

Our Stilt House

Focus on science

Stimulate problem solving	Gold	Stimulate entrepreneurship	Bronze
Stimulate creativity	Gold	Informal learning enviro.	Bronze
Stimulate critical thinking	Gold	Technology use	Bronze
Stimulate group work	Gold		

Practicalities



Preparation: 2u



Group size range: 26
Ideal sub-group size: 4



Duration: 2u



Workshop made for: 12-16
Easily transferable to workshops for ages between: 16+



Material needs:

- Building platform with pole
- A fan with different speeds
- Building materials



Environment FabLab necessary: No



Educational area:

- * Engineering
- * Mathematics
- * Science
- * Technology
- * (Visual) Arts

(for more details see materials box on last pages)



Precognition for the educator

In this workshop the pupils will make a pole house, a house that is balanced around one central stilt that keeps the building above ground. The two main goals are to work in group and to communicate well between the different roles that every pupil will get, as well as to train the problem-solving skills of everyone in the group. The pupils will have to use their problem-solving techniques because they will encounter a variety of problems throughout the workshop.

It's essential for the coach to have some knowledge about:

- Coordination of groupworks
- Balance and a basic understanding of the **center of gravity**;
- **Scales** and how to use them to make plans and prototypes.

If you think you don't have enough information about some topics, you can have a look at the content links at the last pages of these workshop guidelines.

Preparation

For this workshop to work it is essential to construct a **testing platform** with a pole for the participants.

This can be done in a very basic way, taking only 5 minutes of work, or could be made to look more solid and impressive, which will require 1h or more of preparation work.

Minimal design requirements: *(optional design requirements in cursive)*

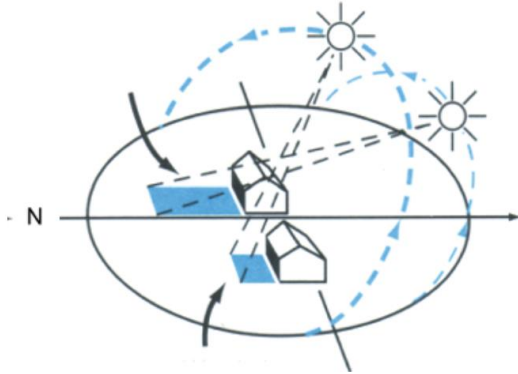
- 1 pole of min 20 cm height. This pole should be fixed in the ground or in a platform so that they can support the additional weight of the house. The diameter of the pole should be at least 2 cm. The easiest way to represent this, is to use a PVC drain pipe.



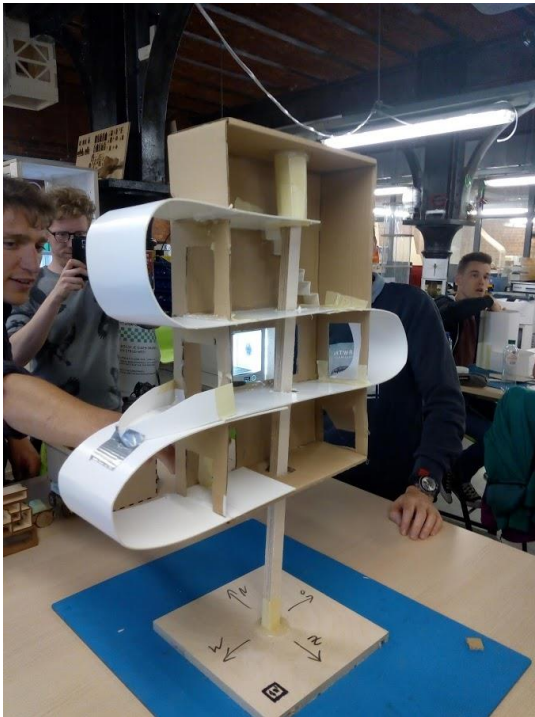
- *Make sure that the pipe is completely spirit level. Do this for the different angles.*



- *Optional focus maths: make the pillars out of different shapes and widths (but keep the same height) to increase difficulty for the participants*
- *Optional focus geography - Technic: Use different types of ground and let them search which one is the best.*
- Make clear where the different cardinal directions (North, East, South and West) will be. For example with a clip or with tape.



- Lastly, don't forget to collect and prepare construction materials for the houses of the participants. See 'materials' in the next section.



Picture: example of the pole and the cardinal directions.

Workshop Guidelines

Phase 1: Orientation and Instruction Phase



Material needs:

Essential: Pictures of pole houses

Optional: /



Goals:

Skill Goals (**Blue**)

(S1) To look up information independently.

Content Goals (**Green**)

(C1) **Optional:** Express the consequences of Climate Change in their own words.



Background story:

Split the group in little groups of 4 pupils. All the pupils will get a role in this workshop. There is an architect, a bank clerk, a city employee and a client who wants to build a house. You can divide the roles how you want.

The client wants to build a house on an estate he bought.

The workshop is divided in 4 parts in which every pupil will get a paper with an extra instruction.

Goals	Activities	Duration
	Divide the group in little groups of 4 pupils and give each pupil a role.	10'
S1	(Optional focus science) You can make a bigger project of this workshop and let your students look up information why Climate Change causes the sea level to rises, and what kind of risk this holds for the places where they live.	To be chosen

Phase 2 & 3 : Designing & making phases



Material needs:

Essential: Cardboard, Hot glue gun, Scissors, utility knife, etc.

Optional: Computer with Google Sketchup.



Goals:

Skill Goals (**Blue**)

(S1) Abstraction of an idea to a 2-dimensional sketch

(S2) Abstraction of an idea to a 3-dimensional virtual drawing

(S3) Make a plan

(S4) Search the center of gravity of an object.

(S5) Argue the choice for a specific type of soil for a foundation.

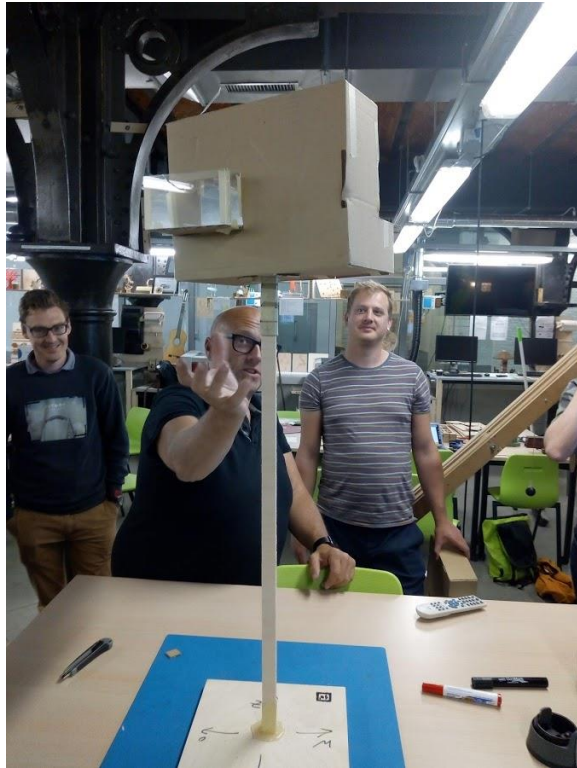
(S6) Leveling an object.

Content Goals (**Green**)

(C1) Work with scales on an 2 or 3-dimensional prototype

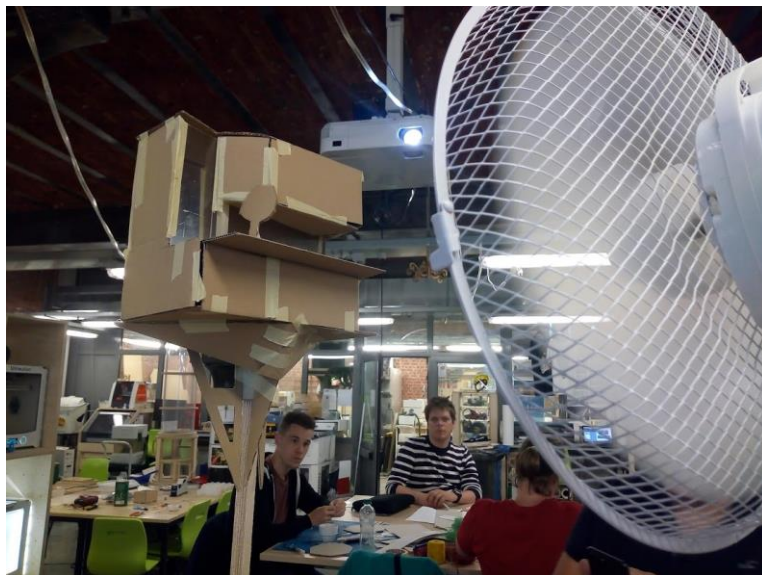
(C2) Indicate where the center of gravity of a simple object lies.

Goals	Activities	Duration
S1-S6 C1-C2	<p>After the pupils have read their first instruction (Round 1 at the end of this guidelines) they start to sketch their first drawings of the house. You can help the pupils with some plans of existing houses. You can also give them perspective drawings.</p> <p>They will have to think about a good way to put the rooms next to each other. To help them for this, there is an Infosheet at the end of this guideline.</p> <p>They can cut out their drawings and make a 3D maquette of their house.</p> <p>Depending the age you can give the pupils a specific scale on which the drawings should be made.</p>	1h
	<p>In the second round the pupils will know that they will have to build a house on a pillar. The pupils search for solutions to build their house on pillar. How will they fasten the house on the pillar, will it balance? Etc.</p> <p>The basic rule here is to put the center as low as possible and it should be above the place of contact between the ground and the house.</p>	30'



The third round the balance of the house will become more difficult. A fan will produce wind that will try to put the house out of balance. As extra exercise they will have to create open places at their houses where the lights can shine through.

30'



	The last round is there for the finishing touches. They will have to make the house waterproof. This can be tested with a watering can. In addition they will have to try to reduce the floor area with 20%	20'
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Phase 4: Operational Phase



Material needs:

Essential: Platform with poles and a light bulb symbolizing the sun going around the platform in an arc of 270 degrees. See preparation for details.

2 Lego figures or similar to test light distribution.

Optional: Microcontroller and light sensor.



Goals:

Skill Goals (**Blue**)

(S1) Deal with failure (Trial and error)

(S2) Working in group

(S3) **Optional focus technic:** Working with basic electronics

Content Goals (**Green**)

(C1) Find the center of gravity and support of a material

(C2) Investigate the strengths and weaknesses of different supporting materials

(C3) Explain the incidence of light and reflectiveness of surfaces

Goals	Activities	Duration
S1, C1, C2	Round of balance testing: the model is put on the pole and the balance is checked. If necessary design adaptations are made.	10 min
S1, S2, C3	Round of light distribution testing: the model is put on the pole and the design requirements on light distribution are checked. 1 Lego figure should be always in the light and 1 should only have light on the midday hour. If necessary design adaptations are made.	10 min
S2, S3, C3	(Optional focus technic) <i>Skilled participants can optionally make more advanced system to check the lighting conditions using microcontroller and light sensors. For example a control led that lights up when a lightray is detected inside the room.</i>	ca. 20 min

Phase 5: Evaluation Phase



Material needs:

Essential: Platform with poles and a light bulb symbolizing the sun going around the platform in an arc of 270 degrees. See preparation for details.

Evaluation documents

Optional: Optical chips that can be placed inside the house to check the lighting requirements.



Goals:

Skill Goals (**Blue**)

(S1) **Optional:** Give a presentation about their product

Content Goals (**Green**)

(C1) Find the center of gravity and support of a material

(C2) Investigate the strengths and weaknesses of different supporting materials

(C3) Explain the incidence of light and reflectiveness of surfaces

Goals	Activities	Duration
C1 C2 C3	Participants deliver their final design for testing and the designs are placed on the testing platform and tested for balance, robustness and lighting distribution.	20 min
S1	(Optional focus technic, economics) <i>Participants present their house and advertise the different aspects of the house: the functionality, the aesthetics, the balance, lighting conditions, etc.</i>	5 min per group
S1	(Optional focus ICT) <i>Participants make a website with the basic information and some pictures of their constructed pole house like it would be a immo website listing. They present this website/listing and other participants can vote on which house they would buy</i>	1 hour + 5 min per group for the presentation





Pedagogical tips

You can give each student a specific role. For example:

- Master of the materials
- Master of the drawings and scales
- Master of puppets

You can use the light-challenge to make the workshop more or less technically challenging for different age groups. For the first design this should not have too much stress on it, but the more advanced the group the more complex these lighting requirements can go.



How to transfer to (non-)Fablab environment

Transfer to non-fablab environment is very feasible, as long there is a working testing setup available (with the pillars and the 'sun' going round).

The materials used for construction of the houses is dependant on the available resources. Participants can at a minimum construct houses out of cardboard and paper or light wood like popsicle sticks.

When more tools are available, some small woodworks and glue can be used for the building as well. Participant can also draw their house on a dxf-format and cut their houses with a laser cutter.



Evaluation of achievements

At the end of the workshop you can give the different groups achievements.

For example for

- The most stable prototype
- The prototype with the most beautiful decoration
- The prototype with the best sustainable materials
- The prototype that would be the most livable (best deviation and orientation of the rooms)
- ...



Content links

You can find interesting links about the following subjects here:

Scales

<https://www.wikihow.com/Draw-a-Floor-Plan-to-Scale>

Google Sketchup

<https://www.sketchup.com/>

Climate Change

<https://www.nationalgeographic.com/environment/global-warming/global-warming-overview/>

Pole houses

https://en.wikipedia.org/wiki/Pole_house

Centre of gravity

<https://www.grc.nasa.gov/www/k-12/airplane/cg.html>

Orientation of rooms

<http://www.level.org.nz/passive-design/location-orientation-and-layout/room-layout/>

Materials

Essential:

Pictures of pole houses

Sketching materials: paper, pens and rulers

Craft materials: paper, cardboard, popsicle sticks, Styrofoam, acrylic glass ...

Craft tools: Stapler, scissors, glue

Light reflectors: Tiny mirrors, aluminum foil,

Platform with poles and a light bulb symbolizing the sun going around the platform in an arc of 270 degrees.

See preparation for details.

2 Lego figures or similar to test light distribution

Platform with poles and a light bulb symbolizing the sun going around the platform in an arc of 270 degrees.

See preparation for details.

Evaluation documents

Optional:

Computer with Google Sketchup.

Wood cutter, Saw, Hammer and nails,

Laser Cutter, 3D-printer, Styrofoam cutter

Microcontroller and light sensor.

Optical chips that can be placed inside the house to check the lighting requirements.

Information sheet - Pole House

What do you have to consider when you divide the rooms in a new house?

1) Orientation with the cardinal directions

It can be very important to look at the cardinal directions of the rooms you want to make in your house. As we all know the sun raises in the East and goes down in the West. In the afternoon the sun will shine on the Southern part of the house.

There are many consequences considering this information. A room that may not become too warm like a storeroom would lay the best in the north. Places where you want to enjoy a lot of sunlight should be in the south.

2) Private – public part of your house

Most of the people divide their house in 2 big parts namely a private part where only people who live there can come and a part where they can receive guests.

Things to think about then will be:

- Which rooms do you want to keep private? Make sure that visitors can walk from the front door to living and to the visitors toilet without passing private rooms.
- The children sleep rooms shouldn't be too close to the living room so the children so they can sleep will without too much noise coming from the living room.

3) Functional groups

a) The wet rooms

Kitchen, Bathroom, toilet, laundry room, etc. Form rooms in which water supply and drainage are required. Grouping these spaces gives certain advantages.

b) The sleeping group

Bedrooms should be in the vicinity of the bathroom and a toilet.

c) The warm group

At last try to group the rooms that will be heated.

4) Reduce the lost space

Try to minimize lost space in corridors. However, do not exaggerate by looking for the solution in very narrow corridors.

ROUND 1

1. Client

Je wil graag een huis bouwen op een landgoed dat je reeks kocht.

Je belangen bestaan er uit om een woning te maken die apart is, die uniek aanvoelt, en toch ook praktisch blijft. Jij let vooral op de opbouw van ruimtes en structuur. Niemand wil vanuit de voordeur in de kelder terechtkomen, of een keuken hebben waar geen licht binnenkomt.

Volgende ruimtes heb je zeker nodig in je woning:

- Slaapkamer ouders
- Slaapkamer kind
- Open keuken (met living)
- Toilet
- Badkamer
- Berging

2. Architect

Je wil graag je **eigen stijl** geven aan het gebouw dat de bouwheer je vraagt om te bouwen. Als architect heb je een eigen stijl en die wil je ook nadrukkelijk laten blijken. Een balk- of kubus-vormig huis zijn uit den boze. Het huis dat je gaat bouwen moet sowieso asymmetrisch zijn.

Het is naast het esthetische ook ten allen tijde belangrijk dat jij de stevigheid van het gebouw in rekening brengt. Het gebouw zou enige natuurelementen moeten kunnen weerstaan.

3. Government

Je verdedigt de langetermijndoelen van de stad. Hou in de gaten hoe de **gevel vanuit stadskant er precies uitziet**. Zorg dat deze er blijft aantrekkelijk uitzien; geen flashy kleuren en geen andere storende elementen. In het begin is je rol misschien beperkt, maar niemand die zegt dat je je niet nog meer zal bemoeien in de toekomst.

4. Bank Clerck

Je ziet er als bank op toe dat er geen onnodige uitgaven plaatsvinden. **Beperk het materiaalgebruik**. Jij houdt ook een oogje op het Kadastraal Inkomen, zorg dat je ten alle tijde weet hoeveel m² bewoonbare oppervlakte het huis heeft. Er moet uiteindelijk nog onderhandeld worden voor een lening.

ROUND 2

Update Client

Je kijkt nog eens kritisch naar het huidige ontwerp. Voldoet het huis aan het gebruiksgemak zoals je het op ogen had.

Update Architect

Je bewaakt je eigen stijl als architect. Ook bij opgelegde aanpassingen probeer je ervoor te zorgen dat iedereen op het eerste zicht ziet dat jij aan de basis lag van het ontwerp.

Je denkt na over mogelijke besparingsmaatregelen waarbij je meer rekening gaat houden met zonnewinsten in de juiste kamers, kortere waterleidingen, ...

Zorg er ook voor dat de plaats waar de paal het huis binnenkomt of aan het huis bevestigd wordt heel duidelijk wordt aangeduid (bv met rode stift). Eenmaal een werkend evenwichtspunt gevonden is dit een permanente beslissing

Update Government

Bouwen in overstromingsgebied is in tijden van klimaatverandering niet ok. De bouwgrond ligt echter wel in overstromingsgebied. Je geeft de bouwheer mee dat hij het perceel enkel mag bebouwen als hij gebruik zal maken van een paalwoning. De paal wordt voorzien van de overheid uit, maar over de dimensies en de eigenschappen kan er niet onderhandeld worden. De paal is ook niet zomaar beschikbaar voor uit te testen, dit moet aangevraagd worden via een complexe procedure.

Update Bank Clerck

Het uittesten van de balans van het huis op de paalwoning is een complexe en vooral dure procedure. Het is erg belangrijk dat jij bewaakt dat dit testen kan beperkt worden tot 1 enkele poging.

ROUND 3

Update Client

Jij volgt de nieuwe bouwvoorwaarden op, en probeert waar mogelijk je initiële eisen en voorwaarden te kunnen behouden.

Update Architect

Een nieuwe studie van het bouwgebied toont aan dat er kans is op sterke rukwinden in dit woongebied. Met de wijziging naar paalwoning baart dat natuurlijk een pak meer zorgen. Vooral uit de **Zuidwestelijke richting worden sterke winden** verwacht. Pas je gebouw aan zodat deze dergelijke windhozen vlot aankan.

Let ook in het algemeen op de structurele stevigheid van je huis. Open ruimtes en ramen verzwakken de stevigheid.

Update Government

Een achterbuur van het perceel waarop wordt gebouwd heeft klacht ingediend tegen de bouw van het huis. Hij klaagt het recht op zijn licht aan. De woning zou namelijk gedurende de dag zijn natuurlijk zonlicht wegnemen. Je onderzoekt de zaak en geeft aan de architect de opdracht om **minstens 50% lichtdoorlatend** te bouwen vanuit de stadskant zodat het zonlicht niet wordt tegengehouden.

Update Bank Clerck

Er is absoluut geen budget meer vrij om de plaats waar de paal aan het huis bevestigd wordt (normaal aangeduid in rood) nog te veranderen. Dit zou een nieuwe structurele studie met zich meebrengen en die kosten daarvoor zijn niet voorzien, er moeten andere oplossingen gevonden worden. Dit is niet onderhandelbaar.

ROUND 4

Update Client

Tijdens een werfbezoek heb je vochtplekken gezien aan de muren. Dit is buiten lelijk natuurlijk ook ongezond aangezien het een broeihaard voor bacteriën is. Je eist als klant dat de woning zo **waterdicht** mogelijk is.

Update Architect

Je probeert aan je voorgaande doelstelling te voldoen ondanks de grote uitdaging van de bank.

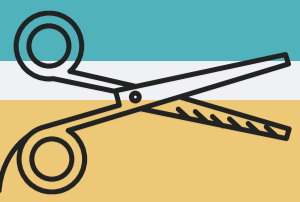
Update Government

Je blijft de standpunten van de overheid verdedigen en ziet erop toe dat er geen bouwovertradingen zullen voorkomen.

Update Bank Clerck

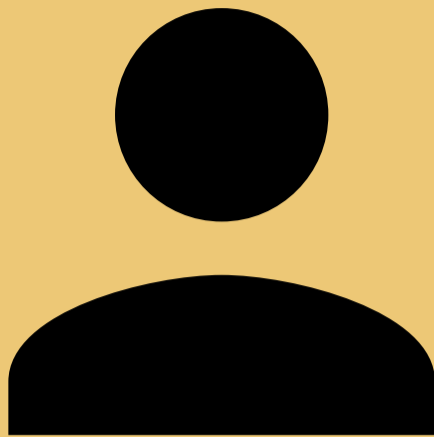
Je merkt dat het budget van de woning volledig opgesoupeerd is. Erger nog: er is teveel geld uitgegeven. Er hoort een drastische maatregel genomen te worden; de **vloeroppervlakte moet met minstens 20% verminderd** worden.

ROUND 1



CLIENT

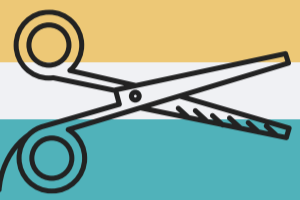
You want to build a house on an estate that you purchased.



You want to create a house that feels unique, and yet remains practical. You pay particular attention to the structure of spaces. Nobody wants to end up in the basement from the front door or have a kitchen where no light enters.

You definitely need the following spaces in your home:

- Bedroom parents
- Child's bedroom
- Open kitchen (with living room)
- Toilet
- Bathroom
- Storage room

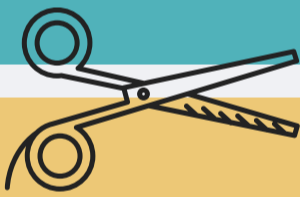


ARCHITECT



You want to give your own style to the building that the client asks you to build. As an architect you have a style of your own and you want to express that explicitly. A beam-shaped or cube-shaped house is out of the question. The house that you are going to build must be asymmetrical anyway.

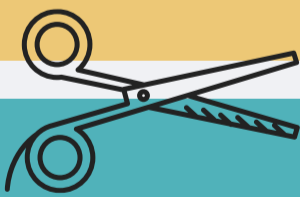
In addition to the aesthetic, it is also important that you take into account the robustness of the building at all times. The building should be able to withstand the elements of nature like rain and wind.



GOVERNMENT



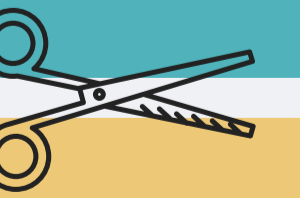
You defend the long-term goals of the city. Keep an eye on how the facade looks exactly from the city side. Keep it looking attractive; no flashy colors and no other disturbing elements. Your role may be limited in the beginning, but no one says that you will not interfere any more in the future.



BANK CLERK



As a bank, you ensure that no unnecessary expenses take place. Limit the use of materials. You also keep an eye on the Property Tax, make sure you always know how much of the habitable space the house has.

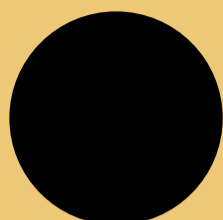
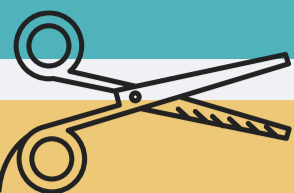


CULTURE LOVER



As a culture and art lover you ensure that there is a culture in the house and various works of art surrounding that culture. You have a work of art 2m by 3m, perfect for the living room, make sure there is room for this work. At first, your role may be limited, but no one says you won't interfere in the future.

ROUND 2



CLIENT

You take another critical look at the current design. Does the house meet the ease of use as you had in mind.



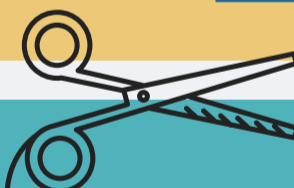
ARCHITECT

You monitor your own style as an architect. Even with imposed adjustments you try to ensure that everyone sees at first sight that you were at the basis of the design. You think about possible saving measures whereby you take more account of solar gains in the right rooms, shorter water pipes, etc. Also make sure that the place where the pole enters the house or is attached to the house is clearly indicated (with a red marker). Once a working balance point is found, it is a permanent decision



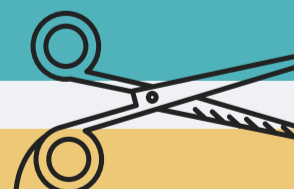
GOVERNMENT

Building in a flood-zone is not ok, certainly not in times of climate change. However, the estate is in a flood area. You inform the client that he may only cultivate the estate if he will use a stilt house. The pole is provided by the government, but the dimensions and properties cannot be negotiated. The pole is also not just available for testing, this must be requested through a complex procedure.



BANK CLERK

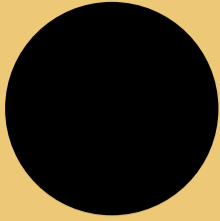
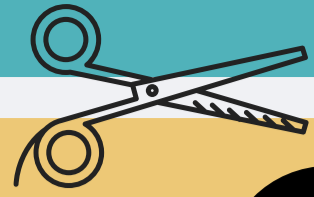
Testing the balance of the house on the stilt house is a complex and especially expensive procedure. It is very important that you monitor that this testing can be limited to 1 single attempt.



CULTURE LOVER

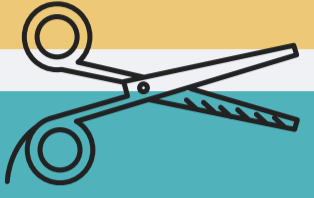
You think the house gives too little culture. Go to the attendant and take a paper from jar one. Here you see a European country. This is the country where the house will be built. Make this visible. Research the culture on the Internet or in the library.

ROUND 3



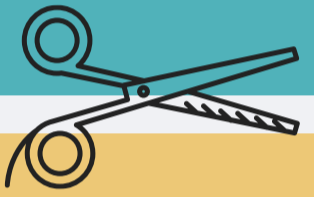
CLIENT

You follow the new building conditions and, where possible, try to keep your initial requirements and conditions.



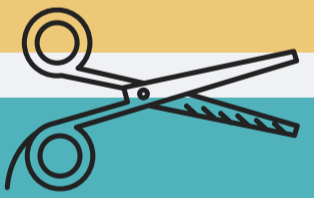
ARCHITECT

A new study of the construction area shows that there is a chance of strong gusts in this residential area. Strong winds are expected especially from the southwestern direction. Adjust your building so that it can easily handle such windbreaks. Also pay attention in general to the structural strength of your house. Open spaces and windows weaken strength.



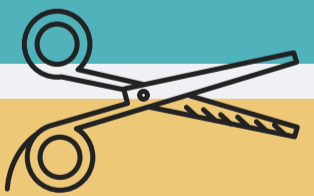
GOVERNMENT

A rear neighbor of the plot that is being built, has filed a complaint against the construction of the house. He denounces the right to his light. The house would take away its natural sunlight during the day. You investigate the case and give the architect the assignment to build at least 50% light-transmitting from the city side so that the sunlight is not blocked.



BANK CLERK

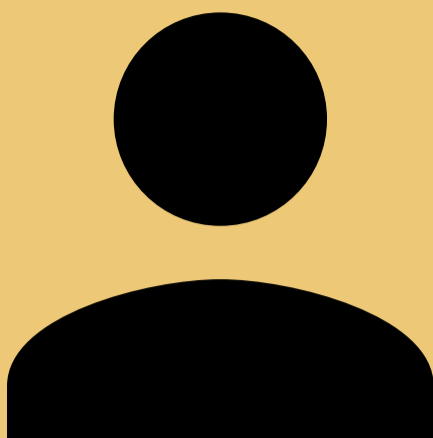
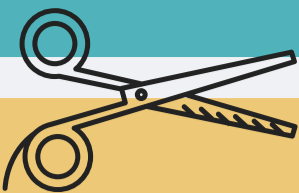
There is absolutely no budget left to change the place where the pole is attached to the house (normally indicated in red). This would entail a new structural study and those costs are not foreseen, other solutions must be found. This is not negotiable .



CULTURE LOVER

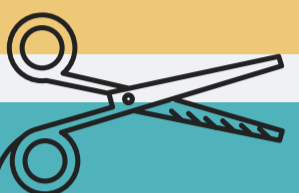
You follow the new building conditions and, where possible, try to keep your initial requirements and conditions.

ROUND 4



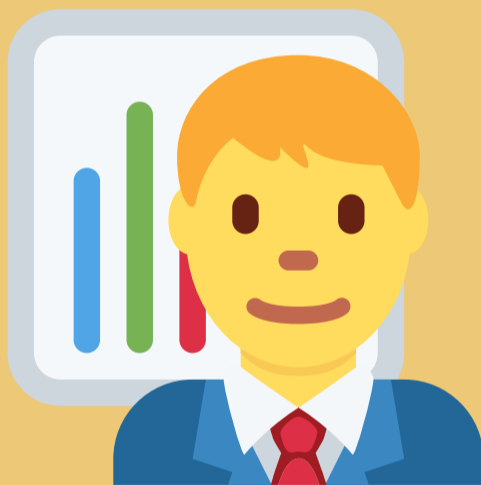
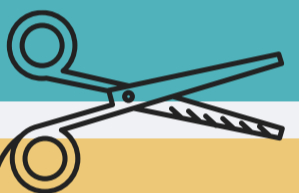
CLIENT

During a site visit you have seen damp spots on the walls. This is of course also unhealthy as it is a breeding ground for bacteria. As a customer, you demand that the home be as watertight as possible.



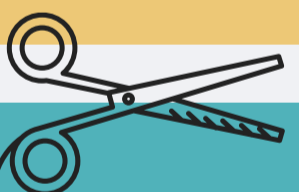
ARCHITECT

You try to meet your previous objective despite the bank's major challenge.



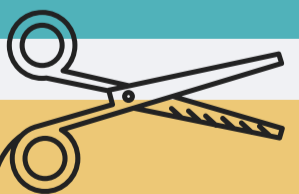
GOVERNMENT

You continue to defend the positions of the government and ensure that no construction violations will occur.



BANK CLERK

You notice that the budget of the house is completely consumed. Even worse: too much money has been spent. A drastic measure should be taken; the floor space must be reduced by at least 20%.



CULTURE LOVER

During a site visit you have seen damp spots on the walls. This is unhealthy as it is a breeding ground for bacteria. It is important for the customer that the house is waterproof. However, you are greatly inspired by the damp spots and want to integrate them into a piece of art that comes to the house.