

TINKERING



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Tinkering is about making stuff. Taking things apart, putting things together, figure out how things work, and attempting to build and make creations using tools. The process of tinkering allows young people to When solve a problem or invent something new, it involves thinking, imagination , make plans, work together, testing ideas, solve problems, improve their ideas to make them better, and share their ideas and creations with others. These are the thinking processes and actions that scientists and engineers use. These professionals, when faced with a challenge, solve real-world problems that often come with constraints, including limited materials, time, and funds to develop solutions.

Tinkering therefore is an essential life skill and a key part of the interaction of our team systems in our sections - Lodges, Sixes, Patrol, Crews. Tinkering takes time, at a meeting we can perhaps introduce the idea of tinkering with small challenges and projects, to really achieve its value it needs a morning or afternoon to extract the most value from the activity.

Tools are required and a collection of things to use to make and create stuff. The ultimate goal is to enable young people to think creatively, take risks, and solve problems. Just as engineers solve problems everywhere. Keep safety in mind, without restricting the use of tools. Using real tools involves letting young people take and manage risks. Using tools also promotes a sense of independence but it is important to know how to use the tools safely. If you notice a safety risk, point it out and use it as an opportunity to teach safe handling techniques.

Engineering starts with a problem to be solved: "We need a bridge" or "We need a house to live in." Tinkering starts with much simpler questions: "What can I do with this?" or "How does this work?". The comparison can be made between pioneering

and gadget making. Large scale pioneering is an engineering activity building with structural frames, strong lashings, pulleys and ropes. Whereas gadget making is more of a creative activity, a novel way to make a pot stand or a coat hanger.

Recycling is also an activity in the tinkering space - how can I modify this item - a milk carton to make a bird feeder or how can I turn this drinks can into a car or a popcorn maker. By recycling items we can engage in scavenging - stripping apart an item to harvest the parts and reuse them to create something new. Most electronic items can be opened up to strip all sorts of components for memory boards - just because an item does not work does not mean that all its parts are broken.

When things are taken apart, participants discover how the parts work together and gain insight into how to put components together in ways that create something new. Broken mechanical toys provide cogs and wheels, levers and button mechanisms. Electronic items contain motors, battery packs, wiring, buzzers and vibration parts and lights.

When tinkering, you learn about the properties of materials and the capabilities of tools. Fine motor skills and eye to hand coordination are also developed. Using tools and having the confidence to use tools become a practical life skill. There will be small accidents and some cuts and scratches along the way but then 'learning by doing' is a key principle that tinkering exploits.



THE ART OF SCAVENGING

Most of the current products we see around us are comprised of a parts - inventions in themselves that are pieced together to make a new invention. Every product is a treasure chest of parts that can be used and recycled into new and re-purposed inventions.

In creating a prototype or trying to understand the workings of a new invention a lot can be learnt by taking apart similar products and discovering how they are made and how problems with space, technology and science are overcome.

Old appliances, that are not working for one reason or another can be taken apart with little more than a screwdriver and basic tools. Small switches, motors, cogs, wiring, electronic components, battery chambers, sensors are just some of the items that can be salvaged. The plastic framework is also useful and can be remodelled as required.

Skips are another useful place to discover some space building materials - bits of timber, insulation board or large cardboard sheets. It is always a good idea to ask permission and keep the skip tidy after your rummaging. Industrial appliances such as discarded photocopiers, printers and computers provide a vast array of components - cogs and wheels, small motors and useful metal parts and assemblies.



DISCOUNT STORES AND CHARITY SHOPS

The local discount store will also yield a collection of useful items - not exactly free but for a reasonable price. Small items such as a cooling fan can be broken down to reveal - a small DC motor, battery compartment, sensors, propeller, a length of cord and other little useful bits. If you had to buy and source each of these items from a supplier it would cost you a considerable amount of money.

Charity shops and your home attic are also good places to find construction toy pieces and collections of old parts. These can be useful for making the body of your invention and for supporting the structure of internal parts.



Keep components in small tubs and containers so that you can easily find the bits you need. Springs, washers, screws and clips they are all valuable.

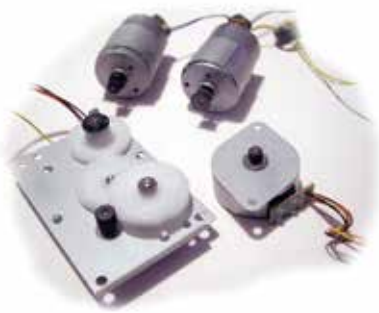


BICYCLES

Bicycles are constructed from many smaller parts and with a little bit of effort you can release from the frame, cogs and chains, wheels, brake assemblies, dynamo's, reflectors, seat and a strong metal frame. In many places around the world local people have redesigned the basic bicycle frame and used it to create man-powered machines and to carry large weights to local markets.



Try and keep cogs and wheel components together within their assemble. An engineer will have spent many hours designing the assemble and as 'one unit' it might be more useful to you than as a collection of mismatching cogs and wheels.



Motors will also have different strengths and torques. Keep AC and DC motors separated and salvage them with wire tails attached.



Toys

Simple and complex discarded or broken toys can also be taken apart to supply you with wheels, axles, cogs and wheels mechanisms, wind up mechanisms and much more. Robotic toys such as walking pets and action figure again will supply robotic components, small motors, sensors, battery compartments and small switches. Some will also provide remote control electronic boards and controllers.



TOOLS

The invention process in two-fold dreaming up a new idea and working out how it will work and secondly building and creating a prototype. In the first phase, a space needs to be provided for each team. This work space needs a table, chairs, pens and paper. As it is a creative environment it is also good to have internet connection available and perhaps a collection of magazines and books that can be used to spark the imagination or create mood or invention boards.

The second phase is a construction, development phase when a prototype will be made and tested. If it is a product or physical item then a collection of tools and materials needs to be available - perhaps in a pool - that teams can draw from. A list of possible materials and tools is provide below.

Within the pages of this manual we have also explored the idea of scavenging for particular parts and the breaking down of existing products, this is also an option. Each phase requires some time to complete and often teams need to go away and find particular parts, through scavenging or working out how they will produce a prototype.

What is important is the process of exploration and discovery.

Craft materials
Lollipop sticks
Bluetac
Sellotape
Bendy straws
Pritt sticks
Corks
Fabric
String
Markers
Pipe Cleaners
Paper cups and plates
Paper clips – plastic covering
Cocktail sticks
Thumbtacks
Mechanics
Cogs and wheels
Rubber belts (cog and wheel drivers)
Wire
LED lights
Solar panels

Kinetic Power sources
Mouse traps
Balloons
Clothes pegs
Elastic bands
Magnets
Motors – (from toy Cars)
Structural items
Cardboard tubes
Aeroboard pieces
Wooden scraps
Lego pieces
Bamboo skewers
Poly board
Plastic tubing
Bulb Holder
Alligator clips
Nuts and bolts
Magnifying glass

Cable ties
Small pulleys
Switches
Peg Boards
Electrical tape
Duct tape
Diodes
Tools
Scissors
Wire cutters
Hammer
Pliers
Hacksaw
Glue gun
Staplers
Screw driver
Drills
Crafting tool



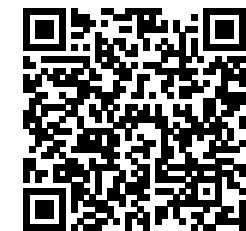
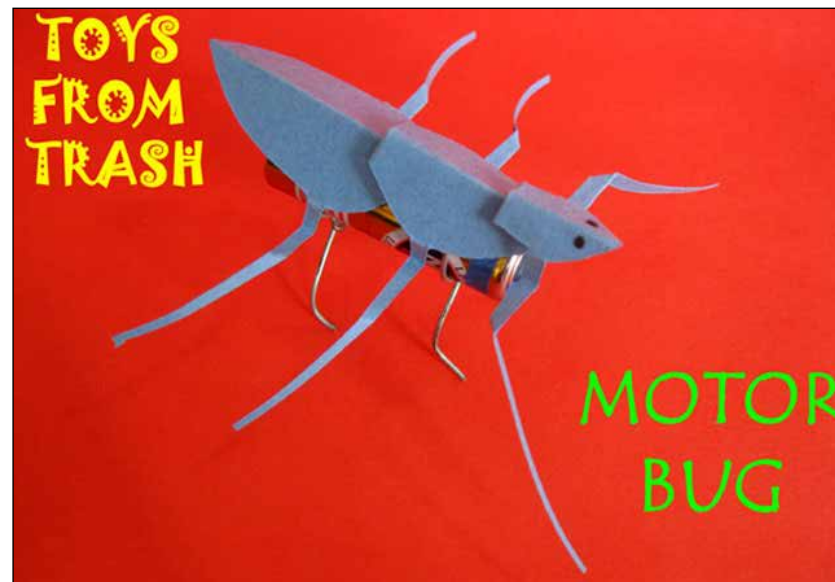
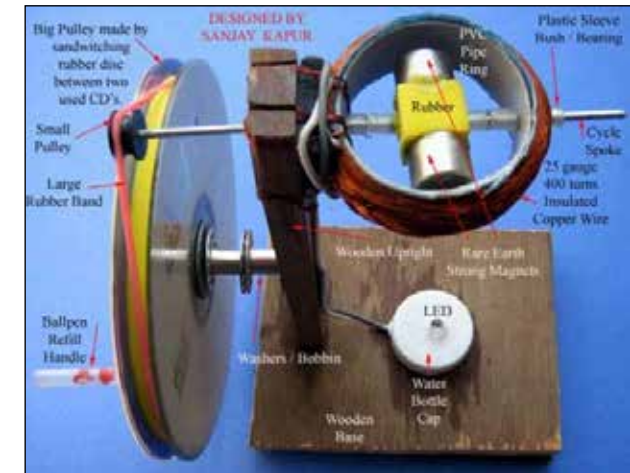
TOYS FROM TRASH

Arvind Gupta is an Indian toy inventor, known worldwide for his improvised toys that are made of what we normally consider as trash. His creations are available online, with lots of instructional material in the form of images, documents and videos.

For thirty-five years he has travelled around India and the world preaching a movement he calls 'Toys From Trash'. Motivated by both the poverty of much of his homeland and the deadening way science is so often taught to young people, Gupta has a vision to create a universally accessible way for all young people—no matter their nationality, creed or class—to both create and learn by repurposing the things we usually throw away.

‘The idea is to show young people how they can reuse trash and make something valuable and extremely delightful without buying anything.’

Arvind’s philosophy is simple. ‘We live in a junk society, which wastes so much. So, pick up this junk and make something joyous.’



TED talk



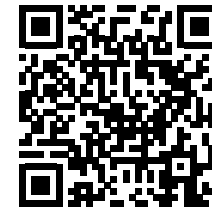
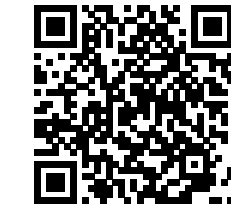
Youtube video channel

DRINKS CANS

The humble drinks can can be reused in many ways. Food tin cans and drink cans are easy to work on with a tin snips, craft knives and some basic tools.

There are a vast collection of ideas and we provide some links here to get the ideas flowing.

There is also a separate resource called Hobo Stoves that provides detail construction details to explore.



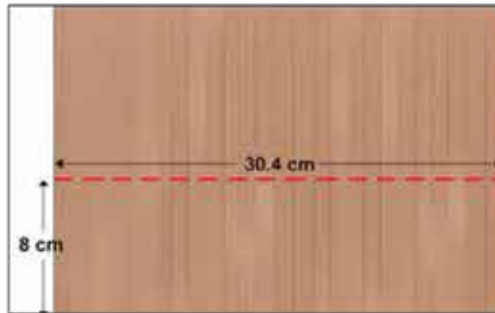
Tut Tut boat



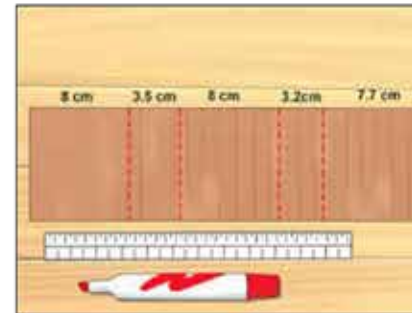
DISCOVERING ELECTRICITY

Electricity is generated by passing/turning a magnet through a coil of copper wire. The magnetic force that exists between the north and south poles of the magnet passes through the copper wire and creates a current of electricity. This simple generator helps to explain and explore the basic principles of electromagnetic properties and how generators and motors work.

Corrugated Cardboard



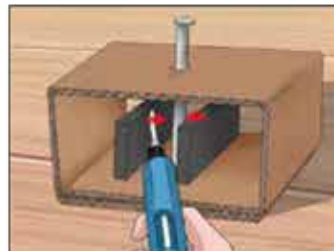
Cut to size as shown



Fold to create a generator frame



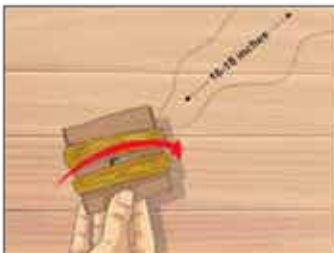
Place nail through the center of the frame



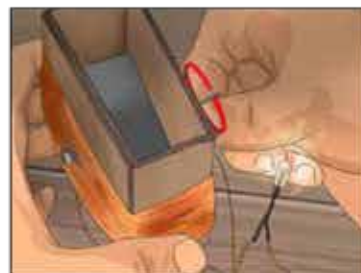
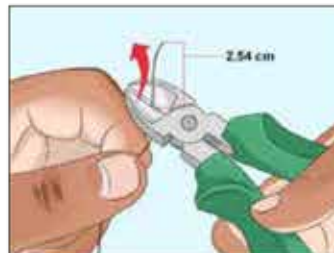
Glue magnets to nail



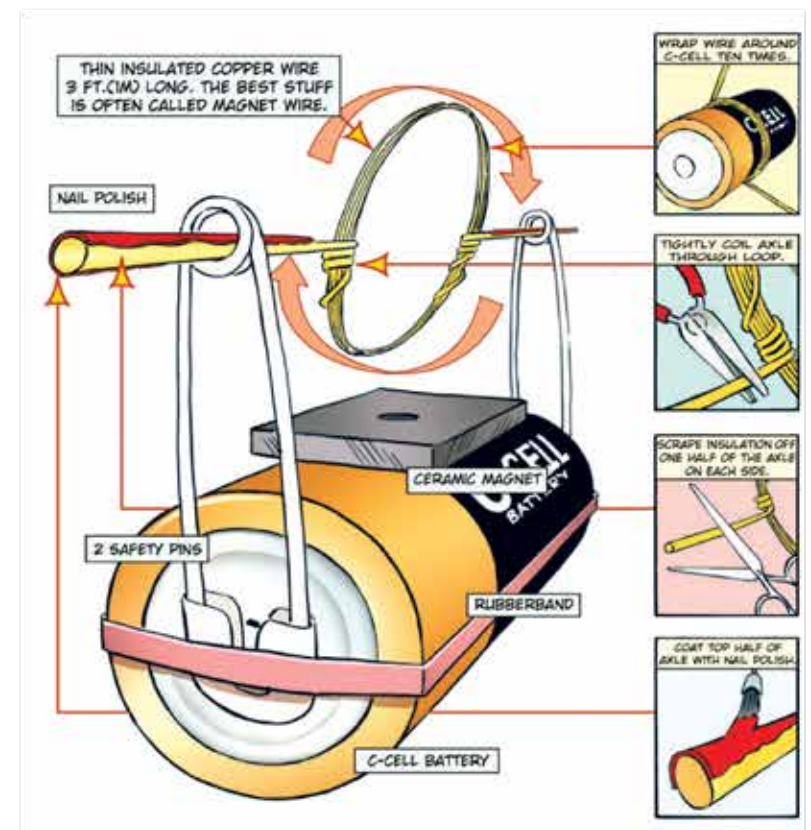
Check for free movement



Wind 61 meters of copper wire around cardboard frame - leaving at least 30-40 cm for connections



Make a simple motor

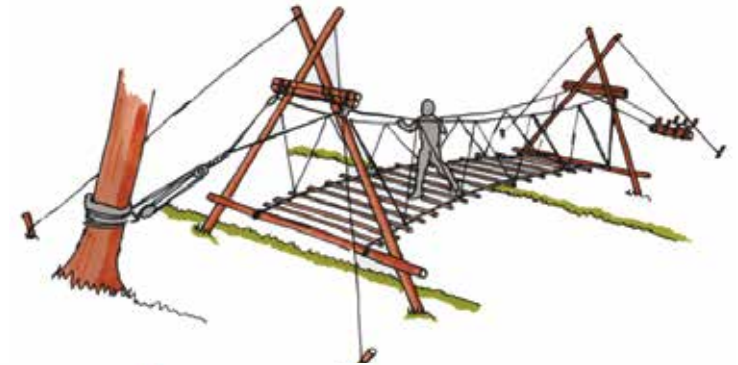
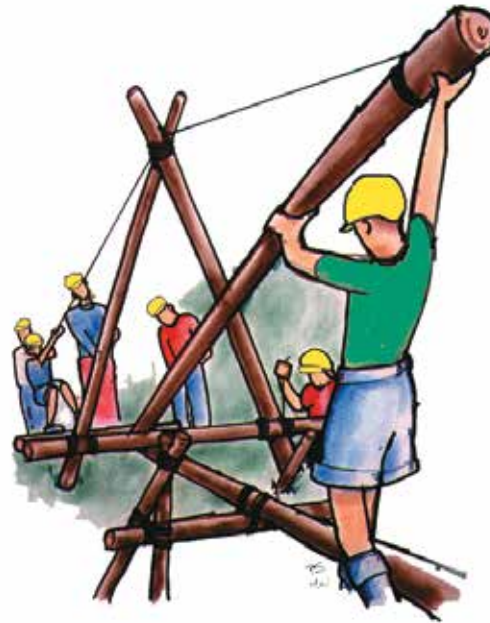


PIONEERING - SCOUT ENGINEERING

Pioneering is a long established Scout skill, introduced to Scouting by Baden Powell and reflecting the activity of the army engineers. These engineers worked in front of the advancing army to build bridges and structures. What attracted Baden Powell was the way the engineering team worked together to solve problems, use all the skills of the team, and collectively achieved their objective.

Pioneering, is a good tinkering activity. While in most cases the challenge is to produce a standard design, in all cases the terrain and location determine that more considerations play a part. The distance of a river, the flow of a river, the lie of the land, the condition of the soil for anchors etc. The length of timbers available can also effect the final design. It is the space of the unknown that tinkering can thrive. Devising a solution that works, creativity and innovation. In fact new designs might work better than the standard model that was first suggested.

Pioneering requires a knowledge of knots, tools, hauling, lifting and pulley work which again mirrors the skills required in traditional tinkering - use of tools, mechanics, overcoming problems, reusing of materials.



GADGETS

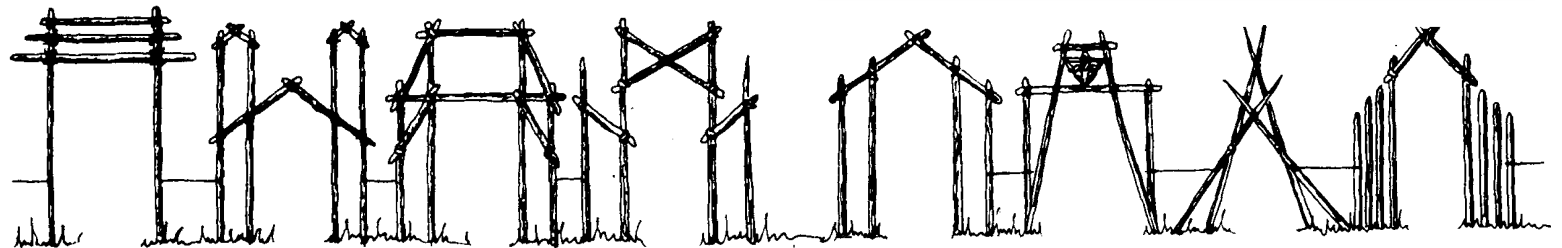
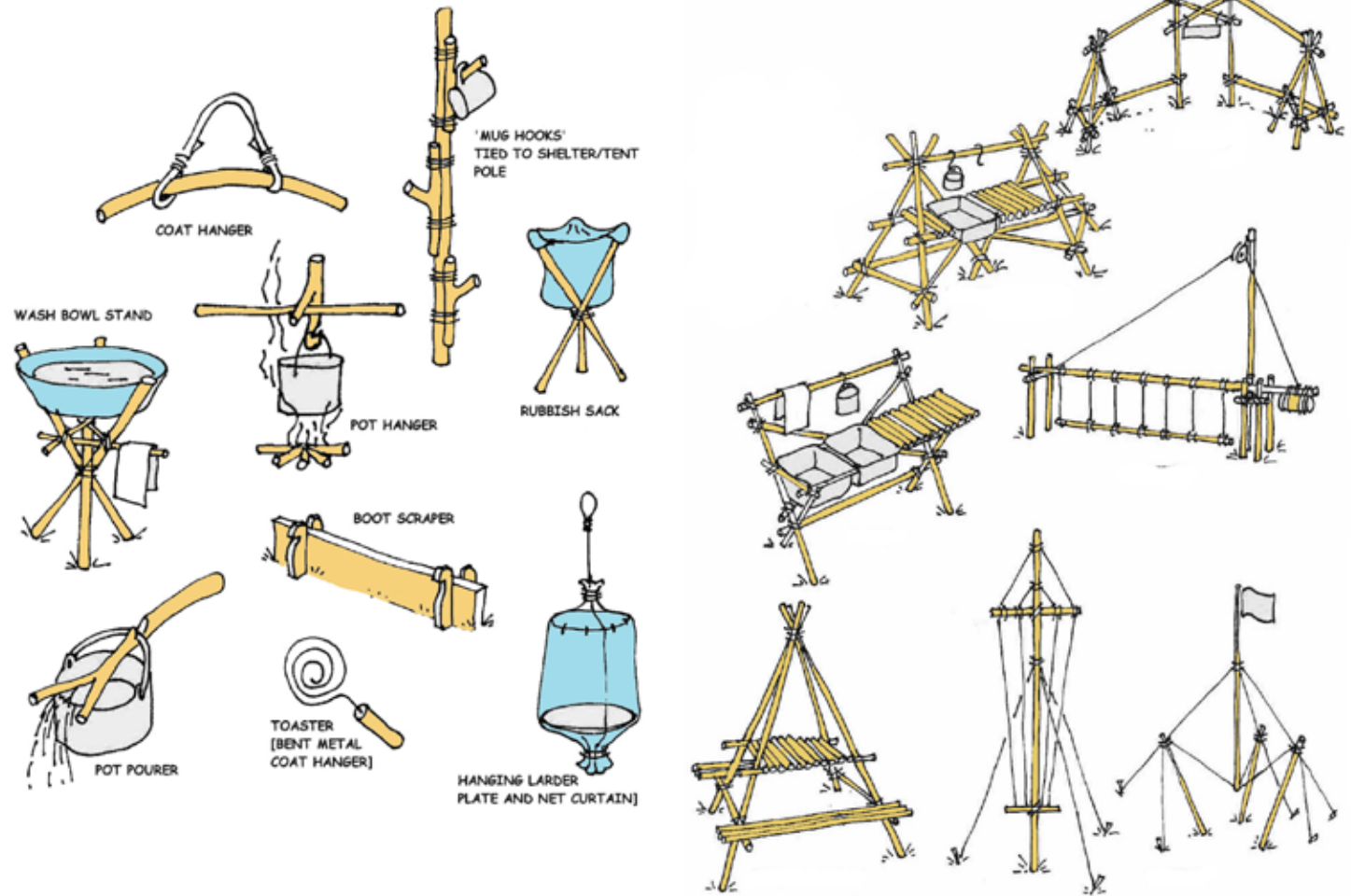
Gadgets are devised that are created on camp to make life a bit more comfortable and organised.

There are collections of good time tested functional designs that can be copied. However, gadget making is an open season of creativity. It is all about inventing and making a useful and functional item. You can also create fun items and decorative items such as gateways, notice boards and Patrol displays.

The same skills set as employed on pioneering is also used in the creation of gadgets - knot- lashings, cutting timber etc. but on a smaller scale. Gadget making is an ideal introduction to lashing and construction that can be taken and used later on bigger pioneering projects.

Like all tinkering projects - it starts with some thinking, then an idea and lastly the creation process.

Traditional designs should be used as a guide but every Scout should be encouraged to come up with new solutions and creations.



GO KARTS

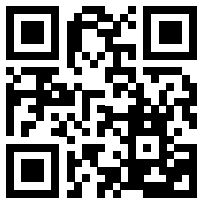
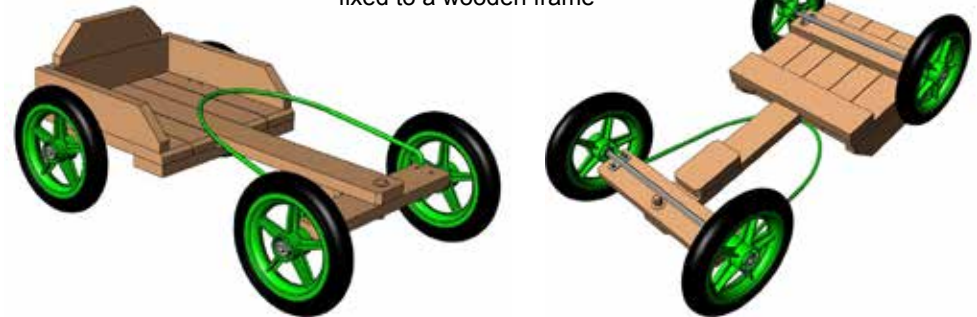
Making go karts are a great fun project to introduce the safe use of tools and simple construction. It can generally be build from scrap timber and some wheel sets from on old pram or old bikes.

A brake is a useful feature and while a simple stick is illustrated here in reality it needs to be built in such a way that it does brake the kart - so again a bit of thinking, and testing is required. When completed set up a race track to try out the karts. Safety needs to be considered so kit up with bike helmet, gloves and knee pads.

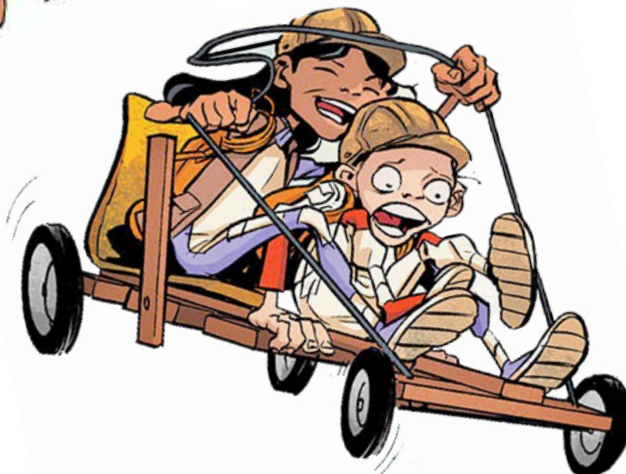


Wheel sets can be bought online or old prams, trolleys or bikes can be harvested for wheels

Basic construction - wheels sets fixed to a wooden frame



Howtoons.com



TREE HOUSES AND BASES

Scrap pieces of wood, some nails and bolts and a big tree - all the elements to create a tree house or team base.

Many designs are possible and need to consider the location in which the project will be built. The idea is to not damage the tree in any way so a platform is created as a first step, resting on branches. Some form of clamping method or frameworks secures the platform to the tree. Bases at ground level or on tree stumps are equally a good tinkering project.



CONSTRUCTION TOYS - MECANNO & LEGO

Construction toys such as LEGO and Mecanno are ideal starters for tinkering. Both toys provide standard construction pieces that can be combined to make anything the imagination can create. While these toys have been a part of children's lives for many years they are constantly evolving. Robotics is a new feature as are the increased use of motors and gearing mechanisms. These additions open up even more possibilities for creation.

Robotics open up a new tinkering medium - coding. Through basic coding skills the creation can be made to move, talk and sense things around them. This basic life skill can be carried forward in an every more complex work of electronics and AI applications.



CHECK OUT THESE TINKERING CHAMPIONS

Tinkering is a movement dedicated to allowing young people to discover and create in a 'learning by doing' model.

There are Maker clubs operating in Ireland and other countries and have festivals to highlight their work and creations.

Exploratorium is another space for creators and the Science Museum in Dublin also have similar spaces in their yearly programme.

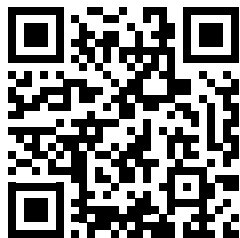
Instructables is a online community where 'how to make' projects of all kinds are presented.

Each of these websites provide hundreds of ideas for making and creating. Scouts in your section can be pointed to these locations to find new ideas and spark their imaginations to create and make new things.

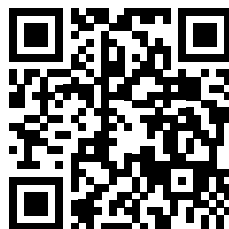
Many of the ideas presented can be reworked to become part of the activity of our meetings and gatherings.



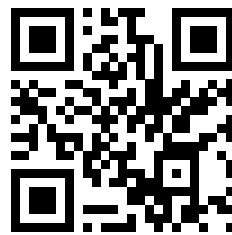
Tinkering lab video



Exploratorium



Instructables



Makerzine

