

# Chain reaction

## focus on programming

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

### Practicalities



Preparation: 2h



Group size range: 20  
Ideal sub-group size: 2-3



Duration: 3h 20'



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



Material needs:



Environment FabLab necessary: NO

- Tapes, strings
- Scissors, utility knife
- Hot glue gun
- Multi-Colored Paper
- Objects that can roll or move
- Robotic kits provided with motors (such as Lego WeDO or Lego Mindstorms) or electronic kits like LittleBits or MakeyMakey



Educational area:

- \* Computer science
- \* Engineering
- \* Science
- \* Technology
- \* (Visual) Arts

*See "Preparation" for a full list of tools and materials needed*

## **Precognition**

Knowledge about relationship between cause and effect.

Knowledge about gravity.

Knowledge about robotic kits programming or electronic kits available for usage during the workshop.

**(see box 'content links' below)**

## Preparation

We suggest to have available different types of materials:

- Objects to build with: scrap cardboard, strings, rubber bands, pieces of wood or scrap building materials, dowels, straws, large paper clips, large domino blocks
- Objects that roll, bounce or move: ping pong balls, tennis balls, rubber balls, wheeled toys, marbles, ...
- Objects to decorate: googly eyes, pipe cleaners, pencils, markers, craft paper, ...
- Objects to inspire: balloons, magnets, funnels, ping pong paddle, chairs ... be creative, any unusual object that you might found around the environment

Depending on the materials you'll need some tools:

- Hot glue guns and glue sticks
- Scissors
- Hacksaw
- Box cutter knives
- A lot of tape



There is no need for a tool for each participant, because it is nice to see the participants walk around asking for and exchange them.

## Technology

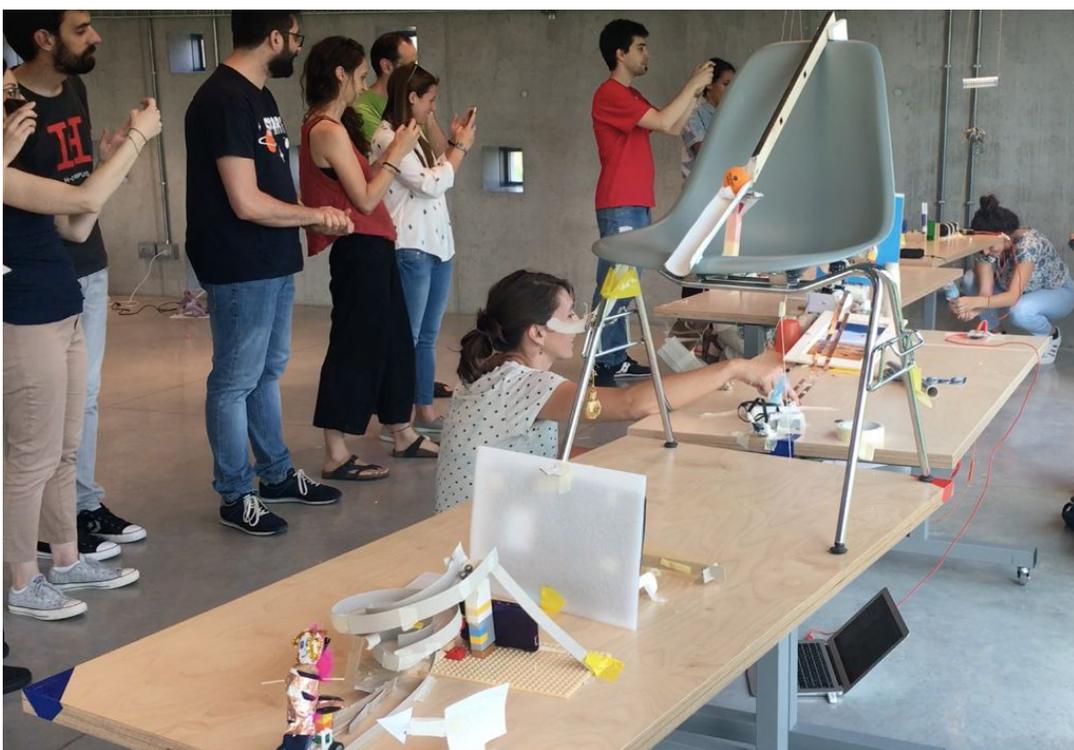
We would like to highlight that, depending on participants knowledge or tools availability, it would be great to add also some small electrical parts to the contraptions. It could be a switch made just with aluminium foil to trigger a small motor or something more complex made with a robotic or electrical kit. For example we usually provide Lego WeDO, Lego Mindstorms, mBot kits or Arduino. If you plan to use such kits we suggest to

prepare in advance small example of programs using sensors to avoid wasting time on the programming part.

### Environment

If available we suggest to arrange the space with tables connected to each other (in line, C-shape or as a snake-like configuration). Each table will be assigned to a group and need to have a starting point (the input) and an ending point (the output). You can also decide to work on the ground, in that case you can highlight starting/ending points with tapes. Just pay attention to the heights since is not easy to find a way to go upwards.

Plan to have some more tables/space for tools and building materials but invite participants to build on their station.



# Workshop Guidelines

## Phase 1: Orientation and Instruction Phase



### Material needs:

#### *Essential:*

- 1 or 2 exemplar videos about chain reaction.
- Tables arranged in a varied shape, with starting and ending point highlighted on it
- Tools and materials on a separate table

#### *Optional:*

- Examples of contraptions
- Theme cards



### Goals:

Skill Goals (**Blue**)

Content Goals (**Green**)

(C1) New uses for everyday objects

(C2) Learning about cause and effect

(C3) **Optional:** Diverse solution to a shared theme



### Background story:

*Chain Reaction is an activity inspired by the whimsical contraptions of 20th century cartoonists and inventors like Rube Goldberg, Heath Robinson, and Bruno Munari, which often revolve around devising an overly complicated way of accomplishing a simple task. Each participant is given space on a table and a collection of everyday materials and found objects to construct a series of events. Then, each individual contraption triggers the start of the one that follows, therefore becoming a component in a large-scale collaborative chain reaction machine across several tables. The relationship between cause and effect is an intuitively simple concept, but one that allows for an incredibly complex and deep investigation into something we experience every day.*

Goals	Activities	Duration
C1, C2	<p><b>Explanation</b> of what is a chain reaction (look up to the background story for some references) and the rules for the challenge.</p> <p>The relationship between cause and effect is an intuitively simple concept, but one that allows for an incredibly complex and deep investigation into something we experience every day. Highlight that by making observations about the ways in which objects behave in relationship to one another, new designs can be realized, constructed, and immediately tested. Seeing common objects such as motors, ramps, toy parts, and kitchen utensils behave in surprising ways leads to unexpected experiments with, and new tests of these things.</p> <p>Feel free to show some videos (you can find some example in the resource section below).</p>	10'
	<p><b>Materials and space exploration</b></p> <p>Give some time to participants to look and touch different materials and tools available.</p> <p>If there'll be technological tools like robotic or electronic kits available, depending on the level of knowledge of the participants it could be better to prepare in advance small example of contraptions to use.</p> <p>If participants are not so confident with the technology available it could be better to leave it for decoration. For example a Makey Makey or a sensor from a robotic kit could trigger a sound or an animation made with Scratch.</p>	5'
C3	<p><b>Optional:</b></p> <p>To inspire creativity you could assign:</p> <ul style="list-style-type: none"> <li>- A specific theme for each station. This could be an object that they need to actually use (eg. a bottle) or something to reinterpret (eg. a “rocket” that could become something that goes up, an “elephant” that could become something that use make use of water...)</li> <li>- A general theme to the chain reaction, such as “space” or “love”. They could use this theme as an inspiration to decorate and</li> </ul>	5'

customize the station. Also they could decide to tell a story as the reaction goes.

Sometimes we ask people to bring one of their beloved object to embed in their station (eg. a puppet, a diary,...). This could be useful if you plan to use this activity for teambuilding.



## Phase 2: Design Phase



### Material needs:

*Essential:* sketching materials: paper, pens, pencils, ...



### Goals:

Skill Goals (**Blue**)

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

(S2) Teamworking

(S3) Rapid prototyping

(S4) **Optional:** communication

(S5) **Optional:** to provide feedback on someone else idea

Content Goals (**Green**)

(C1) Strengths and weaknesses of different materials

Goals	Activities	Duration
S1, S2, S3, C1	<p><b>Make a plan</b></p> <p>Each group needs to brainstorm and draw a sketch of how their station will look like, which kind of materials they want to use to build the contraptions on their station.</p> <p>The expected outcome is a list of materials they need and an explanation of how the contraption works (and how the theme is embedded in the project if you decided to use a theme).</p>	15'
S4, S5	<p><b>Optional</b></p> <p>You can make a circle and ask each group to present and share its idea with the rest of participants. After each presentation ask for feedback from the public. You can organize the feedback with the following guiding questions:</p> <ul style="list-style-type: none"> <li>- Is there something you didn't understand from the presentation?</li> <li>- Is there something you liked about the presentation?</li> <li>- Have you got some suggestions (for example about the implementation of the design or the use of materials or about the contraptions)?</li> </ul>	20'

## Phase 3: Making Phase



### Material needs:

**Essential:** building materials and tools (see “Preparation” section)

**Optional:** electrical or robotic kits (see “Preparation” section)



### Goals:

Skill Goals (**Blue**)

(S1) Trial and error / Deal with failure

(S2) Working in group

(S3) **Optional:** communication

Content Goals (**Green**)

(C1) Strengths and weaknesses of different materials

Goals	Activities	Duration
S1, S2, C1	Each group build their own contraptions with a lot of trial and error :)  If you make use of themes, remember participants to embed it somehow in the contraption or in the station. From time to time remember participants to test not just their own contraptions but also the connection with the following or previous group.	2h'
S3	<b>Optional</b>  <b>Gallery walk</b> To spark creativity guide the whole group through every station and let each team briefly explain to the others how the station will work.  You can do the gallery walk when the stations are almost completed or if you have one or more group that feel they finished their station. This is an opportunity to highlight how they can help other groups or to prevent huge mistakes.	20'

## Phase 4: Operational Phase



### Material needs:

*Essential:* something or someone to ignite the reaction



### Goals:

Skill Goals (**Blue**)

(S1) Trial and error / Deal with failure

(S2) Working in group

Content Goals (**Green**)

(C1)

Goals	Activities	Duration
S1, S2	<b>Final test</b> Let teams try at least once the whole reaction and give them some time to fix problems that could prevent the reaction to work.	15'
S2	<b>Reaction</b> Before the grand finale review the whole reaction going through each station highlighting the expected functionalities. We assure that everything will not work as expected, so ask each group to find one team member to be near the team station. They will use their own “magic finger” to fix last minute problems (like a ball not rolling properly or some domino piece not falling down as expected)	5'

## Phase 5: Evaluation Phase



### Material needs:

*Essential:* Pen and paper



### Goals:

Skill Goals (**Blue**)

(S1) Reflecting on the project

(S2) Communication

Content Goals (**Green**)

Goals	Activities	Duration
S1	<b>Reflection</b> Ask each participant to reflect on their own about the whole process. Provide them with some guiding questions like: <ul style="list-style-type: none"><li>- What did work well in the reaction and in your station? Why?</li><li>- What was the most difficult thing to achieve as a group? Why?</li><li>- How different is the final outcome of the contraptions compared to the design you made on paper at the beginning? Why?</li><li>- How you embedded the theme in the station or in the contraptions?</li><li>- If you had another couple hour what would you add, fix or change?</li></ul>	15'
S2	<b>Sharing</b> Let the participants share their reflection in group.	15'



## Pedagogical tips

The whole activity is about tinkering with materials, working together and gaining confidence in how to design and build a solution.

We invite you to spend some time before the activity trying and experimenting with materials, building your own contraptions.

Facilitating this activity require you to support everyone's ideas, inviting to test contraptions and offering suggestions on how to make things work. We know how difficult it will be, but remember to let the participants explore their own path, without imposing your own ideas about how they might do something.

A couple things usually undervalued by participants are testing and the links between stations (the input and output of each station). This require them to collaborate between groups. Invite them to test not just the contraptions in the middle of the station but also the starting and ending points.

During the activity, even if you don't have time for the gallery walk, invite groups to take a look on different solutions and what's happening around.



## How to transfer to (non-)Fablab environment

Transfer to non-fablab environment is very feasible, as long there is enough space available. The materials used for construction of the reaction is dependant on the available resources.



## Evaluation of achievements

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

- The most original use of an everyday object
- The station with the most beautiful decorations or use of the general theme
- The most collaborative team or the team that helped more other teams
- The station that actually worked, or that worked as expected



## Content links

You can find interesting links about the following subjects here:

Tinkering Studio [project page](#) and [activity guide](#)

Tinkering Studio [Instructable page on creating workshop elements](#)

Some inspirational videos:

- [OK Go - This Too Shall Pass - Rube Goldberg Machine](#)
- [The Page Turner | Rube Goldberg | Joseph's Machines](#)
- [Tinkering Zone - Chain Reaction \(videoclip\) | Museoscienza](#)