AS500156

The Show Must Go On: The Art and Technology of Virtual Set Design

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Learning Objectives

- Learn how to use familiar tools to design unconventional objects
- Learn how to model the audience seating to validate sight lines
- Discover best practices for set pieces that move
- Learn how to incorporate animation for animated backdrops and special effects

Description

The pandemic may have shut down live theater for now, but planning for future shows continues. A set for a live theater production is often a building that just happens to be built inside another building. After designing sets for numerous theater productions using 2D and 3D tools in AutoCAD software, the speaker switched almost exclusively to Revit software. In this class, we will discuss and explore the techniques the speaker used to design stage sets, why they switched to Revit, why they still use AutoCAD for some tasks, and why they have now added VR (virtual reality) to the technology mix. This class will cover workflows learned from this somewhat unconventional use of familiar software tools, as well as how to use phasing and design options to handle scene changes, and why directors love to don a set of VR goggles. We will also look at using other tools to create animated backdrops and special effects. Virtual set design is a lot like virtual building design, and many of the same skills and workflows can be applied to both.

Speaker

David is the Senior Content Manager for CADLearning® products at 4D Technologies, where he develops content standards and creates affordable training solutions for Autodesk software, including AutoCAD, AutoCAD LT, and ReCap. He has more than 30 years of hands-on experience with AutoCAD and 15 years with Revit as a user, developer, author, and consultant, and is an Autodesk Certified Professional for both AutoCAD and Revit. A contributing editor to *Digital Engineering* magazine, he is also the former senior editor of *CADalyst* magazine and is the author of more than a dozen books about AutoCAD. A licensed architect, David was also one of the earliest AutoCAD third-party software developers, creating numerous AutoCAD add-on programs. As an industry consultant, David has worked with many companies, including Autodesk. He has taught college-level AutoCAD courses and has consistently been a top-rated speaker at Autodesk University.

What is a Set and what does it do?

Set design is the creation of the physical space in which the action of a performed event takes place. Primarily used to describe theater productions, it constitutes all the scenery, furniture, props, appearance, and overall look of the stage. Set design is also known as *scenic design*, *theater design*, *theatrical design*, and *stage design*. Although these terms are used interchangeably in most instances, *set design* or *scenic design* have become more popular in current terminology because they can be applied to television and film as well as theater.

My job as a set designer is in many ways similar to my job as an architect. Every aspect of the set design is meant to further the director's vision of the show. The director is my "client".

While designing a theater set can be a lot like designing a building, there are some significant differences (particularly in the community theater environment in which I work):

- Budgets for the set are extremely limited (usually around $1,000 to $1,500 per show)
- The construction time frame is extremely compressed (usually 4-6 weeks, with actual construction taking place for just 3 hours per day, twice a week, with an all-volunteer crew—a total of 24 to 36 hours of actual construction time, or around 150 man-hours)
- Rehearsals typically take place during the other 5 days of the week on the same stage where the set is being built (imagine a building being fully occupied while it is under construction)
- A set design may use various techniques to make materials look like they're something else, but the set must still be structurally sound and appear to be solid
- Unless it's a static set (for a play that takes place in a single space), the entire set or various set pieces may need to quickly move on and off the stage during scene changes (and those pieces stored so that they are out of sight of the audience, out of the way of the actors and crew backstage, and able to be quickly moved back onto the stage when needed)
- All areas where action takes place **must** be visible to everyone in the audience
- The set must conceal the entire backstage area (except possibly during scene changes)
- Actors must be able to safely move around the set (both while on-stage and backstage)
- The lighting designer must be able to light all of the areas where action takes place (with multiple lighting *instruments* so that actors are never in shadow, unless meant to be)
- The entire set must be demolished within a few hours after the final performance—known as "striking the set"—to make way for the next production (which will then open 4-6 weeks later) while retaining as much reusable material as possible

My unwritten rules of set design

Now that you better understand the constraints, juxtapose those with my unwritten (until now) rules of set design:

- The set is a character—the set is just as important as the actors on the stage
- It's not JUST community theater—just because it's not Broadway doesn't mean it shouldn't look as professional as possible
- If the set moves, it better do so quickly—any scene change that takes longer than 90 seconds is too long

Where do you start?

The design of any set begins with three knowns:

- The script
- The director
- The physical confines of the stage, backstage area, and audience space

The Script: The script *may* include a set design. For example, most Agatha Christie plays include a plan view of the set design, which even specifies the direction of door swings meant to reveal or conceal action. So, while the set designer may certainly design something very different than what Ms. Christie originally envisioned, the designer must understand why she made specific choices or risk creating something that does not properly serve the play.

Other scripts may not provide any overt guidance in the design of the set. But a careful reading of the script itself, as well as some research, often dictates many aspects of the design.

The Director: The director often has a vision of what he or she wants to see on stage.

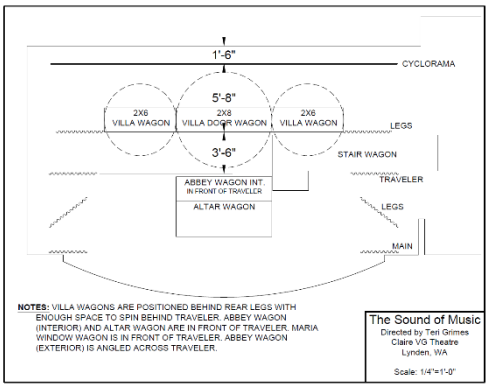
> "It should look like a sun-drenched apartment in San Tropez."
>
> "The walls need to dematerialize during the dream sequence."

The Theater: Every theater is different. The size of the stage (width, depth, and height) is different. The size of the wings and backstage space (or lack thereof) is different. Is there fly space (the area above the visible portion of the stage into which you can lift scenery/set)? What is the configuration of the stage (proscenium, thrust, in-the-round, black box)? The size of the house (the audience space) is different (width, depth, height, number of rows, number of seats in each row, location of aisles, orchestra pit or no orchestra pit, balcony or no balcony).

The Sound of Money

The first set I designed was for *The Sound of Music* (which is often referred to, somewhat tongue-in-cheek, as "The Sound of Money" because, thanks to the number of children involved, it typically sells out every performance). My design for this show consisted of a dozen rolling platforms (referred to as *wagons* is theater parlance). I began by taking measurements of the stage and—using an old-style approach—built a scale model. But once I completed my conceptual design, I realized that the biggest constraint would be storing the unused wagons backstage. At that point, I switched to using AutoCAD.

Each wagon was modeled individually in 3D (using lots of 3D modeling tools: extrude, loft, etc.), saved as blocks (so each could be moved/rotated separately), and then inserted into a 3D model of the stage. Working in plan view, I could immediately determine whether I had enough space to store and move all the wagons between the 28 scene changes. Materials and textures, applied to surfaces in the model, enabled me to produce rendered views so that the director could understand my design. And working drawings were printed to aid the set construction crew.



For the backdrop (which was supposed to look like the Austrian Alps), I took a photo of Heather Meadows with Mount Shuksan in the background. This view at Mount Baker Ski Area (where I work on winter weekends as a volunteer ski patrol) was then painted on canvas by a local scene painter, who started work months before set construction began. I also brought files of my design for stained glass windows of the church (one of the numerous set locations) and had them printed on a wide-format printer in the Epson booth at a trade show I attended a few weeks before set construction began. (In community theater, you find any opportunity to save money.)

A 5-door Comedy

My second set was also designed using AutoCAD, although in hindsight, Revit would have been a better choice. This set, for the 5-door comedy *Moon Over Buffalo*, consisted of nothing more than doors, walls, and a staircase, forming the backstage actor's lounge or *green room* at a theater in Buffalo, New York.

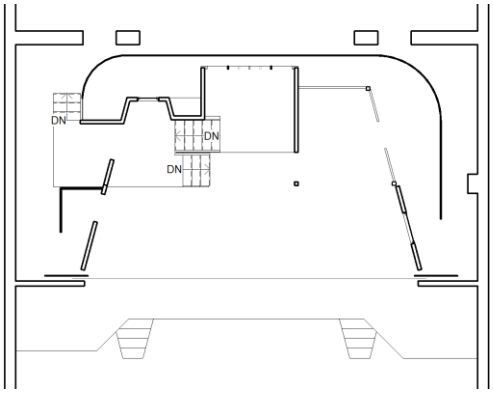
This time, I took advantage of the fact that I was in the midst of reviewing a wide format Epson printer for a magazine article. I used it to print all the posters and other artwork that would hang

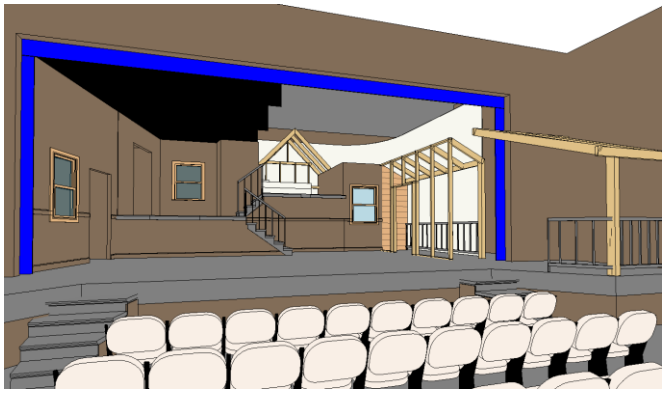
on the walls of the set. I even printed six 36-inch wide by 14-foot-tall sheets of brick, which were then applied to several of the walls of the set (visible through doorways) to make it appear that those were brick walls. The “artwork” for those bricks was the image file supplied as part of the AutoCAD render library, the exact same file used to create the material applied to those walls in my AutoCAD model.

Building a House on Stage

It wasn’t until I was approached to design the set for *August: Osage County* that I realized that a stage set is often nothing more than a building constructed inside another building. At that point, I switched to Revit, and have used it *almost exclusively* ever since.

Tracy Lett’s Tony and Pulitzer prize-winning play *August: Osage County* takes place inside a rambling country house outside Pawhuska, Oklahoma. The script calls for a 2-story structure, plus an attic, as well as an outside porch. This posed quite a challenge on a small stage with a proscenium that measures only 12'-3" high. The limited height meant that I obviously could not stack the floor levels.

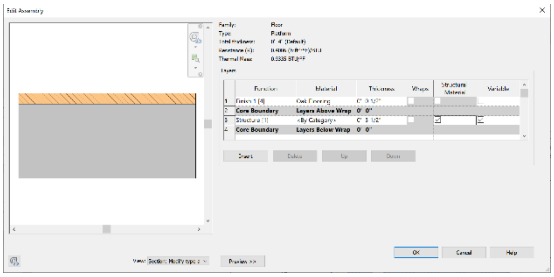


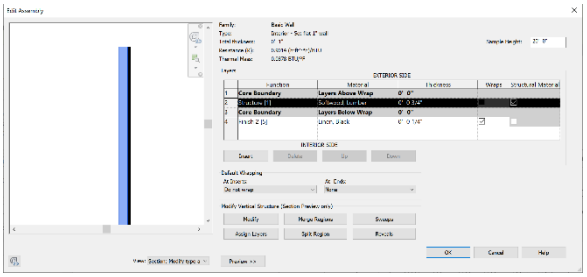


Because the director felt that my design might cause sight-line issues, after taking detailed measurements, I modeled the stage, backstage area, and the entire auditorium, complete with all 198 chairs, so that I could “show” the director the view from any seat in the house (by placing a camera in any seat location). That effort yielded lots of dividends—I have since designed numerous shows in the same theater, reusing the Revit model of the theater as the *as-built* existing condition, and creating the set as a New Construction phase.

Walls on a set are still walls as far as Revit is concerned. Of course, some walls on a set are pretty thin. Theaters often utilize *flats*, lightweight walls consisting of nothing but thin wood frames (often just 1x4s laid flat) covered with fabric or a thin veneer of luan plywood. These walls are therefore less than 1-inch thick. Other walls, particularly those hosting windows or

doors, are framed with 2x4s and covered with OSB (oriented strand board), plywood, or luan. Raised platforms are often prefabricated in 4'x8' modules, consisting of 2x4s covered with plywood. I model these as Revit floors, placed with their offset height equal to the height of the platform above the level of the stage.





The fact that I could quickly produce a complete set of dimensioned construction documents for the set construction crew, as well as simplified plan views the director could use to work out the *blocking* (actor movements) for each scene also proved invaluable. My design went on to win a local theater award for *Best Set Design*.

Making a Set Disappear

As my success as a set designer increased, I was approached by several other directors to design their shows. The next major undertaking was the set for the Holocaust remembrance play *A Shayna Maidel* (Yiddish for “a pretty girl”). In Barbara Lebow’s 1984 play, Rose, who escaped Europe with her father before the war, now lives comfortably on her own in an apartment on New York’s West Side. All she remembers of her childhood is what her father has told her. But when her sister, Lusia, who has survived the Nazi concentration camps, arrives in New York, Rose takes her in, bringing back long-lost memories.

The juxtaposition of many *dream sequences* with the reality of the present led me to a design featuring a *raked* (sloped) stage (easily modeled as a sloped floor in Revit). To further reinforce the intrusion of dreams into reality, the walls of Rose’s apartment were broken as if drawn as cutaway isometric views.

Being able show the director a 3D model—and to be able to orbit around that model—convinced her of the viability of my design. And when it came time to build the set, I was able to provide the volunteer construction crew with dimensioned plans and elevations, enabling them to efficiently build the set. A crew of four scene painters then applied an aged look to the walls and painted the floor to look like oak planks. I also incorporated Revit furniture for the first time.

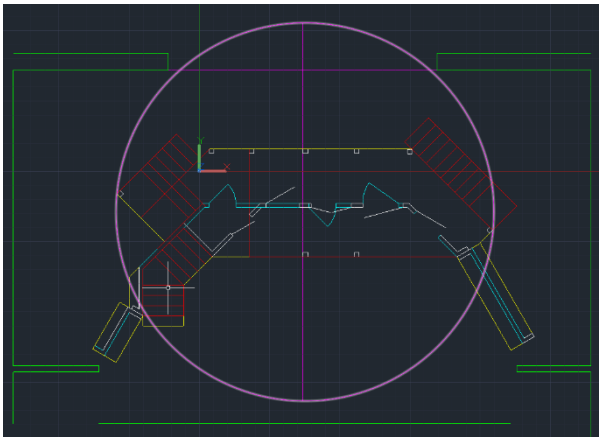
Building a House that Moves

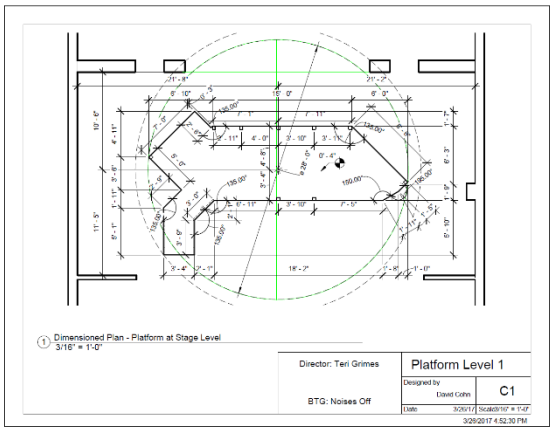
While I continued to design sets for other shows, the next BIG challenge came a few years later when I was approached to design the set for *Noises Off*. This comedy is essentially a play within a play. As the curtain rises on ACT ONE, a dysfunctional British acting troupe is rehearsing a farce called *Nothing On*, a show in which young girls run about in their underwear, old men lose their trousers, a maid delivers multiple plates of sardines, and many doors continually bang open and shut.

The layout of the house is dictated by the stage direction. This time, the house truly had to be two-stories in height, with upstairs doors stacked above those below. In addition, the entire set must revolve, because in ACT TWO, the audience gets to see the actors' antics from backstage, providing a view that emphasizes the deteriorating relationships within the cast. Then, in ACT THREE, the entire set revolves back so that the audience sees the performance of the play within a play again from the front, with the actors determined at all costs to cover up the mounting chaos.

The show's director threw down a virtual gauntlet when she stated that it would be impossible to design a two-story set—complete with both an onstage staircase and a pair of backstage exit stairs—that could be turned as a single unit. All previous attempts by other nearby theaters resulted in designs in which the set had to be broken apart into multiple pieces, which would then be turned and rearranged between acts—a long process that would disrupt the flow of the show. I was therefore determined to come up with a design that could be turned as a single unit.

Instead of starting out in Revit, I turned first to AutoCAD to work out the set's intricate geometry as stacked two-dimensional plan views. It required a lot of trial and error to get all the doors, walls, and stairways arranged just right so that the entire assembly could be rotated 180-degrees about a fixed, central pivot point without crashing into the walls of the proscenium arch or falling off the front of the stage, all while providing enough structure to support the second story, and enough bracing to keep the set from swaying, while still allowing for the required door and window openings. I found that it was easier to do this preliminary design in AutoCAD.





Once I was sure that the geometry really worked, I imported the DWG file into Revit and began to model the actual walls, doors, windows, and stairs in 3D. To fit a two-story house onto a stage with just a bit more than 14-feet of total clearance below the lighting racks, the crew cut standard 6'-8" doors down to 6'-4". The platform holding the entire set was only 4" thick, supported on 26 casters. The second level floor was also only 4" thick. Several of the two-story walls had to be shortened at their ends, where the 14-foot-tall set had to pass through the 12'-3" proscenium arch and an opening in the rear stage wall as it was turned.

Before the start of construction, I handed the shop foreman a 16-page set of construction documents showing every critical dimension. This is the only play thus far where the actors rehearsed in a separate space while the all-volunteer crew spent more than 500 man-hours to build “the beast”, which ultimately weighed approximately 2 tons.

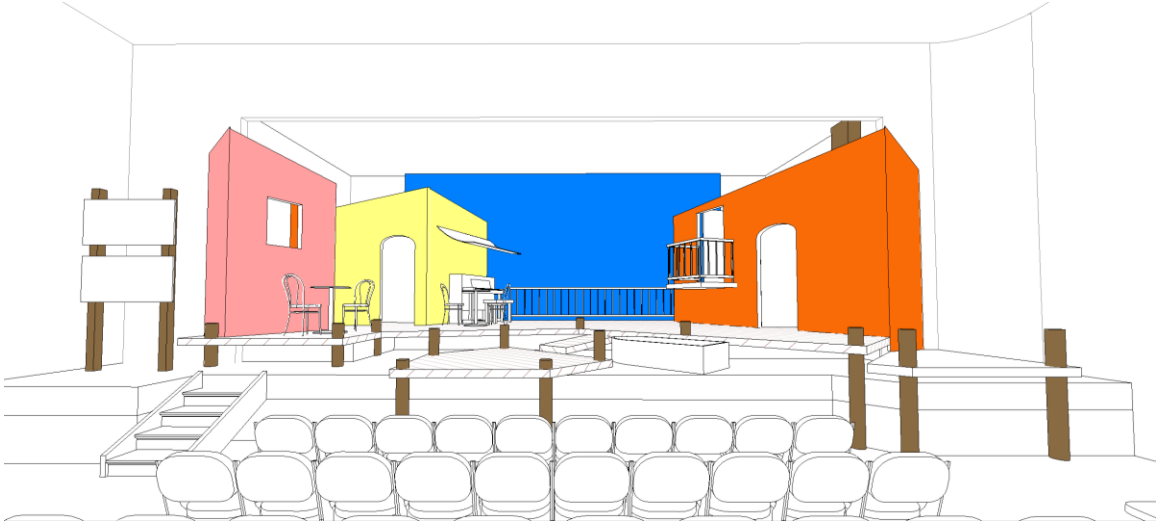
The set not only stood up to the demands of a dozen actors opening and slamming doors, running, jumping, and falling down flights of stairs for more than a month of rehearsals followed by 14 sold-out performances, it also survived being turned 180 degrees twice during every performance.

It took five stagehands less than 30 seconds to rotate the set. When turned, the set cleared the rear of the stage by just 2". This design also garnered my second consecutive award for *Best Set Design*.

Adding VR to the Mix

Scapino is a liberal adaptation by Jim Dale and Frank Dunlop of Molière's *Les Fourberies de Scapin* (Scapin the Schemer), performed in a zany *commedia dell'arte* style. The original French play was first staged on May 24, 1671, in the theatre of the Palais-Royal in Paris. Despite a few alterations and modernizations of language, the play still retains much of its original structure.

The script states that the play can be performed on an empty stage with just a simple cloth backdrop. But I convinced the director to let me go in a completely different direction—a small Italian fishing village, complete with a dock, a boat, and several adjacent buildings.



But rather than making the village look realistic, I wanted the set to reinforce the fact that this was a farce. So, the buildings are what you might see in a cartoon, rather than on a trip to Italy. None of the walls are vertical. Since Revit at the time did not support sloped walls, I first modeled building masses using FormIt, imported those masses into Revit, and then used the Wall by Face tool to convert them to Revit walls. I also "broke the fourth wall" (between the actors and the audience) by extending the dock off the front edge of the stage, using actual wood pilings, painting the stage and front stage apron blue (to represent water), and then covering that apron with fish decals and fish nets. There was also an animated "Billy Bass" on one of the set walls (which came to life—minus its soundtrack—at an appropriate point in the action).

With the director still unsure of the viability of my design, I turned to virtual reality to convince her. I used Revit Live (which is no longer available) to convert my Revit model, and had her don the VR headset I had recently acquired so she could inhabit the virtual model.

During the show, actors swing from ropes, ride bicycles across the stage, hit each other with salamis, cross dress, get tied up in sacks, serenade their loves on piano and guitar, eat ice cream… and then things get crazy. The set was also populated with a pelican and a large seagull.

Every part of the set, with the exception of the bags and boxes strewn around the docks, was modeled in Revit, so that the director could see what it would be like to walk (or ride a bike) around the set. The boat was modeled as a mass object. All of the signage and the fish decals were created digitally, printed at a local shop, and then applied to the set. (I created many of these in my hotel room at night while on a business trip, emailing them to the local print shop.) We even chose paint colors based on the colors applied to the Revit model.

Once again, my design for *Scapino* resulted in another *Best Set Design* award.

When Sets Must Move

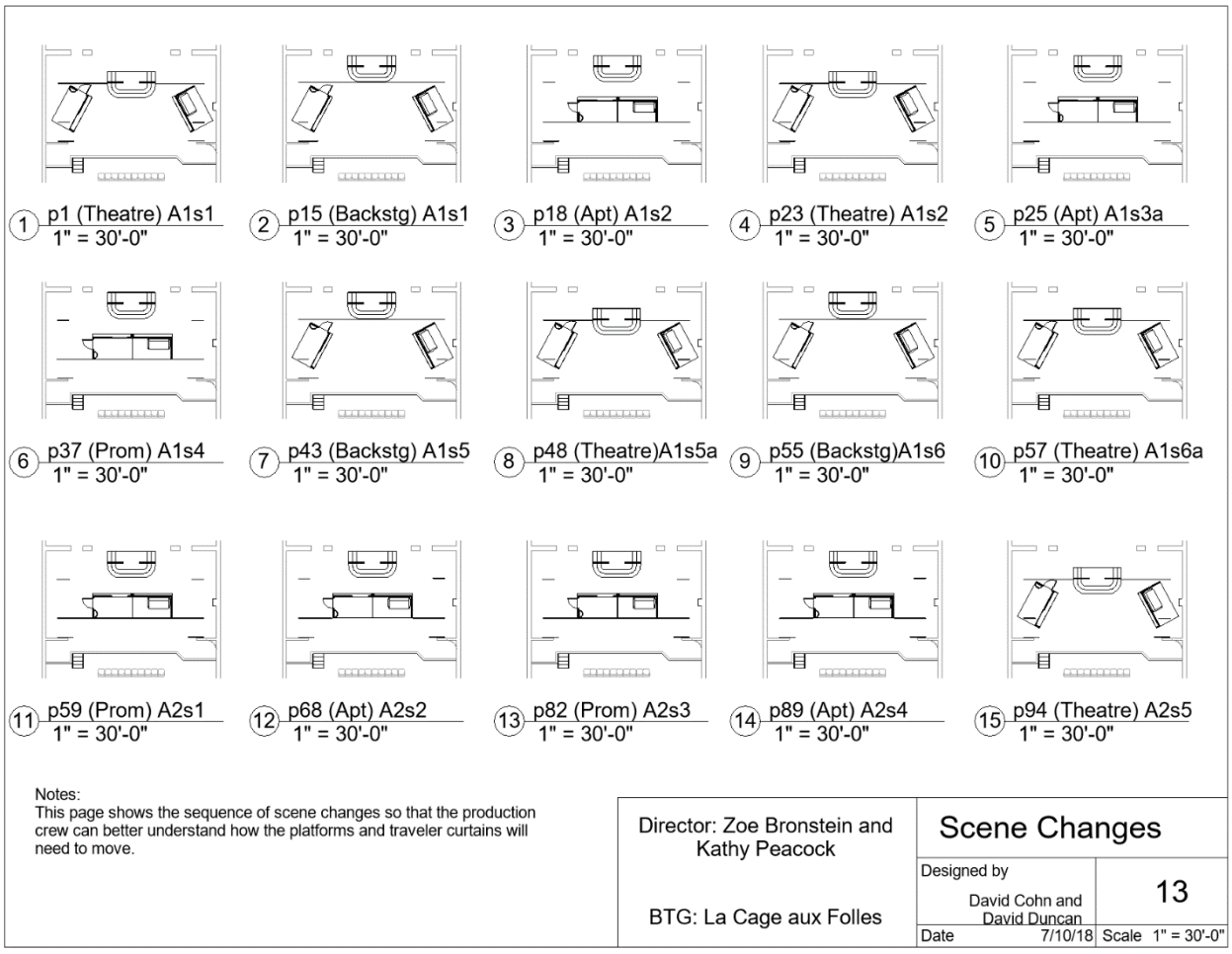
Musicals present many unique challenges, particularly when produced in theaters with small stages, no wings, no fly space, and no orchestra pit—otherwise known as community theater. But one of the main reasons musicals are so difficult to design for is that most musicals include multiple scenes, with multiple set changes. And more often than not, those scene changes must take place between—or sometimes even during—musical numbers. That means the set must move and it must move quickly and quietly. (There is nothing worse than sitting in the audience with the main curtain closed while listening to the rumbling of a set being moved… for 4 – 5 minutes.)

That was the challenge presented by *La Cage Aux Folles*. After identifying five different set configurations—a burlesque theater stage, backstage at the same theater, an apartment in San Tropez, a beach-front promenade, and a restaurant—and a total of 15 set changes between these sets (many happening *during* musical numbers), it was clear that this show would be a challenge.

Working with a co-designer, our final design solution consisted of three main set pieces: two platforms that rotated about fixed pivot points (with wall extensions that could hinge back out of the way) and a third platform that rolled forward and back. The two rotating platforms would represent the burlesque theater (when swung open to reveal the rolling platform) and the apartment (when swung closed to form a solid-looking wall across the width of the stage, concealing the rolling platform), while the rolling platform would be the burlesque stage.

One problem down. The geometry worked. The pieces could be quickly rotated or rolled into position. But I was initially at a loss as to how to manage this using Revit. How would I model the different platform configurations? Then came the *light-bulb moment*—design options.

By making each of those 15 set changes a design option, I could quickly reconfigure the design to represent the various scenes and show them all on one sheet so that the production crew could better understand how the platforms and traveler curtains would move.

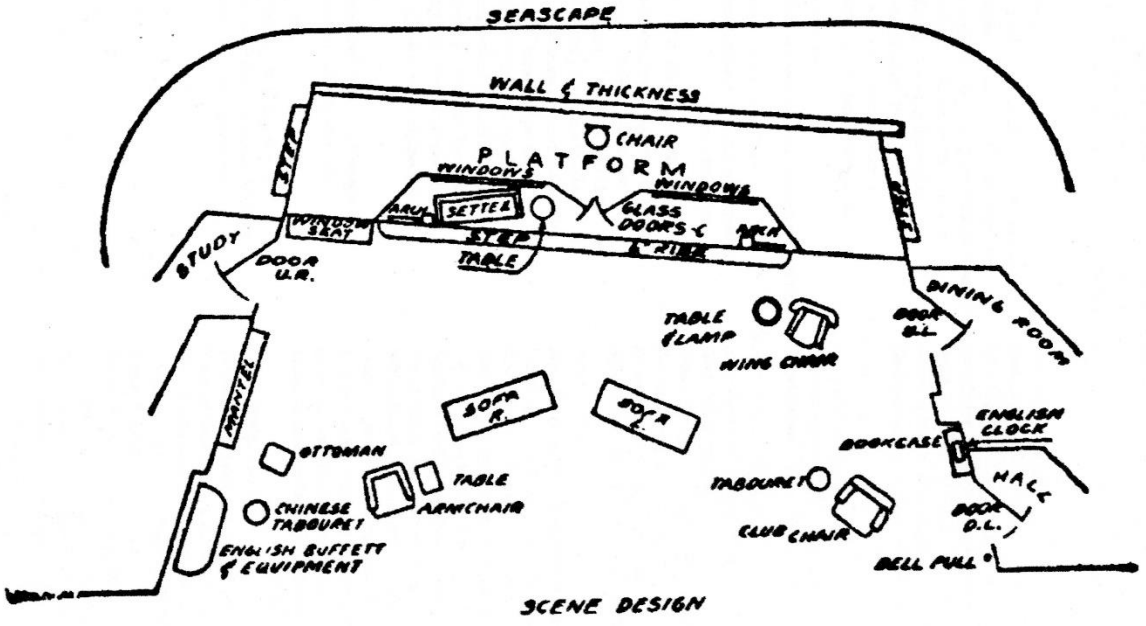


To create the appearance of the apartment looking out over the beach at San Tropez, I found some appropriate photos, which were then printed on a wide-format printer by a local print shop, and then mounted on flats so that they appeared to be what one would see when looking out through the apartment windows.

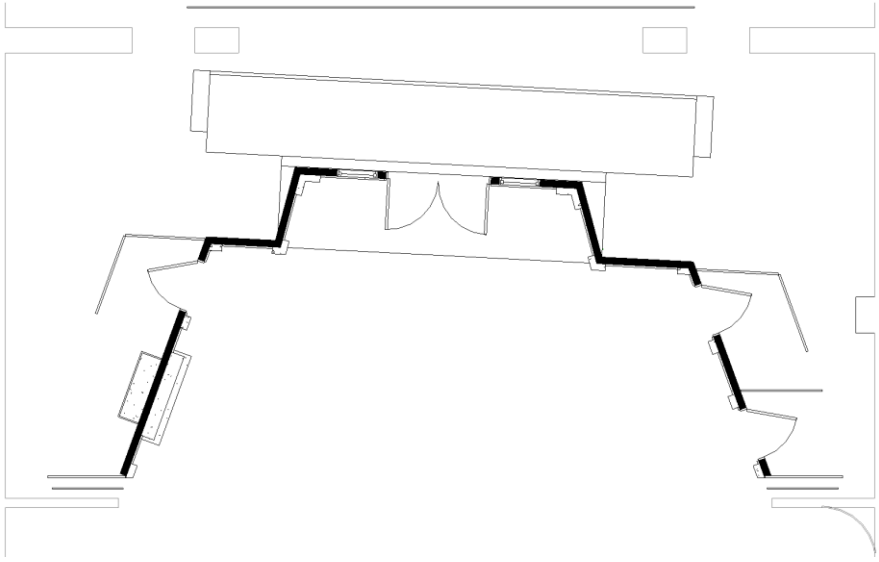
And Then There Was Rain

In September 2019, just months before the pandemic shut down all of the theaters, I got to complete my design for a production of Agatha Christie's *And Then There Were None*. In this play, ten people arrive on a small, isolated island off the English coast, each having received an unexpected personal invitation. Then, one by one, the guests are found dead.

Like most Agatha Christie plays, the script included a detailed plan, which showed exactly where doors needed to be located and their direction of swing.



Having previously designed a set for Agatha Christie's most famous play, *The Mousetrap*, I knew that the plan for my set needed to match this as closely as possible.



There is also a very detailed description of the setting at the top of ACT ONE:

> *The scene is the living room of the house on Soldier Island. It is a very modern room, and luxuriously furnished. It is a bright sunlight evening. Nearly the whole back of the stage is a window looking directly out to sea. French doors are open in center to balcony. It should give the impression of being like the deck of a liner almost overhanging the sea. There is a chair out right on the balcony and the main approach to the house is presumed to be up steps on the left side of the balcony. There is also presumed to be steps on the right of the balcony, but these are not the direct way up from the landing stage, but are supposed to lead around the house and up behind it, since the house is supposed to be built up against the side of a steep hill. The French doors are wide so that a good area of the balcony is shown. In the left, near windows, is a door to dining room. Downstage left is a door communicating with hall. Pull cord below this door. Up right is a door to study. Middle stage right is fireplace. Over it hangs the reproduction of the "Ten Little Soldier Boys" nursery rhyme. On the mantelpiece is a group of ten china soldier boy figures. They are not spaced out, but clustered so that the exact number is not easily seen. The room is barely furnished with modern furniture, center are two sofas with space between. Chair and small table up left. Club chair with tabouret right and above it, down left, where these is also a bookcase. There is a window seat up right and cocktail cabinet below mantelpiece, tabouret down right. Before fireplace is a big white bearskin rug with a bear's head. There is an armchair and tabouret right center. A square ottoman at lower end of fireplace, a settee with table left of it in front of window right at back…*

While that sounds pretty specific, the set designer still has some leeway. In this case, I decided that "a very modern room, luxuriously furnished" meant that the interior of the house included a lot of marble (marble floors, marble pilasters, marble paneling). I also felt strongly that the set was as important as any character in the play. At the top of ACT ONE, the weather is pleasant—a bright, sunny, cloudless afternoon. Day turns to night. People start turning up dead. And just before the next body is discovered, another china soldier boy figure disappears from the mantelpiece. (Hint: The framed nursery rhyme reproduction over the mantelpiece is hinged at the top so a set crew member can reach through a hidden hole behind it to remove a soldier during a blackout.)

Although the next day (ACT TWO, Scene 1) dawns sunny, a storm is rolling in, and by ACT TWO, Scene 2, there is lightning, thunder, and heavy rain, preventing any boat from reaching the island (an important plot twist). As the storm reaches its peak, people continue to die.

Clearly, the view out the large windows and French door needed to establish the locale of the house, and the changing weather needed to be clearly visible. It was time to utilize computer animation and rear-screen projection. I enlisted the help of my 4D co-worker, Steve Schain, who develops our 3ds Max and Maya courses, asking him to create a series of animations that could be projected onto a screen, which would be visible through those windows and doors.

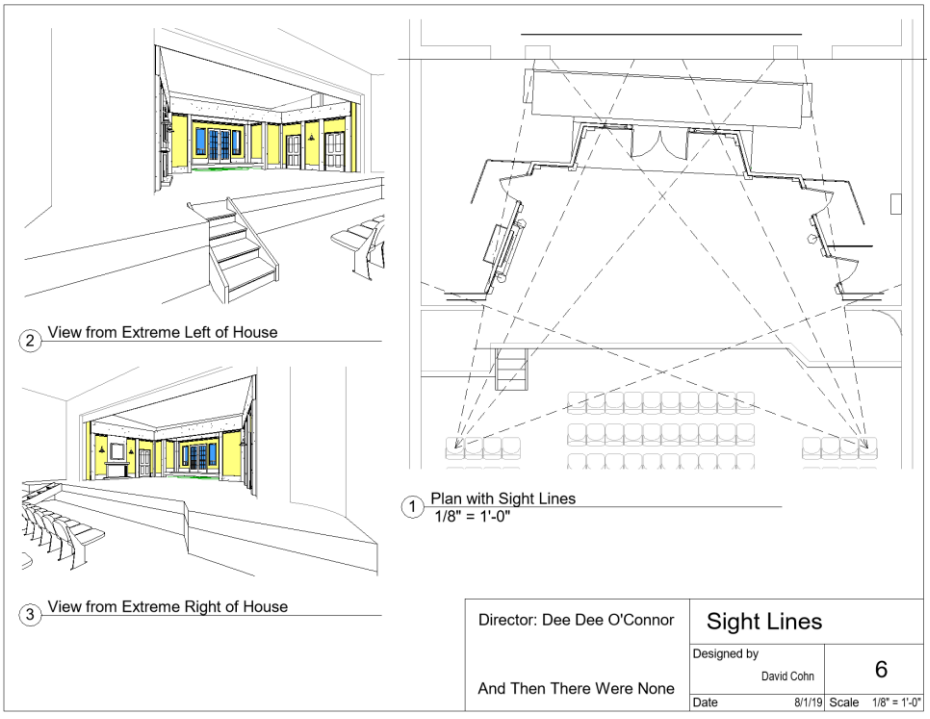
Steve started out using 3ds Max, but then switched to Unity, because it has plugins for clouds, trees, environments, and so on. He eventually delivered a series of MP4 files, one for each scene. For ACT ONE, grass and shrubs in the foreground give way to a calm ocean horizon and clear blue sky, which eventually darkens as night falls. For ACT TWO, Scene 1, the morning sky is filled with scattered clouds, which continue to build as the day progresses. By ACT TWO, Scene 2, the sky is completely overcast, the grass and shrubs are buffeted by the wind, rain is falling, and lightning flashes—all of this would be clearly visible to the audience. Each animation was triggered by a lighting cue programmed into the theater's lighting control board.

But since several characters subsequently enter through the French doors, obviously drenched by the now torrential downpour, I needed rain… REAL RAIN… as in, *real water*.

After doing quite a bit of research into how others have made it rain on stage, my solution consisted of a 3-inch diameter PVC pipe with small holes drilled to create nozzles, which was suspended above the windows and door on the backstage side of the wall. Behind this wall, I created a narrow, sloping trough in the balcony platform. This was lined with a rubber membrane to capture and direct the water to a small wading pool. An immersible pump (borrowed from a local pond supply store) then recirculated water back to the PVC pipe, with the pump controlled as a lighting cue.

Real water on stage proved to be tricky. During dress rehearsals, we discovered several small leaks, resulting in lot of puddles under the set. But by opening night, the “rain” only hit the glass, drenched the actors entering through the French doors, and then returned to the wading pool to be pumped back to the PVC pipe. The effect was so successful that during some performances, the oohs and aahs turned to applause.

While it is important that everyone in the audience is able to see all of the active areas of a set, that is doubly important in a play like *And Then There Were None*. You don’t want any ticket holder to feel that they’re missing a clue because they can’t see what’s happening in a scene due to poor sight lines. So, once again, I used Revit to verify that every part of the set could be seen from every seat in the house. This was easily proven to the director by placing cameras in strategic, worst-case scenario seats, and showing the views from those seats.



And just to make things even more interesting, the final character to die hangs herself, on stage, in full view of the audience. To accomplish that feat, special effects coordinator Russ Nelson manufactured a special harness that the actress wore under her costume. As the killer slips the noose around her neck, he also clips a thin stainless-steel cable to the harness, so that when she falls, her weight is carried by the cable and harness, rather than the noose around her neck.

Kudos to the incredible set construction crew at the Bellingham Theatre Guild (which happens to be the oldest continuously running community theater west of the Mississippi River) and the amazing scene painters, who spent days painting the walls, flats, platforms, and stage floor to look like fine-grained marble. Thanks, too, to my incredible wife, Genny Cohn, who was the costume designer for *And Then There Were None*, as well as most of the other shows I have designed (and many other shows with which I had little or no involvement).

What Happens Next?

While it remains unclear if the pandemic is under control or we're on the cusp of another wave, most of the theaters in the Pacific Northwest are poised to reopen and have announced their 2021-2022 seasons. I have already completed my design for *Proof* and will be designing for three additional shows that are scheduled to open in the winter and spring of 2022:

- *Scarecrow for Hire* — a film noire detective story with characters based on *The Wizard of Oz*. I have not started the design yet, but it's looking more and more like the set will be entirely virtual—rear-projection backgrounds with a few large props that roll in and out.
- *Vino Veritas* — set in a living room on Halloween night, this dark comedy examines the truth—how some people need it to survive while others need to avoid it at all costs. This simple set needs to be convincing as the interior of an upscale house.
- *Into the Woods* — originally scheduled for the spring of 2020, the design for this show will have it all—rear projection, front projection, raked set platforms, Rapunzel's tower, fairy tale cottages, a castle, giants, bean stalks, Milky White cows, hens that lay golden eggs, Little Red Riding Hood and a wolf who eats her, levitating witches—all set to an amazing score by Steven Sondheim.

And, just to make things interesting, I also plan to audition for that final show. Every few years, I step out from behind my computer, don costume and makeup, and get up on stage in front of the curtain. I can't let the actors have all the fun.

Mr. Welch: *Damn Yankees* (2011)

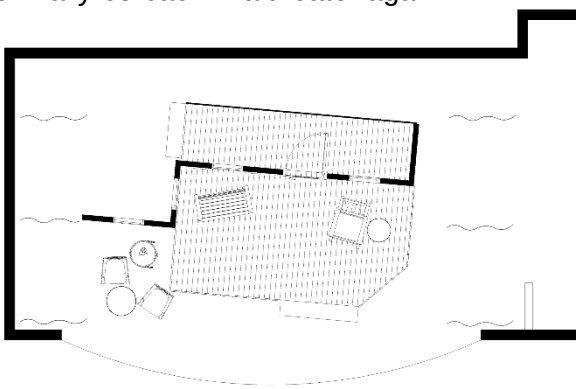
Erronius: *A Funny Thing Happened on the Way to the Forum* (2018)

Mr. Feldzieg: *The Drowsy Chaperone* (2015)

Elisha Whitney: *Anything Goes* (2016)

Postscript

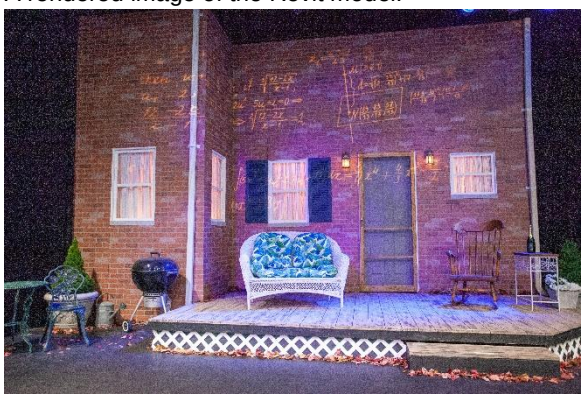
In the month since I completed the writing of this paper and the recording of the class video, I completed the design and construction of the set for “Proof” and the show has opened. Below are some of the design drawings and images of the Revit model as well as some actual photos of the set and performance. After being in virtual seclusion for the past 18 months, it was great to finally be back in a theater again.



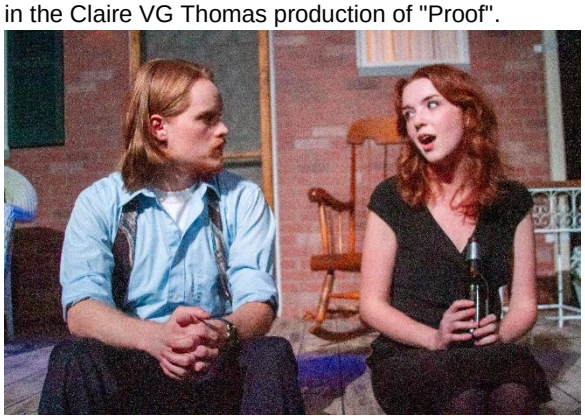
A simplified “blocking” plan view of the Revit model.

A rendered image of the Revit model.

Hannah Rants as *Catherine* and Mark Miller as *Robert* in the Claire VG Thomas production of "Proof".



A photo of the finished set, with an animated mathematical proof projected onto the walls.



Conner Moulaison as *Hal* and Hannah Rants as *Catherine*.

Tori Niewohner as *Claire* and Hannah Rants as Catherine in the *Claire*.