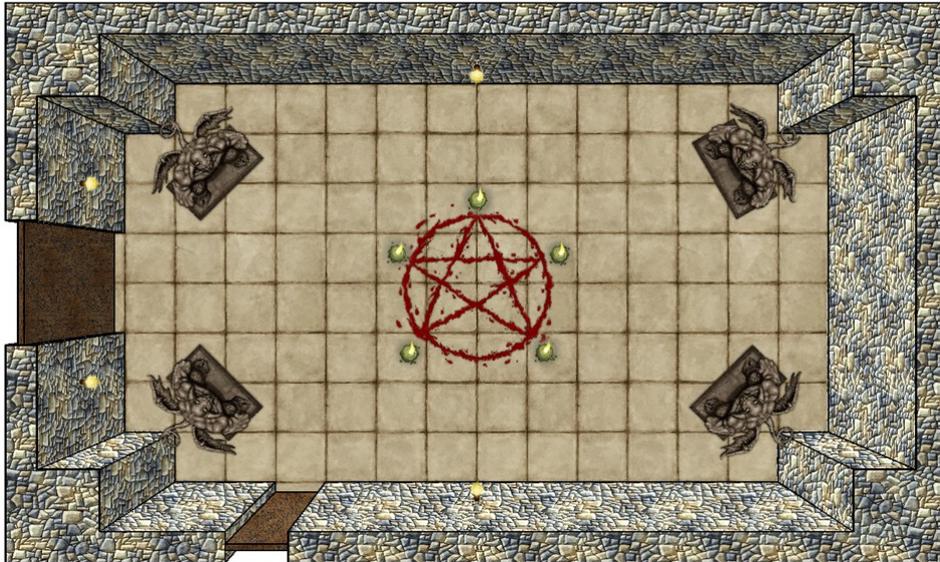# CC3 and Perspectives
A Campaign Cartographer 3/3+ Tutorial
by Joachim de Ravenbel
Part 1 - Basics

Conventions

Throughout this tutorial, I will use a color coding to clearly identify all the keywords:

Sheet names will always appear in **Green**, and layer names will appear in **Blue**.

Keyboard commands or keys will always appear in **Red**,

CC3 menu commands will always appear in *Italic Orange*.

A bold **Black** name followed by an arrow pointing right → and, at least at the end, an *Italic Orange* name indicates a CC3 menu drop-down list leading to a command. **Black** names also represent buttons or sheet effects.

"**RC**" means "right-click".

This document has been written just a few weeks after CC3+ (the latest version of Campaign Cartographer) has been released. All the icons will be displayed with the old CC3 picture followed by the new CC3+ version, for example the *Line* tool: .

Screen shots were made from CC3+ with the floating prompt that CC3 users won't see. With CC3, the name of the command will appear in **Light Blue** in the command line (bottom left) but not the hints.
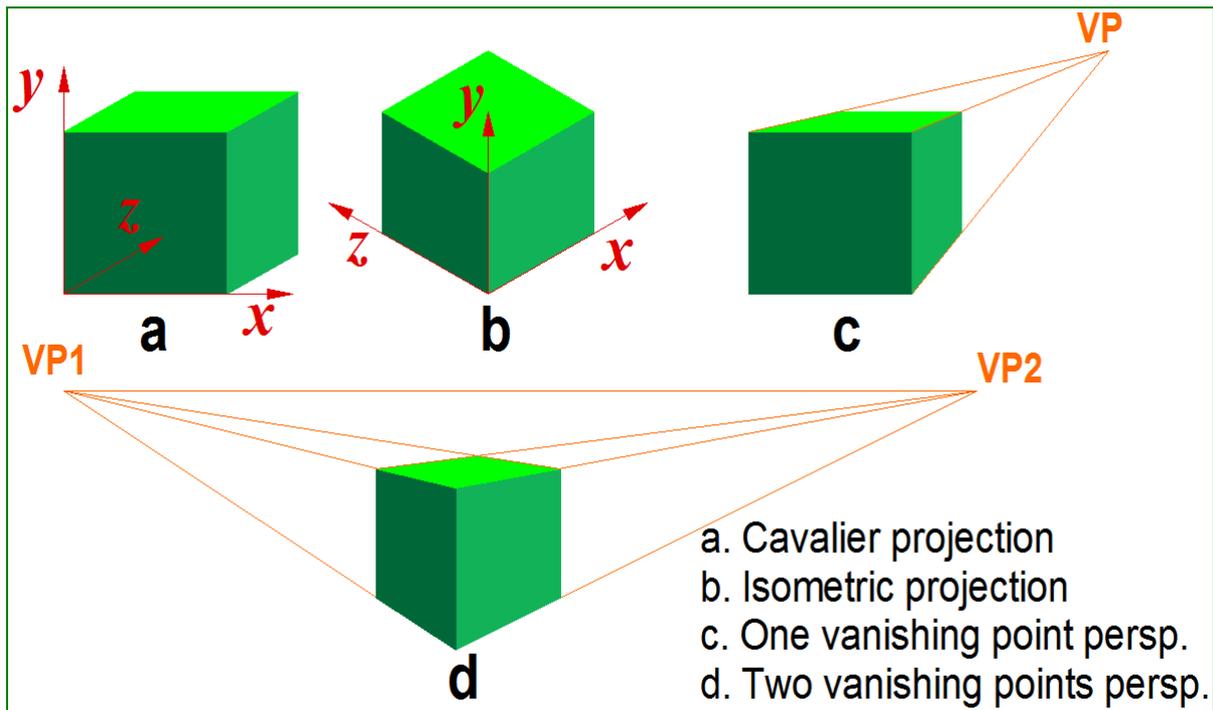
Introduction

Perspectives are techniques of representing three dimensional objects on a two dimensional, flat surface.

The most common perspectives are
- the cavalier projection (**a**)
- the isometric projection (**b**)
- one (**c**) or two (**d**) (or even more) vanishing points perspectives.

a. Cavalier projection
b. Isometric projection
c. One vanishing point persp.
d. Two vanishing points persp.

- The cavalier projection (**a**) keeps real dimensions on the x-axis and y-axis but shorter lengths on the z-axis. Parallel lines are always drawn parallel. This projection is of limited use to cartographers.
- The isometric projection (**b**) keeps real dimensions on all three axises (but not outside these axises). Parallel lines are always drawn parallel. This projection is used in the CC3 add-on Perspective Pro (and probably forthcoming Perspective 3) and will thus not be detailed in this tutorial.
- The vanishing points perspectives (**c** and **d**) only keep real dimensions in a plane perpendicular to the view line because the further you go from the eye, the smaller the objects get. Parallel lines are only drawn parallel if they are in a plane perpendicular to the line of sight. The one vanishing point perspective will be detailed in this tutorial.

Top-down views with a one vanishing point perspective

With CC3/CC3+ you can create such a perspective map in order to give a 3D effect by following these 8 steps:

1. Choose the focal length.
2. Draw the walls at floor level.
3. Choose a vanishing point.
4. Compute the scale and draw the other lines of the walls.
5. Use shaded polygons to texture the walls.
6. Texture the top of the walls.
7. Add all the other elements.
8. Optionally line the walls.

1. Choose the focal length

The focal length of a lens defines how this lens scales a picture. The theory is explained in the side bar.

The short version is that the scaling factor of any part higher or lower than the reference level (height = 0) will be calculated using the formula:
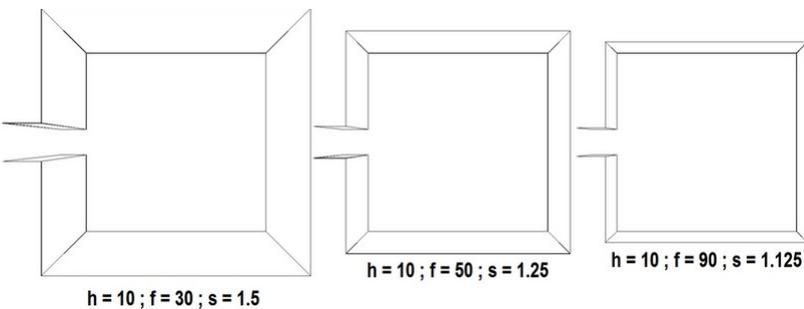
$$\text{scale factor} = \frac{f}{f-h}$$

Where h represents the height (positive if higher than the reference level, negative if lower) and f represents the focal length you now need to choose. This number is always positive.
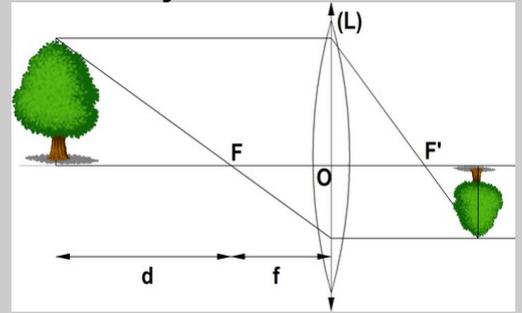
Tips on choosing the focal length:

- Try some values and keep the one that gives you the "best feeling".
- If you want to add other rooms with each its own perspective, the width of the perspective walls must not exceed the "real" width of the walls.
- Nothing should be higher than the focal length, or, the focal length must be greater than the highest object you need to show.
- The higher the focal length, the thinner the walls.

For the small room depicted in this tutorial, a focal length of 50 has been chosen but the samples below show you how changing this value affects a map:

h = 10 ; f = 30 ; s = 1.5
h = 10 ; f = 50 ; s = 1.25
h = 10 ; f = 90 ; s = 1.125

The same 35' wide room with 10' high walls at various focal lengths and the corresponding scaling factor at this 10' height.
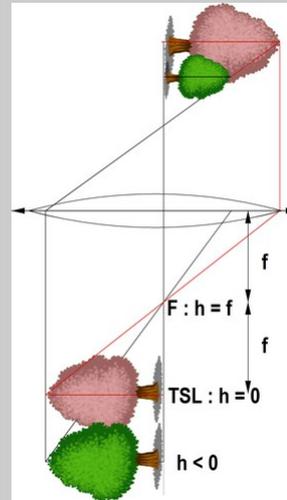

Lens theory

When you use a tool equipped with a lens, such as a camera, the scale of the result (upside down tree here) depends on the distance between the front focal point F and the center of of lens O. This length is the focal length f. Of course, the scale of the result also depends from the distance d between the target (the tree) and the focal point.
The back focal point F' is not relevant to the scale of the result, but to it's distance to the lens.
Thus :

$$\text{scale} = -\frac{f}{d}$$

(the minus meaning that the tree is upside down).

Obviously, if d=f scale = -1:1. This is the True Scale Level (TSL) and will be established as height zero (h = 0). Objects lower than the TSL will have a negative height.

The scaling at a height h is now:

$$\text{scale} = -\frac{f}{f-h}$$

For our purpose, we can get rid of the minus because, like in a camera, we just rotate the picture to get it upright :
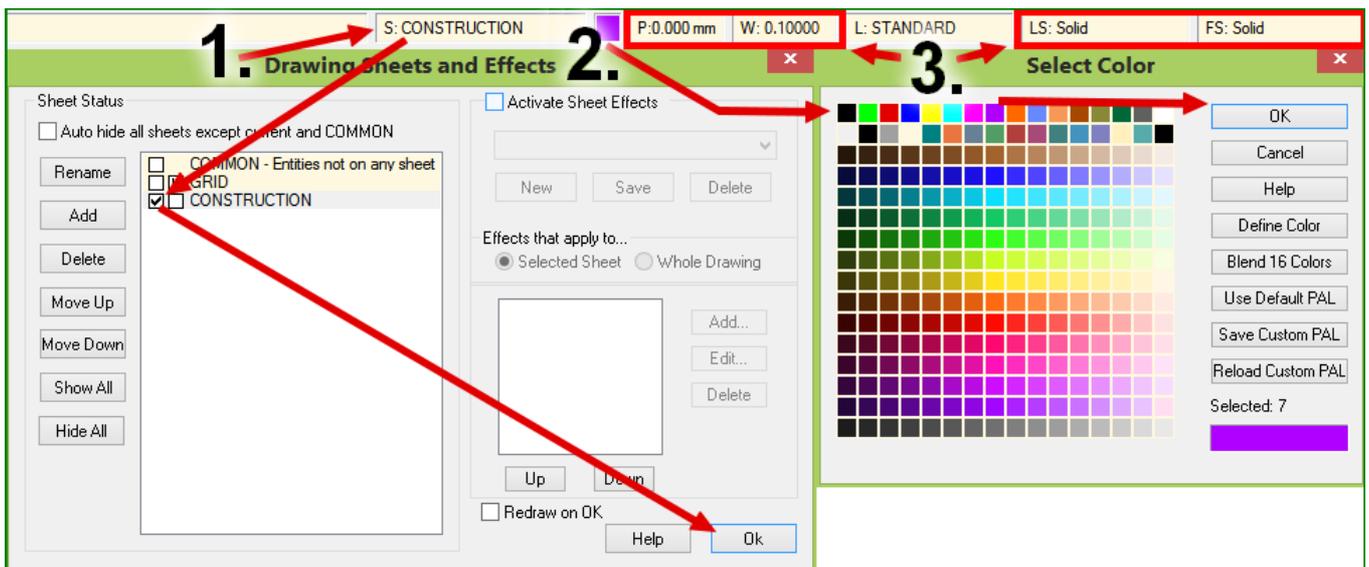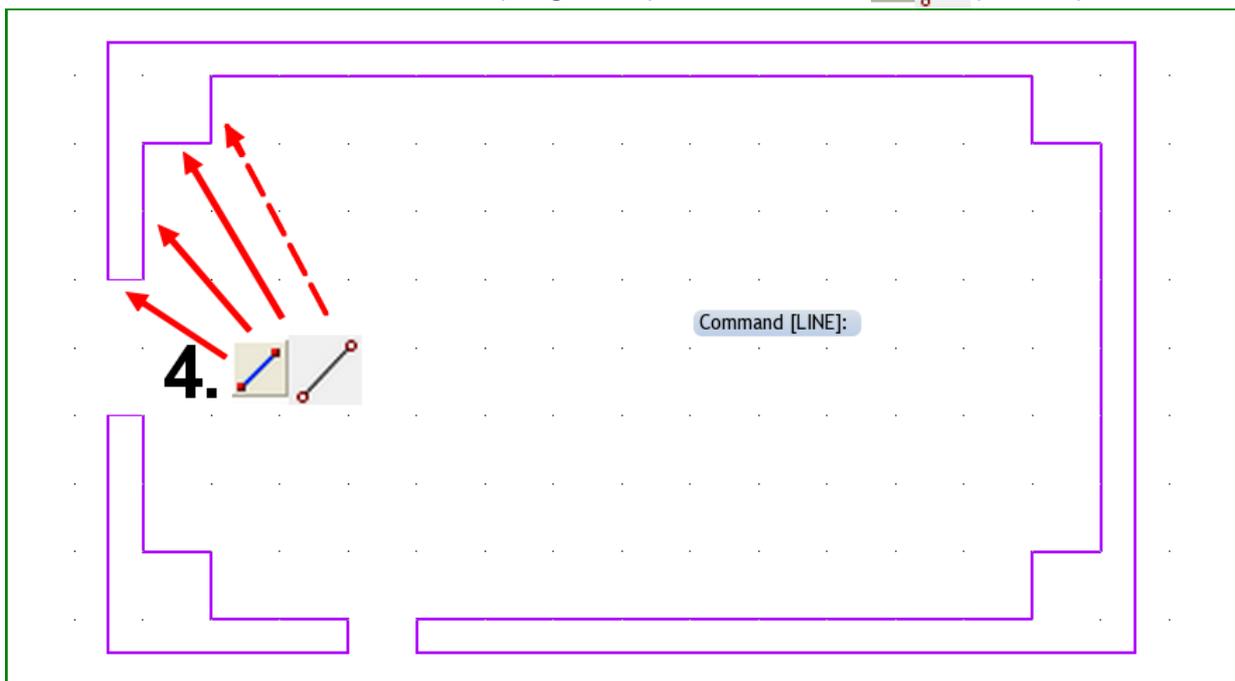
$$\text{scale} = \frac{f}{f-h}$$

2. Draw the walls at floor level

By floor level, it is assumed that you work at the height where all the lengths have the *real* values (for example, in DD3, a 10' long wall would be exactly created with a 10' length, printing scale not taken in account).

1. Click on the Sheet Indicator, create and make the **CONSTRUCTION**[1] sheet active.
2. Click on the Color Selector and choose a bright color, for example purple #7, because you are drawing temporary lines. This will allow you to hide or erase these lines at the end of the project.
3. Set the Line Style and the Fill Style to Solid. Set the Pen Width to 0 and the Line Width to a value you are comfortable with (from 0 to 0.1 for example).

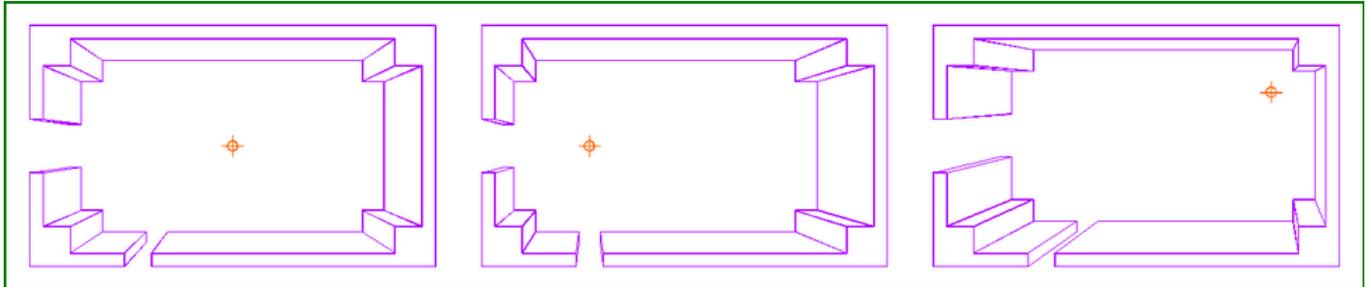4. Draw the walls at the normal scale (height = 0) with the *Line* (**LINE↵**) tool.

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1   For more on Sheet creation and management, please take a look at the Chapel Tutorial.

3. Choose a vanishing point

You'll probably want to use the center of the map. In some situations it can be interesting to use another point as the vanishing point:
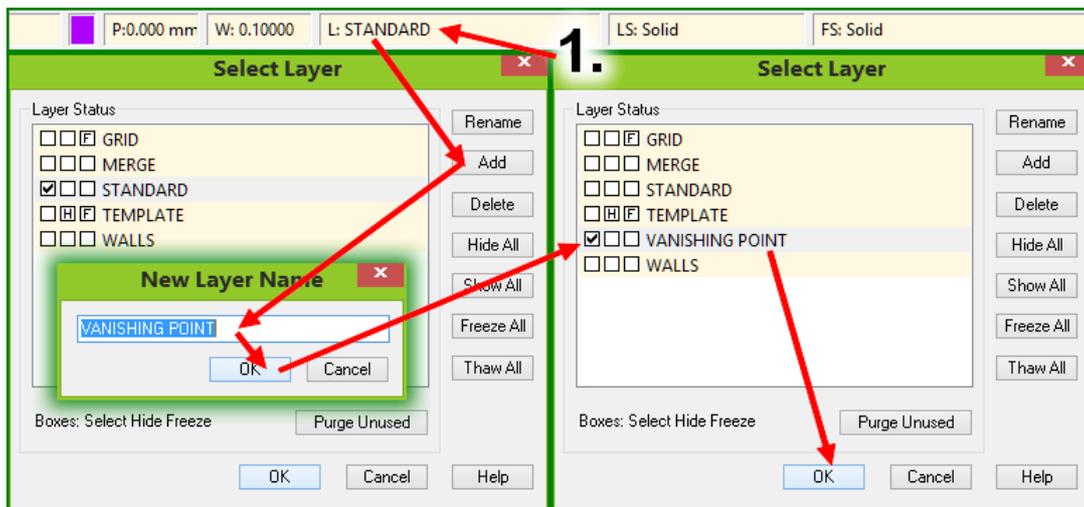

Effects on changing the location of the vanishing point (orange reticule). Left: a centered vanishing point. Mid: the vanishing point is more to the left, but still aligned with the main door. Right: a totally of-centered vanishing point. For these sample maps, the focal length was set to 50' for 10' high walls, yielding a scaling factor of 1.25 (see page 3).

Tips on choosing the vanishing point:

- In most cases, the best choice is the most central point.
- The closer a wall, or any other entity, is to the scaling center, the thinner it will be.
- If you want to focus on a feature, move the scaling center away from it, preferably aligned with the axis of the feature, if any.
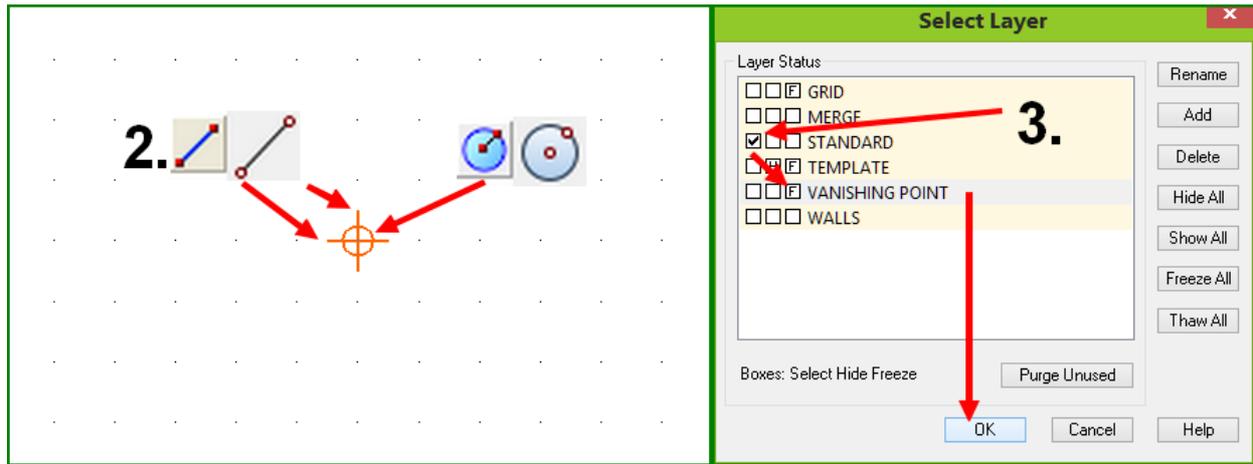
IMPORTANT: Once you've decided on the location of the vanishing point, draw something like the reticule shown in the sample map to remember where it is:

1. Click on the **Layer Indicator** then on the **New button**. Create the **VANISHING POINT** layer and click **OK**. Make this layer current by checking its leftmost check-box then click **OK**.

2. Use the *Line* (**LINE↵**) and *Circle* (**CIRP↵**) tools to create the reticule.
3. Click on the **Layer Indicator.** Make the **STANDARD** layer active by checking its leftmost check-box then click on the rightmost check-box of the **VANISHING POINT** layer. Instead of a check-mark, this box now shows an "F" for "frozen", meaning that your reticule is on a layer where no action can be taken to modify entities. This will prevent erasing or moving the reticule. If you need to modify or erase the reticule, repeat step **1.** to be able to interact with it.
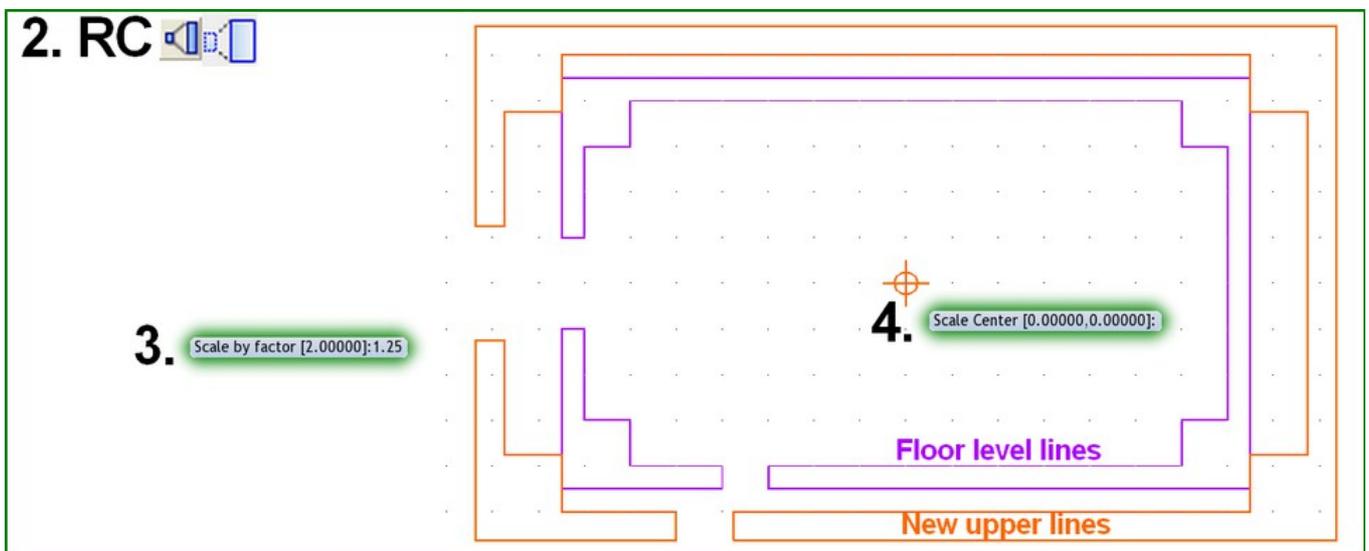
4. Calculate the scale and draw the other lines of the walls.

Once you have your scaling factor, you just use the *Scaled Copy* tool:

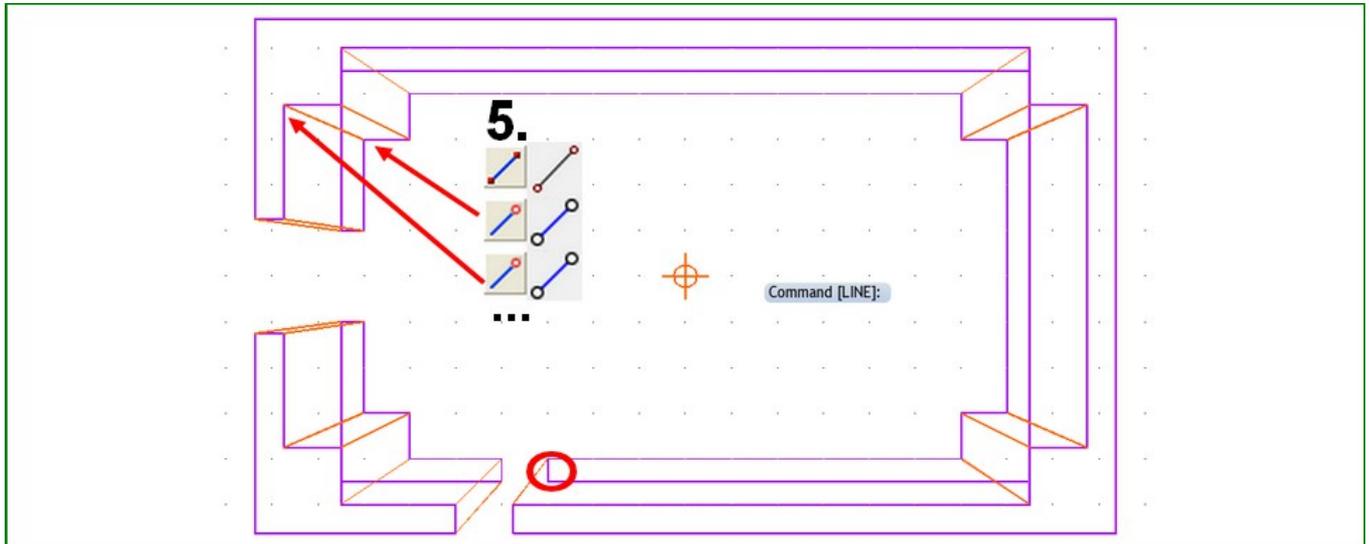1. Calculate the scale factor: scale factor $=\dfrac{\text{focal length}}{\text{focal length}-\text{wall height}}$.

    If you chose a focal length of 50' and a wall height of 10' you get: scale factor $=\dfrac{50}{50-10}=1.25$

2. Right-click on the *Scale* icon and choose the *Scaled Copy* tool (**SCLCPY↵**). Carefully select all the wall elements and right-click then choose **do it** (or hit the "**d**" key).
    To select the walls you can either use a selection box around your lines (after choosing the command), or right-click, choose **Combine** then **And (both)**, right-click again, choose **Color**, right-click a third time and select the color number of your wall lines. End the selection by a fourth right click and **do it** (**b**, **c**, **7**, **d** on the keyboard).
3. When the prompt (command line, bottom left) asks for the **Scale factor** type the value from **1.** (1.25 for the sample map).
4. When the prompt asks for the **Scale center** click on the point representing the vanishing point.

5. Use the *Line* (**LINE↵**) tool with the *Endpoint modifier* (**F5**) to join the corresponding corners of the "true scale" entities and the new ones.
6. Save your map!

Scaling up the walls. New entities are in orange for academic purpose only and will all turn purple later on.

IMPORTANT: One of the most difficult part of using perspective is to keep track of what is at the top and what is at the bottom. The lines of the back of the walls at floor level are hidden and so is the left line, also at floor level, of the bottom door frame (circled in red).

SOLUTIONS:
Zoom out to have a global view on you map.
Use line work rather than filled entities.
Try to finish every part before starting a new one. For example, in the example map, keep the circled line (you'll need it to add the door) but *Erase* (**ERA↵**) the back lines at floor level.
Use new sheets to store top and wall elements.

Note: if you need more levels, just repeat the steps, calculating the scaling factor for each level.
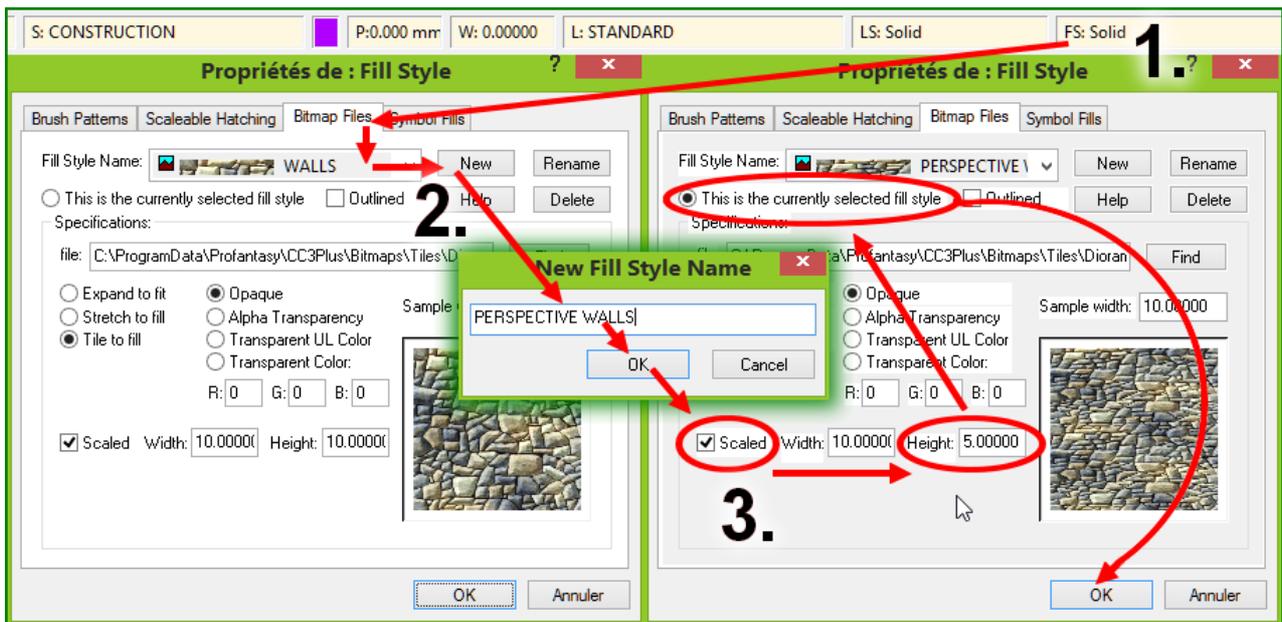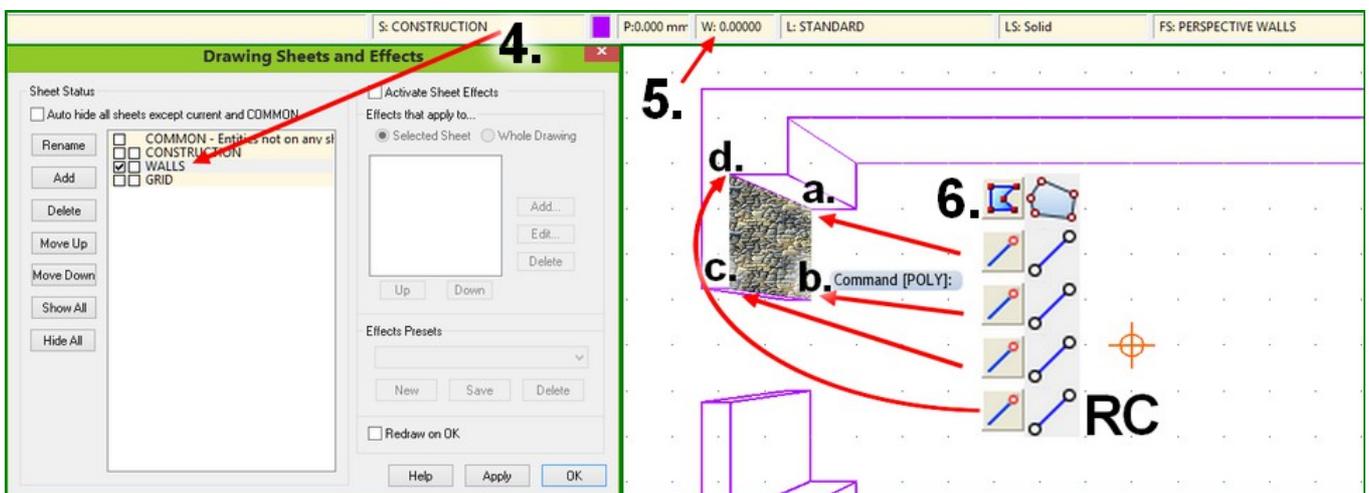
5. Use shaded polygons to texture the walls

To further enhance the 3D effect of the map, create a distorted fill style and use it to fill the walls area with shaded polygons:

1. Click on the **Fill Style Indicator** then on the **Bitmap Files** tab and select or create[2] a bitmap fill style for the walls.
2. Click on the **New** button and rename the clone of the chosen fill style. Click **OK**.
3. Check the **scaled** check-box and change the **height** parameter to something smaller than the **width** (for example **height** 5 if the **width** is 10). Check the **this is the currently selected fill style** radio button and click **OK**.

4. Click on the **Sheet Indicator** and select or create a **WALLS** sheet. Click **OK**.
5. Set the **Line width** to 0.
6. Click the *Polygon* tool (**POLY↵**) and the *Endpoint modifier* (**F5**) on all the nodes (or vertices) of the first wall panel in circling order (**a.** to **d.**). Right-click to end the command after the last node.
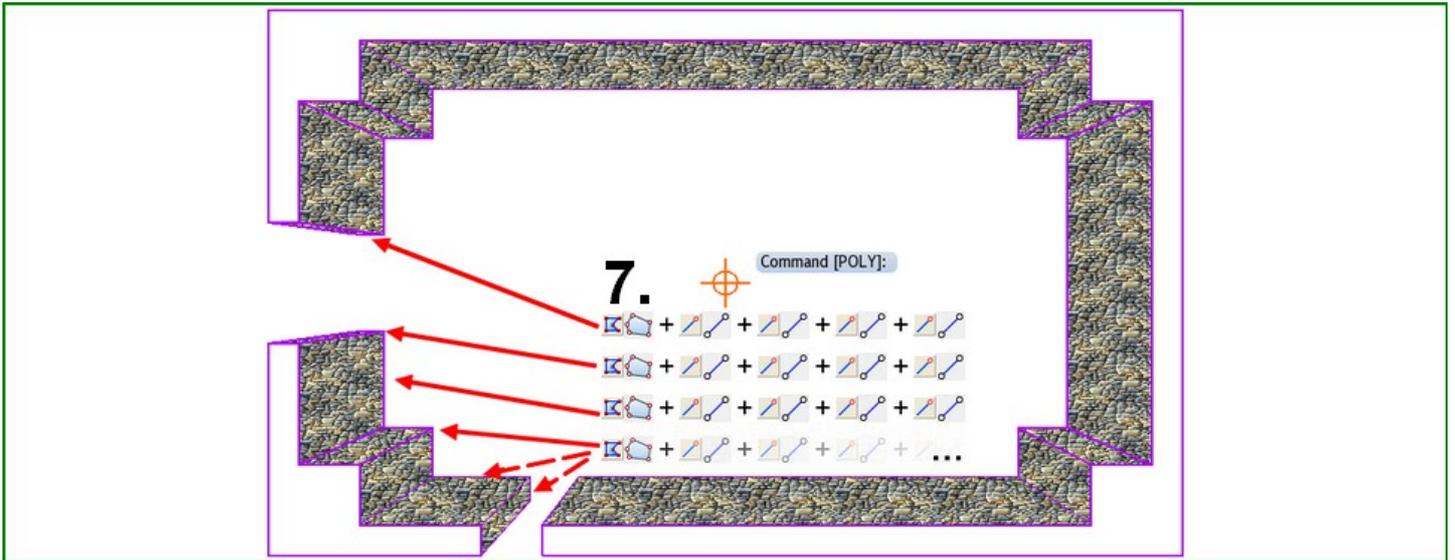

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2   For more on Fill Style creation and management, please take a look at the Chapel Tutorial.
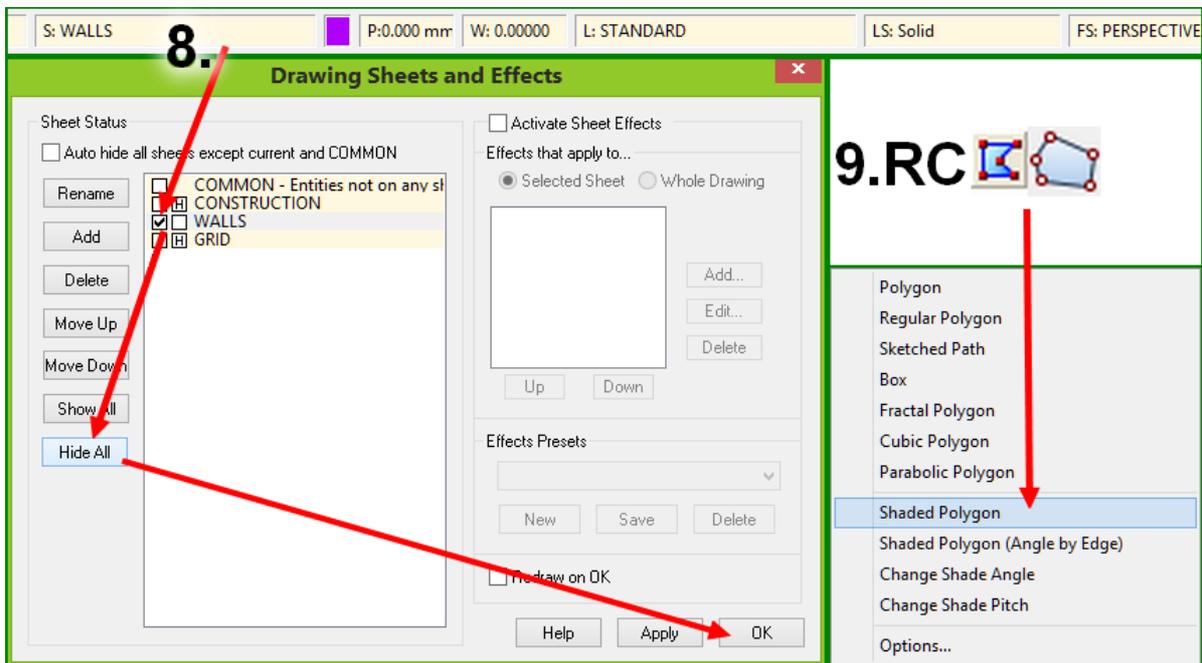
7. Repeat step **5.** for all the wall panels. All the walls almost look like a single entity.

Lining of the panels for academic purpose.

8. Click on the **Sheet Indicator**, make sure the **WALLS** sheet is active (left check-box checked) or make it active. Click on the **HIDE ALL** button. All the right boxes should display an "H" for "Hidden" except for the **WALLS** sheet. Click **OK**.

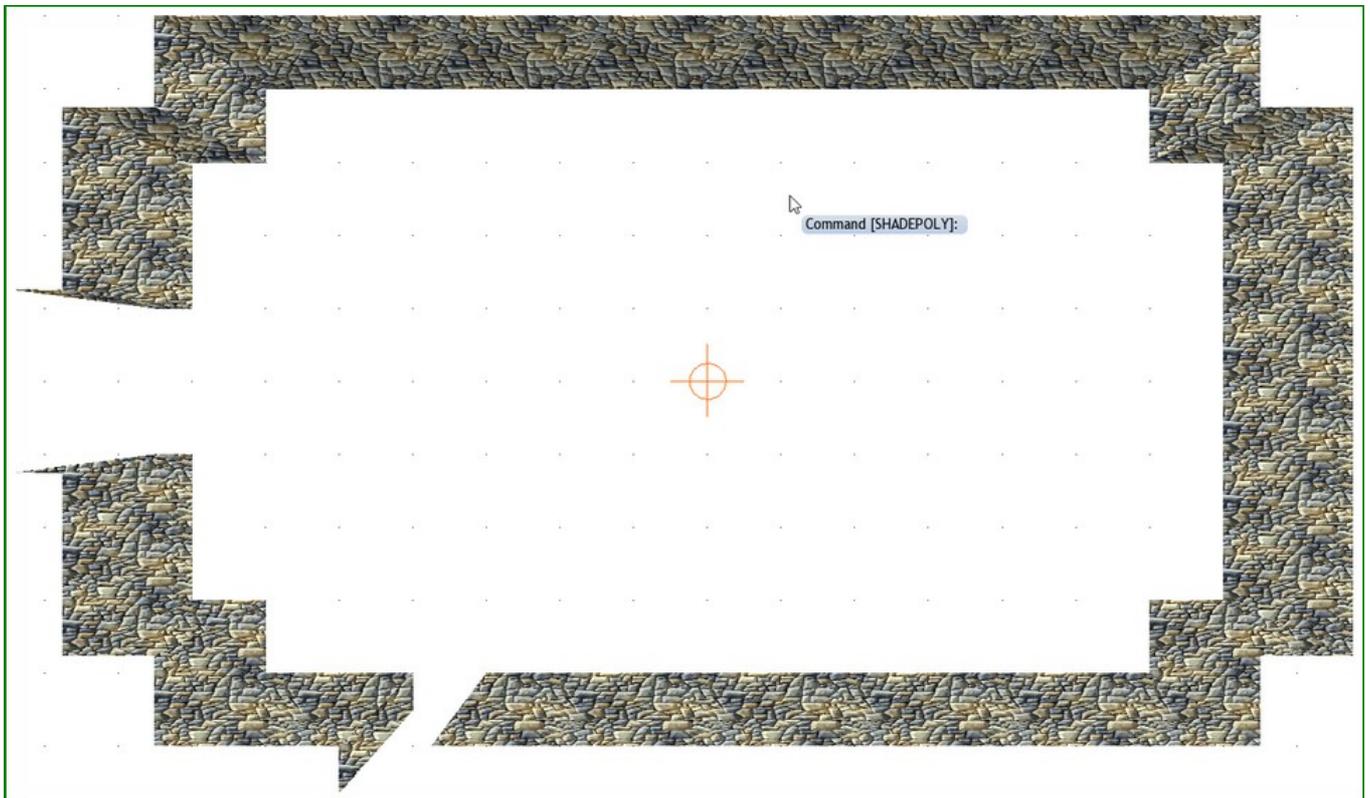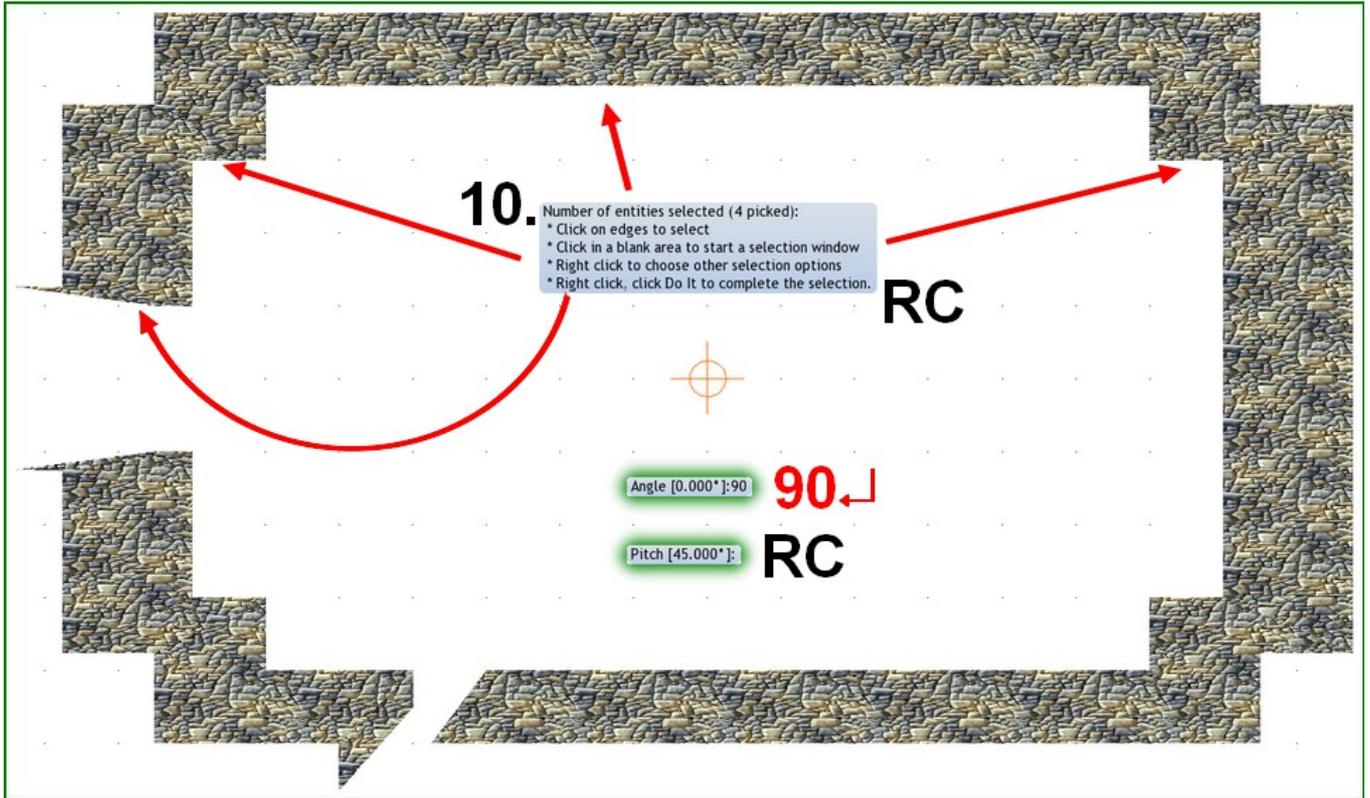9. Right-click the *Polygon* tool and choose **Shaded Polygon** (**SHADEPOLY↵**)).

10. Select all the wall panels facing north (assuming north is the top of the map). Right-click **do it** (**d**).
    When the prompt asks for the **Angle [0.000°]** type **90↵**. In CC3/CC3+ 0° refers to due east, 90° north, 180° west and 270° south.
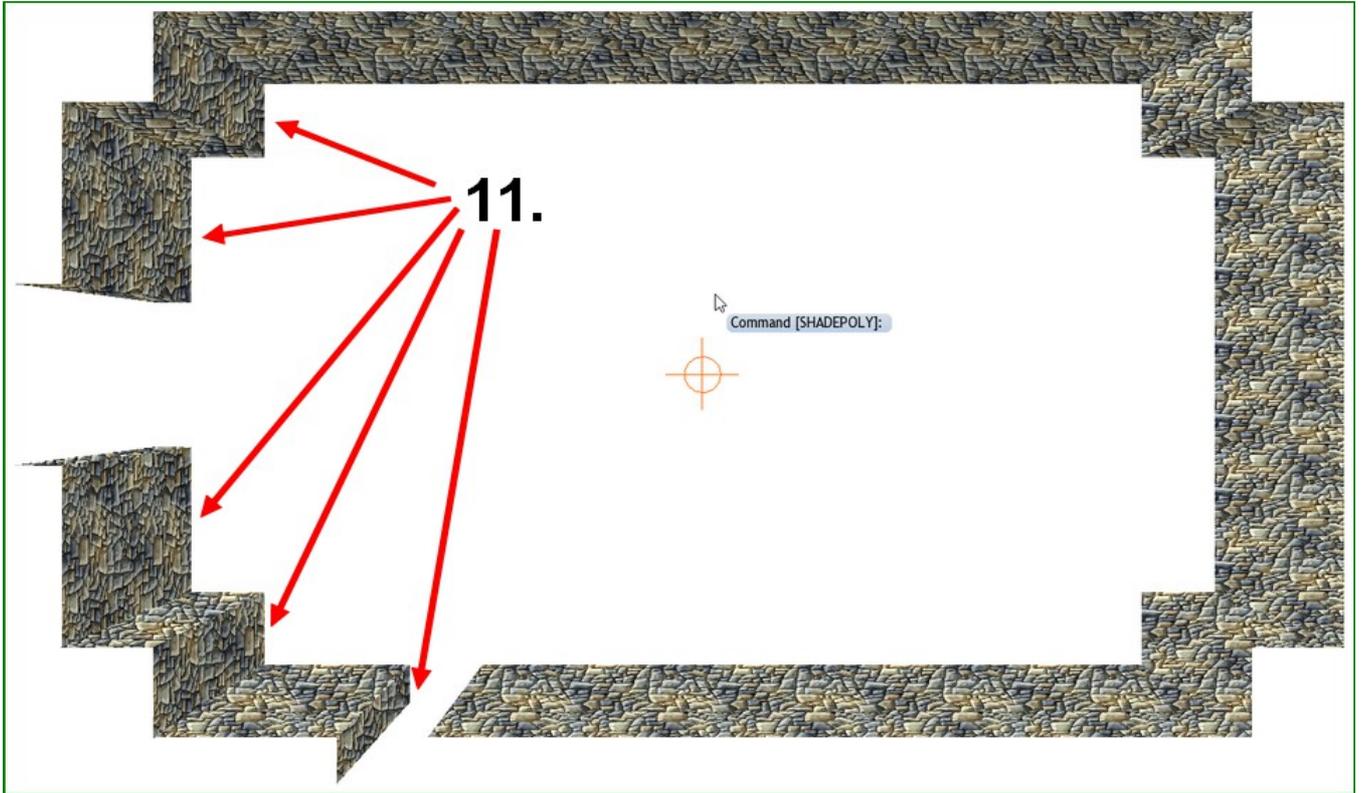   When the prompt asks for the **Pitch [45.000°]** right-click or hit Enter (↵) to accept this default value or choose another value to your liking. Higher pitch values will give darker tones while lower values will make the wall lighter.
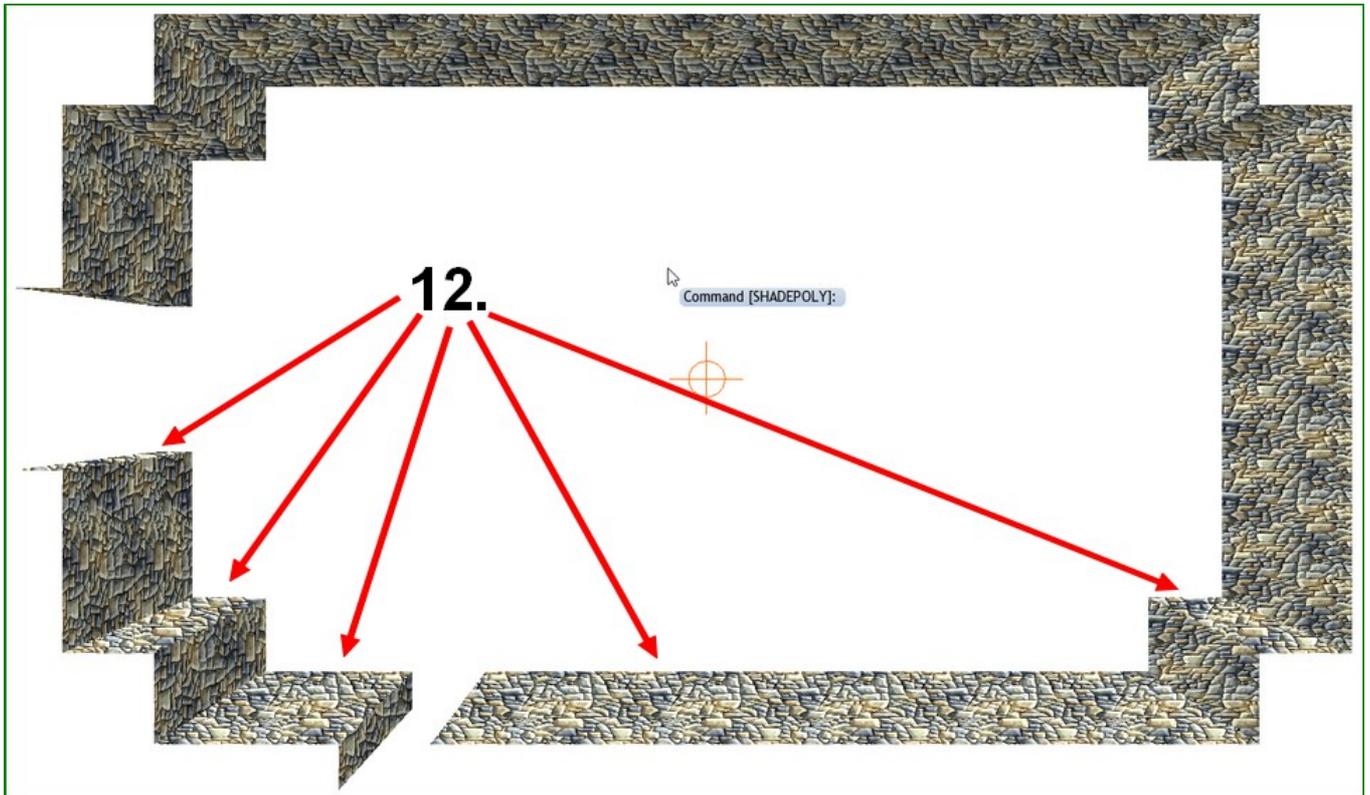
10. Number of entities selected (4 picked):
* Click on edges to select
* Click in a blank area to start a selection window
* Right click to choose other selection options
* Right click, click Do It to complete the selection.

RC

Angle [0.000°]:90 **90**↵

Pitch [45.000°]: **RC**

Command [SHADEPOLY]:

11. Repeat step **8.** and **9.** with the panels facing west and an **Angle** of 180°. Note how the fill style rotates to adapt to the new direction.
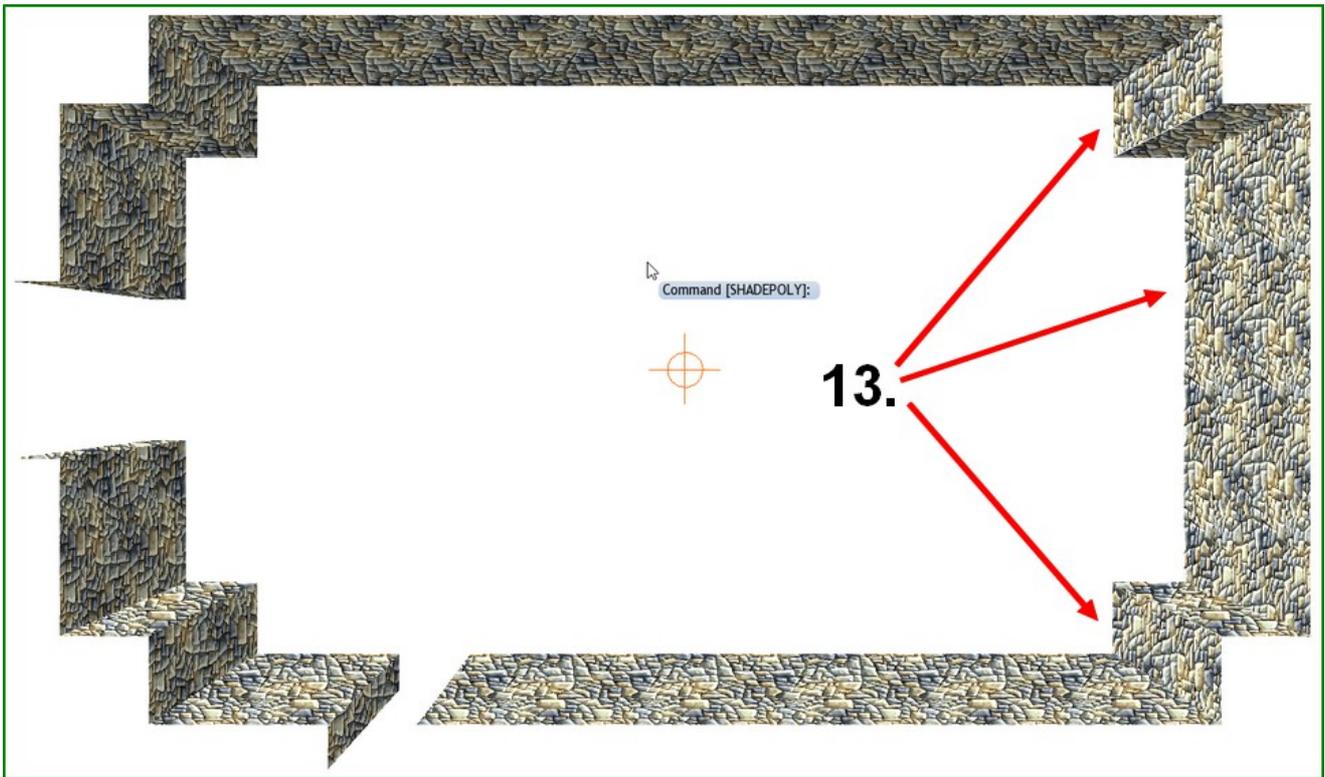

12. Repeat step **8.** and **9.** with the panels facing south and an **Angle** of 270°.
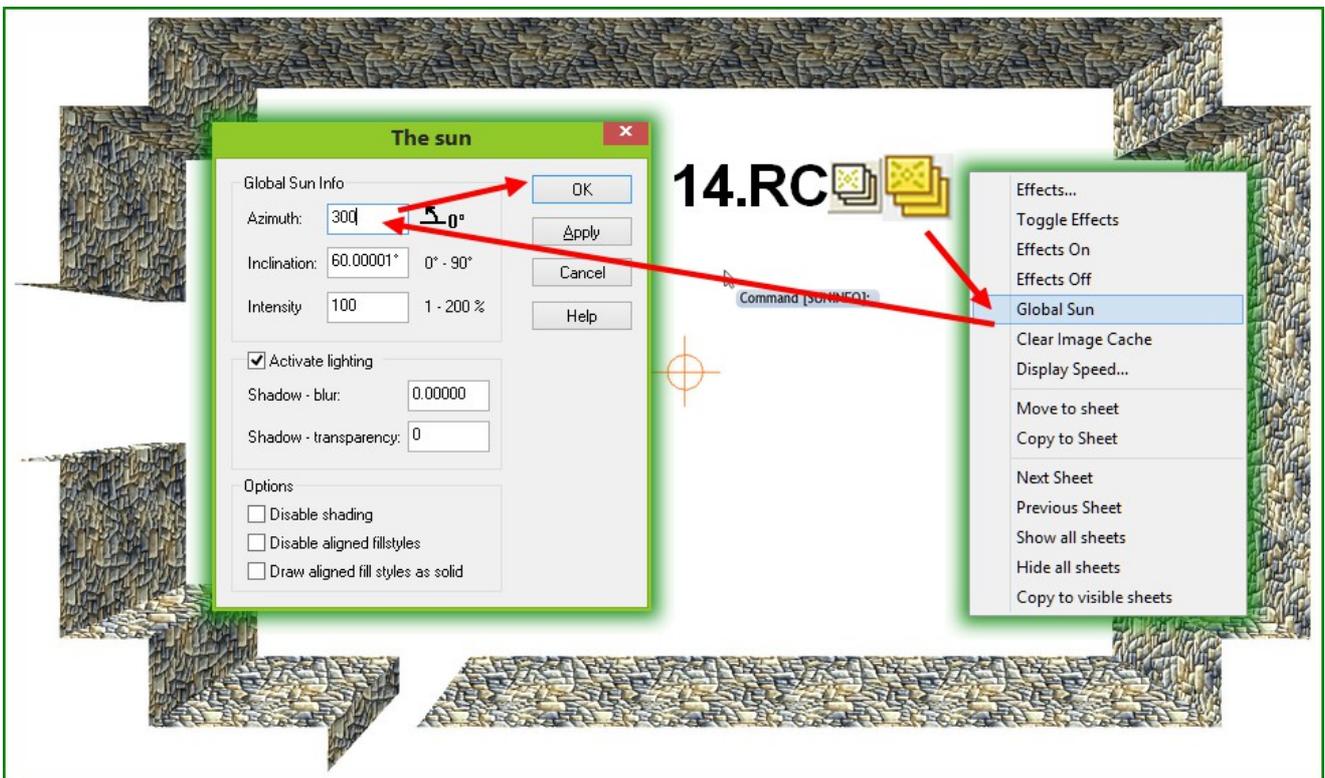
13. Repeat step **8.** and **9.** with the panels facing east and an **Angle** of 0°. Again, the fill style rotates.

14. Note how the north and west walls have the same shading. It's the same for the south and east walls. This is due to the CC3/CC3+ default azimuth setting of 315°.

To change the azimuth, right-click on the **Sheets and Effects** icon and select *Global Sun* (**SUNINFO↵**) and set the **Azimuth** to the desired value, for example **300** then click **OK**.
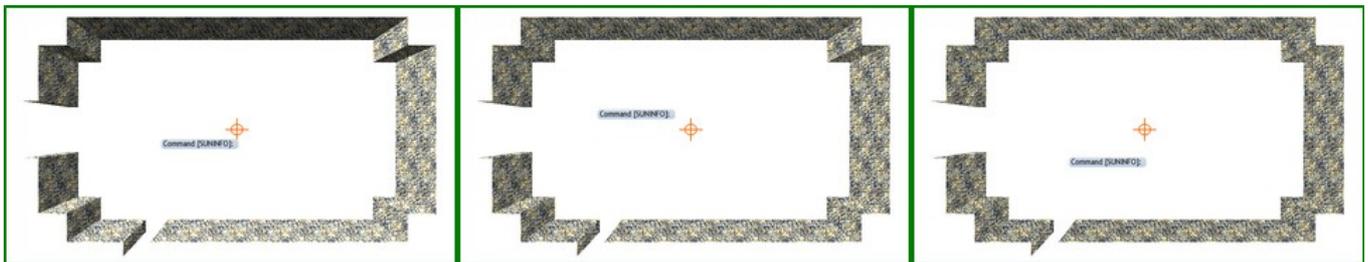
The azimuth parameter is supposed to indicate the direction the sun lights is coming from because the main use of shaded polygons is drawing roofs. Here we simulate 3D effects and the azimuth gives the direction the light is going to. 0° still being due east, an azimuth of 315° means the light if going to the south-east, thus coming from the north-east.

If the azimuth is equal to 45°, 135°, 225° or 315° you'll have pairs of directions of the same shading.

If the azimuth is 0°, 90°, 180° or 270° you'll have facing directions of the same shading.

Values in between will have four different shadings for the four compass directions.

15. You can also change the **Inclination** parameter. Also an angle, the inclination represents how high the sun is in the sky. Low values usually correspond to dusk or dawn while an inclination of 90° would be zenith.

   The lower the value, the sharper the contrast. Experiment until you find a satisfying setting.
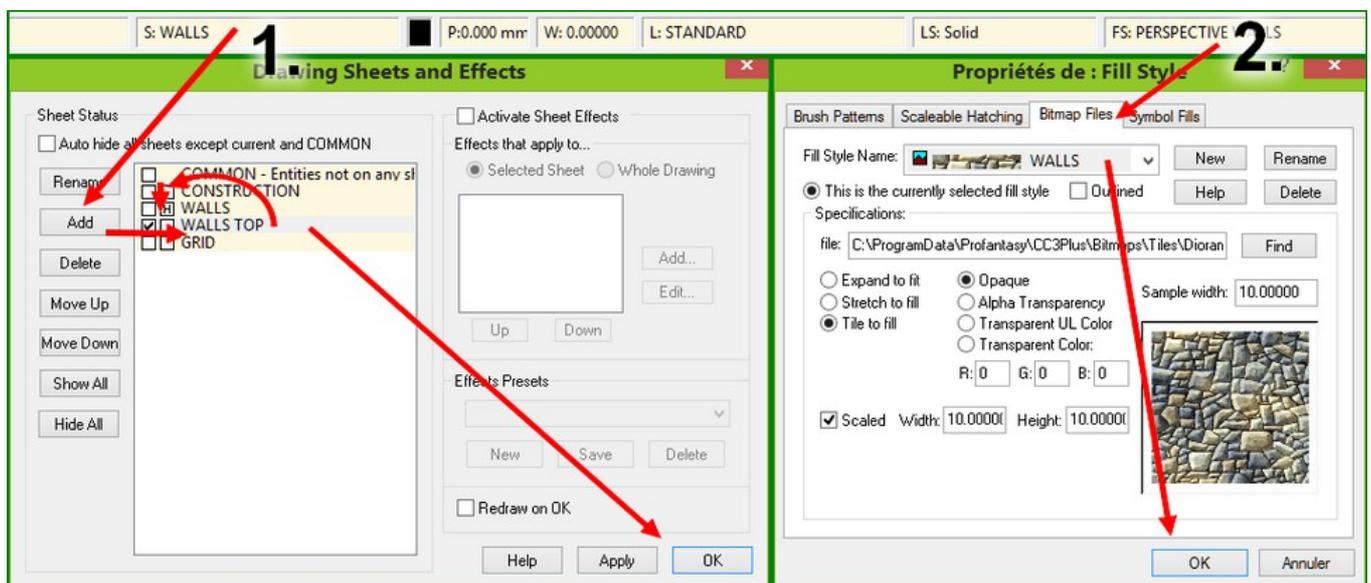

From left to right, **Inclination** of 10°, 60° (default) and 80°. **Azimuth** set to 300°.
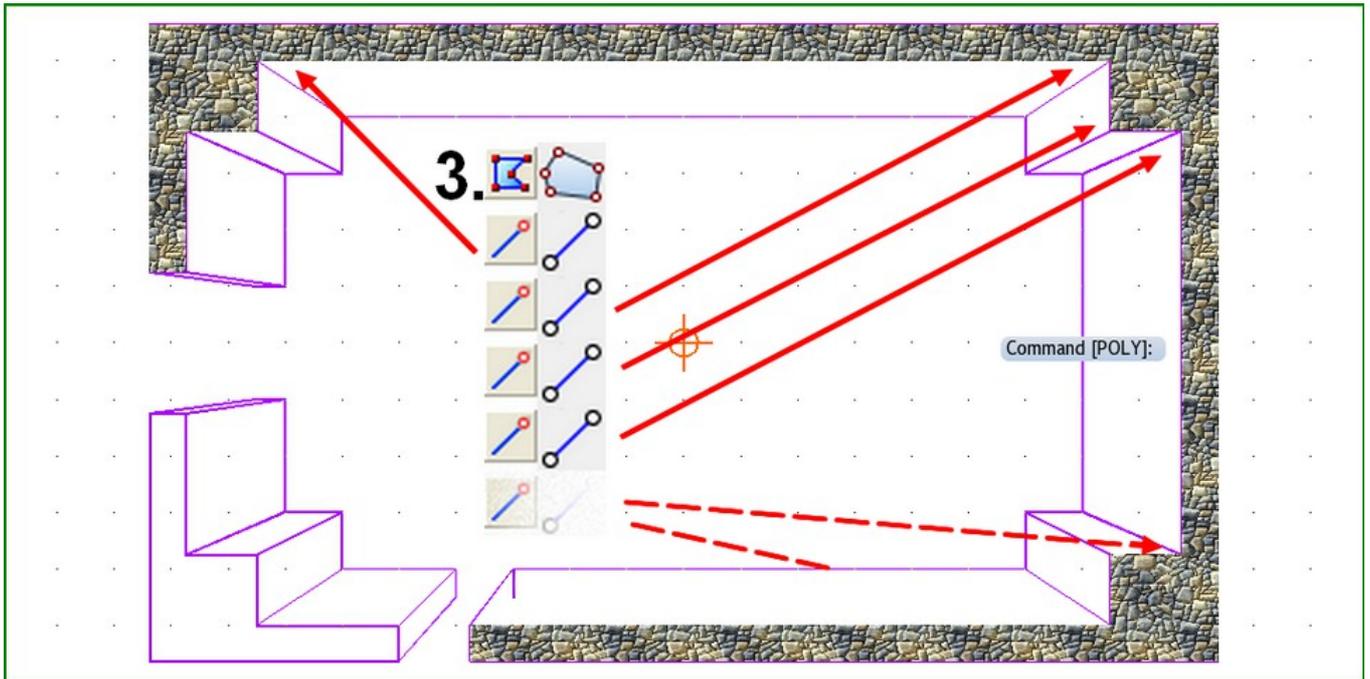
6. Texture the top of the walls.

The process is the same with an undistorted version of the fill style:

1. Click on the **Sheet Indicator** and create a new **WALLS TOP** sheet. Hide the **WALLS** sheet and show the **CONSTRUCTION** sheet by clicking on the "H" in the right check-box. Before clicking **OK** verify that the leftmost box of the new **WALLS TOP** sheet is checked or check it. Now click **OK**.
2. Click on the **Fill Style Indicator** and select the undistorted version of you wall fill style, or choose another style to your liking. Click **OK**.
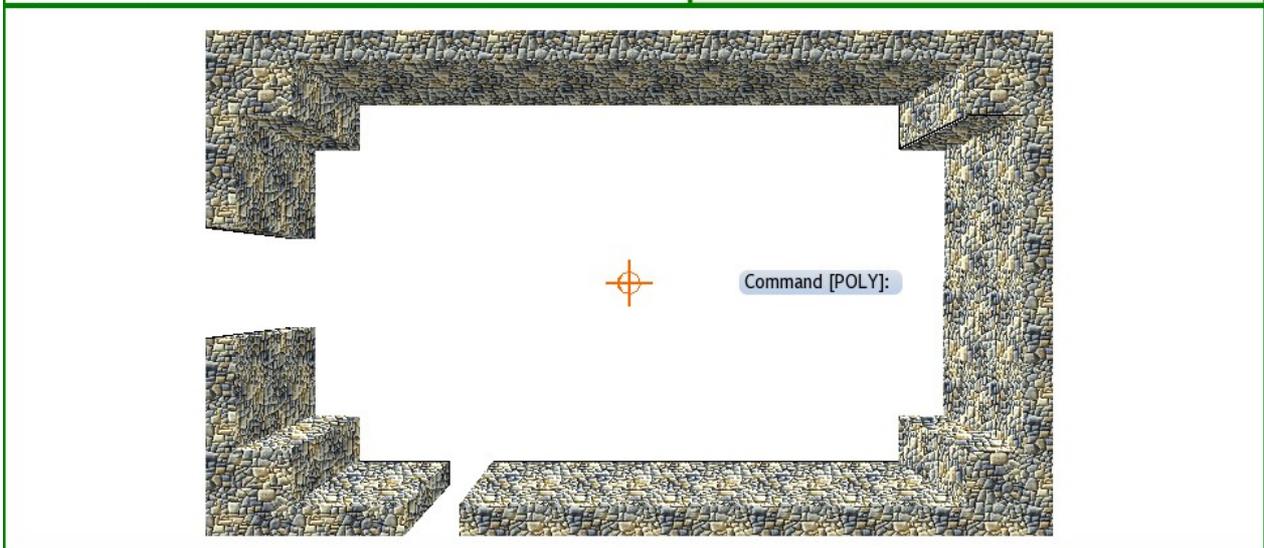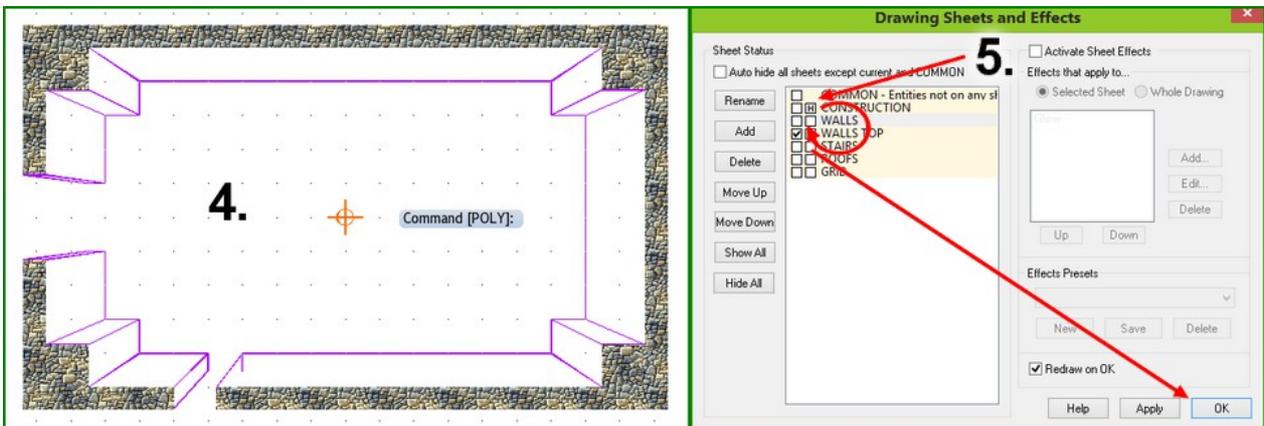
3. Use the *Polygon* tool 🔲◯ (**POLY↵**) and the *Endpoint modifier* 🖊🖊 (**F5**) to create a first polygon.

4. Repeat step **3.** for every other wall top polygon.
5. Click on the **Sheet Indicator**, on the right check-box of the **Construction** sheet to hide it and on the right check-box "H" of the **Walls** sheet to show it. Click **OK**.
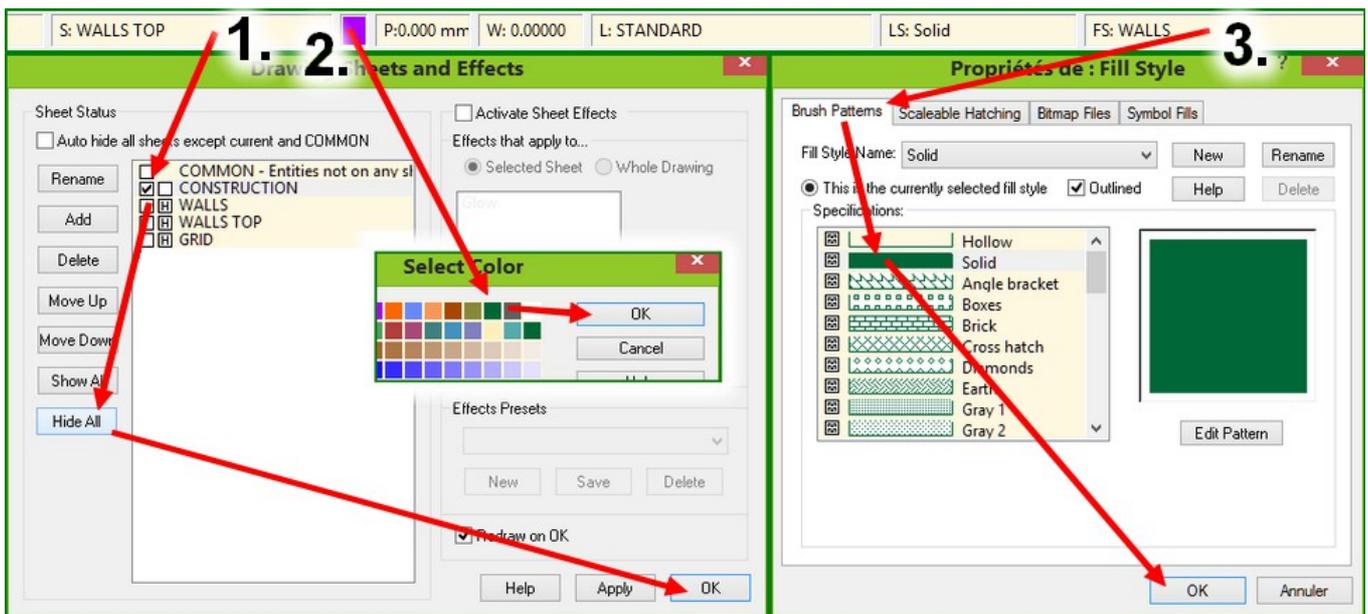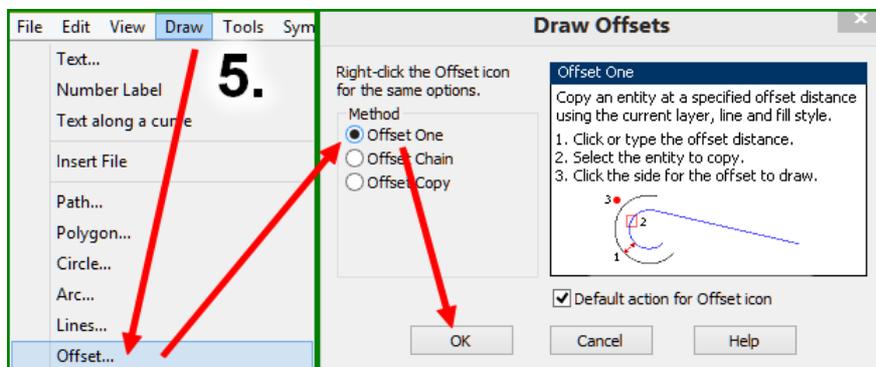
7. Add all the other elements.

This involves drawing doors, the floor and placing symbols.

Adding doors

1. Click on the **Sheet Indicator**, on the left box of the **CONSTRUCTION** sheet and on the **Hide All** button. Click **OK**.
2. Click on the **Color Indicator** and select a bright color, contrasting with the purple of the wall lines, for example forest green (13).
3. Click on the **Fill Style Indicator**, the **Brush patterns** tab and select **Solid**. You can also change the **Line Width** to something greater than 0 if you wish.
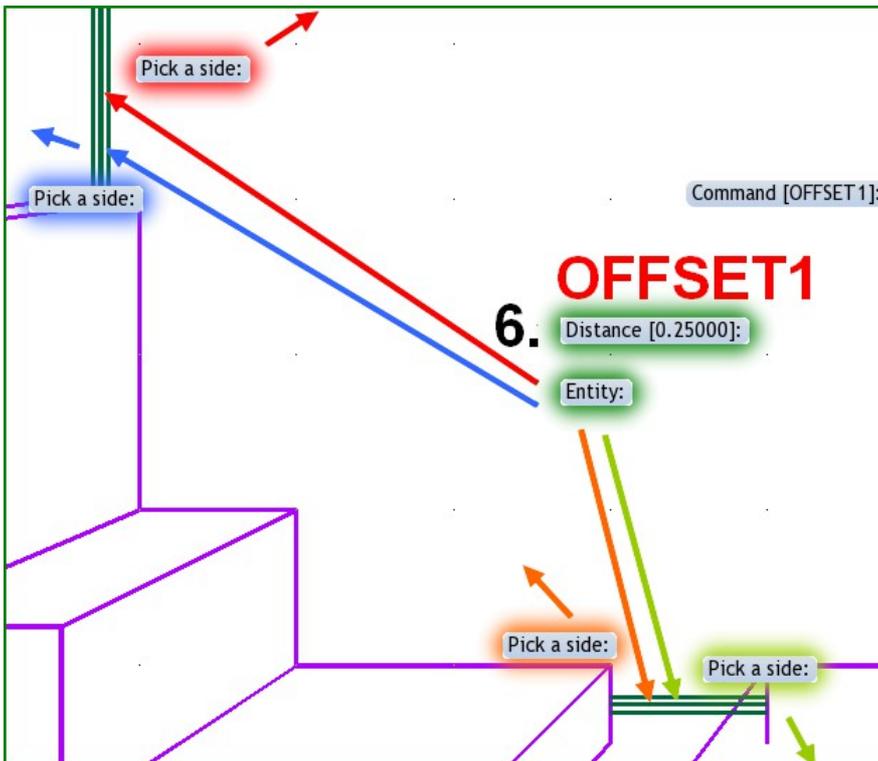

4. *Zoom In* 🔍 to focus on the door frames and use the *Line* ✏️ (**LINE↵**) tool with the *Midpoint modifier* ✏️ (**F3**) to draw lines between the walls of the door frames. Right-click after the first line then left-click to use the tool again.
5. Click on the **Draw** menu and select **Offset**. Choose *Offset One*. Alternatively type **OFFSET1↵**, and if you have CA46 installed[3], you can also use the icon ⌗.

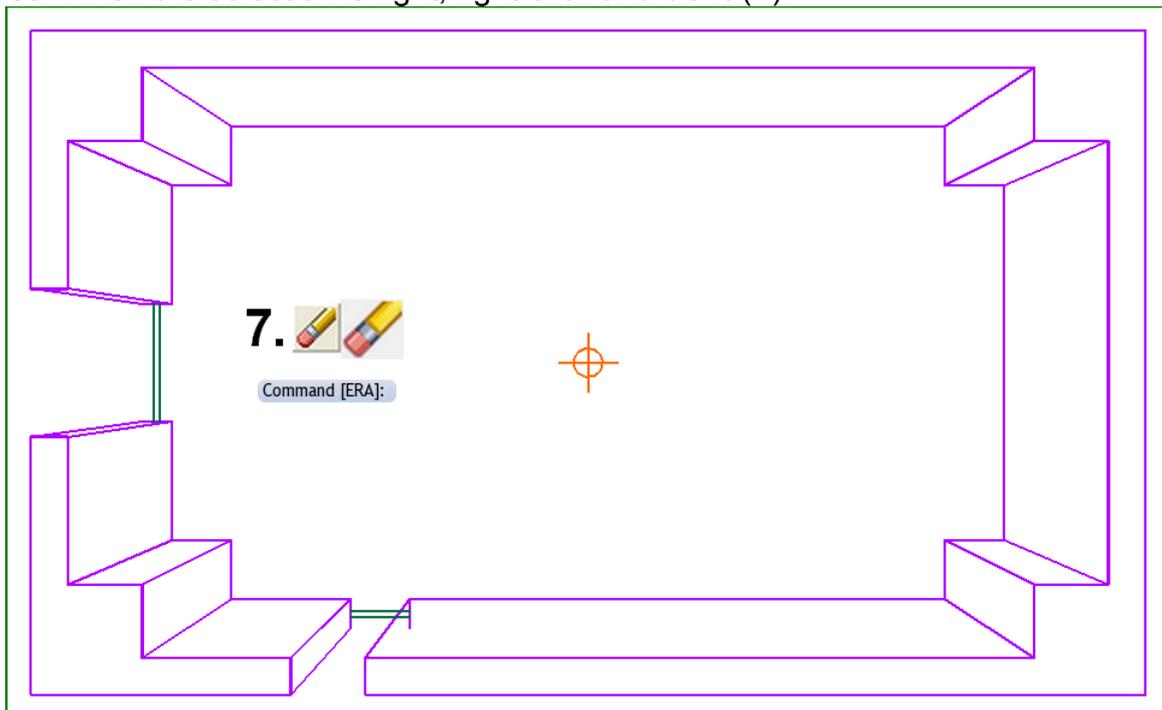3   To this date, neither the menu nor the CA46 icons are implemented into CC3+.

About Offset1
After you picked a side, CC3/CC3+ doesn't perform an automatic **redraw** so you don't really now where the new entity really sits.
With small offset distances, the new entity can be quite close to the old one and the computer might well take the wrong one when you want to select the original one again.
You can however manually force a *Redraw* by clicking on it's icon: 🔄🔄 or by using the keyboard combination **CTRL+R** without interrupting *Offset1*.

6. At the prompt asking for the **Distance [0.25000]:** type half the width of your door, or right-click to keep the default value of 0.25'. The prompt asks for an **Entity:** so select the main door line. The prompt now wants you to **Pick a side:** so click either somewhat to the right or to the left of the line. When the prompt returns to **Entity:** carefully (see side-bar) select the same original line but **Pick** the other **side**.
Repeat for the small door, of course choosing above and below instead of right and left. Right-click to end.

7. Use the *Erase* 🖊️🖊️ (**ERA↵**) tool to erase the mid lines from step **4**. If you select one of the new, offset lines, first select everything else you need to erase then right-click, choose **Combine**, **Not**, (just **n** at the keyboard) and click on all the selected entities you don't want to erase. When the selection is right, right-click and **do it** (**d**).
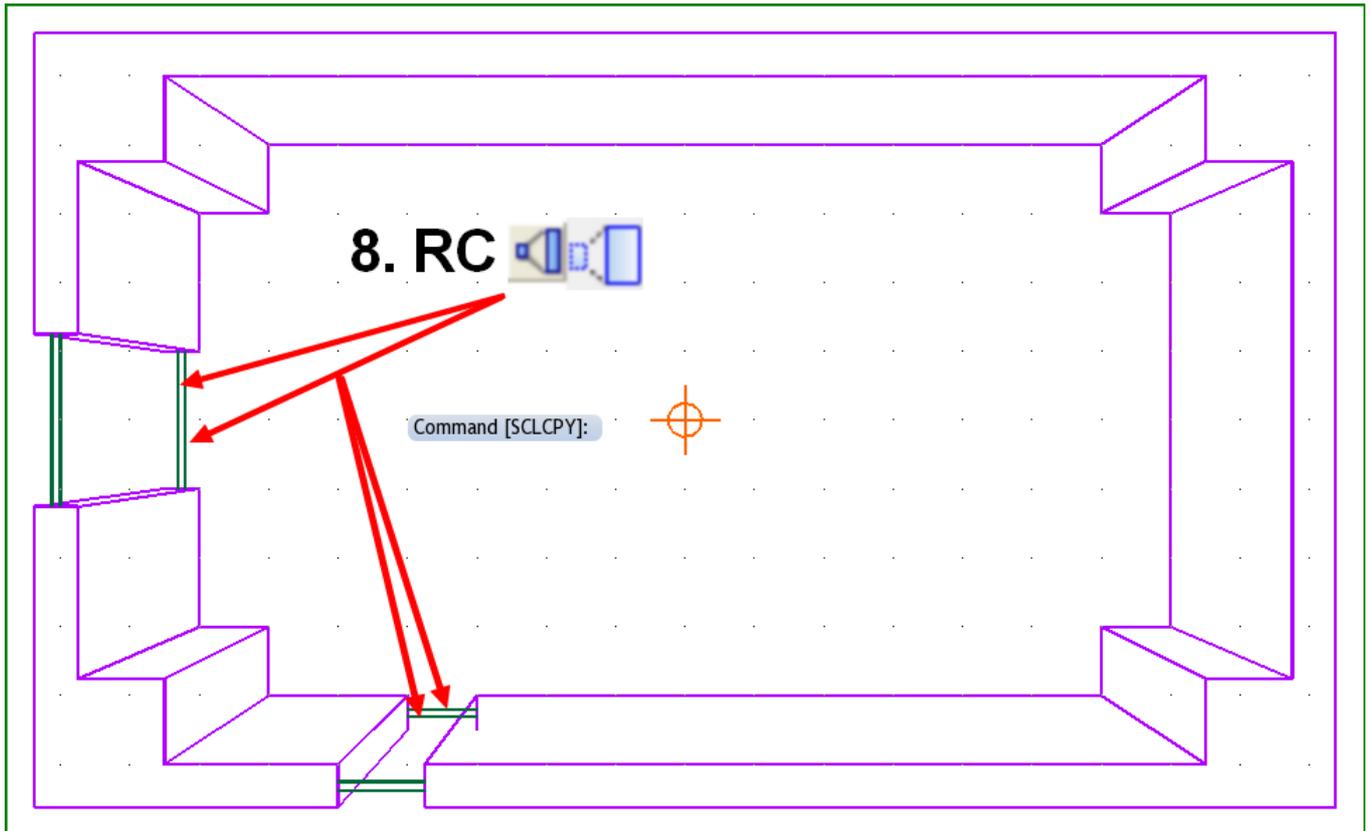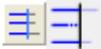
8. Right-click on the *Scale* icon ◁▯▯ and choose the *Scaled Copy* tool (**SCLCPY↵**). Carefully select all the door lines and right-click **do it** (**d**). Alternatively select by color (**b**, **c**, **13**, **d** on the keyboard).
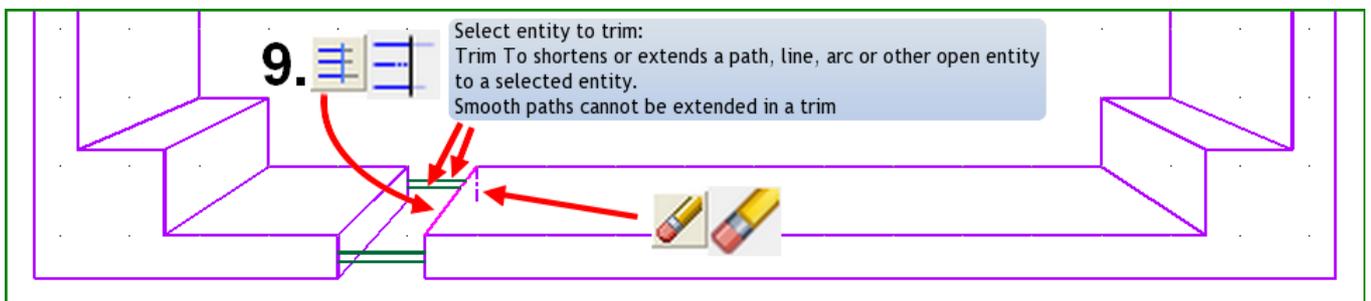When the prompt (command line, bottom left) asks for the **Scale factor** type the value you used for the walls (see page 3, 1.25 for the sample map).
When the prompt asks for the **Scale center** click on the vanishing point.

Note: you can achieve the same result by drawing mid lines on the top of the walls and multiplying the offset value by the scale factor when using *Offset1*.

9. To get rid of the hidden parts of the small door, select the *Trim to* ≡┤┤ (**TRIMTO↵**) tool. First select the purple line to trim to, then click on both lines to trim. You can now also *Erase* ▨✏ (**ERA↵**) the short purple line hidden by the wall.
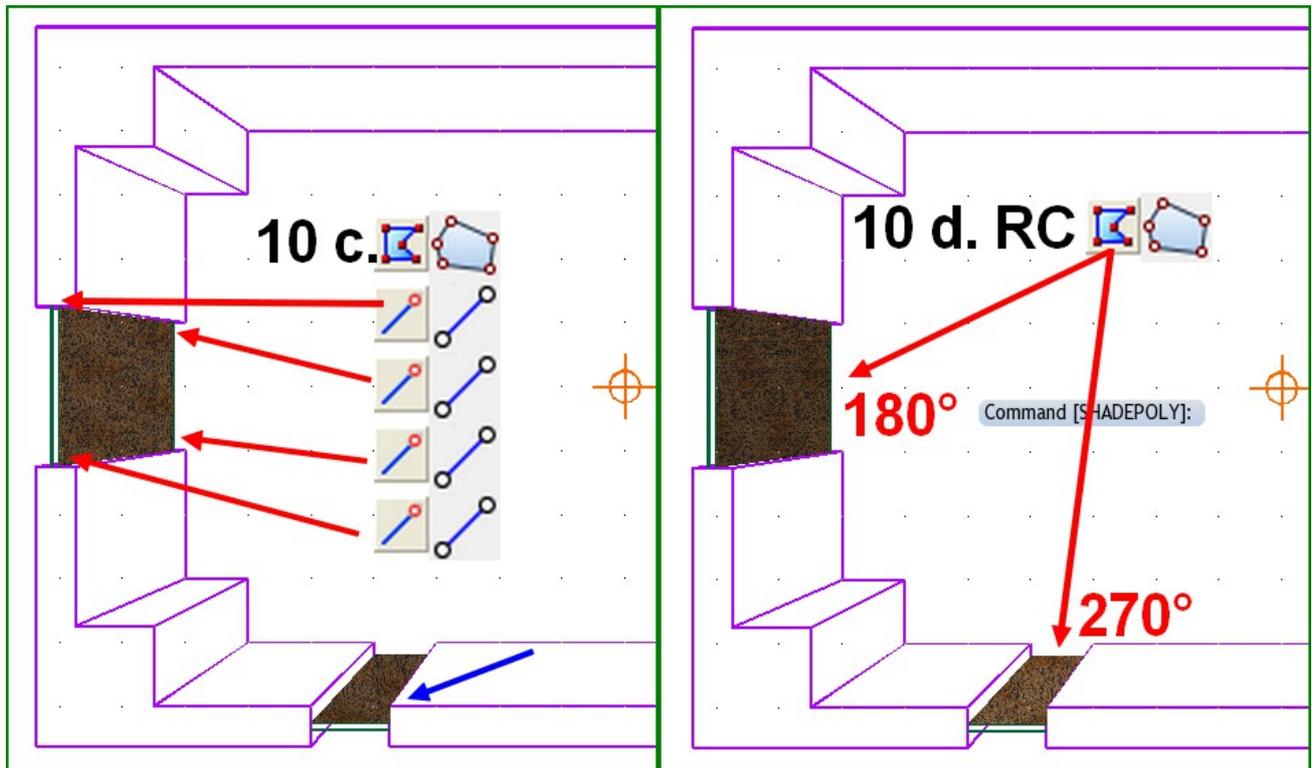
10. Now just repeat the process used to texture the walls:
    a. Create a distorted fill style of your chosen texture and make it active.
    b. Create a **DOORS** sheet.
    c. Use the *Polygon* tool [icon] (**POLY↵**) and the *Endpoint modifier* [icon] (**F5**) to draw the visible parts of the doors. Note that in the sample map the small door is a pentagon due to the wall corner (blue arrow).
    d. Right-click on the *Polygon* tool [icon], choose **Shaded Polygon** and shade the doors with the relevant angle (see page **9** step **10.**)
    e. Add the top of the doors with the undistorted fill style to the **WALLS TOP** sheet.
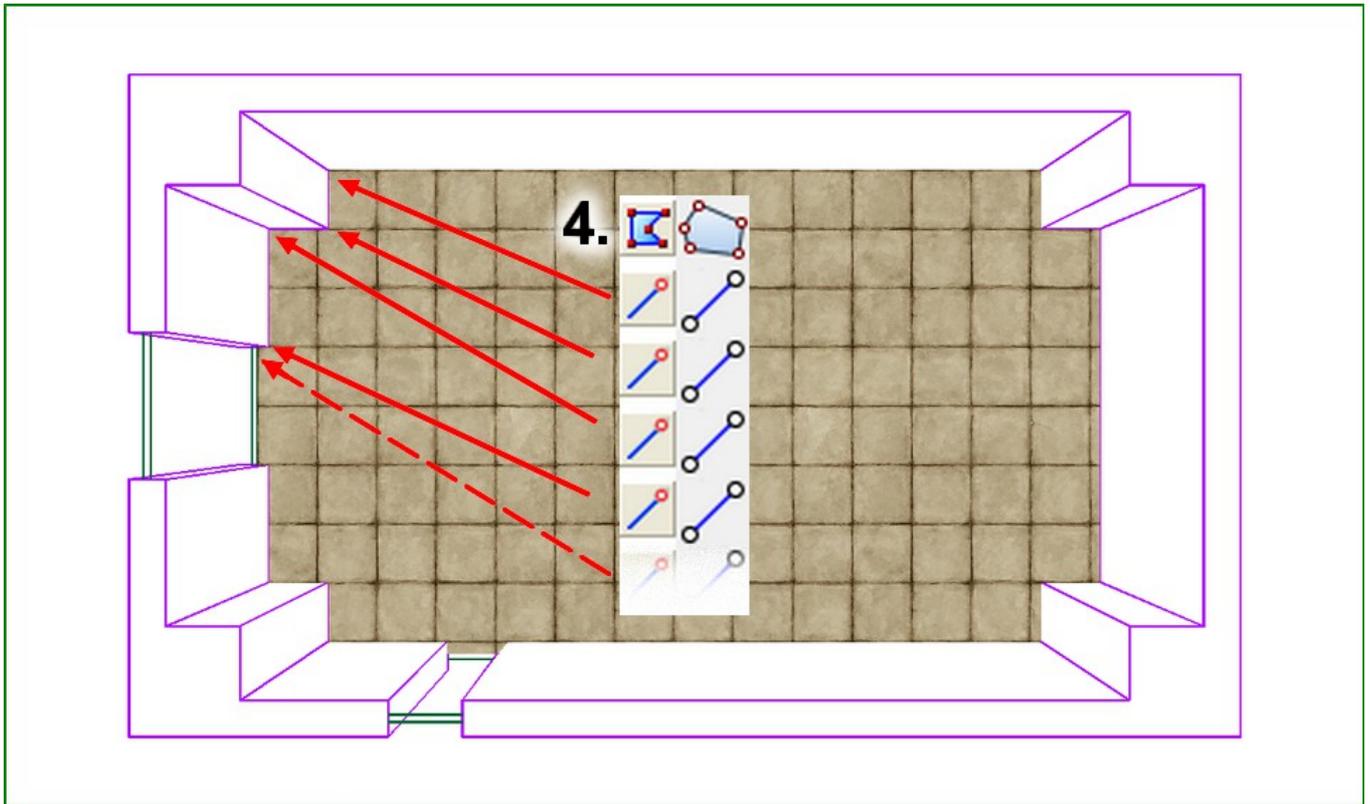   See pages 7+ for more details.

Note: to create more realistic door frames, with lintel or arches, see the forthcoming part 2 of this tutorial.

Adding the floor

1. Click on the **Sheet Indicator**, make the **CONSTRUCTION** sheet active and click on the **Hide All** button. Click **OK**.
2. Click on the **Fill Style Indicator** and select, or make and select, a fill style to your liking.
3. Create a **FLOOR** sheet and make it active.
4. Use the *Polygon* tool [icon] (**POLY↵**) and the *Endpoint modifier* [icon] (**F5**) to draw the floor polygon.
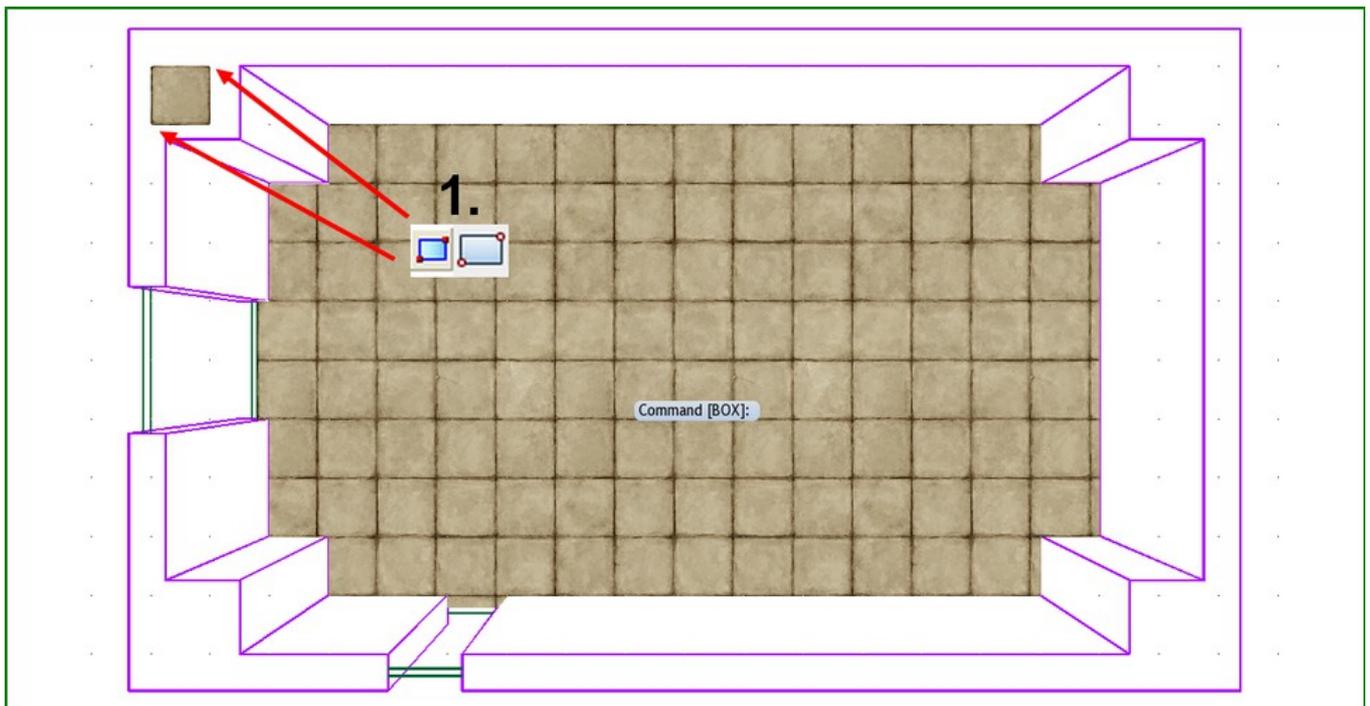
4.

PROBLEM: Due to the small amount of space between the front of the main door and the walls, and because fill styles are applied from the top and the left, the embedded grid of this fill style looks translated, yielding a small band of tiles to the right...
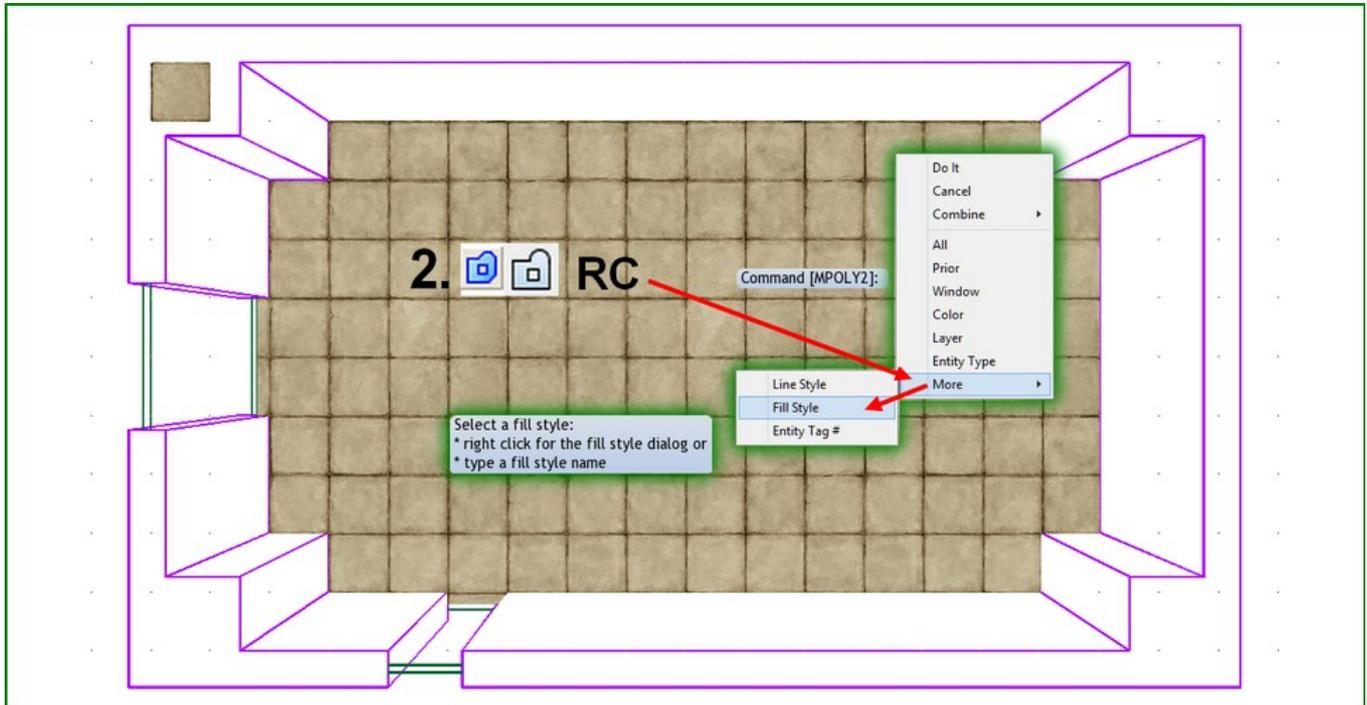
SOLUTION: create a multipoly with a hidden entity aligned to the grid:

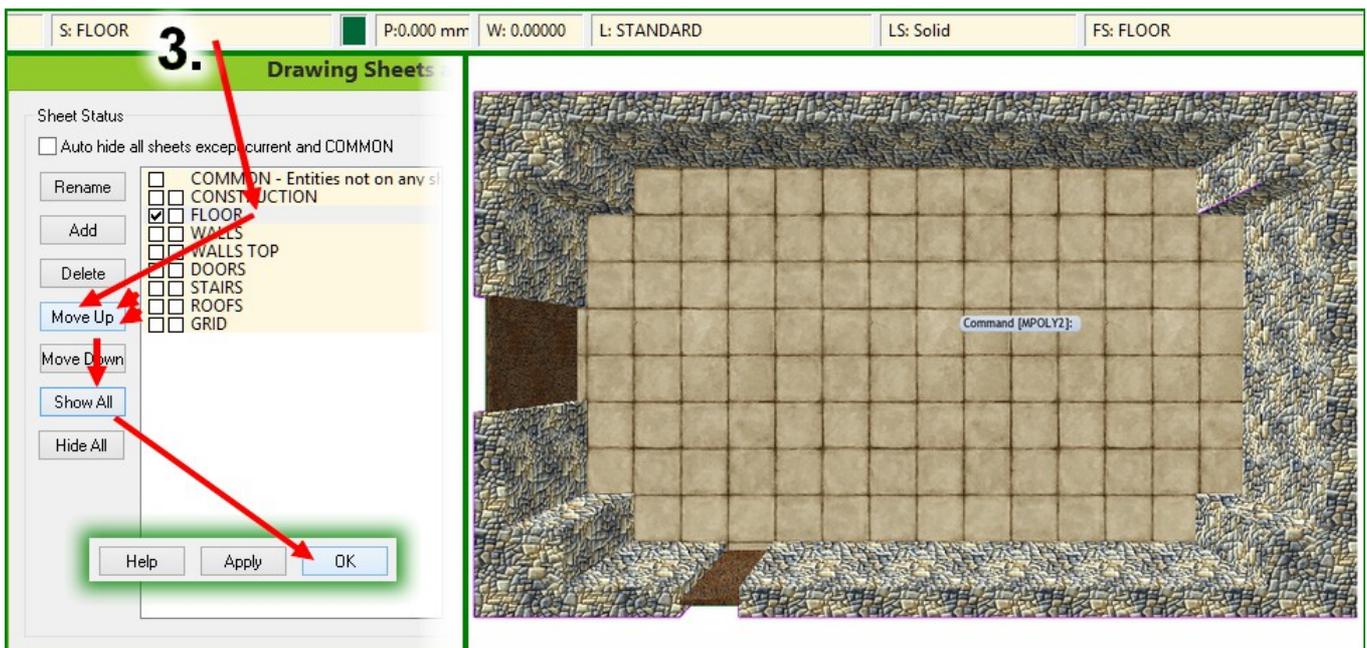1. Add a square with the *Box* tool (**BOX↵**) aligned to the desired grid somewhere to the top left of the map.

1.

Command [BOX]:

2. Click on the *Multipoly* 🔲🔒 tool (**MPOLY2↵**) and right-click to choose **More** then the selection by **Fill Style**. Right-click to invoke the **Fill Style Dialog** and choose the fill style applied to the floor entities. Alternatively, type **f** and right click, or even **f** and the full and exact name of this fill style if you know it.

3. The alignment square must however be hidden. This means that the **FLOOR** sheet should appear under the **WALLS** sheet that can effectively hide this square.
Click on the **Sheet Indicator** and highlight the **FLOOR** sheet by clicking on its name, not on any check-box. Use the **Move Up** button until the **FLOOR** sheet is above the **WALLS** sheet (and thus, perhaps illogically, graphically under it). Make all the sheets visible by clicking on **Show All** then click **OK**.
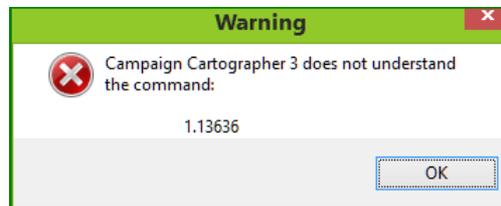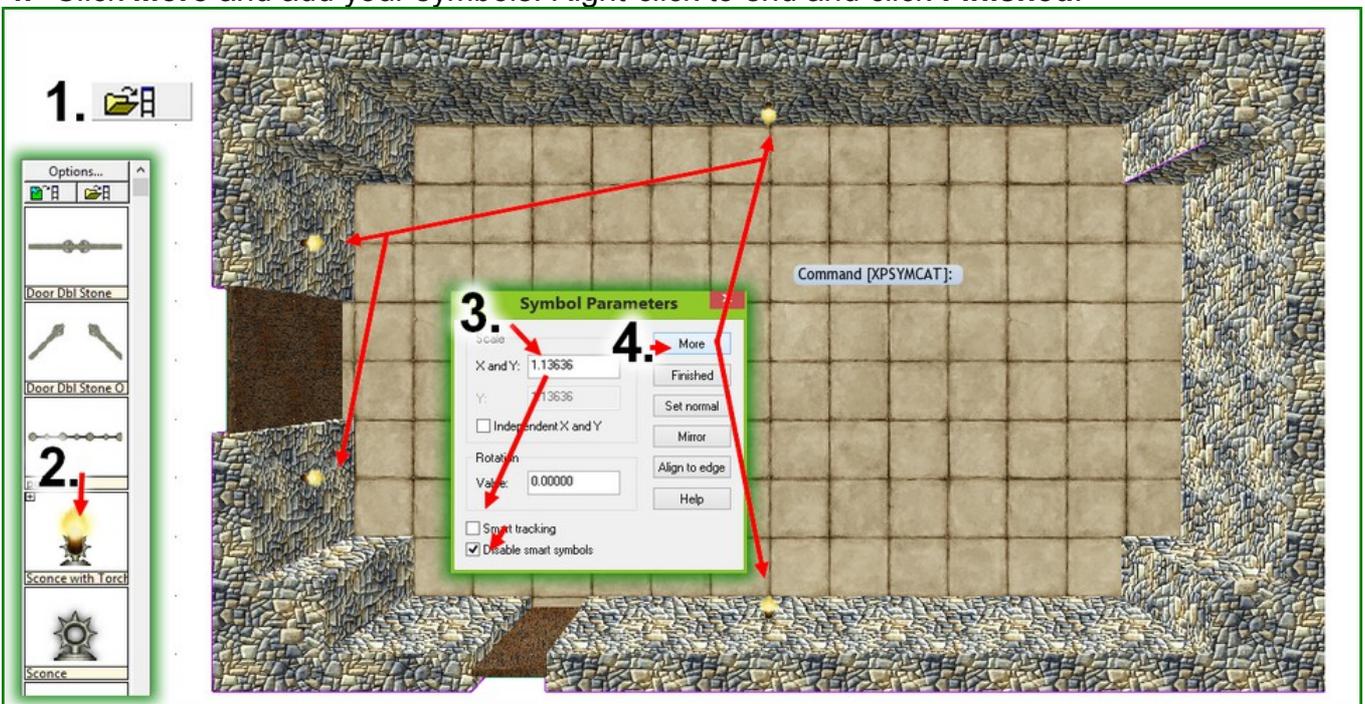
Adding symbols

For most features, adapting the scale is a matter of taste but if you want to stick to the rules, you just need a calculator to find the scaling. CC3/CC3+ can even do it for you:

For example, if you want to add torches at a 6' height, you'll need to scale your symbols to $\dfrac{f}{f-6}$ (see page 3). With a focal length of 50, this translate into $\dfrac{50}{50-6}=\dfrac{50}{44}$. To get the result, type the following:

1. **GV↵** . This means **G**et **V**alue.
2. The prompt asks for a **Variable:** in fact a variable name. Don't use any keyword such as *Scale* for example because it's the name of a command, and don't use spaces, coma etc. **SF↵** – for scaling factor – is ok.
3. Now the prompt asks for a **Value:** and here you can type any correct simple mathematical expression[4]. For the example above, **50/44↵** is correct, and so is **50/(50-6)↵**.
4. To read the result, type **SF↵**. You get an error message box but it contains the rounded value you're looking for: 1.13636

1. Click on the symbol **Catalog** icon and select the **Wall features.fsc** catalog file[5].
2. Click on the **Sconce with torch 1** symbol.
3. Hover over the map area and right-click. Type the rounded (if necessary) value in the **X and Y** box, uncheck **Smart tracking** and check **Disable smart symbols** to avoid symbols sticking to the entities sides.
4. Click **More** and add your symbols. Right-click to end and click **Finished**.
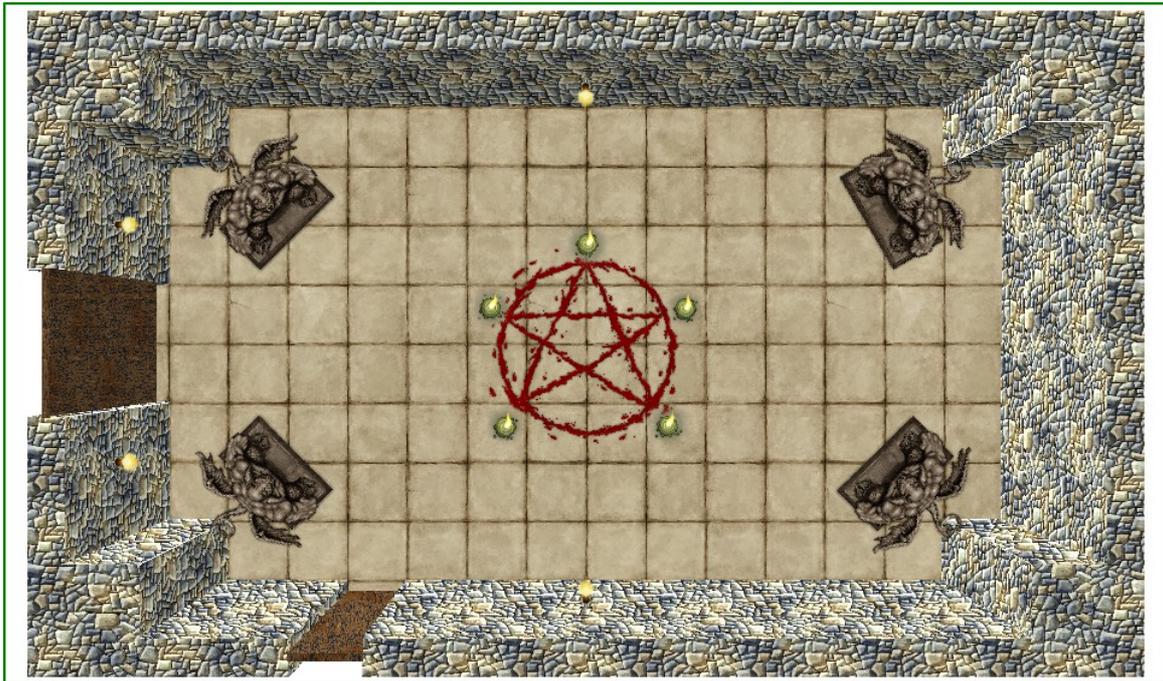

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4   You can use the four operations and brackets but alas no function like sine, cosine, square root and no power like 5^2.

5   If you have an early version of CC3+ you might have to copy the CC3\Symbols\Dungeons folder to your Applications Data\CC3+\Symbols\ folder to access this catalog.
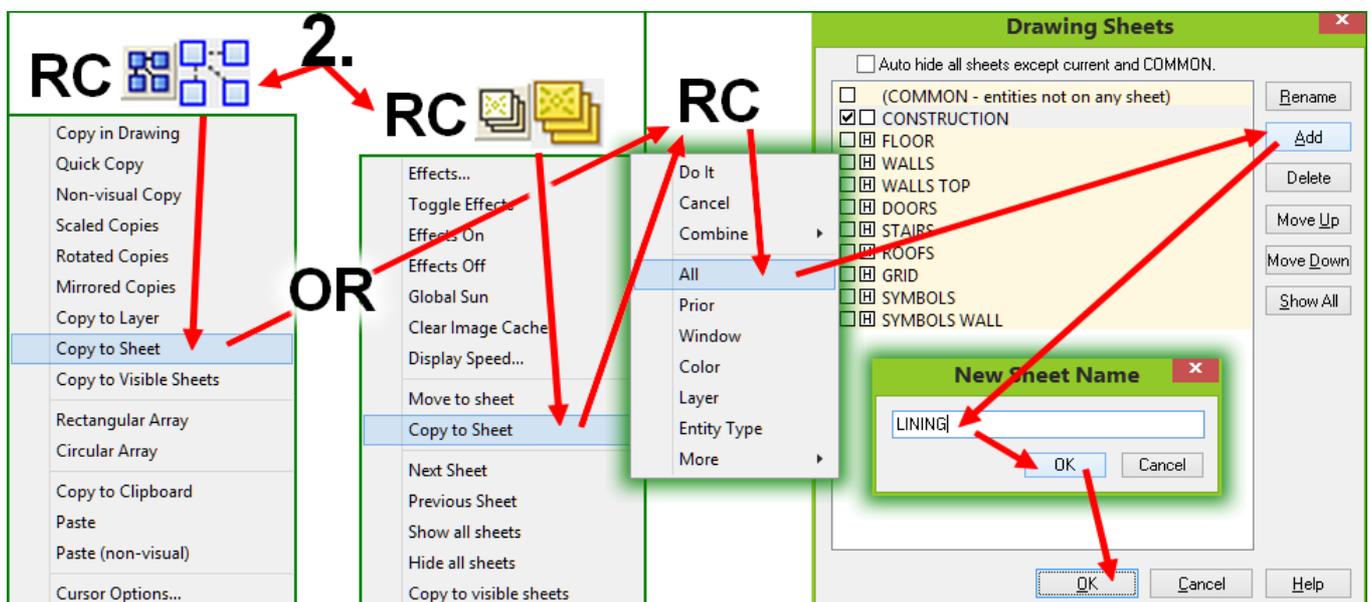
Now add any symbols you like, adapting the scale if necessary...
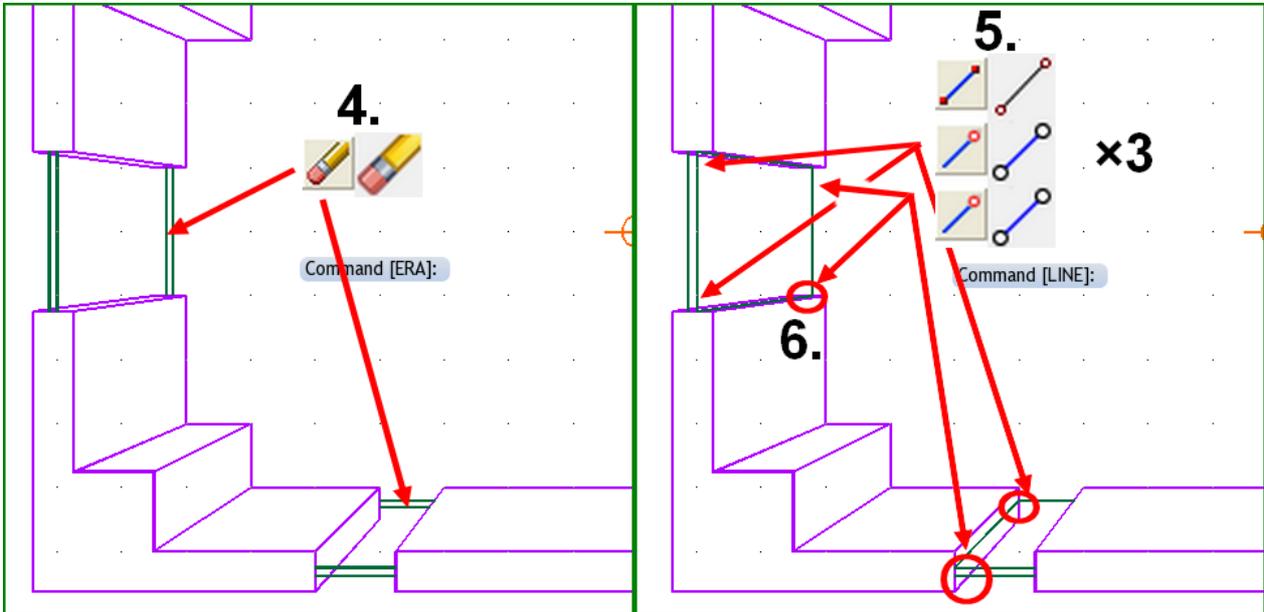

8. Optionally line the walls

You can enhance the 3D look of your map, especially on more elaborate ones, by lining the walls. It's not very difficult because you already have most of the entities you need:

1. Click on the **Sheet indicator**, on the left box of the **CONSTRUCTION** sheet, then on the **Hide All** button. Click **OK**.

2. Right-click either on the **Copy** 🔲 icon or the **Sheets and Effects** 🔲🔲 icon and choose **Copy to Sheet** (**COPYSHT↵**). Right-click and choose **All** ("**a**"). Right-click **do it** ("**d**"). A reduced sheet list appears. Click on **Add** and name the new sheet **LINING**. Click **OK** twice.
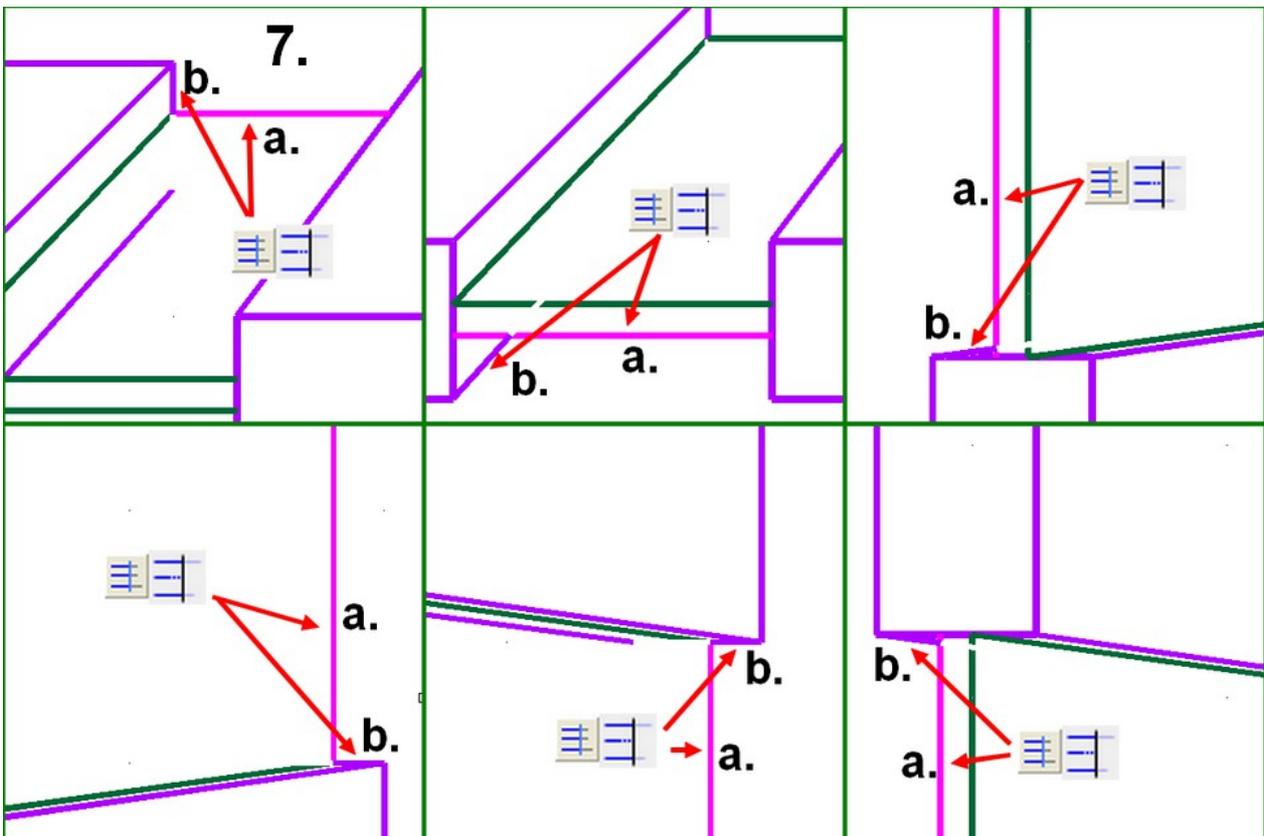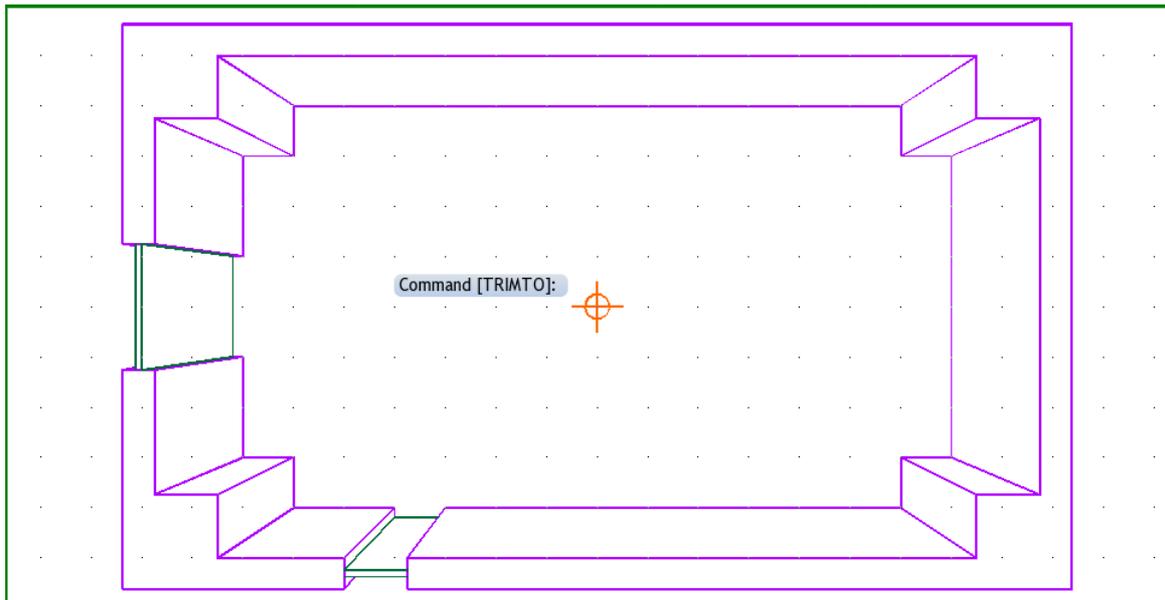
3. Click on the **Sheet Indicator**, on the left check-box of the **LINING** sheet then on the **Hide All** button. Click **OK**.

4. *Erase* ✏️🖍️ (**ERA↵**) the doors back lines at floor level that are hidden.

5. Change the fill style to **solid** and use the *Line* 📐📏 (**LINE↵**) tool with the *Endpoint modifier* 📐📏 (**F5**) to add the vertical lines of the doors.

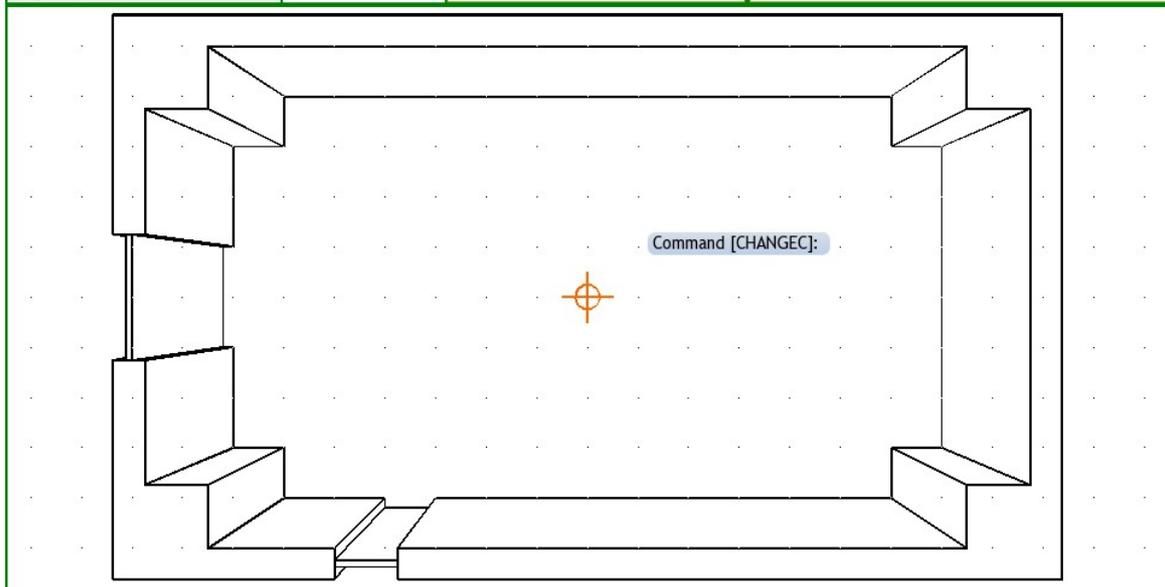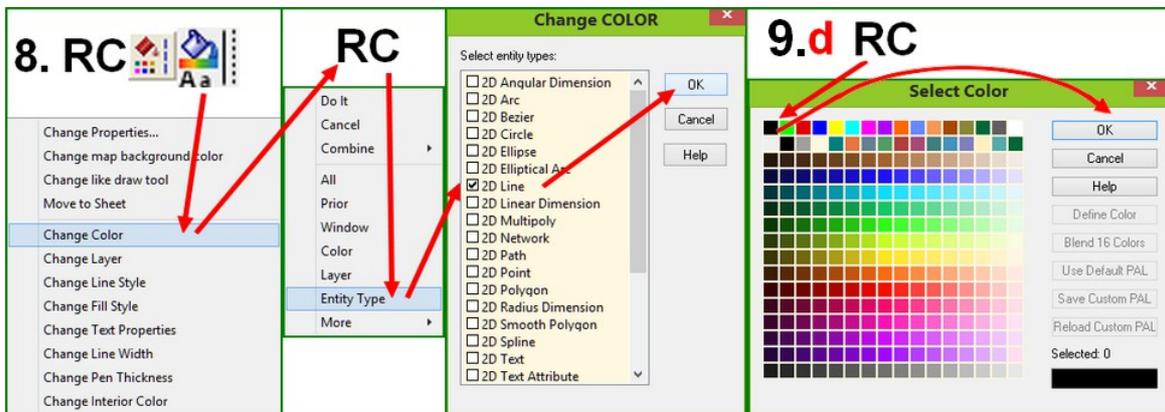6. Note how some lines cross each other (circled in red).

7. Use the *TrimTo* ▤▤ tool (**TRIMTO↵**) to get rid of the hidden parts, selecting first the line to trim to (**a.**) then the line to trim on the part to keep (**b.**). Right-click then left-click to end and start again the tool before zooming to the next trim to perform.
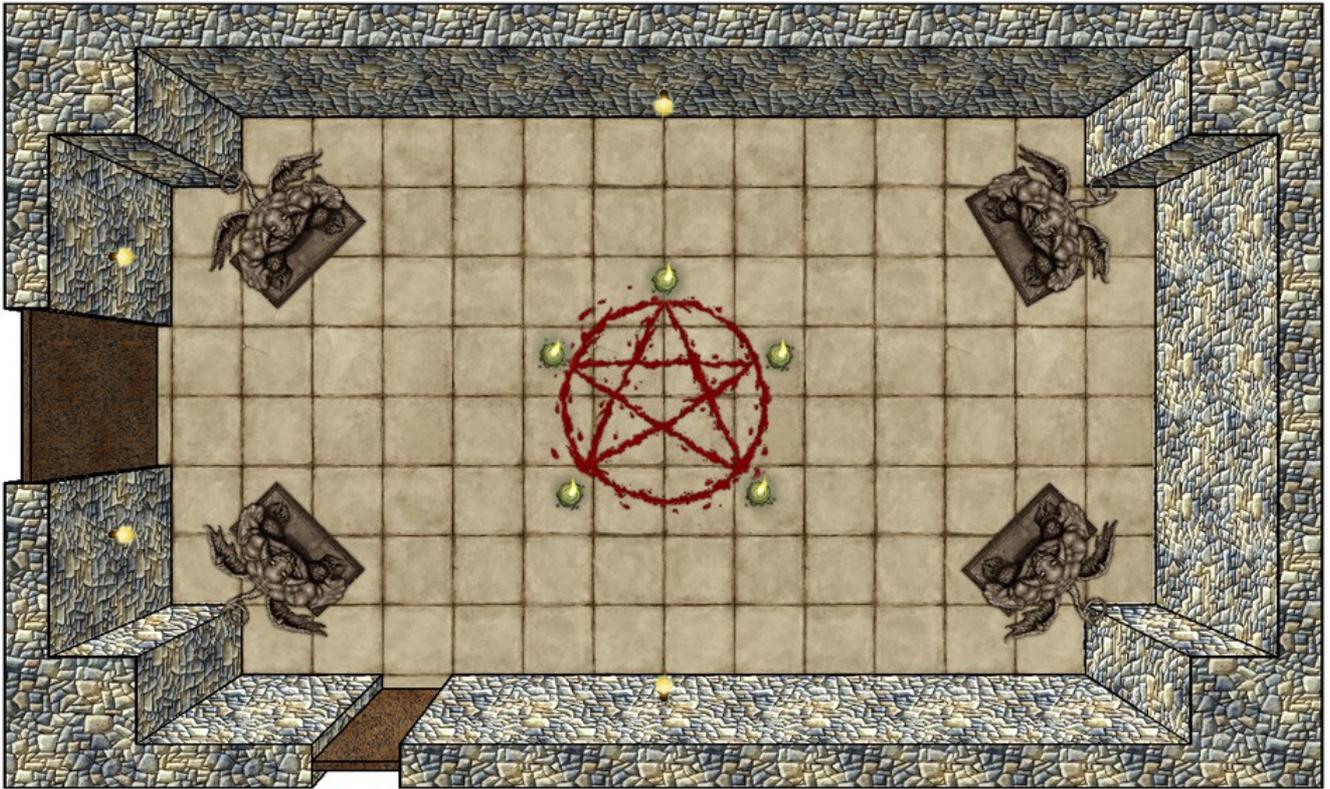
Command [TRIMTO]:

8. Right-click on the *Change properties* ⬛ tool (and not the *Edit properties* ⬛ tool which looks quite similar) and choose *Change color* (**CHANGEC↵**). Right-click and choose **Entity type** ("**e**"). Check the **2D Line** check-box of the pop-up and uncheck everything else if necessary. Click **OK**.

9. Right-click **do it** ("**d**"). Type **0↵** to set the new color to black or right-click to show the **Color selector**, click on the desired color and click **OK**.

10. Click on the **Sheet Indicator** and on the **Show All** button. Click **OK** and enjoy!

Conclusion

In this tutorial, we saw:

- The theory of a one point vanishing point perspective to create perspective top down views.
- How to choose a focal length and the vanishing point.
- How to calculate the scaling factor at a given height.
- How to apply this theory to the walls of a room.
- How to further apply this theory to the features of the room.
- How lining the walls enhances the map.

In part 2, more advanced techniques will be detailed, like adding window frames, arches and stairs.

Happy mapping!
Joachim de Ravenbel
February 2015