twin

Spreading the Joy of Science

ROBOTIC ART KIT USER'S GUIDE

CONTENTS

WHAT IS TWIN?

FREE MINDS

UNIQUE EXPERIMENTS

CONFIDENT INDIVIDUALS

Twin is a robotics kit that develops creativity in a fun and **instructive** way.

It feeds the curiosity in our nature, shows how simple and easy-to-understand science is, and encourages us to do more.

“Science is to apply science; science is to know thyself.” Yunus Emre

Twin consists of electronic modules that can be attached with magnets. It requires no risky process of welding. We aim to make the science and technology popular and develop the sense of know-how for the public.

With Twin kits, children and teenagers are able to develop the latest technology of robotics and autonomous cars by simple attachments. With the projects we provide, they will be able to develop their own unique projects to provide solutions to world problems. At advanced stages, we shall provide the kids with the scientific knowledge of the projects they have performed to complement the “learning by doing” concept.

The kids that play with Twin;

- Have creativity,
- Have dexterity,
- Have their best dreams realized!

Kids can also enjoy playing with their LEGO® bricks to the fullest because Twin is compatible with LEGO® bricks!

TWIN AS A SOCIAL PROGRAM: Latest Technology to the Remotest Rural Areas

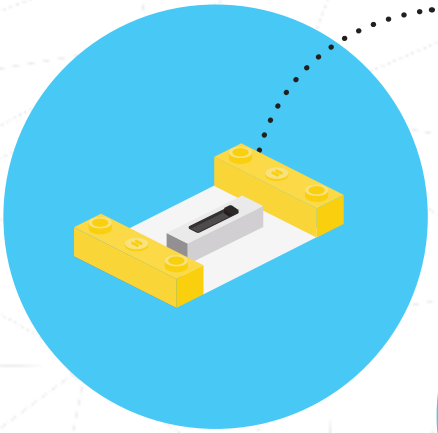
We believe that the human knowledge and love grow by sharing. Twin not only presents the most advanced technology to the kids, but it also delivers it to those in the most disadvantaged echelons of the society.

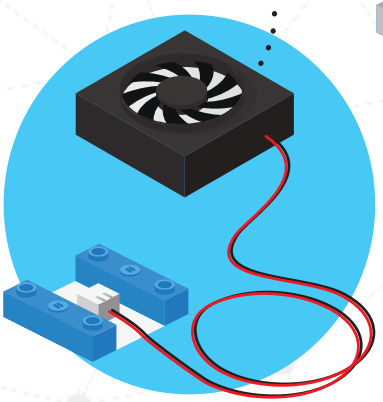
Twin implies being two-winged by heart and mind. We dream of spreading the Twin concept of creating and sharing to the world. Twin as a social program works within the scope of a global Science Movement campaign of YGA (Young Guru Academy) worldwide, in partnership with universities, education and training centers as well.

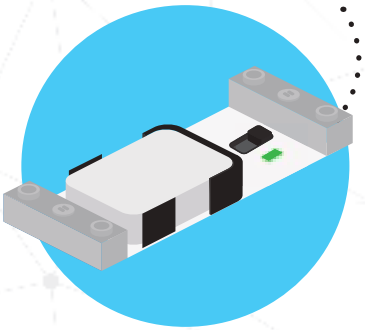
By purchasing this kit, you’ve contributed to the Science Movement Campaign extending to the remotest villages.

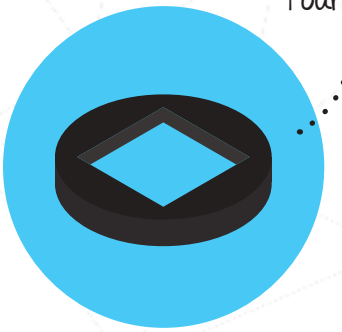
Twin is a start-up founded by YGA graduates. It has been developed with the guidance of Turkey’s first science Nobel laureate **Prof. Aziz Sancar**, Harvard & MIT **Prof. Mehmet Toner** and **Prof. Doğan Cüceloğlu.**

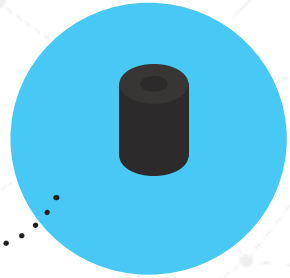
WHAT IS INSIDE THE ROBOTIC ART KIT?

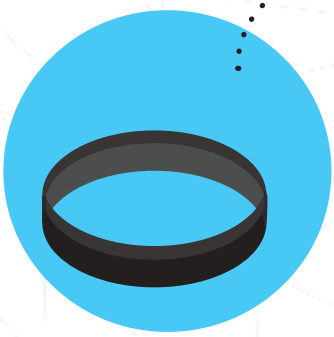

Slide Dimmer

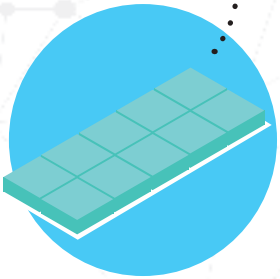

Fan

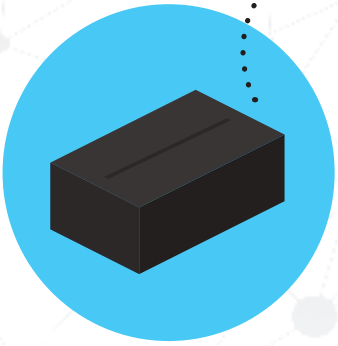

Power


Fan Header
Foam

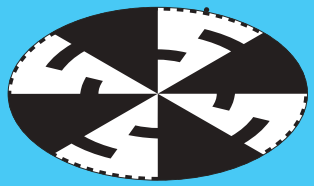

Round
Foam


Foam Ring

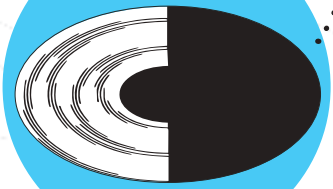

Sticky
Putty


Thaumatrope
Foam

Benham's Top



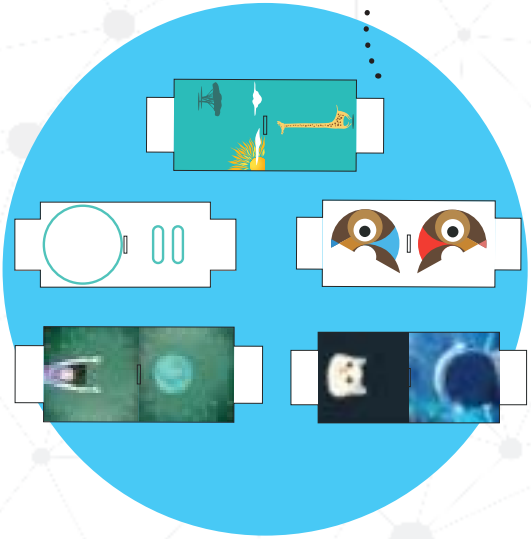
Benham's Top



Color Wheel

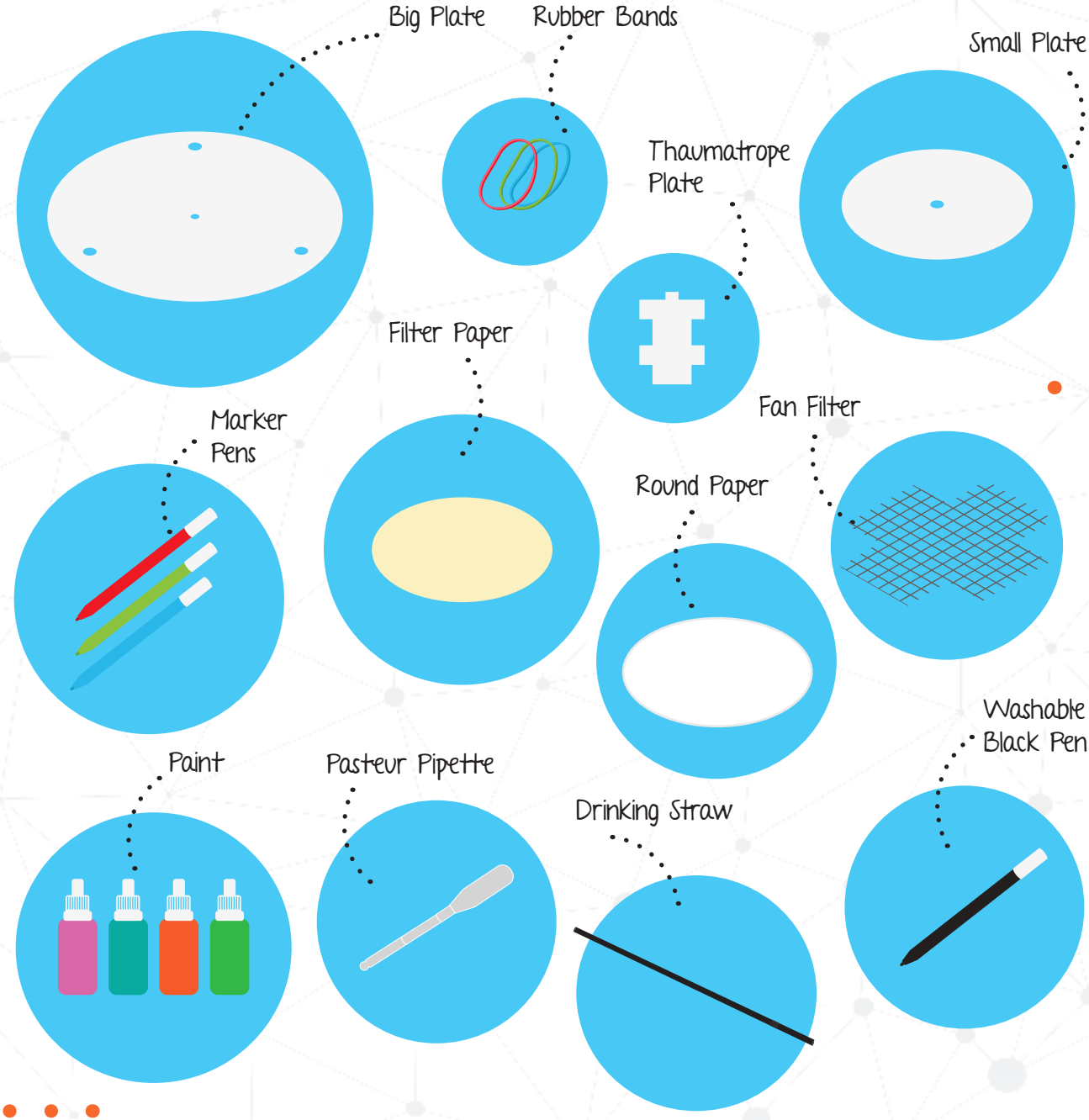
Newton Disc

Thaumatrope Cards

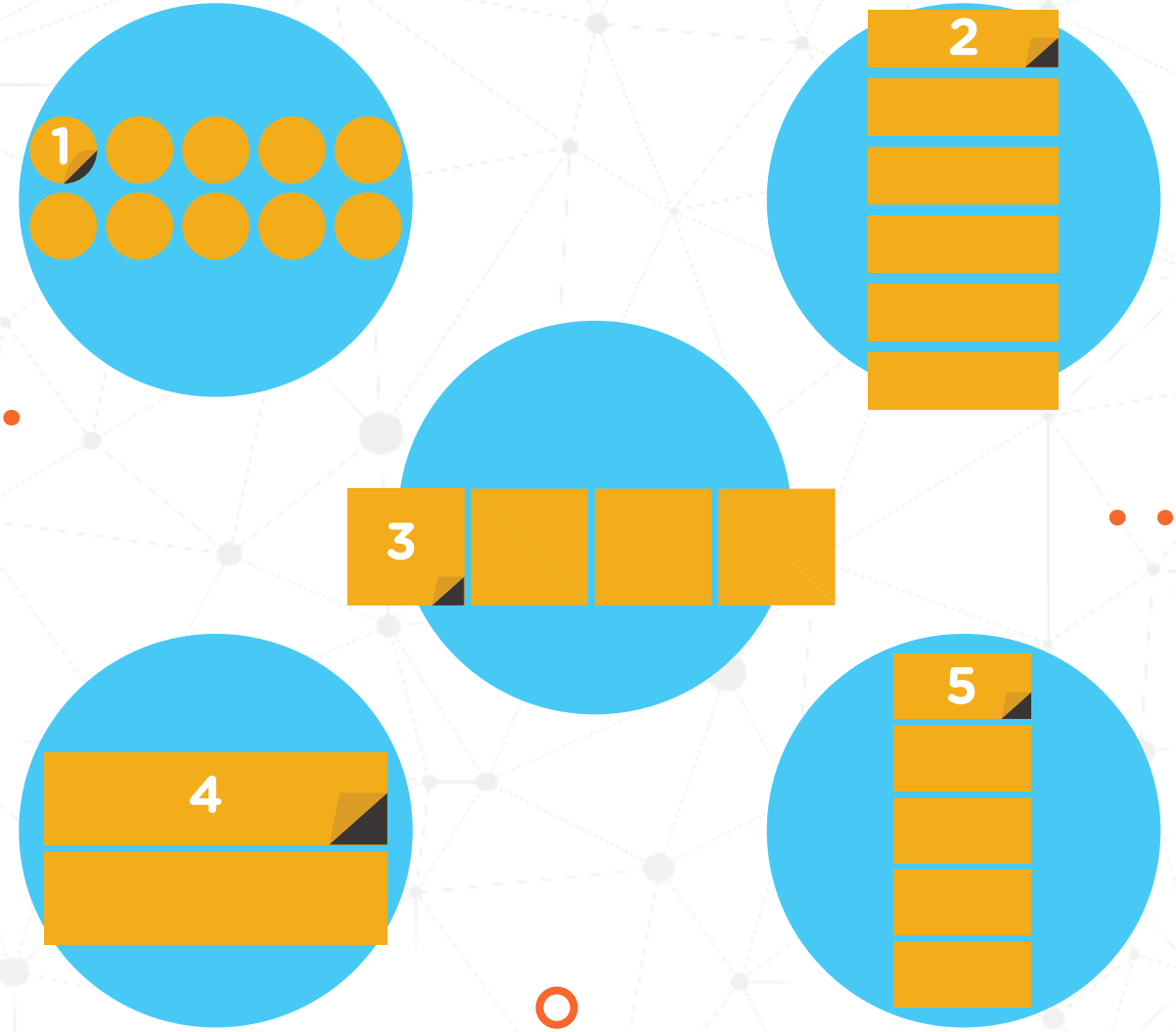


Vacuum Paper

Confetti Paper

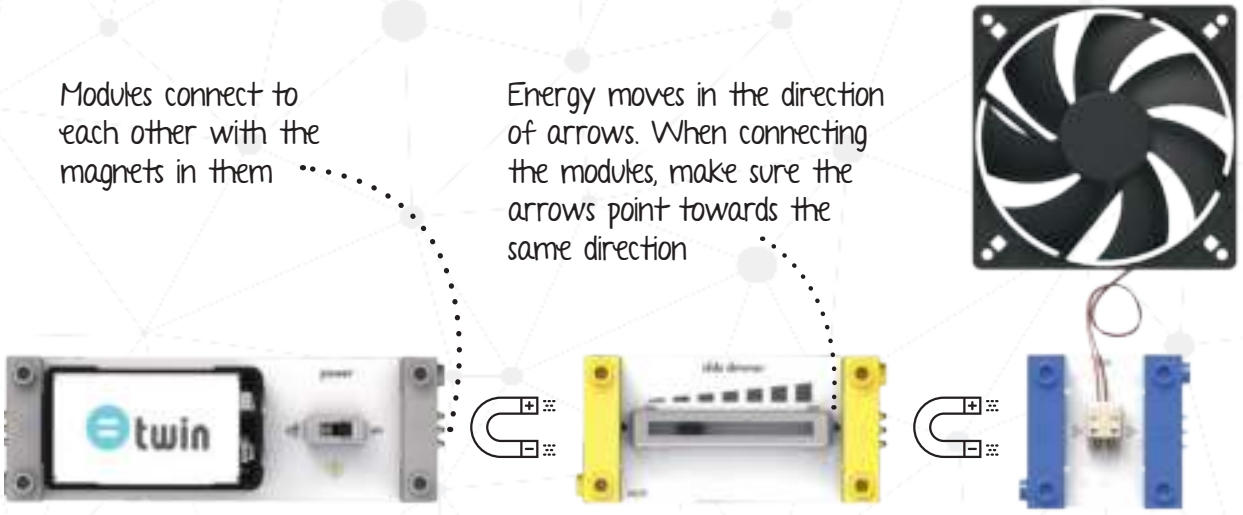

Big Plate
Rubber Bands
Small Plate
Thaumatrope Plate
Filter Paper
Marker Pens
Fan Filter
Round Paper
Washable Black Pen
Paint
Pasteur Pipette
Drinking Straw

Tape Numbers



MEET THE TWIN MODULES

Place the modules next to each other to connect them.



Color Codes of Modules

power

Power modules come first and provide power for the circuit to work.

input

Input modules send signals to the module that comes afterwards.

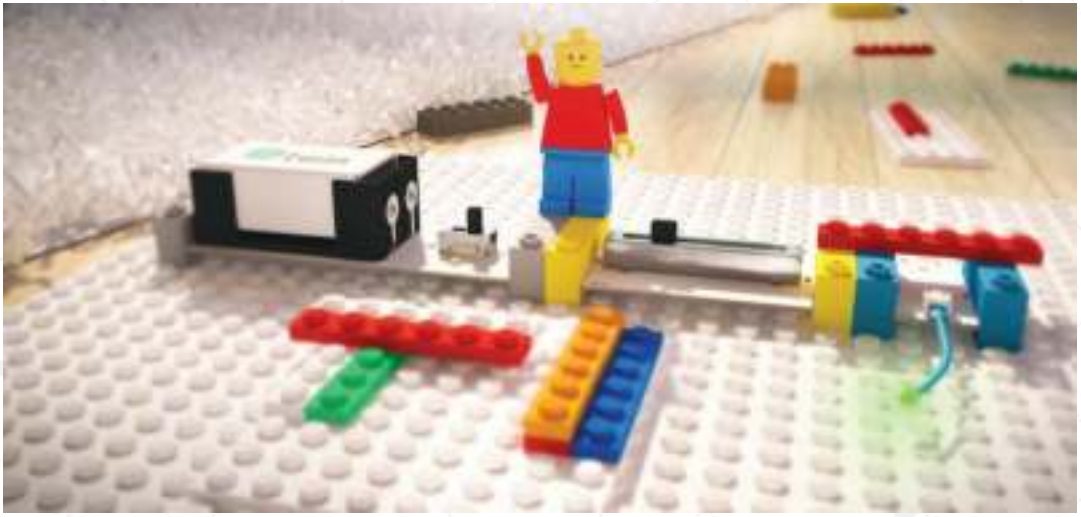
logic/transmission

These modules allow you to expand and change the direction of your circuits, as well as controlling modules.

output

Output modules produce output such as sound, motion, and light.

The Robotic Art Kit contains power, input and output modules.
You can create circuits by connecting grey, yellow, and blue modules in that order.



Twin modules have been designed to be compatible with LEGO® bricks.
You can prepare your circuit and combine it with LEGO® bricks as you wish.

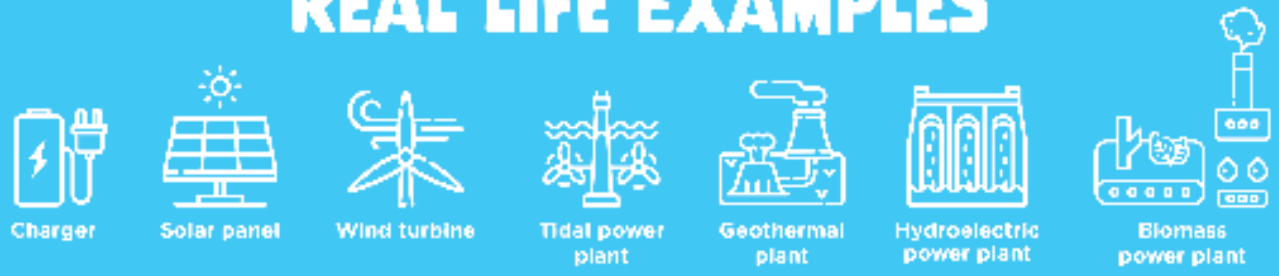
POWER

The module transfers the energy from the battery to the circuit.
The switch on it allows for the energy flow to be turned on and off.

You can get energy from both sides of the module

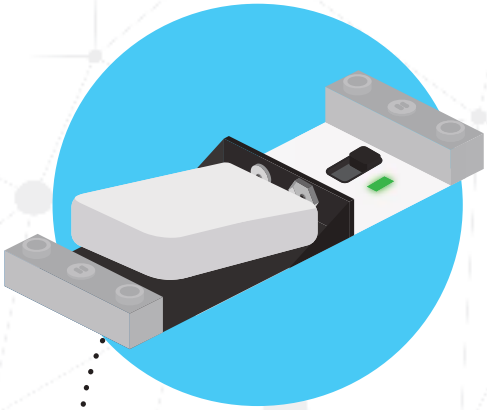
Turn the switch on.
Did the light turn on?

REAL LIFE EXAMPLES

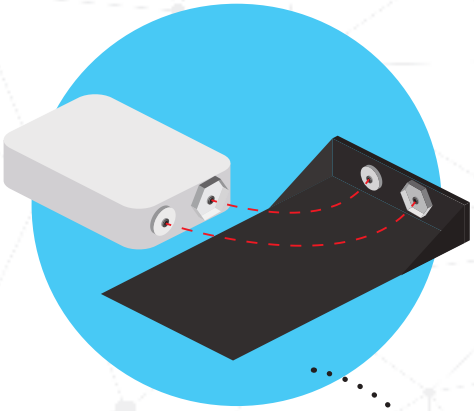


How It Works

The battery you use produces 9 volts of electricity. Twin modules work with 5 volts. What does the power module do, then? It converts the voltage of the battery to 5 volts and makes it compatible with the modules.



Make sure the "+" and "–" connections are done correctly as shown in the image



Make sure the circle tip of the battery aligns with the hexagonal slot on the module

Warning!

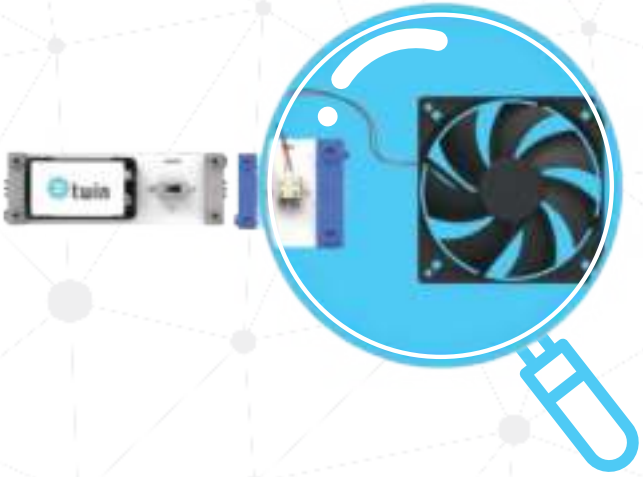
Incorrect connections may damage the circuit.

For the Curious

Alkaline batteries create electricity through a chemical reaction between zinc and manganese. The chemical energy is converted into electrical energy.

FAN

This module that rotates using electrical energy creates a gentle breeze.



Let's Try

Connect the fan module to the power.
Hold your hand over it. Can you feel the breeze?

How It Works

The fan module contains an electric motor.
The motor converts electrical energy into motion.

For the Curious

Can you guess how many times the fan rotates every second? At maximum speed, the fan turns at 91 rotations per second. Calculate number of rotations per minute.

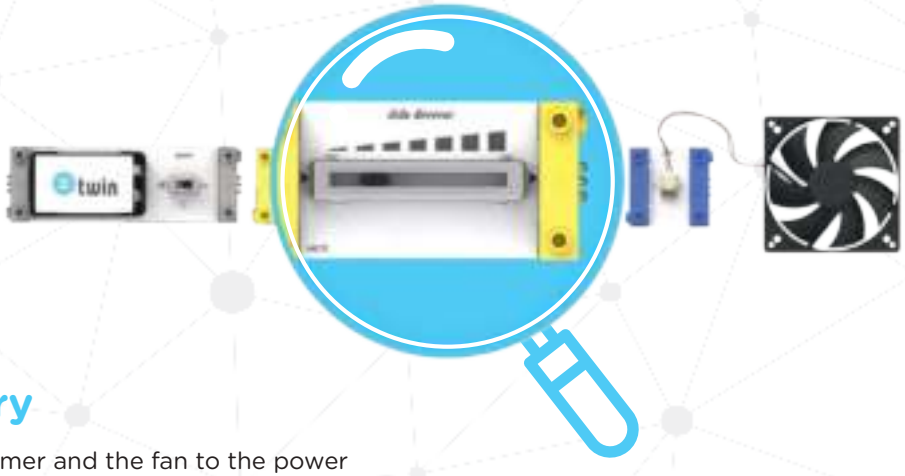
REAL LIFE EXAMPLES

Room fan

Computer fan

SLIDE DIMMER

It's time to control the fan's speed! The strength of the electrical signal changes as you move the dimmer back and forth. This allows you to control the fan's speed.



Let's Try

Add the slide dimmer and the fan to the power module. Move the slide dimmer and control the speed of the fan. Is it too hot? Make the fan spin faster!

How It Works

The slide dimmer changes the voltage of electrical signal between 0 and 5 volts.

For the Curious

Have you heard of a potentiometer before? The slide dimmer has a potentiometer in it, which allows its electrical resistance to increase or decrease. As you move the slide dimmer, you control its resistance. This allows for the energy that is transferred to the circuit to be controlled.

REAL LIFE EXAMPLES

Gas pedal

Light dimmer

Speaker volume control

DISCOVER TWINNER

Finished booklet?
Find more projects in the Twinner mobile app!

You can download the **Twinner** mobile app
from **Google Play** or the **App Store**.

Download on the App Store

ANDROID APP ON Google play

PROJECT TIME!

GET READY FOR THE WORLD OF COLORS

Necessary Modules

Power

Slide Dimmer

Fan

Materials

Small Plate

Sticky Putty

Round Double-Sided Tape No. 1

Round Foam

Double-Sided Tape No. 3

Time to Prepare

Empty the Robotic Art Kit box.
Use tape no.3 to place the fan in the middle of the box
We will use the box to keep our surroundings clean

Connect power, slide dimmer, and fan next to each other
Make sure the modules are placed outside of the box

Stick tape no.1 on the round foam

Place the round foam on the fan's center

Place tape no.1 on the foam

Stick the plate on the foam
Make sure the holes on the plate and foam are aligned

You are ready now to explore the world of colors.

SPIN ART

Learn Step by Step

Stick the round paper on the plate using sticky putty

Turn on the power. Slide the dimmer all the way forward and drip the colors you want on the spinning paper

Wait a couple seconds for the paint to mix

Turn off the switch on the power. Your artwork is ready!

Let's try other colors!

20 MIN. BEGINNER LEVEL

KNOW HOW

Like every object that has mass, paint has **inertia**, meaning that it doesn't want to change its movement. Just like how you feel being pushed when in a rotating car, the paint on the rotating plane experience a similar force. Since they don't have a seatbelt to hold them, they fly around and create these wonderful patterns.

COLORS IN BLACK

Learn Step by Step

Black paint is actually very colourful! Surprising, but true. Would you like to learn how? Prepare a glass of water for this experiment. Let's start!

Stick the filter paper on the plate using sticky putty

Turn on the power. Slide the dimmer all the way forward. Wait for 10 seconds for the fan to speed up. Use the tip of the washable black pen to draw circles on the paper

Touching the circle with the pen is enough to draw the circle

Draw water from the glass using the Pasteur pipette and start dripping on the paper

15 - 20 drops is enough

What do you see?

Warning

Use at most one pipette of water, depending on the number of circles. Using too much water will damage the circuit. Do not put modules in direct contact with water. Aim for the paper!

20 MIN. INTERMEDIATE LEVEL

KNOW HOW

In this experiment you saw how black seperated into its colors. Black paint is made by combining paint of all colors. What causes an object to appear in a certain color is the light it reflects. For example, something you see as being red reflects red light while absorbing all others. Do you know how we see the color black? Black is seen when no light is being reflected. When you mix paint of all colors, all colors of light are absorbed and the object is seen as black.

For the Curious

Why did you use **filter paper** instead of **regular paper** for this experiment. Take one piece of each in your hands and touch the surface. The filter paper is rougher due to its more **porous structure**. The wider distance between the fibers of the paper allows the filter paper to absorb more water.

This paper has another important property. The **capillaries** inside the filter paper allow water molecules to move inside. If you drip water to one part of the paper, it travels to other areas. Trees have similar structures in their trunks. Which allows for water to be easily carried from the roots to the leaves of the plant.

COMBINING COLORS

Learn Step by Step

Do you want to surprise your friends?
Spin the disks and create visual illusions!

Stick the color wheel on the plate using sticky putty

Turn the switch on and make sure the slide dimmer is at maximum

Did it start to move?

Observe how the red, green, and blue combine to create new colors

Make your own color wheels to observe new color combinations, discover the world of colors!

15 MIN. INTERMEDIATE LEVEL

PRIMARY COLORS OF LIGHT

PRIMARY COLORS OF PAINT

KNOW HOW

Computers and televisions use the **RGB** color code. Do you wonder what that means? It stands for Red, Green, and Blue. The colors you see on the screen are created by these three colors being combined in different ratios. The primary colors of light and paint are different. The primary colors of light are red, green, and blue whereas the primary colors of paint are cyan yellow, and magenta.

The human eye has receptors for three colors: red, green, and blue. Every color you see is a mixture of these three. We used these three colors in the experiment so that the reflected light from these three colors combined to seem as new colors to our eyes.

For the Curious

Do you wonder how screens work? You've probably heard the word **pixel** before. Pixels are the smallest building block of screens. Every one of them is, in fact, made up of three small light sources. A different ratio of red, blue, and green light creates the colors on our screens.

Have you heard of the word **resolution?** The resolution of a screen represents the number of pixels on it.

For example, a screen with a resolution of 1920 x 1080 has 1920 pixels across and 1080 pixels down the screen.

NEWTON DISC

Learn Step by Step

The illusion continues!

Stick the Newton Disc on the plate using sticky putty

Turn the switch on and make sure the slide dimmer is at maximum

Did it start to move?

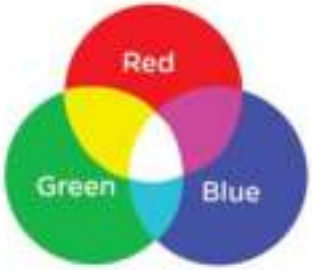
What color do you see?

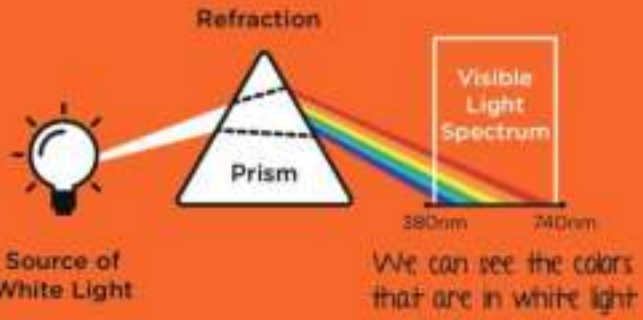
15 MIN. INTERMEDIATE LEVEL

For the Curious

Our eye does not record the world as a continous video. Instead, it takes around 24 photos per second. The spinning of the disc is much faster than our eye and this causes different sections of the disc to overlap. This leads to the **colors combining** and creating the color **white.**

PRIMARY COLORS OF LIGHT





KNOW HOW

In "Colors in Black" project we saw how all paints mix up to create black paint. In this project, however, when this disc rotates, the light combines. Since all colors of light are combined, we see it as white.

MYSTERIOUS COLORS

Learn Step by Step

Have you heard of Benham's top before? With this project, you can learn all about it and impress your friends.

Remove the small plate and place the big plate on the foam using the round tape

Stick the Benham's top on the plate using sticky putty

Turn the switch on, slide the dimmer forward, and watch the illusions that form

To observe the illusion make sure the speed of the fan at minimum

Even though the Benham's tops are in black and white, their rotation frequency deceives the eye and makes them look colorful

Don't forget to check the other Benham's top!

20 MIN. INTERMEDIATE SEVİYE

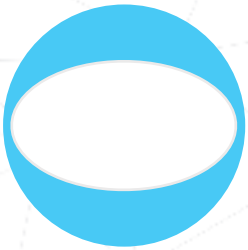
KNOW HOW

Even though the Benham's top is in black and white, it creates an illusion that makes it seem colorful. To understand how our eyes see colors that don't actually exist, we must first look at nature.

To gain color, plants mostly form pigments on their own whereas animals get it from what the plants they consume. Some animals with wonderful colors, such as butterflies and peacocks, use some pigments to get certain colors. However, the special patterns in their tails and wings **reflect** and **refract** light in special ways so as to create the amazing colors we see.

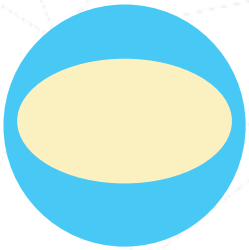
DON'T GET SAD IF YOU RUN OUT

If you run out of materials you can still keep doing your projects with the following supplies.



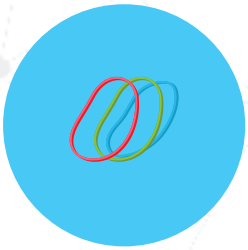
Round Paper

You can use round paper with a diameter of 9 cm. If you want, you can use paper of different sizes and shapes



Filter Paper

You can use blue ribbon or white ribbon filter paper with diameter of 9cm

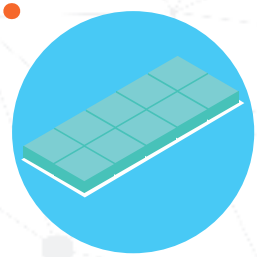


Rubber Bands

You can use any rubber bands you want

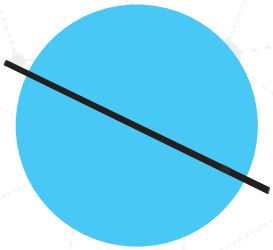
Paint

You can use any gouache or acrylic paint to fill the tubes. You may need to dilute the paint if it is too dense



Sticky Putty

You can buy sticky putty easily from any office supplies store



Drinking Straw

You can use any straw with a diameter of 6mm

Marker Pens

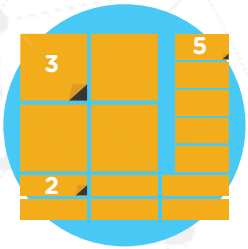
You can use any marker pen you want.

Washable Black Pen

You can use any washable felt-tipped pen you want.

Double Sided Tape -1

You can get adult supervision to cut the following pieces of tape
Tape 4 – Rectangle with sides 16 x 3.5 cm
Tape 1 – Circle with diameter 2 cm



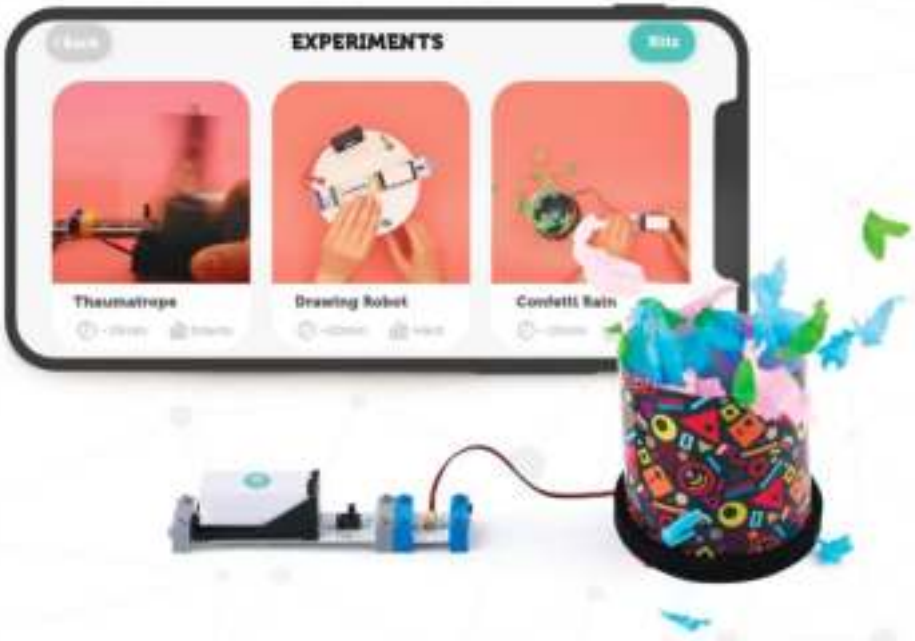
Double Sided Tape -2

You can get adult supervision to cut the following pieces of tape
Tape 3 – Square with sides 5 x 5 cm
Tape 5 – Rectangle with sides 4 x 2 cm
Tape 2 – Rectangle with sides 5 x 1.5 cm

EXPERIMENTS IN TWINNER

The adventure continues on Twinner!

To explore the new projects you can do with the other materials from the kit, you can check out the Twinner app. Don't forget to download it!



You can download the **Twinner** app to your device from the **App Store** or **Google Play.**

Download on the App Store

ANDROID APP ON Google play

Warnings

- This set contains chemicals and/or pieces that may be harmful in misuse. For proper use, please read the warnings inside the box and the entire booklet carefully.
- The box and the booklet contain important information and warnings. For proper use, keep the box and the booklet for future reference.
- This product contains small magnet(s). Swallowed magnets can stick together across intestines causing serious infections and death. Seek immediate medical attention if magnets are swallowed or inhaled.
- Twin modules contain small parts. DO NOT allow children under 3 years old to play with or near this product. – Choking Hazard
- Some of the Twin modules contain long cords. -Risk of suffocation.
- Do not connect Twin modules to an electrical socket or to a source of alternative current.
- Keep conductive materials away from sockets and the circuit.
- Turn the circuit off when not in use.
- Do not use Twin modules near water or other liquids. Do not use the modules inside a liquid and avoid spilling liquids on the modules.
- Do not use the modules in extreme conditions. Do not use the modules in very hot, very cold, very humid, dusty or sandy places.
- Make sure the modules are clean before using them. The magnets can stick to small metallic pieces and prevent modules from connecting.
- Make sure the connectors of the modules are clean if there are issues with modules' connections.
- Some modules may heat up due to how they are used. If the modules reach extreme temperatures reassess the circuit and stop using the overheated parts.
- Remove any broken or damaged modules from the circuit and stop using those modules.

Important Note: **Several projects in this kit involve the use of a scissors. These tools should be used ONLY under direct adult supervision and ONLY by children capable of using them safely.**

Electronic Waste

Warning! Pieces that have been marked with this symbol contain components which are harmful to nature and to people and should not be discarded alongside other waste. If discarded improperly, the process might cause harm and will be subject to legal punishment. These components should not be used incorrectly. It is forbidden to remove these electrical and electronic components from the toy or using a damaged product. These actions may be harmful.

Electrical and electronic waste must be collected separately and should be passed to designated waste collection sites. Alternatively, you can get in contact with your place of purchase and ask for return the product for disposal back to the shop when a similar product is purchased. Users of the product play a vital role in the collection and discarding of those which have completed their life cycle. For further information, contact your local authorities.

Battery Warnings 

The symbol on the right means that the battery should not be discarded alongside home waste due to its harmful and/or toxic contents. Batteries should be taken to the nearest recycling or waste collection station to be discarded. Dispose of all batteries in accordance with current regulations, by using the appropriate containers at an authorized recycling center or by returning them to the shop where they were purchased. Penalties are applied for incorrect disposal. For further information, contact your local authorities.

- Batteries are dangerous if swallowed; keep away from children.
- Pay attention to the battery's + and - poles when using
- The insertion and removal of batteries should be done with an adult's supervision.
- Do not short circuit the battery by connecting the ends.
- Remove batteries once they have run out
- Do not attempt to recharge non-rechargeable batteries
- Rechargeable batteries should be removed before being charged.
- Rechargeable batteries should be recharged with adult supervision
- Do not try to open the batteries
- Do not expose the batteries to high temperatures and fire. They may explode or leak
- Remove the batteries if the device will not be used for a long time
- Only use recommended batteries
- Discard used batteries carefully at designated disposals.

Cleaning the Modules

Only clean the Twin modules when they are not connected to electricity and only with a dry or slightly damp towel with isopropyl alcohol.

Frequently Asked Questions

- **One of the modules isn't working. What should I do?**
  Check if the module has been connected correctly. Clean the connectors as instructed in the guide. If it still isn't working, you can send an e-mail to **support@twinscience.com**
- **What is the recommended age for the Robotic Art Kit?**
  Because of the electronical and magnetic parts, 8+ age is recommended.
- **I have finished the sample projects in the booklet. Where can I find more sample projects?**
  You can access all project instructions, videos, and codes from the Twinner mobile app. Do not forget to check website, YouTube channel and social media account for more projects..
- **I am having trouble with sample projects in the booklet. How can I get support for the projects?**
  Check Twinner mobile app. You can find all projects' detailed videos and instructions in the app.
- **Where can I download the mobile app?**
  You can download it from App Store or Google Play Store. Do not forget to create an account to use the application fully.
- **Can I connect my Twin modules with LEGO® bricks?**
  Twin is fully compatible with LEGO® bricks. You can use them to create as many projects as you wish.
- **Which batteries are recommended?**
  9V alkaline batteries are recommended. Make sure your batteries' quality is good.
- **What should I do if I run out of materials?**
  Take a look at "Don't Get Sad if You Run Out" part.

Reach Us

Feel free to reach us for your all questions, feedbacks and demands.
Reach us via e-mail: **support@twinscience.com**

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