

# **Wooden Hierarchical Material**

**Notes:** The children come to the elementary classroom with some experience in mathematics. We begin working with them to practice and refine the skills they already have and to introduce new concepts to them when they are ready. When the children work with the wooden hierarchical material, they are enlarging their knowledge of our number system and our number system is the decimal system – a base-ten system. So far, the children coming from the primary know four of the categories: they know units, tens, hundreds, thousands. This material gives the children an impression of numbers beyond a thousand. It goes beyond the numbers that the children have used with the golden bead material. It summarizes the work the children have done in the casa and expands upon it. It opens the door to the rest of the decimal system. **This work is a key piece of material – it is a key to the decimal system.** This material is a piece of transitional material: children coming to the classroom may have already experienced this material or not – it doesn't matter because they will have an elementary level experience with it and **the presentation differs from the primary level presentation.** The children will not work with this material as much as they do other mathematics materials that we have, but it is a very, very critical piece of material and it should be given to everyone.

**New Children:** You'll want to assure that the children can count to and understand the concept of 10. This material can then serve as an introduction to the decimal system shortly after giving them an initial presentation with the golden bead material (similar to primary, but a bit quicker pace).

**Material:** 3 green cubes: smallest is  $.5(\text{cm})^3$ ,  $5(\text{cm})^3$  (marked with red lines to show the hundreds),  $50(\text{cm})^3$  (marked with red lines to show the hundred-thousands); 2 blue bars/rectangular-prisms:  $.5 \times .5 \times 5\text{cm}$ ,  $5 \times 5 \times 50\text{cm}$  (both bars are divided by green lines into 10 equal sections); 2 red square prisms:  $5 \times 5 \times .5\text{cm}$ ,  $50 \times 50 \times 5\text{cm}$  (both are divided by blue lines into 10 equal sections); set of cards of equal size, printed with 1, 10, 100, 1,000, 10,000, 100,000, 1,000,000 in incremental sizes; tray to hold the four smallest pieces; large mat or a set of smaller mats.

## **Presentation 1: Presentation of Quantity**

(remove any clunky jewelry or watches so as not to scratch the material)

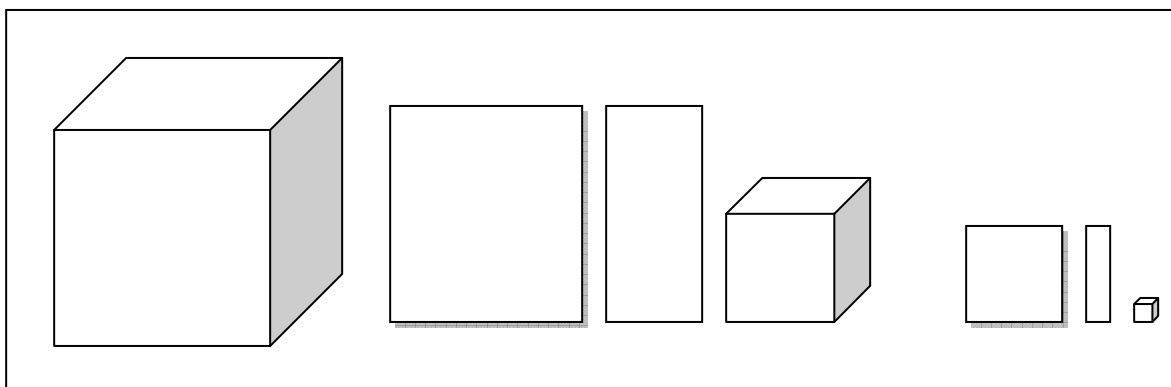
Speak slowly and reverently, moving separately from the speaking as in primary.

- Gather 2-4 children. Show them where the material is kept. Invite one child to gather and lay out the rugs while the others help to carry the material to the mats. Note to the children how careful we should be with these materials.
- Lay them out in random order on the mat.
- This is a unit. The unit stands alone. (place the unit to the far right of the children). This is a unit.
- When ten units walk together they form a line. (place the ten to the left of the unit). This is a ten.
- When ten tens come together, they form a square. (place the square). This is a hundred.
- When ten hundreds group together, they make a thousand. (Place the thousand to the right of the square, but leave a space between the hierarchies.) This is a unit and the unit walks alone.
- When ten thousands walk together, they form a line. (Place the piece) This is ten-thousand.
- If ten ten-thousands come together they form a square. (Place the piece) This is one hundred thousand.
- When ten hundred-thousands come together, they form one million. (Place the piece) This is a unit and a unit walks alone.

(for the following: indicate each as the name is mentioned, beginning at the far right)

- We have unit, ten, hundred. Here we have unit, ten, hundred. We have a unit.
- Here (indicate the first set) we have the simple hierarchy. We have the unit, ten, hundred.
- Here we have the hierarchy of thousands. We have the unit of thousands, ten of thousands, hundred of thousands.
- Here we have the unit of the hierarchy of millions. We have the unit of millions.

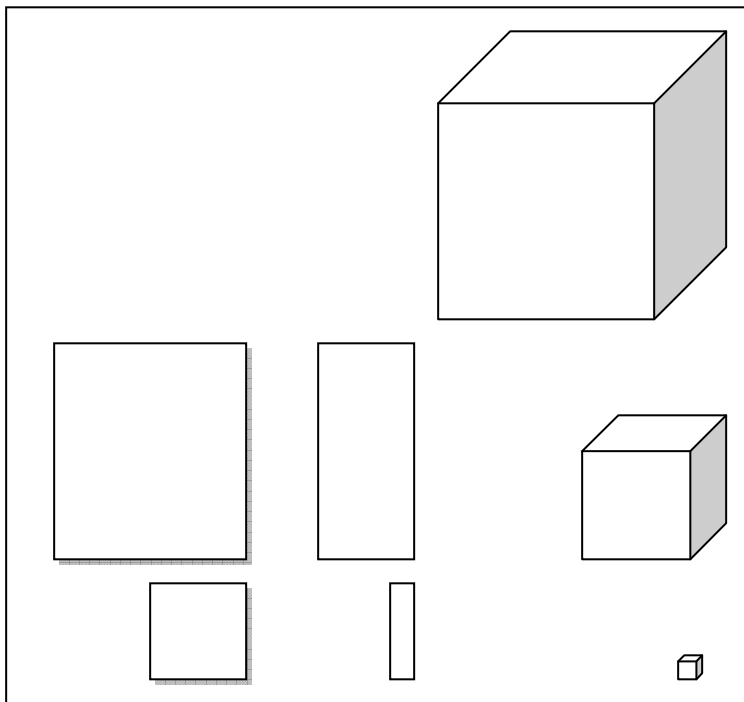
The linear layout:



Continue with only the 2<sup>nd</sup> period of a 3-period lesson, giving in instructions to move the material around in a game-like fashion: point out, move to another location, count the number of one category in the next.

To finish the 2<sup>nd</sup> period, ask the children to bring the materials back and place them in a particular order: if 3 mats, the first mat would have from top to bottom the units from largest to smallest, aligned on the right. The second mat has the tens, aligned long-ways. Then the squares.

The layered lay-out:



Analyze with the children what you have:

- Here we have the simple hierarchy (**indicate the near row**) – the unit, ten, hundred.
- Here we have the thousand-hierarchy: the unit; the ten; the hundred-thousand.
- Here we have the unit of the million-hierarchy. (**pause**)
- One of the children will ask, “What about the rest of the hierarchy?”
- Answer: “Wouldn’t it be wonderful if our environment could hold such large material?”
- Review with the children. Use 3<sup>rd</sup> period only if they are ready.
- Invite the children to return the material.

## Presentation 2: Comparison of Pieces

Children often spontaneously discover this step on their own. We want them to have this concrete sensorial experience so it should be presented if they don't come to it on their own. At some point, their attention must be drawn to the relationship between the units of the simple and the million hierarchies.

- (The children set out the material in either of the two layouts.)
- Look at this ten. It's as tall as this thousand. It's also as tall as the ten thousand. It's also as tall as the hundred-thousand. **Hold it to each piece as suggested.**
- Can you see anything else we can compare? **Let the children compare.**

**General Notes:** The first presentation is to awaken the children's awareness to the pattern within the hierarchies. That pattern is unit, ten, hundred; units, tens, hundreds. The second presentation is to give them an experience of comparison between hierarchies and the dimensions of the material. If you have children who are capable, eager, enthusiastic, and they seem to get it, you can combine presentation one and two, but measure your time, because you'll have 30-35 children (or other family members) and others will want lessons from you too.

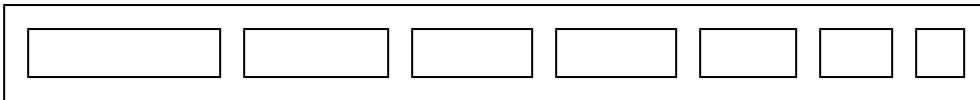
## Presentation 3a: The Cards – Focus on the number *\*before\** the comma

While speaking, place the first card to the far right, then each one to the left of the last, with equal space between each one.

- What number is this? (1)
- What number is this? (10)
- What numbers is this? (100)
- What number is this? (1,000) Notice there is a zero in the units place, a zero in the tens, a zero in the hundreds, a comma, and a 1.
- Here we have ten-thousand. We have three zeroes, a comma and in front of the comma: 10. This is ten-thousand.
- Here we have one hundred-thousand. We have three zeroes, a comma, and in front of the comma: 100. That is how we know it is one hundred-thousand.

- Here we have one million. We have three zeroes for the simple hierarchy and a comma, three zeroes for the thousands hierarchy, and another comma. In front of that comma, we have 1. This is one million.
- Note: Do **not have the children count the zeroes as in the casa**; here we are looking at the hierarchies and at the numbers in front of the comma to tell us how many of each hierarchy, which will aid the children in reading large numbers.

The card lay-out:



Move on to a second period in the 3-period lesson: show me thousand – how do we know it is one thousand (because there are three zeroes, a comma and a 1 in front of the comma). Show me 10. Return the card to their placement each time they've identified it. Encourage the children to practice on their own, together.

Can include a 3<sup>rd</sup> period activity: what does this card say?

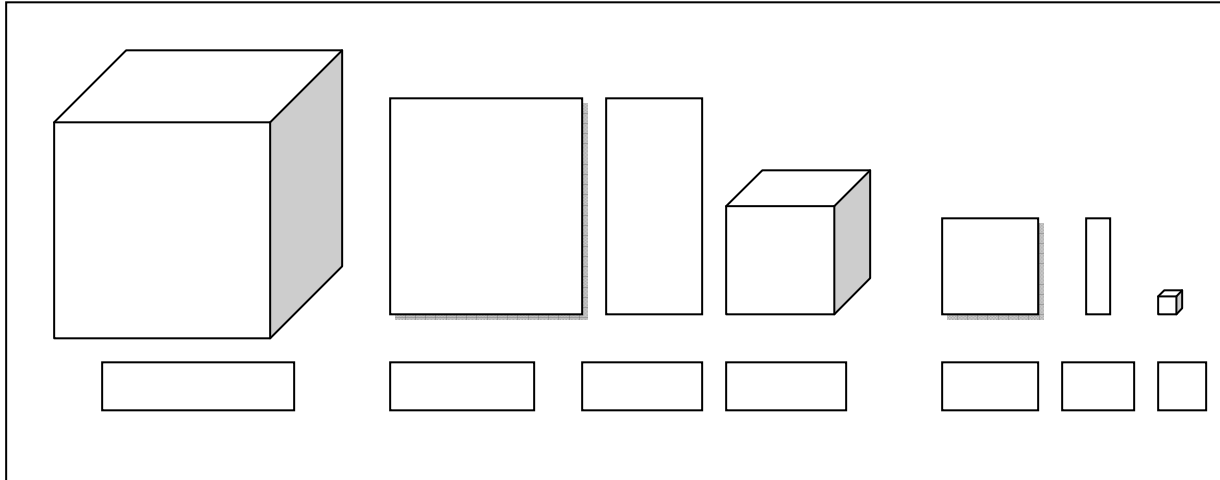
### **Presentation 3b: Combining the card and the material**

Could be a separate day if needed, but usually the children will move on right away.

Begin with the material in a random order.

- Who can get this piece for me? (**hold up a card without saying the name**)
- **Reconstruct the linear lay-out when the child brings the piece and direct the child to lay the card directly under it. Ask for the pieces in random order but place them in their appropriate locations.**
- Who can get this piece for me? And this one?
- Repeat this step as many times as the children need. If they bring the wrong piece, say, "Hm. That's not quite the one I needed; let's try another one." (Come back to the missed one the next time)
- Now we have matched the material with the numbers.

The complete lay-out:



When the children have done all three exercises, they have experienced quantity, symbol and the association of the two:

- presentation one introduced the quantity with which we gave the pattern in two ways (linear layout and layered layout);
- presentation two gave the experience of making comparisons;
- presentation three in its two parts gave the symbols, showing the pattern therein (grouping of zeroes and comma, with a number in front of the comma – a pattern which can extend to the highest number) and associating the quantity with the symbol.

**This is one of the earliest materials presented in the elementary environment, even most especially for the children who did not have primary or who did not get to this material in primary.**

**Purpose:** to give an impression of the relationship between numbers, and the relationship of the hierarchies and the categories within the hierarchies.

Subconsciously, other things come into the presentation, such as geometric progression: point leading to line, leading to surface or plane, leading to point.