Suggestions for Making an APT Specially Designed Seat

(adapted from a sheet prepared by Kennett and Jean Westmacott)

1. Plan the seat according to the child's needs and possibilities. With the child's help (as much as is possible), experiment to find a helpful sitting position. Try different placement, angles, and amounts of support. (To do this, use chairs, hands, boxes, sandbags, and wedges as needed.) Look for a position the child likes, that provides good posture and encourages more self-control and use of head, body, and hands. Sketch a seat design accordingly.

2. Measure the child. With the child in a sitting position, take measurements for the height, depth, and width of the seat, and the height of the seat-back (see page 42).

3. Make several laminated (layered) cardboard flats. For the sides, back, seat, armrests, and lapboard of the special chair, cut corrugated cardboard sections from old cartons. Paste together 4 to 10 layers with the corrugation alternating (each layer criss-crossing the one below).
4. **Pressure-dry.** Put a flat board, with heavy weights on it, on the cardboard until it dries completely and is hard. (This may take several days.)

5. **Make cardboard tubes (for girders and struts).** Rub paste onto large sheets of thin, dense (not corrugated) cardboard and roll it around a straight bamboo or broomstick. Pull off and let dry. Make 8 or more tubes, depending on your design.

(If thin, solid cardboard is not available, cross-struts can be made by cutting bars from a laminated section of corrugated cardboard.)

6. **Cut holes** in the chair-sides that will fit tightly around the cross tubes. (For best alignment, place the two chair-sides together and cut the holes in both sides at once.)
7. **Assemble and check.** Cut the sides, seat and back flats to the correct size. Assemble, and make necessary adjustments. (If possible, try sitting the child in the chair before gluing.) Let tubes stick out a little. Slice tube ends lengthwise, bend strips over, and paste them firmly to chair-sides with many thin layers of strong paper strips. (Or rub tube-ends with a stone to flatten them. Torn edges stick better than cut ones.)

8. Turn chair over and **paste "angle irons"** of dense cardboard bent at a right angle between seat and sides.

9. **Paste over all other edges** with layers of thin, strong paper. Finally, **cover the whole chair with a finishing layer of strong paper.** (Cement bags, wall-paper, or pages from old magazines work well.) Using paper with colorful pictures makes it more fun! Decorate as sparks your fancy!

10. When totally dry and hard - it may take a week or more - **varnish to seal.** A plastic (polyurethane) varnish provides good, safe protection.

How PROJIMO's Cardboard Aids Differ from the APT Developed in Zimbabwe

The methods used at PROJIMO for cardboard special seats and other assistive devices have been adapted from those developed in Zimbabwe by Bevill Packer and described in his fine
book *Appropriate Paper-Based Technology (APT): A Manual.* (For the full reference, see Resource List 2, page 344.) The Zimbabwe methodology, summarized on the facing page, has been modified somewhat to meet the situation in rural Mexico in the following ways.

**TYPES OF PAPER.** The Zimbabwe APT seats use 4 main kinds of paper, in different ways:

1. **Corrugated cardboard** such as that used in cardboard cartons. Laminated sections of this thick, light cardboard are often used for the sides and backs of special seats.
2. **Extra-strong paper** such as that used for cement bags. Strips of this are used for edging, and for joining pieces of the frame together. Pasted in place, it makes strong angle joints.
3. **Thin (solid) cardboard** such as that used for shoe boxes. This, and other strong, thick paper is mainly used to make structural supports, often in the form of tubes (see facing page).
4. **Ordinary newsprint, wrapping paper, and the like.** These are usually used by tearing the paper along its grain into thin strips. In a criss-cross pattern these are pasted into layers, either upon a flat surface, or over a form of the desired shape (paper-maché technology).

In Mexican villages, only the first two kinds of paper are readily available: **corrugated cardboard cartons,** and the **strong brown paper** from old cement bags, building-plaster bags, and corn flour (*Maseca*) sacks. Therefore, at PROJIMO, paper-based devices are made almost entirely of corrugated cardboard and surfaced with strong brown paper. Because of the air spaces within corrugated cardboard, walls of assistive devices must be extra thick.

For support struts such as those that hold up the horizontal seat of a Zimbabwe APT chair, you can use round tubes of thin cardboard. PROJIMO uses rectangular "beams" made by laminating corrugated cardboard. These must be extra thick to have enough strength.

**PASTE.** Zimbabwe APT recommends making a thin paste with flour and water, as follows:

![Paste Recipe Image]

The Zimbabwe manual emphasizes that for gluing strips of paper or thin cardboard, *a very thin paste* be used, so that it penetrates the paper's surface. (Use of thick paste may later attract termites!) However, when making flat boards by pasting together layers of corrugated cardboard, it is essential to work fast and use very little paste. You must "Race the stretch!" says the manual. If the cardboard gets too wet (from too much paste or from working too slowly) the inner, wavy (corrugated) layers tend to come loose or lose their shape. Drying time is also longer. *To end up with strong, flat, smooth boards, the laminated cardboard must be pressed on a flat surface under a weighted plank until completely dry.*
To glue together small cardboard structures, PROJIMO sometimes uses carpenter's white glue instead of flour-and-water paste. It dries faster and may be stronger but costs more.

**CARDBOARD PLUS OTHER MATERIALS.** While the Zimbabwe APT Manual encourages using only paper products as building materials, PROJIMO has experimented with combining paper with other low-cost and scrap materials. For example, the special seat for Cruz has a few wood hooks and pegs. Its narrow foot-bar consists of a scrap piece of metal bar (for strength) covered with layers of corrugated cardboard (for padding). Cruz's walker combines the use of cardboard and wood. Each material has advantages.

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**PAPER-BASED TECHNOLOGY IS NOT JUST FOR POOR COUNTRIES:**

*Examples from England*

Paper-based technology (APT) is not only appropriate for poor countries. Its adaptability and versatility make it useful anywhere. In England, Ken and Jean Westmacott run a workshop called People Potential where they train families of disabled children to design and create home-made assistive devices. The examples below were made by Sigi Lester for her daughter Kim who has Rett Syndrome, a profound mental and physical disability. Sigi became so skilled at making aids for her daughter that she now runs her own courses on APT, teaching parents of disabled children. All her equipment is beautifully decorated.

This swing seat was made from cardboard layers. A low back-rest helps Kim gain better body control. Molded hollows under her butt keep her from sliding forward and help her to sit straighter. Sigi covered the seat with a non-slip material to prevent Kim from slipping

Kim loves her APT car-seat because it is covered with colorful old maps. The seat swings toward the van door for easy access.

This APT chair-insert with armrests enables Kim to use the same furniture as the rest of the family, yet gives her the extra support that she needs.

An anti-slip surface ensures good posture and safety.
forward, and thus improve her posture.

Kim's mother made this walker from rolled tubes of thin, pasted cardboard. The A-frame gives just enough trunk support so Kim can begin to take steps. Wheels made with hard plastic-balls (toilet floats) strengthened with layers of pasted paper, roll well on soft ground.

Measuring and Fitting Devices

for Children who Need a Special Seat or Standing Aid

Apart from other difficulties, the over-sized wheelchair of this paraplegic child in Angola increases her spinal deformity.

The Need for Careful Measurement and Fitting of Special Seating to Meet each Child's Needs
If special seating is to help a child sit well, gain better head and body control, or move and do things more easily, it is essential that the design be appropriate for the child's needs, and that it fit the child correctly.

In many parts of the world, one sees disabled children sitting in specially-made seats or wheelchairs that simply do not fit them. Often the seat is far too big. Before building a seat for a child, it is important to take correct measurements. Equally important is to carefully evaluate the child's individual needs, interests, limitations, abilities and possibilities, as well as her likes, dislikes, and fears.

The most important test of a special seat is: Does the child like it?

Although this seat was especially made for her, this child howled every time she was put into it, and she never learned to accept it.

Even a child who is mentally delayed or cannot express her wishes with words may have strong feelings about how she is treated or seated. I (the author) have seen occasions where a beautifully built, accurately fitted seat is painstakingly made for a child. Yet the child screams every time she is put in the seat, and despite repeated attempts and coaxing, she never learns to accept it. (For an example, see page 66.) Sometimes the child may have good reasons (see the special seat made for a child with hydrocephalus, page 293). Such a seat can perhaps be modified or rebuilt so that it is more acceptable. But clearly, it is preferable to make a seat that from the first comes close to meeting the child's needs.

One of the best ways to find out what type and size of seating may best meet a child's needs and preferences is to experiment with a variety of different pre-existing seats.
The solid straight lines show the measurements that are usually needed to build a seat that is the right size for a child.

For this reason, PROJIMO likes to keep on hand a collection of special seats of different types and sizes. Often a seat that does not quite fit a child can be provisionally adjusted by putting a block over the footrest or a thick pad against the backrest. If the angle (tilt) of the seat needs to be changed, try putting one or two books under the front or back of the seat, according to the child's particular needs. Such experimentation, by trial and error, is important before actually designing and building seat for an individual child.

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An "Evaluation Seat" - for Fitting, Measuring, and Testing to find the Best Positions for a Child

A good way to take the basic measurements for making a seat is to lie the child on his back with hips and knees bent at right angles. But such measurements are only a small part of the evaluation and testing needed for good seating.
Building an appropriate seat for a child who has a lot of spasticity or deformities often involves much more than simply taking accurate measurements of the child. Trials with different seating possibilities can be very helpful. But a pre-existing seat that both fits the child and has the combination of features and positions the child needs is often not available.

PROJIMO has experimented with the design and construction of a completely adjustable "fitting-and-measuring seat," in which a child of any size can be tested in a range of positions.

Such a seat needs to have independent adjustments - for width, depth, height, and for the angle of the seat, the foot-rest, the back, and the head-rest (when needed). It must also have adjustable, removable supports for positioning and alignment of the hips, back, shoulders, and head. And it should have a removable table with adjustable height, angle, hand holds, and other features.

Fortunately, a physical therapist, Jean Anne Zollars, was making visits to PROJIMO to help teach short courses on special seating. She helped to design and build the early experimental special seats.

Note: Adjustable sides of the seat, and wedges for sideways stability of the hips, body, and legs are not shown in this sketch, yet will be needed for some children.

**Headrest**: moves up, down, forward, back. Headrest or its sides are removable.

**Backrest**: angle and height are adjustable.
**Lower-back support bar:** adjustable.

**Seat:** depth and angle adjustable.

**Heel bar:** adjustable.

**Blocks:** under front and back of base-board, to tilt the entire seat.

**Foot-rest** (and seat height): adjustable.

**Cross-bar** for feet or ankles: adjustable.

**Leg separator** (pommel): adjustable width, removable.

**Table:** adjustable height and angle.

*These drawings show how the early, experimental measuring seat could be adjusted to test a child with the seat tilted both back and forward (see p.47).*

The first experimental measuring seats designed and built at PROJIMO could be modified for children of many sizes and needs. But they were too complicated, too big, and too difficult to adjust.

Eventually, the team made simpler designs that were easier to adjust. These include the adjustable seat-with-wheels shown on the next page.

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*A wheeled, adjustable measuring seat*
Adjustable wedges

To provide special support for persons who need it, wedges of different sizes and shapes can be made. For the adjustable wheelchair shown here, the team molded wedges made of sawdust mixed with white glue. Wedges can also be made of paper maché or layers of corrugated cardboard (see page 73).

![Diagram of adjustable wedges]  
A quick and easy way to attach the wedges is to use Velcro (self-sticking tape).

The PROJIMO team equipped the wheeled seat with a variety of adjustable wedges and a removable knee separator (pommel).
PARTICIPANTS FROM OTHER LANDS IMPROVE THE DESIGN

Some of these measuring seat designs were developed during a series of short courses at PROJIMO by participants from community rehabilitation programs in different Latin American countries. One participant in the course was Monica Rook, an occupational therapist from Holland who was helping to facilitate a CBR program in Belize. After returning to Belize, Monica and her team designed a simpler, easier-to-build measuring seat, details of which are shown on the following page.

It is exciting when course participants improve on innovations in their own programs and countries.

044

The adjustable chair from Belize is made of wood. Wooden support pieces of various sizes and shapes are attached to the seat and back of the chair. These can be positioned, adjusted, or removed depending on the child's needs. The supports - which can be used to stabilize the
feet, hips, trunk, shoulders, and head - are attached by bolts. These fit through rows of small holes drilled in the footrest, seat board, and back board. The seat belt and foot straps are also adjustable.
An Adjustable Frame for Fitting and Measuring a Child for a Standing Frame

Using a similar technology with adjustable pieces of wood, Monica Rook and her team of community rehabilitation workers in Belize also invented a device for fitting and measuring children who need a custom-made standing frame.

The feet are held in position by wooden heel-stops which can be adjusted with bolts that pass through the floor board. The standing board is hinged, and the angle (tilt) can be easily adjusted.
Use of Sand-Bags to Help a Child Sit

"Special seating" can sometimes be quite simple. Here the mother of CRUZ, who has cerebral palsy, helps her son sit upright by placing sand-bags across his folded legs and behind his hips. Later, PROJIMO created a cardboard seat for Cruz (see Chapter 8).
Paper-Based Aids:

Seating and Standing Aids for Cruz and Kim, and a Helmet for Edgar

This stool, made only of paper and cardboard, can support 3 people. The photo is from the APT manual mentioned on page 73.

This stool, made only of paper and cardboard, can
support 3 people. The photo is from the APT manual mentioned on page 73.

APPROPRIATE PAPER-BASED TECHNOLOGY

Most of the special seats described in this book have been made, at a fairly low cost, with wood or plywood. But for many families, even local wood is too expensive or difficult to obtain. For this reason, in Zimbabwe, Africa many years ago, an elderly man named Bevill Packer began to make special seating and other assistive devices out of waste paper and cardboard. In this Appropriate Paper-Based Technology (APT), layers of paper and/or cardboard are glued together with a paste made from flour and water. Paste can be made from maize flour or even with left-over "sadza," a wheat-flour baby food widely used in Africa. Well-made paper-based seating aids and other devices can be unbelievably strong.

Apart from being low-cost (in terms of materials), paper-based technology has other advantages. It is:

- **Easy and fun to make.** Children love to help make this equipment. (However, care with technique is needed for the results to be strong and durable.)
- **Adaptable to personal needs.** Seat-backs and supports can be molded to meet individual needs. Adjustments can easily be made, hollows scooped out, or lumps or wedges added where needed, for greater comfort, protection, or support.
- **Gentle to the touch.** The finished seat or device has a surface that is somewhat flexible, especially when made of corrugated cardboard (from "thick wall" cardboard boxes). This provides a softer, giving, personal touch and is gentler where it comes in contact with knees, butt bones, and other bony areas. It tends to be more comfortable and protective (against pressure sores) than wood, plastic, or metal.

During the last few years, the art of Paper-Based Technology has spread over much of Africa, and is now being discovered in other continents, including the Americas and Europe.

For years, PROJIMO and Project Piaxtla in Mexico have made limited use of paper-based technology for things such as paper-maché puppets, learning aids, and wheelchair cushions. (A cardboard cushion to prevent pressure sores is shown on page 157.) PROJIMO has only recently begun to experiment with using APT for special seating, standing boards, and other assistive devices. The aids in this chapter are among PROJIMO’s first experiments.
This donkey, with a head of paper maché, was made by Piaxtla health workers and used in a farm worker theater skit to awaken villagers to their constitutional land rights.

To make a paper-maché frog, strips of newspaper several layers thick are pasted over a balloon. A child with developmental delay plays at feeding a frog by putting small stones into its mouth.

Cruz learns to sit, with the help of sandbags on his legs and behind his hips (see page 46).

**Cruz** is a 2 year old boy with cerebral palsy that is in part floppy (low muscle tone) and in part spastic (uncontrolled tightening of muscles). His mother devotes a lot of time to helping him develop his body, mind, and spirit to their best potential. Cruz's brothers and sisters play with him, talk to him, and help him with activities.

Thanks to this loving family effort, Cruz has gained fairly good head control and, with effort, he manages to open his hands to wave hello and goodbye. He also tries very hard to speak. His words are difficult to understand, but his family has learned to interpret them, and they encourage him to speak as much as possible. The boy thrives on all the hugging, handling, and encouragement he receives.
**A wooden Seat the child hated.** Cruz's mother brought him to PROJIMO from a nearby village. She understood his condition so well that the rehabilitation workers learned as many practical developmental activities from her as they were able to teach her. It was agreed that Cruz might benefit from a special seat. Juan designed and built a handsome plywood seat for him with a removable backrest.

But for some reason, Cruz hated his wooden seat. Usually a cheerful child, no sooner was he placed in the seat than he began to scream and wail. His mother was sure he would get used to it, but after two months he still refused to accept it.

**A cardboard seat that he liked.** PROJIMO had been experimenting with paper-based technology. So they tried sitting Cruz in a still-unfinished seat made of laminated cardboard (layers of cardboard from old cartons, glued together). To everyone's surprise, Cruz was all laughs and smiles. His mother was amazed at the difference.

We are not sure why Cruz, who had such a strong dislike for the plywood seat, took such an instant liking to the cardboard one. The positioning and support provided by each was much the same. We suspect that the cardboard seat - with its thick, rounded, relatively soft, yielding structures - was somehow friendlier and more similar to human touch. By contrast, the plywood seat, even with its cushioned lining, was more rigid and unyielding. Despite the smiling rabbits painted on its sides, the wooden seat was not as child-friendly.
A Cardboard Seat Built for Cruz

The seat was designed with many special features. A removable post, or pommel, was placed between the boy's thighs to keep him from slipping forward. A table-top fits around his waist to help stabilize his lower body. A removable, U-shaped hip support fit into the seat to stabilize his hips. It held him slightly forward from the seat-back so that when he wanted to, he could sit up without leaning against the seat-back. (This idea came from watching Cruz's mother place sand bags around his hips to help him sit upright.)

All of the seat parts, including the table top, the pommel, and the U-shaped hip support, were made by pasting together (laminating) layers of corrugated cardboard cut from old cartons.

On his first try, Cruz sat fairly well in the seat. But there were problems that required some modifications:
1. When Cruz was excited, his legs stiffened and his tense body pushed backward. So a removable ankle bar was added to keep his feet on the foot-rest. The bar was made of cardboard, reinforced by a flat metal rod, bent to help position his feet. A removable foot separator of layered cardboard was added to help him position his feet well.

2. Although the U-shaped hip-support at times seemed to help Cruz sit upright, often he would slump or push back against the seat back. So a 2-piece low-back support was made of layered cardboard. It could be easily removed as he gained better hip and back control.
**Addition of an adjustable tilt to the seat.** On experimenting with the angle of the seat, it was found that sometimes Cruz sat more upright when the seat tilted forward. (See discussion of positive seating in Chapter 4, page 48.) So a mechanism to change the seat angle was added.

A thin cloth strap was attached to the back edge of the seat-board. By pulling the strap the seat could be positioned at different angles.

Three small wooden hooks were made, with posts that fit tightly into holes drilled into the back side of the cardboard seat-back.
The forward tip of the seat seemed to help Cruz sit in a more upright position. The tilt caused him to push downward with his legs to keep from slipping forward. This increased the muscle tone in his back. But since the foot-bar kept his knees bent, he avoided spastic arching backwards.

All of these adaptations and additions were simple and fun to make because the cardboard frame and attachments were so easy to cut, drill, and modify. Almost the only tool needed was a knife. Removable pieces molded from cardboard could be firmly attached by pressing them (or the pegs attached to them) through grooves or holes cut into the frame. The thickness and texture of the cardboard frame provided a firm grip for the inserted posts and attachments.

The different pieces and attachments to Cruz's seat are almost all removable and many are easily adjustable. The final version of the seat with its removable parts is shown here.
An instruction sheet for making cardboard seats is on page 72.

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**A Cardboard Standing-Frame for Cruz**

Village children paste together sheets of cardboard to make a standing-frame.
Cruz's mother, brothers, and sister often held him upright, and Cruz did his best to stand. At first his legs stiffened in a tip-toe position. But, if he was held quietly for a while, the spastic muscles would gradually relax and his feet would flatten on the ground. Cruz's mother had bought him new, high-top shoes, which seemed to help him position his feet better.

The PROJIMO team felt Cruz might be ready for a standing-frame. Again, they decided to use mainly corrugated cardboard. The cardboard was reinforced with wooden struts, and had a wooden base-board.

**In a preliminary trial** of the standing frame, Cruz stood fairly well on it. His feet rested flat on the base-board and were held apart by the foot-holes in the vertical frame. The boy seemed delighted with being able to stand by himself.

However, his knees angled inwardly as he stood. He needed something that would hold his legs straight and apart. So a **leg-separator** was made by re-shaping and gluing together 2 cardboard boxes to form a long, thin triangle.

A big advantage of a standing-frame made of cardboard is its smooth, soft surface, and its capacity to bend or sink in slightly, under pressure. The cardboard, therefore, provides more gentle support for bony areas such as Cruz's knees.
**In conclusion:** PROJIMO's early trials with cardboard assistive devices show great promise. The PROJIMO team still needs to improve its technique, to create smoother and cleaner products. But the results are working remarkably well. Cardboard provides a number of advantages over other materials: especially its low cost, and the ease with which the structures can be modified and adapted to meet individual changing needs.

Alte resurse

http://www.cerebralpalsyafrica.org/APT_Programmes.htm

http://www.youtube.com/watch?v=Yr2lIlcYKhs&feature=related

http://www.youtube.com/watch?v=VsjRFLjaNI0&NR=1&feature=endscreen

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