 6: Example data set for 3D symmetrical objects showing shelf and height calculations

Calculating shelving space is a balance of math, and intuition; just because the math says that five particular items need 4ft² of shelf does not mean they will fit on a shelf with 4ft² of surface area. Dimensions must line up as well; think back to the example of shirts on shelves in Section II. While efficiency is a factor, you must also be conscious of the reality of the project. This relies on mentally balancing space and items. Analyses should determine how many shelves the collection realistically needs, not how much space they take up. It is not an exercise in virtually placing every item onto a specific shelf.

Larger items are simpler to calculate because they create less option for where they fit: there is realistically only one place to put a 16 inch wide item on an 18 inch wide shelf. With smaller items, it is more reasonable to rely a bit more on math, dividing the total surface area needed for a height group by the area of a shelf. Smaller items have more options for placement and arrangement on a shelf to ensure they all fit. Smaller, shorter items can also fill in gaps on taller shelves, but remember, there are preservation concerns when storing very small items with very large items. In your spreadsheet, record the number of shelves needed for each height group, for each section of the collection.

If you want to check your calculations, to be sure your balance of math and intuition is producing usable results, select a small section to test; lay out the items onto an area the size of your shelf, and see if you were right; if you've dramatically over calculated, go back and remove shelves from your calculations. If you did not have enough space, determine which heights need more shelving. Think critically about what assumptions or calculations you made that lead to an incorrect result. Maybe you overestimated how many items of a certain size would fit on a shelf in reality. You should only have to lay out items once to get an idea of the accuracy of your calculations. For example, you may assume that six 8x8" items will fit on a shelf, but by laying them out see that eight will fit safely.

Once you know how many shelves, or bins of different sizes for art, or tubes for textiles you will need, you can calculate the number of fixtures required. This is based on the abilities and measurements of your selected fixtures, for example how many slots are in the art bins, or how many textile tubes can fit on each level of your rack.

For fixtures with shelving, this is based on the interior height dimension of the fixture. Total the amount of height needed, **remembering to add the thickness of the shelves** too. For example, if you need five shelves at ten inches high, with one-inch thick shelves, then that sections needs 55" of height total ($(5*10)+5$). Divide your height total by the available height in a fixture to find the

number of fixtures needed for each section. In the example below, the total vertical space in a shelving unit is 70.5”.

Taos						
	Number of Vessels	Cubic Feet Total	Square Feet Total	# of shelves	Shelf Height	Total Height Needed
6x6x4	1	0.083	0.250			
6x6x5	1	0.104	0.250			
6x6x6	2	0.250	0.500			
10x10x6	1	0.347	0.694	1	6	7
8x8x7	1	0.259	0.444			
10x10x7	1	0.405	0.694			
6x6x8	4	0.667	1.000	1	8	9
8x8x8	1	0.296	0.444			
10x10x9	1	0.521	0.694			
12x12x12	1	1.000	1.000	1	12	13
Totals	14	3.933	5.972	3		29
						70.5
						0.41

Table 7: Example data set for 3D symmetrical objects showing calculations of total number shelves and vertical height needed.

Sum up the number of fixtures needed by each section, and determine their overall cubic footprint using their exterior dimensions. For example, if you determined you need 2.5 cabinets that each have a footprint of 29.25ft³, their total footprint would be 73.125ft³. Compare the current footprint of the collection to the results of the assessment (the combined footprint of the total number of fixtures needed) to determine how much space the collection needs to expand to be appropriately stored. This can be expressed as the increase in fixtures or overall space (i.e. 20 more cabinets, 1500 ft³ more space, or 55% more space).

Space needed for oversized must be calculated separately, with their own fixtures that can accommodate their size and weight. Calculate their footprint in the same way, and add it to the overall total.

Growth Space

Determine your desired growth space. If you are using a percentage of the total collection per year, you can calculate based on a percentage of the item footprint and use that to determine fixture growth, or you can take the percentage from the total footprint, and extrapolate a fixture growth. If you are relying on a number of items per year, use your gathered data to make an assumption about average size, and how many shelves that many items would need. However you plan for growth space, these totals should either be added to the relevant sections, or added to the overall space total.

Including growth space is a smart way to *ensure* you have enough space. Your calculations and analysis should come up with a useful, relevant number but this will be based in part on visual balancing and mental juggling. By always acknowledging and including growth space, you ensure that the worst won't happen: coming to end with not enough space. It is not just part of collections planning, it's realistic wiggle room. You should not rely on it to cover a badly executed assessment, but it is reasonable to have growth space in reserve.

Analyzing the Results

There are several different ways to look at the data to gain greater insight into the collections. By comparing the needed growth of shelves/drawers versus the needed growth of fixtures, you can determine which sections are using their existing space the most inefficiently. You can also compare overall expansion needs of sections to identify general overcrowding. That data can indicate how many new fixtures of certain types are needed, or how much space a new building would need to accommodate the collection correctly. Knowing the number of fixtures needed means you can start to plan collections layouts, while knowing the cubic space needs can assist with planning space allowances in a new building. Based on your needs and unique situation, exploit your data for the information most useful to you. The analysis provides you with information; use that information to make plans and recommendations for the future of the collections.

Stage Four: Planning, Recommendations, and Communication of Results

Planning

Space assessment results allow you to efficiently make plans. The data from your assessment supplies you with knowledge about the size and number of fixtures you need to accommodate the collection, or even just the space required for the collections. This can be used to plan a new collections layout or an entirely new space. It tells you how much space you need in a new building, lets you compare how many fixtures you need in a space with how many will fit. Knowing from the start what you are planning for is key to having useful results. If the results will be used to plan for a new building, then you can assume as much space as needed. If you are trying to fit the collections into a predetermined amount of space, that constraint will impact what kind and size of fixtures can be used, and how much expansion the collections can reasonably have.

There are multiple methods for planning a space layout; simply sketching on paper, using PowerPoint designs, or rearranging paper pieces cut to the shape of your fixtures around an outline of the space. All of these require you to be sure you are working with shapes of the right size and scale exactly, which may be difficult. To ensure accuracy and precision, you may wish to use a

computerized design program, such as SketchUp, a free 3D modeling software. Program like this allow you to design your space in 3D, accounting for the height of your space and fixtures, which the other methods do not. CAD (computer-assisted design) programs like SketchUp allow you to specify the exact size of elements you place in a space, and lets you easily manipulate elements into multiple configurations (see Figure 1). In an item-based assessment your measurements will be cubic, so your planning tool should be as well. Even if you opt to use a 2D method, you will still need to account for height as you plan. The height of your fixtures has huge implications; the taller you go, the more the floor area needed by the collection shrinks. However, you also need to be aware of what your space can accommodate; don't plan for ten feet high units in a space with 8-foot ceilings.



Figure 1: Example of storage layout designed in SketchUp

During planning there are practical matters to keep in mind. Ensure your space is ADA accessible, and that your carts and ladders can make it through each aisle. Be aware of your ceiling heights and any extraneous things that impact the physical space of the room; immovable fixtures like cabinetry, ducts and pipes in the ceiling, structural pillars, staircases, doorways, and windows. Consider if you need to include space for work tables, chairs, and supplies. Be aware of the limitations of your space; what are your floor loads, and how will this impact your planning? Can you even put the required number of fixtures into this space? Does your floor load allow for compact storage? Planning should focus on the usability of the space.

Layouts should be made with preservation standards and object care in mind. For example, best practices recommend not storing items near vents, heaters, windows, or up against external walls; is this possible in your space? Remember that all items should be at least six inches off the

floor for protection against water leaks. When planning for oversized and heavy items, remember to keep them on lower shelves, for their own safety and the safety of those working in the collection. Your layout should also be guided by your organization plan for the collection; however, you will still have to decide where each section goes in relation to the others. If you decided to organize the collection by culture group, where does each group go in the space?

Recommendations

If there is no plan to immediately act on the information gathered, it can be employed to advocate for the needs of the collection to administrators or on grant applications. The data and analysis allows you to express exactly what you need, to calculate costs, and to demonstrate how you know the information is accurate. The information will need to be presented in easy to understand and compelling ways. For example, you can create color-coded maps of the information analyzed, including overcrowding and space efficiency. If you do not have enough space to completely rehouse as the assessment recommends, this can guide areas of prioritization, and be a powerful visual tool when presenting the problem to others. Comparing needed space to current space can be a powerful and easily understood expression of the overall crowding in the collection.

After an assessment you will have a complex understanding of the space; use this to think creatively about ways to improve storage. What changes can be made right now? There may not be enough room for all the recommended fixtures, but maybe rearranging aisles and fixtures can improve overcrowding. Can you move vertically at all? What could be moved out of this space to free up room? Be able to justify your plans and decisions to others based on collection care and the information embedded in the space assessment.

Space assessments do not need fancy software or professional planners; collections professionals can plan one that meets their own needs and their resources. The methodology presented here for item-level assessments outlines the key steps and concerns for this process, but I know that it may seem overwhelming. In Section IV I will use the same outline to share my case study of an item-level assessment to demonstrate more clearly the execution of each step, hopefully underscoring how any institution can perform an assessment like this.