What is origami?
Origami

The ancient Japanese Art of Paper Folding
NOT EXACTLY.
TIMELINE

I. TRADITIONAL ORIGAMI
105 AD, CHINA › LET THERE BE PAPER!

BECAUSE PLAYING ROCK-SCISSORS IS DUMB
6TH CENTURY › PAPER COMES TO JAPAN
VIA KOREA AND A BUDDHIST MONK, AS LEGEND TELLS
751 AD, SAMARKAND › PAPER GOES WEST
NO LONGER A SECRET
15TH - 17TH CENTURY ➔ FOLDING IN EUROPE

FIRST PRINTED REFERENCE (DISPUTED), GERMAN GODPARENTS, AND FANCY NAPKINS
18TH - 19TH CENTURY › FOLDING IN JAPAN

INSTRUCTIONS NOW AVAILABLE
1782 › FRIEDREICH FRÖBEL BORN IN GERMANY

GAVE KINDERGARTEN ITS GERMAN NAME
1868 〉 MEIJI RESTORATION
JAPAN WAKES UP, REALIZES THE TIME
“This Winter, a lady of my acquaintance taught me how to make cockerels by folding paper ... so that when you pull their tails they flap their wings. This invention comes from Japan.”
II. POPULAR ORIGAMI
1911 › AKIRA YOSHIZAWA BORN IN JAPAN
ORIGAMI MASTER AND DOOR-TO-DOOR CONDIMENT SALESMAN
There was a young fellow of Mayence
Who, in defiance
Not only of custom
And morals, dad-bust him,
But most of the known laws of science.

1945 › GERSHON LEGMAN BREAKS HIS ANKLE
IRONIC, GIVEN HIS LAST NAME
1965, UNITED KINGDOM  ›  ROBERT HARBIN’S “PAPER MAGIC” IS PUBLISHED
SO BEGINS A PROLIFIC CAREER
1970 › THE RON RESCH PAPER AND STICK FILM

AVAILABLE IN ITS ENTIRETY ON VIMEO
ORIGAMI TIMELINE

III. MODERN ORIGAMI
1980-89  JOHNN MONTROLL (US) / JUN MAEKAWA (JAPAN)

COLORING OUTSIDE THE LINES BUT REMAINING ON THE PAPER
EARLY 1990S › THE BUG WARS

A LITTLE COMPETITION NEVER HURT ANYONE
THE INTERNET

MAKING IT HAPPEN EVERYWHERE AT ONCE
ORIGAMI TODAY
HOW WE’RE FOLDING OUR PAPER
WET FOLDING

IT EVENTUALLY DRIES
MODULAR

MAKING SOMETHING BIG OUT OF LARGE AMOUNTS OF LITTLE
TESSELLATIONS

TRY REPEATING YOURSELF
CORRUGATIONS
BACK AND FORTH AND BACK
Origami constructible numbers

Straight edge & compass (for comparison)

Axioms:
1. Given points p, q, construct line thru p, q
2. Given lines l, l', construct l ∩ l'
3. Given points p, q, r, construct circle centered at p with radius lq - r
4. Given circle C & line l, construct C ∩ l (≤ 2 points)

Constructible numbers = constructible coordinates starting from two points (0, 0) & (1, 0)

Field extension F(α) = smallest field containing field F & number α
= { f(α) | f, g are polynomials in F & g(α) ≠ 0 } 2

Characterization: r ∈ R is constructible via SE&C
⇔ there exist α₁, α₂, ..., αₙ = r ∈ R such that αᵢ is a root of a degree-2 polynomial
over Q(α₁, α₂, ..., αᵢ-1), for all i.

Proof sketch:
- constructible numbers form a field i.e. α, β constructible ⇒ α - β, α/β constructible
(⇒) each operation solves a particular degree-2 polynomial
(⇐) αᵃ constructible ⇒ √α constructible, + quadratic formula

Classic impossible challenges:

COMPUTATIONAL
REAL PAPERS ABOUT HYPOTHETICAL PAPER
EXPERIMENTAL

DO FOLDS HAVE TO BE STRAIGHT?
THE FUTURE

WHAT DOES IT FOLD?
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Folders
The Ron Resch Paper and Stick Film
John Montroll
Robert J. Lang
Chris Palmer
Joel Cooper
Eric Gjerde
Erik Demaine
Photo Credits

1. Rhombicosadodecahedron (Koss, photo by John Sluder)
2. Traditional origami crane
3. 5, 14, 20. Tsuki, Bird Nest (Yoshizawa), Corrugation (Koss)
5. Shakyamuni Triad Horyuji
6. Shah-i Zinda, Samarkand, Uzbekistan
7. Fancy Napkin Fold, Patenbrief, De Sphaera
8. Ranma Zushiki, Senbazuru Orikata
9. Friedrich Fröbel
10. Meiji Joukyou
11. Leo Tolstoy
12. Akira Yoshizawa
13. Robert Harbin, Downhill Skier
14. The Ron Resch Paper and Stick Film
15. Erik Demaine, Origami Constructible Numbers (Demaine), Miura Ori Metamaterials
16. Curved Folds (Albers/Tee)
17. USS Enterprise (Cahoonas)