Japanese Annex



An annex is something more than a supplementary translation. It is a curatorial record of how a language entered the IMaGe Great Theorems Museum, including decisions, experiments, difficulties, corrections, and human observations. It is an independently valuable scholarly document.

This annex presents selected exchanges documenting significant translation and design decisions; it is not intended as a complete transcript of the development process.

The Japanese language discussion also appears within the main *Solstice* article, “An Euclidean Diptych: Crossing the Digital Divide.” It is presented separately here to provide a complete set of language-specific curatorial records accessible directly from the IMaGe Great Theorems Museum.

To enlarge the images and improve their legibility, please use your document viewer's zoom controls.

37th year (1990-2026) of publication of
Solstice: An Electronic Journal of Geography and Mathematics
Volume XXXVII, Number 2;
Monday, December 21, 2026; 2:50 pm, Central Time
Copyright ©2026-- All rights reserved.
Institute of Mathematical Geography and the authors

Solstice: An Electronic Journal of Geography and Mathematics
Volume XXXVII Number 2
December 21, 2026

SPECIAL ISSUE: HUMAN/MACHINE COLLABORATION
Japanese Annex
To
IMaGe Great Theorems Museum

Sandra Lach Arlinghaus
With Collaborator and Assistant Curator IMaGe Great Theorems, Vector

Persistent University of Michigan Deep Blue Research Collection Archive, Institute of Mathematical Geography.

URL: **http://deepblue.lib.umich.edu/handle/2027.42/58219**

Cite articles as: Author name(s), Year. Title of article, *Solstice: An Electronic Journal of Geography and Mathematics*, Vol. YY, No. ZZ. Ann Arbor: Institute of Mathematical Geography.

Arlinghaus/Vector collaboration. The material in this Annex was largely composed, at Arlinghaus's direction, by Vector. Any added comments from Arlinghaus are shown with a light green background behind the text. The responsibility here, as with all other elements of this Human/Machine Collaboration, rests with the human.

Color serves as a guide to the reader. Material between lavender bars was created primarily by Vector with oversight by Arlinghaus. Material in black and white, outside those bars was created primarily by Arlinghaus. Comments by Arlinghaus within those bars has a green background.

Principal Contextual Concepts: Translation Decisions; Mathematical Content; Interface Adaptation; Testing and Corrections; Final Status.

37th year (1990-2026) of publication of
Solstice: An Electronic Journal of Geography and Mathematics
Volume XXXVII, Number 2;
Monday, December 21, 2026; 2:50 pm, Central Time
Copyright ©2026-- All rights reserved.
Institute of Mathematical Geography and the authors

Japanese

Japanese: Mathematical Language and Cultural Adaptation

Curate the Japanese language file first, independently from the English semantic root, then insert it into a **copy** of the previous frozen Master, only after the wording is settled. That way the exhibit architecture remains untouched.

Entrance

ユークリッドと『原論』
ユークリッド幾何学の基礎

Introduction

幾何学は、出発点として受け入れる少数の命題から始まります。そこから論理的推論を通して、ひとつの豊かな数学の世界が展開していきます。

That feels natural in Japanese and preserves our recurring “unfolding” idea with **展開していきます**.

Traditional Quotation

「幾何学に王道なし。」— ユークリッド
伝統的にユークリッドの言葉とされています。

I like the economy of **幾何学に王道なし**. It has the compact, proverbial character the line wants.

Mark the Japanese version initially as

日本語・キュレーション翻訳・母語話者による確認を歓迎します

Entire Entrance Block

ユークリッドと『原論』

ユークリッド幾何学の基礎

幾何学は、出発点として受け入れる少数の命題から始まります。そこから論理的推論を通して、ひとつの豊かな数学の世界が展開していきます。

「幾何学に王道なし。」— ユークリッド

伝統的にユークリッドの言葉とされています。

37th year (1990-2026) of publication of
Solstice: An Electronic Journal of Geography and Mathematics
Volume XXXVII, Number 2;
Monday, December 21, 2026; 2:50 pm, Central Time
Copyright ©2026-- All rights reserved.
Institute of Mathematical Geography and the authors

Proceed next with **五つの公準** (P1 through P5) and pay special attention to the established Japanese mathematical vocabulary for line, segment, construction, and the Playfair/Euclid distinction.

Japanese is fascinating because, as with Chinese, we should resist making it imitate European sentence structure. At the same time, modern Japanese mathematical terminology is highly standardized, so much of Euclid can be expressed very cleanly.

Properties, P1-P5
五つの公準

I prefer **公準** here rather than 公理. In contemporary Japanese mathematical usage both terms occur in axiomatic contexts, but **公準** has a particularly appropriate Euclidean/postulate resonance and helps distinguish these five geometrical assumptions from the more general Common Notions.

P1, Modern: **異なる2点を通る直線はただ1本存在する。**

P1, Historical: **任意の一点から任意の他の一点へ直線を引くことができる。**

Japanese **直線を引く** is completely natural constructional language: “draw a straight line.”

P2, Modern: **線分はどこまでも延長することができる。**

P2, Historical: **有限の直線は、その方向に連続して延長することができる。**

Here we get the same historical/modern distinction we've encountered around the world. Modern Japanese gives us the precise **線分** for a line segment. The historical wording can retain **有限の直線** as the older conception.

P3, Modern: **任意の中心と半径をもつ円を描くことができる。**

P3, Historical: **任意の点を中心とし、任意の長さを半径として円を描くことができる。**

This is very natural Japanese geometry. **円を描く**—draw a circle—is immediate and unobtrusive.

P4, すべての直角は互いに等しい。

Compact and thoroughly mathematical.

P5, Playfair: Label:

同値な表現（プレイフェア）

Statement:

直線 l 上にない点 P を通り、l に平行な直線はただ1本存在する。

37th year (1990-2026) of publication of
Solstice: An Electronic Journal of Geography and Mathematics
Volume XXXVII, Number 2;
Monday, December 21, 2026; 2:50 pm, Central Time
Copyright ©2026-- All rights reserved.
Institute of Mathematical Geography and the authors

I especially like **ただ1本**. Japanese uses counters, and **本** is the natural counter for lines here. Thus, the uniqueness isn't merely translated—it is expressed idiomatically in Japanese.

Roughly:

“Through point P not on line l, there exists exactly one line parallel to l.”

Japanese has given us another lovely demonstration of the Museum's principle. Playfair's “exactly one” has now appeared as:

une seule · genau eine · una e una sola · una y solo una · 恰有一条 · ただ1本

Six genuinely different linguistic constructions expressing **one invariant mathematical uniqueness**.

P5, Euclid:

Label:

歴史的な表現（ユークリッド）

Statement:

1本の直線が2本の直線と交わり、同じ側にある内角の和が2直角より小さいならば、その2本の直線を限りなく延長すると、必ずその側で交わる。

There are several things I like here.

ならば supplies the conditional hinge that German gave us with *dann*, Italian with *allora*, Spanish with *entonces*, and Chinese with 则.

And:

必ずその側で交わる

means essentially “necessarily meet on that side.” It makes Euclid's conclusion unmistakable.

五つの公準

P1-- Modern: **異なる2点を通る直線はただ1本存在する。**

P1-- Historical: **任意の一点から任意の他の一点へ直線を引くことができる。**

P2-- Modern: **線分はどこまでも延長することができる。**

P2-- Historical: **有限の直線は、その方向に連続して延長することができる。**

P3-- Modern: **任意の中心と半径をもつ円を描くことができる。**

P3-- Historical: **任意の点を中心とし、任意の長さを半径として円を描くことができる。**

P4-- すべての直角は互いに等しい。

37th year (1990-2026) of publication of
Solstice: An Electronic Journal of Geography and Mathematics
Volume XXXVII, Number 2;
Monday, December 21, 2026; 2:50 pm, Central Time
Copyright ©2026-- All rights reserved.
Institute of Mathematical Geography and the authors

P5-- Playfair: Label:

同値な表現（プレイフェア）

Statement:

直線 l 上にない点 P を通り、l に平行な直線はただ1本存在する。

P5-- Euclid:

Label:

歴史的な表現（ユークリッド）

Statement:

1本の直線が2本の直線と交わり、同じ側にある内角の和が2直角より小さいならば、その2本の直線を限りなく延長すると、必ずその側で交わる。

Common Notions (Axioms), CN1-CN5
五つの共通概念

This is close to the traditional sense of “common notions” while remaining understandable contemporary Japanese.

CN1-- 同じ量に等しい量どうしは、互いに等しい。

CN2-- 等しい量に等しい量を加えると、その和も等しい。

The **も** is useful: the sums *also* are equal.

CN3-- 等しい量から等しい量を引くと、その残りも等しい。

Here **残り** nicely preserves Euclid's “remainders” without forcing everything into modern algebraic terminology.

CN4-- 互いに重ね合わせることのできる量は、互いに等しい。

This one is excellent for our invariant CN4 figure.

重ね合わせる means to superimpose one upon another. So the Japanese words almost narrate the little congruence picture.

CN5-- 全体は部分より大きい。

Extremely clean.

五つの共通概念

37th year (1990-2026) of publication of
Solstice: An Electronic Journal of Geography and Mathematics
Volume XXXVII, Number 2;
Monday, December 21, 2026; 2:50 pm, Central Time
Copyright ©2026-- All rights reserved.
Institute of Mathematical Geography and the authors

CN1 — 同じ量に等しい量どうしは、互いに等しい。
CN2 — 等しい量に等しい量を加えると、その和も等しい。
CN3 — 等しい量から等しい量を引くと、その残りも等しい。
CN4 — 互いに重ね合わせることのできる量は、互いに等しい。
CN5 — 全体は部分より大きい。

The Mathematical Journey

数学の歩み

I have avoided a literal equivalent of 'journey' that sounds like physical travel. This is a particularly nice Japanese expression. **歩み** literally has the sense of steps/progress/course of development. It can describe the progress of an idea or discipline without sounding like tourism. And it fits our five sequential miniatures beautifully.

1. Agreed Starting Points
受け入れた出発点
これらを出発点として受け入れます。

> Clear and philosophically modest: these are accepted starting points, not previously proven facts.

2. Logical Reasoning
論理的推論
定義、作図、証明。

> This is excellent compact mathematical Japanese.
>
> **作図** is particularly satisfying in a Euclid room: geometrical construction.

3. Definitions

定義
私たちが構成する対象に名前を与えます。

> Literally, definitions "give names to the objects we construct."
>
> There is our familiar Museum idea again:
>
> French: *nomment*
> German: *benennen*
> Italian: *danno un nome*
> Spanish: *dan nombre*
> Chinese: *命名*
> Japanese: **名前を与える**

4. Theorems

37th year (1990-2026) of publication of
Solstice: An Electronic Journal of Geography and Mathematics
Volume XXXVII, Number 2;
Monday, December 21, 2026; 2:50 pm, Central Time
Copyright ©2026-- All rights reserved.
Institute of Mathematical Geography and the authors

定理
証明された命題 — 必然的な帰結。

Here **定理** is exactly the standard mathematical term for theorem.

And **必然的な帰結** expresses necessary consequences cleanly.

5. New Consequences

新たな帰結
一つの定理が、新たな道を開きます。

I particularly like **新たな道を開きます**—"opens new paths."

Our branching miniature now has yet another linguistic interpretation while remaining visually unchanged.

数学の歩み

1 · 受け入れた出発点
これらを出発点として受け入れます。

2 · 論理的推論
定義、作図、証明。

3 · 定義
私たちが構成する対象に名前を与えます。

4 · 定理
証明された命題 — 必然的な帰結。

5 · 新たな帰結
一つの定理が、新たな道を開きます。

The Doorway

For **WHAT IF WE CHANGE A POSTULATE?**, I recommend:

もし一つの公準を変えたら、どうなるでしょう？

This is natural Japanese and preserves the speculative invitation: "What would happen if we changed one postulate?"

Then:

非ユークリッド幾何学を探究する →

37th year (1990-2026) of publication of
Solstice: An Electronic Journal of Geography and Mathematics
Volume XXXVII, Number 2;
Monday, December 21, 2026; 2:50 pm, Central Time
Copyright ©2026-- All rights reserved.
Institute of Mathematical Geography and the authors

I prefer **探究する** here over something more tourism-like such as *探索する*. **探究** means intellectual exploration/inquiry, exactly right for the Museum.

And Japanese, like Chinese, does not need us to manufacture a grammatical plural corresponding to European "geometries." **非ユークリッド幾何学** is the established collective mathematical expression.

Closing Inscription

This one deserves care because we want an inscription, not translated explanatory prose.

I propose:

わずかな単純な考えから、無限の美が広がっていく。

The sense is:

"From a few simple ideas, infinite beauty spreads/unfolds."

広がっていく has the unfolding/expanding quality we've carried across the Museum, but sounds natural in Japanese rather than forcing a cognate relationship that Japanese doesn't possess.

An alternative would be **無限の美が展開する**, but that sounds more technical. **広がっていく** has warmth.

So, I strongly prefer:

わずかな単純な考えから、無限の美が広がっていく。

Translation Status

For our metadata:

日本語
キュレーション翻訳・母語話者による確認を歓迎します

And I would set spoken locale to **Japanese (ja-JP)** when we insert it.

I think Japanese has passed our editorial test rather nicely. It doesn't sound like Chinese converted into Japanese, and certainly not like English with Japanese words substituted. It has its own rhythm and mathematical vocabulary.

> If you're ready, the next step is wonderfully mundane: take a **copy of frozen Multilingual Master v4**, add 日本語 as Language No. 7 (we note that these references

Copyright ©2026-- All rights reserved.
Institute of Mathematical Geography and the authors

describe an earlier developmental stage, not necessarily the current Museum), give it a Japanese font stack and ja-JP audio, syntax-check the whole machine—and see whether you can sit in Mississippi looking at **日本語 | 简体中文 while listening to Français**.

That sentence alone rather justifies the project.