

# Three-Dimensional Solid Models for Tactile Teaching Materials

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We have been implementing the project 'Research on the recognition of 3D objects by visually handicapped persons and development of 3D geometrical teaching materials' in Japan since 2006.

One of our main aims is to develop teaching materials to enrich the world of observation of blind people by touch. We have been creating models that blind people have never touched. The models have innumerable topics, but can be divided into two categories.

The first includes models with objects that we cannot actually touch because of their size-gigantic or microscopic objects. As concrete examples, we are developing models of the planets in the solar system (e.g., Earth and Mars). These models have bumps on their spherical surfaces that can be felt by blind persons. Enlarged models of microorganisms like radiolarian and foraminifera are also examples of such models.

The other category consists of models with abstract objects (e.g., mathematical curved surfaces, polyhedra, Klein bottle, crystallographic structures, puzzles, and famous pictures). These models are also instructive for sighted people. Some simple improvements make the models more helpful for blind people.

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## Our Project

### “Research on Recognition of 3D Objects by Visually Handicapped Persons and Development of 3D Geometrical Teaching Materials”

(FY2006-FY2009)

The project is supported by Grants-in-Aid for Scientific Research (A) (18200049) of the Ministry of Education, Culture, Sports, Science and Technology.

#### *Project Members / Research background*

**TESHIMA, Yoshinori** / Discrete Geometry, Physics  
**FUJIYOSHI, Mamoru** / Special Education for the Blind  
**IKEGAMI, Yuji** / Design, Manufacturing  
**KANEKO, Takeshi** / Special Education for the Blind  
**OUCHI, Susumu** / Special Education for the Blind  
**WATANABE, Yasunari** / Crystallography  
**YAMAZAWA, Kenji** / Manufacturing

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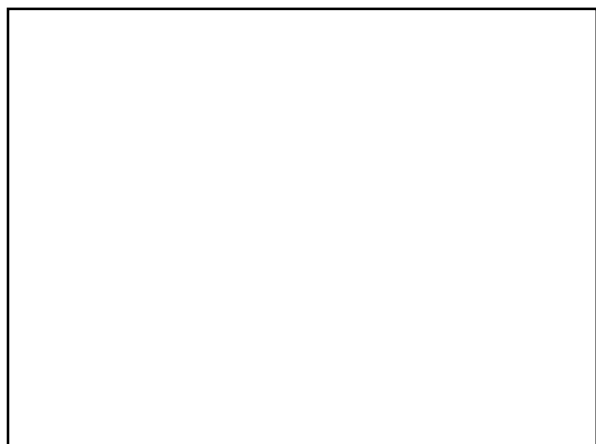
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**Tactile Globes:  
Earth, Mars, Venus, and Moon**

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*To enrich the touch world - Miniaturized models*

**Gigantic objects that we cannot recognize in actual size**

Globes of planets and satellites in the solar system.  
We created the globes with Exact Topography data from Planetary exploration by the man-made satellite.

We gave emphasized ups and downs on their spherical surfaces that can be felt by blind persons.

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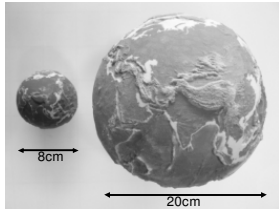
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### Globes of Earth



-Topography data: ETOPO5  
Elevation Data created  
by National Snow and Ice  
Data Center  
-Layered Manufacturing  
(3D colour printing)  
with plaster powder

- Real size: 6378 km (radius)
- Reduction ratio: 1/63,780,000 (right model)
- Relief emphasis ratio : 50 times

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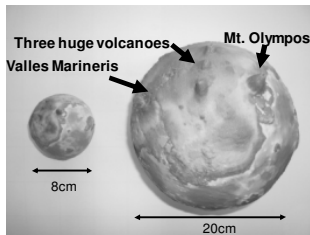
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### Globes of Mars



-Topography data:  
Digital Elevation Model Data  
from NASA  
-Layered Manufacturing  
(3D colour printing)  
with plaster powder

- Real size: 3397 km (radius)
- Reduction ratio: 1/33,970,000 (right model)
- Relief emphasis ratio: 25 times

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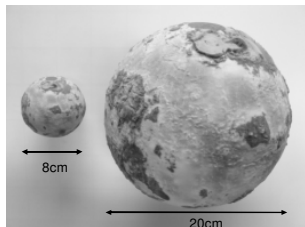
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### Globes of Venus



-Topography data: Altimeter  
and Radiometry Composite  
Data Record from NASA  
-Layered Manufacturing  
(3D colour printing)  
with plaster powder

- Real size: 6052 km (radius)
- Reduction ratio: 1/60,520,000 (right model)
- Relief emphasis ratio : 50 times

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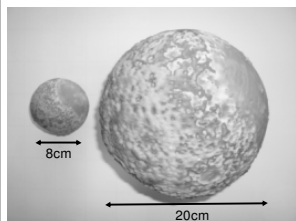
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### Globes of Moon



-Topography data:  
DLTM2\_TOPO from NASA  
-Layered Manufacturing  
(3D colour printing)  
with plaster powder

- Real size: 1738 km (radius)
- Reduction ratio: 1/17,380,000 (right model)
- Relief emphasis ratio: 12.5 times

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