



**E.I.N.S.**

E<sup>U</sup>UDRES<sup>2</sup> Entrepreneurship and Innovation Network  
for Smart and Sustainable European Regions



# Touch Me Viz

## Intro to Data Physicalization

**dmh**  
digital makers hub

**DIHOST**  
DIGITAL INNOVATION HUB  
Niederösterreich | Wien | Burgenland | Oberösterreich

Unterstützt von:

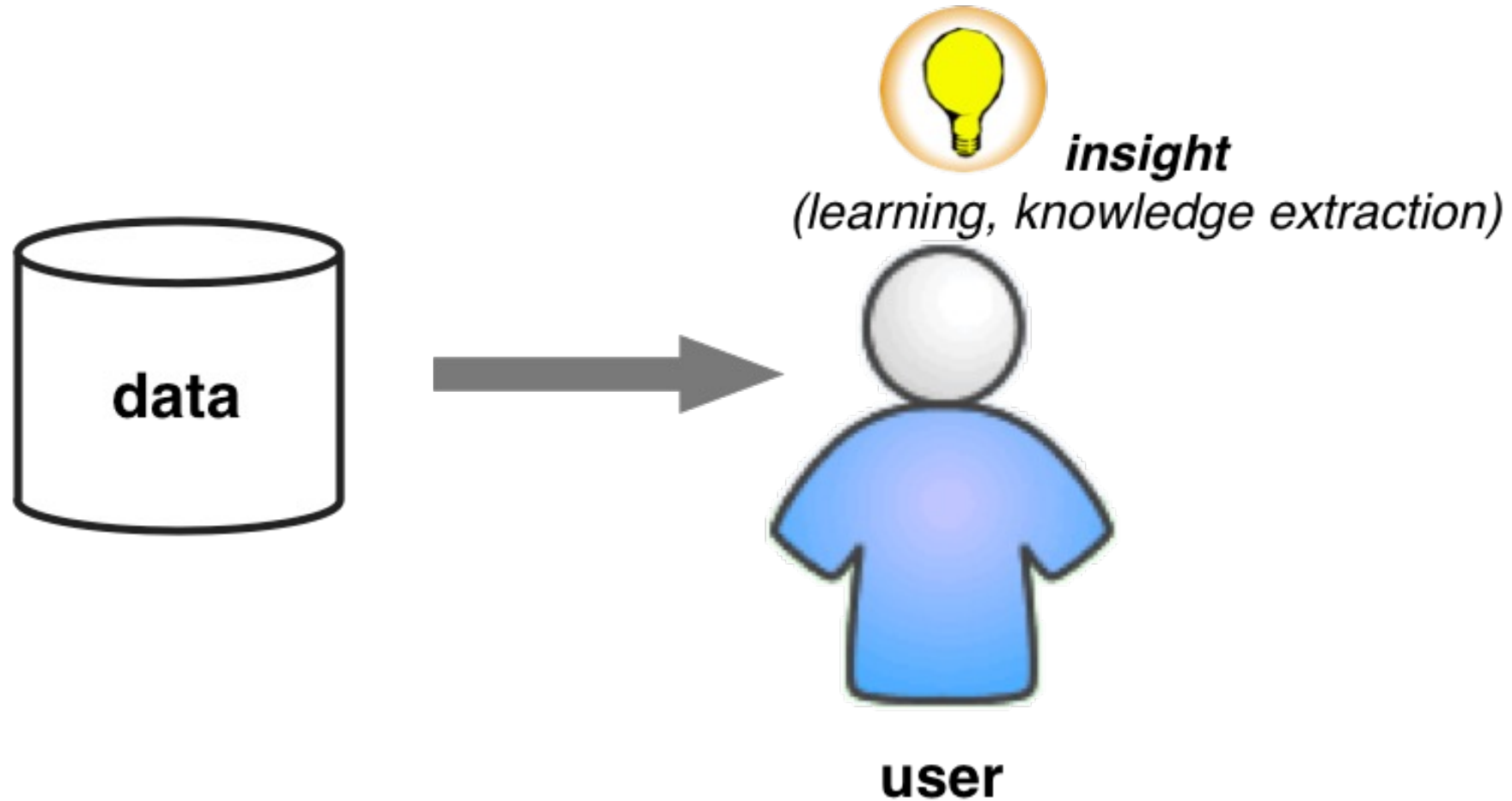








# Goal





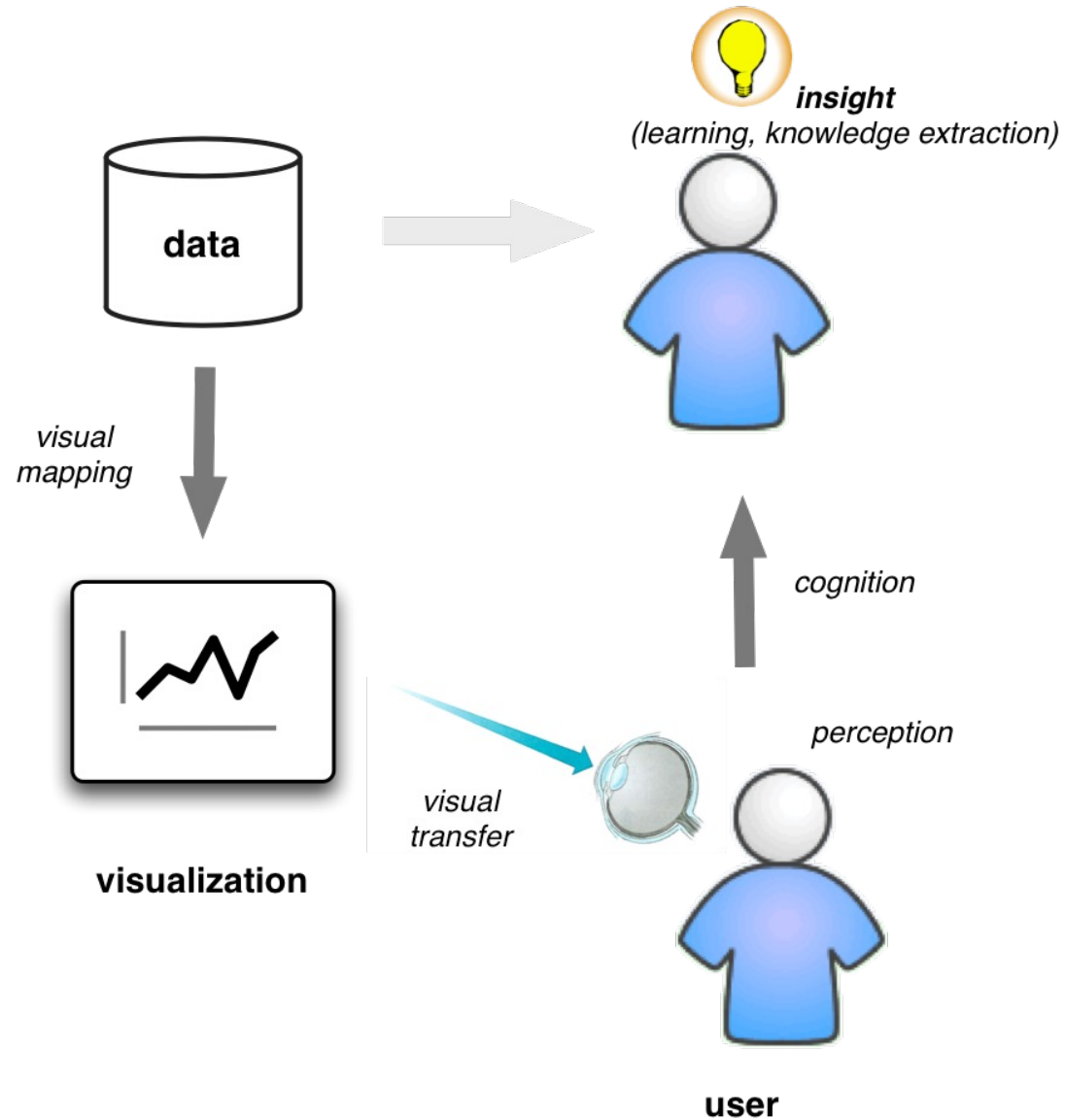




**„No matter how much data one can amass, without form, organization and context, data itself has no meaning.“** [Segal, 2022]

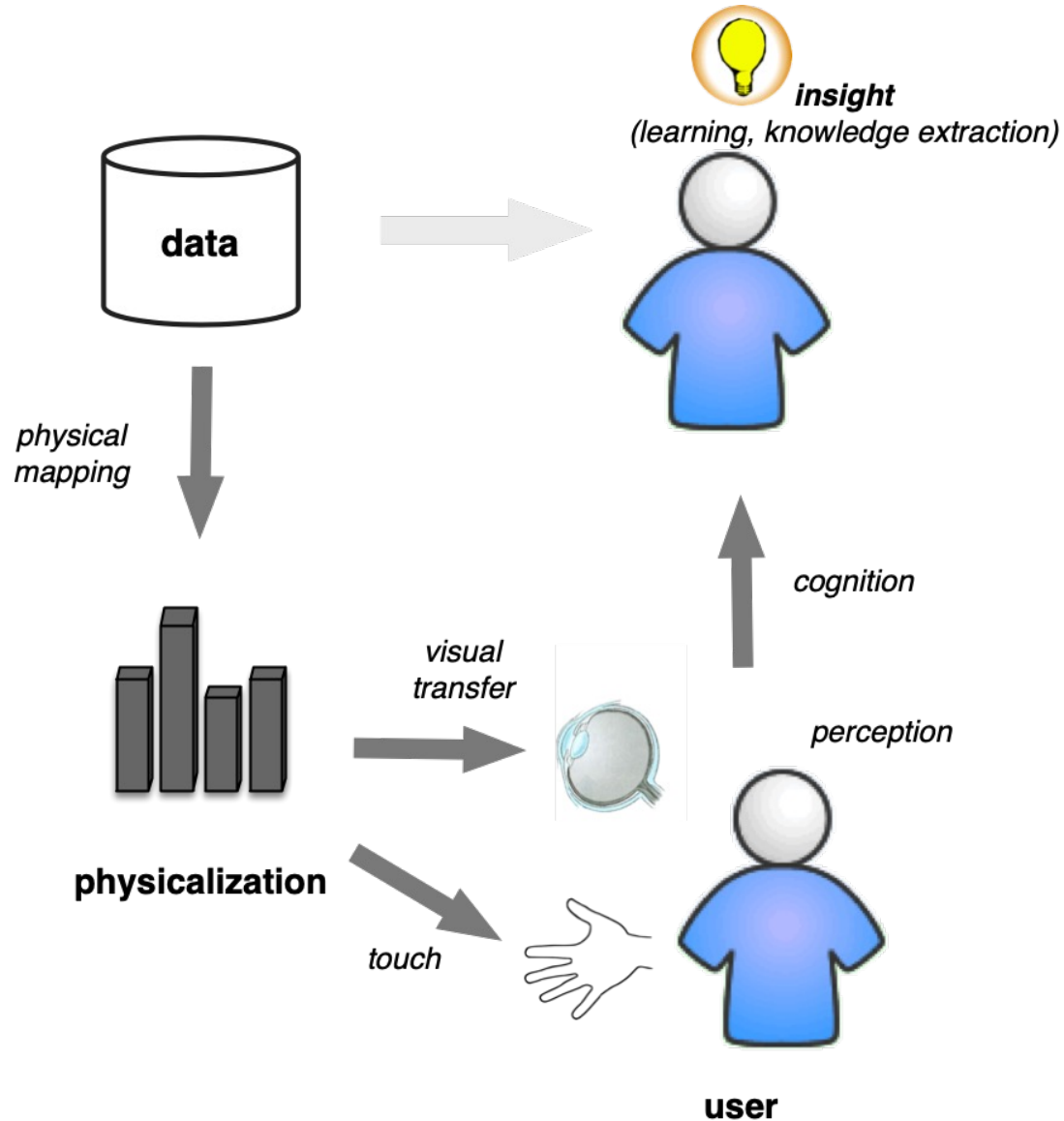
# Process Overview

# Data Visualization

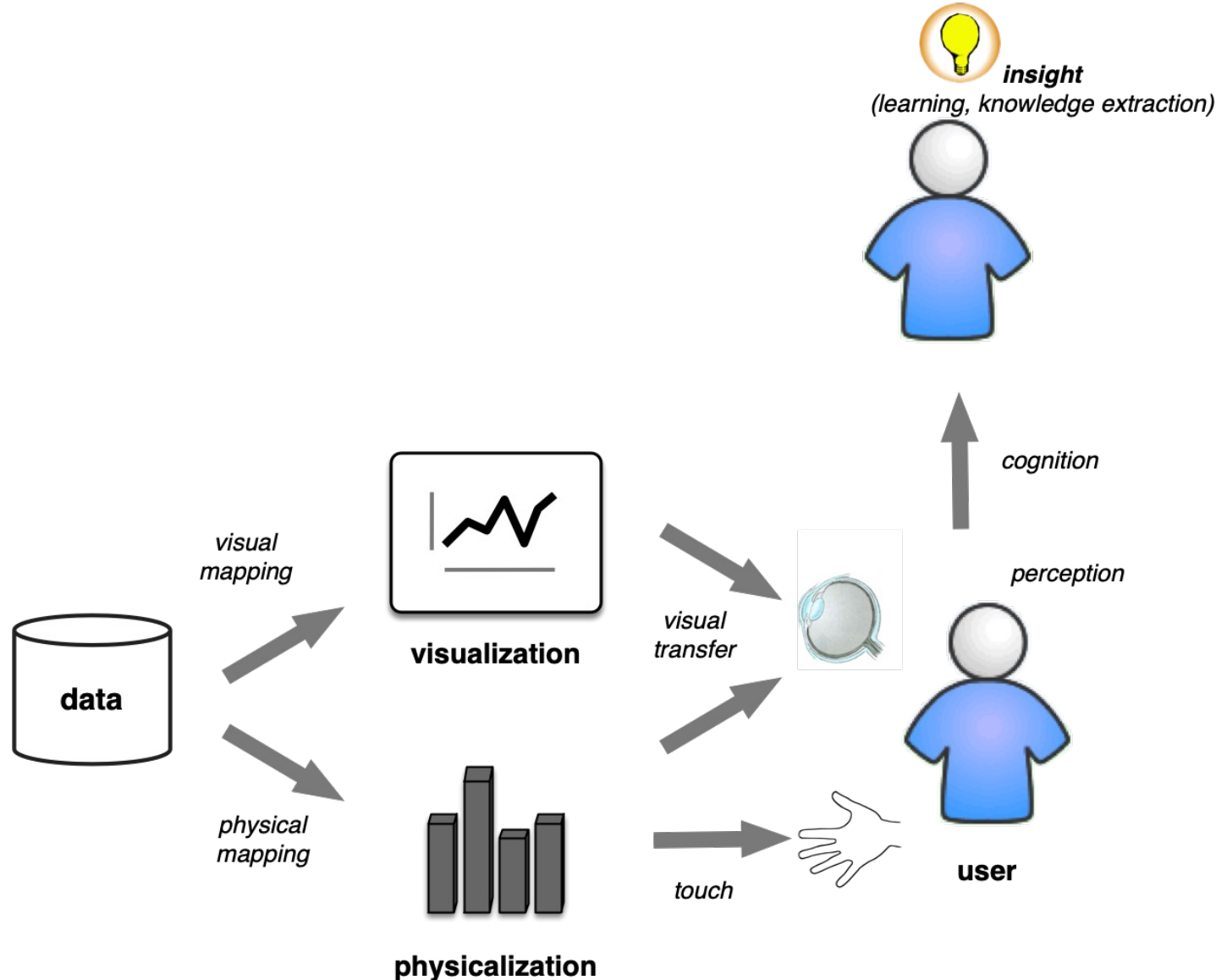




# Data Physicalization



# Data Visualization + Physicalization



„exploit potentials  
of both, physical  
and digital  
paradigms” [Segal, 2022]

# Examples





# 2050



# Break free into new dimensions

„The screen is no longer the goal or the limit; freeing designers to explore more dimensions and shape deeper experiences to reach people with important messages about their health, communities, and climate. Data physicalizations break free into new dimensions where playful imaginations can use water, plastic, wood, or stone to fabricate data stories for public installations and private reflections.“ [Ben Shneiderman in

Huron et al, 2023, frontmatter]



# Definitions

# data visualization

„The use of computer-supported, interactive, visual representations of abstract data to amplify cognition.“

[Card et al., 1999]

# data physicalization

„A physical artifact whose geometry or material properties encode data.“ [Jansen et al., 2015]



# physecology

"the relations between the different design elements—physical and digital—of a physicalization, and their coupling to the audience and (physical) surroundings" [Sauvé et al., 2022]

# Most data begin as being of physical origin

„There is nothing inherently digital about data“ [Dragicevic & Jansen, 2012]

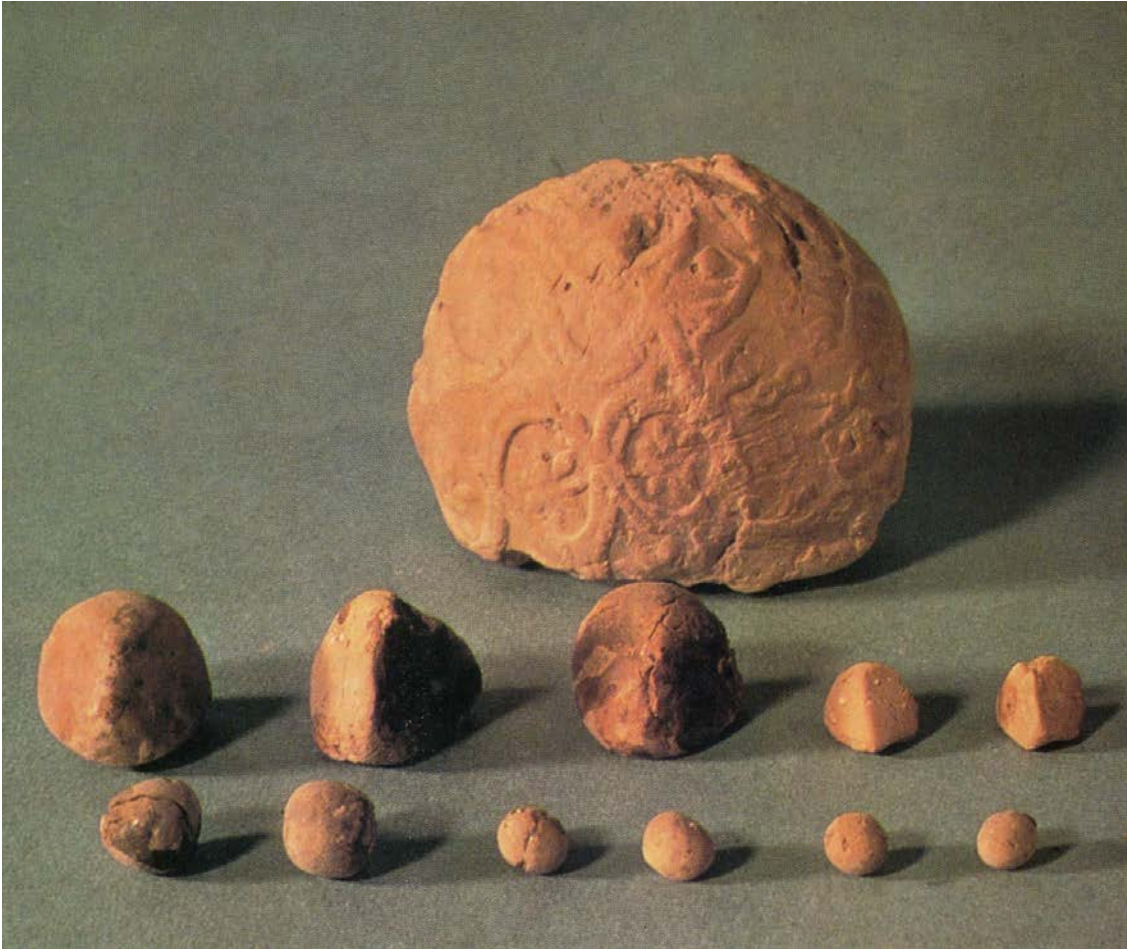
„Data begin as physical, real stuff in real space and in real time: people, things, places, events, ticks in time, a birth, a death, an atom smashed, a price declined, dots in space that accumulate.“

[Barbara Tversky in Huron et al, 2023, frontmatter]

# A Brief History of Physical Data

„Since long before recorded history,  
humans have created objects imbued  
with information.“ [Huron et al., 2023]

# 5500 BC – Mesopotamian Clay Tokens



count, store and communicate economic data  
date back to 7500 BC (around the time when  
agriculture began)

made from clay shaped into geometric  
symbols (cones, spheres, cylinders,  
tetrahedrons)

represent commodities (barley, oil, units of  
work)

in different sizes denoting quantity

[Schmandt-Besserat, 2009; Dragicevic &  
Jansen, 2012]

# 2500 BC – Abacus



tactile data processing tool



# 1300 - Hourglass



time measurement device

# 1920 – Yakama Time Ball



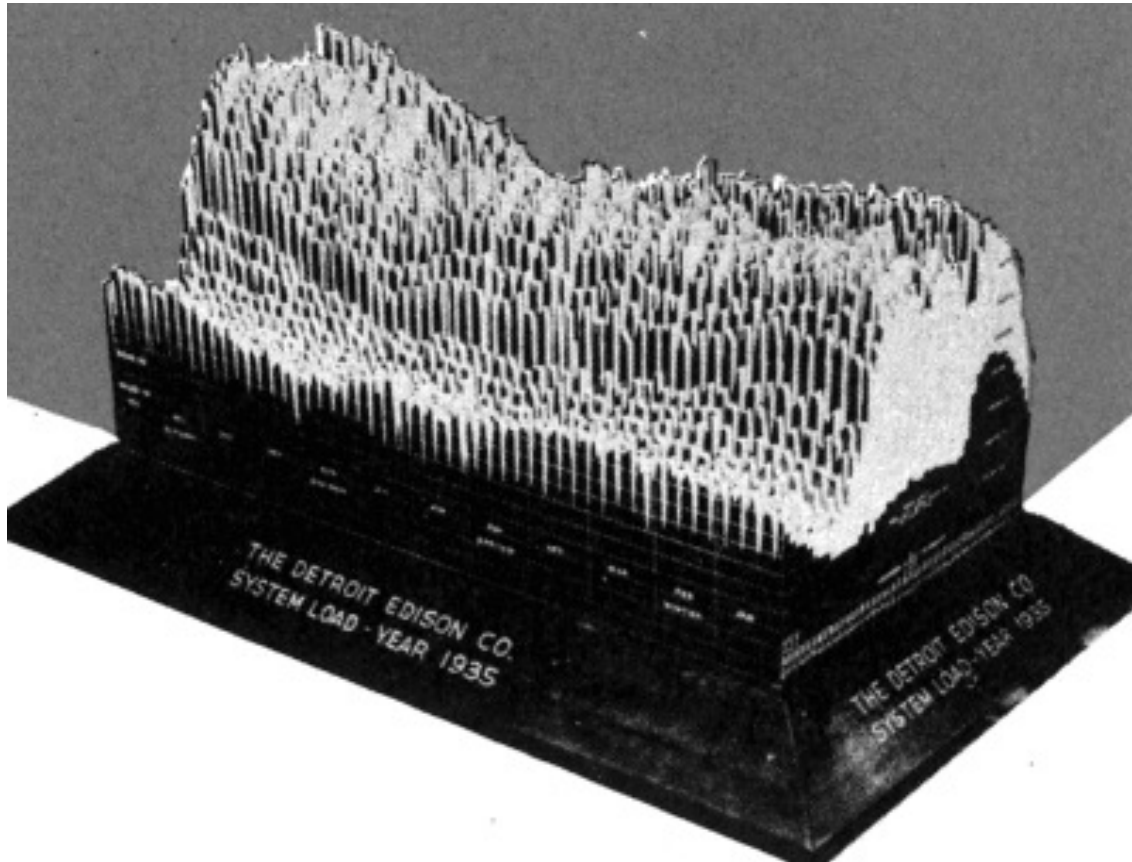
strings of hemp as personal diaries

used by women from the Yakama Native American tribe

major event in their life was represented by a knot, a bead or a shell

[Image from the Cooper Hewitt Smithsonian Design Museum; [dataphys.org](https://dataphys.org), 2023]

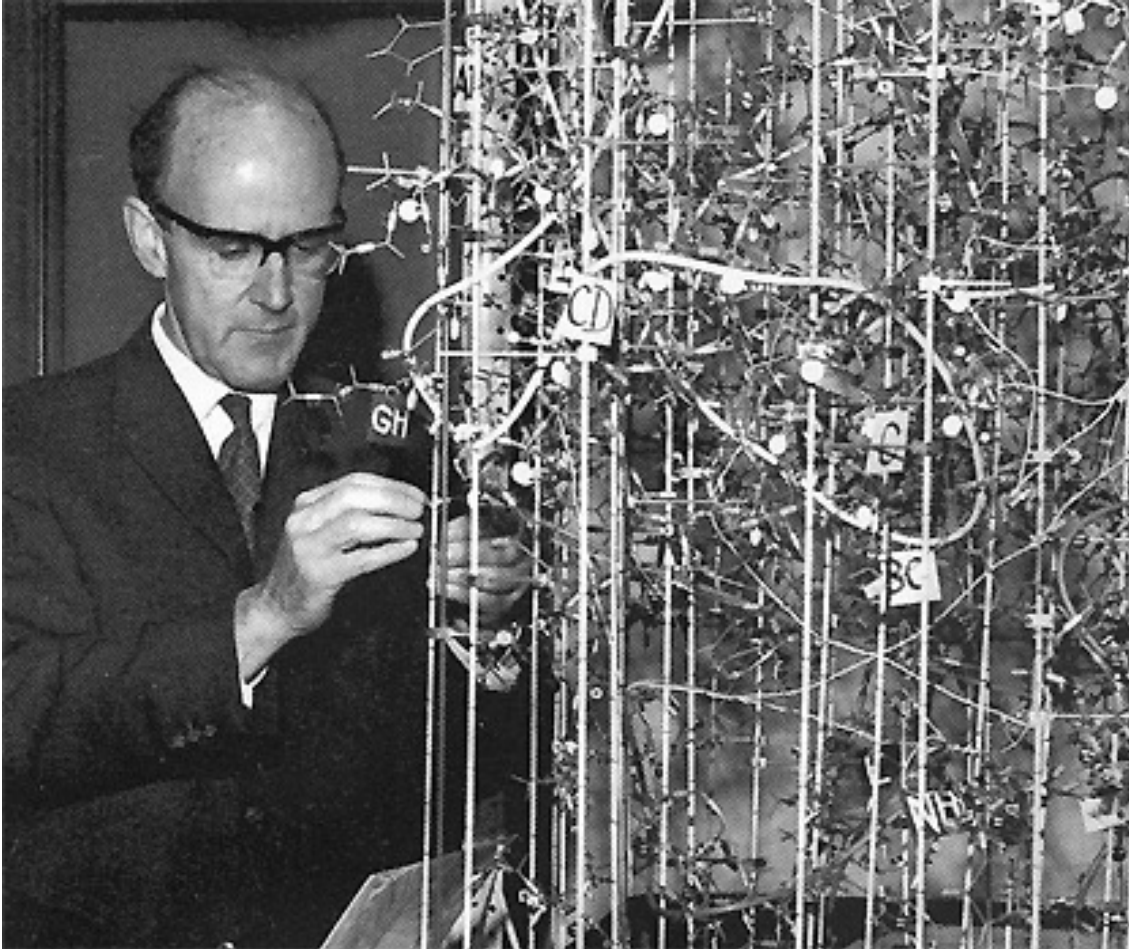
# 1935 – 3D Visualizations of Power Consumption



American electricity companies were building and maintaining solid 3D visualizations of electricity consumption presumably to better anticipate power demands

[Brinton, 1939; Jansen et al., 2013; [dataphys.org](http://dataphys.org)]

# 1957 – Proteine Visualizations

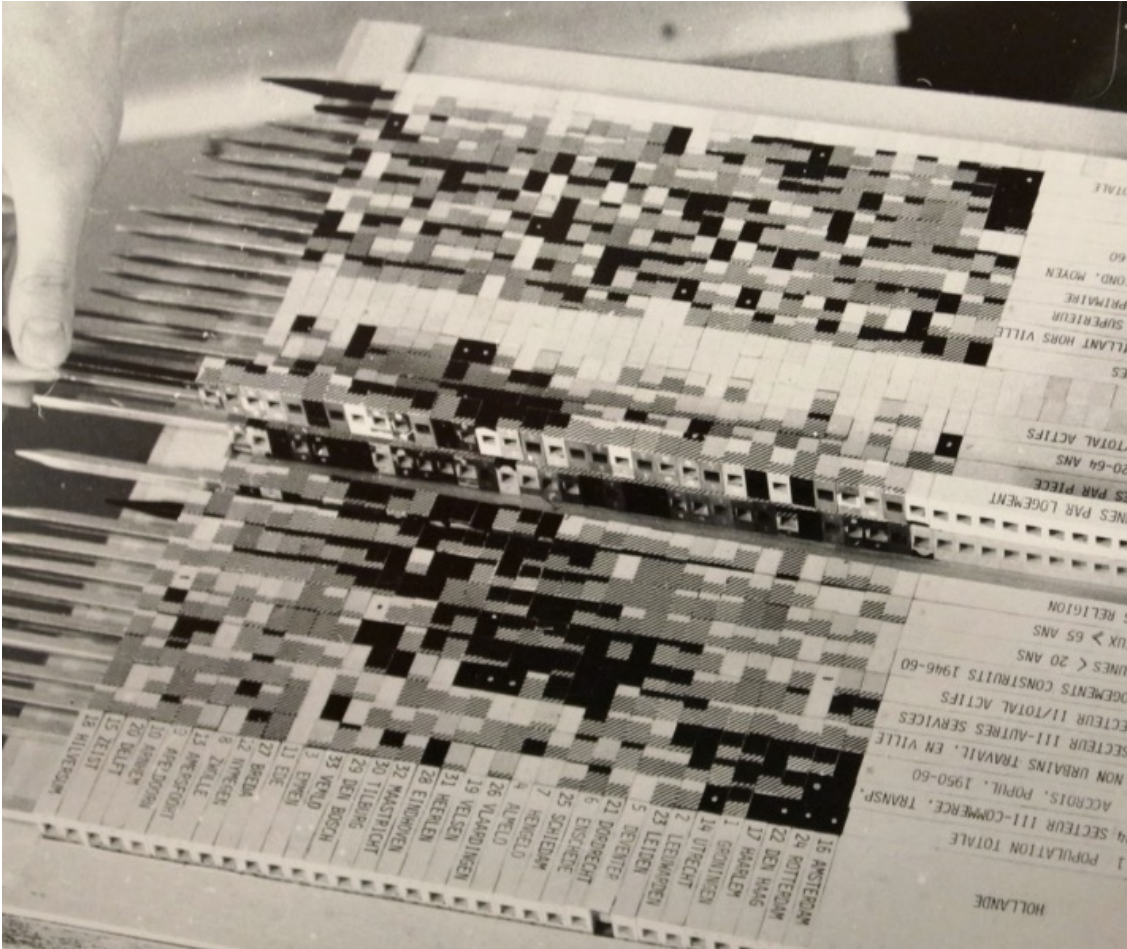


Biochemist Max Perutz working on a model of hemoglobin similar to the "forest of rods", completed in 1968. Hemoglobin is made of 10,000 atoms. Perutz and Kendrew shared the 1962 Nobel Prize in Chemistry for working out the structure of those giant molecules.

[Martz and Francoeur, 2004; dataphys.org]



# 1968 – Jacques Bertin's Reorderable Matrices



physical device for exploring and presenting tabular data

rod mechanism allowed unlocking either rows or columns for reordering

[Bertin, 1981; dataphys.org, 2023]



# 2004 – Cylinder: Early Sound Sculpture



one of the first digitally-fabricated sound sculptures

Source:

<http://extraversion.co.uk/2003/cylinder/>

[dataphys.org, 2023]

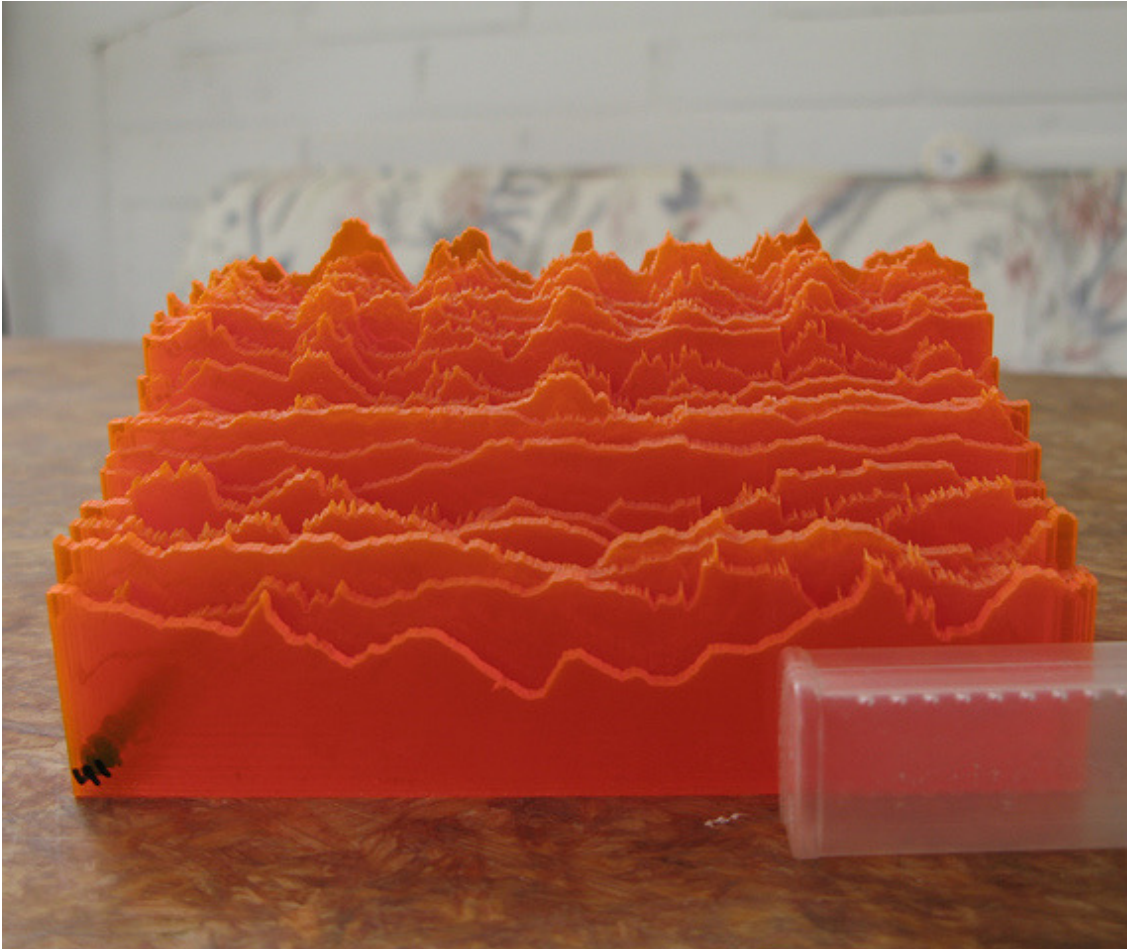
# 2010 – Thematic Maps of Germany



physical cartographic visualizations

[Wolf-Dieter Rase, 2012; dataphys.org, 2023]

# 2011 – Laser-Cut Time Series

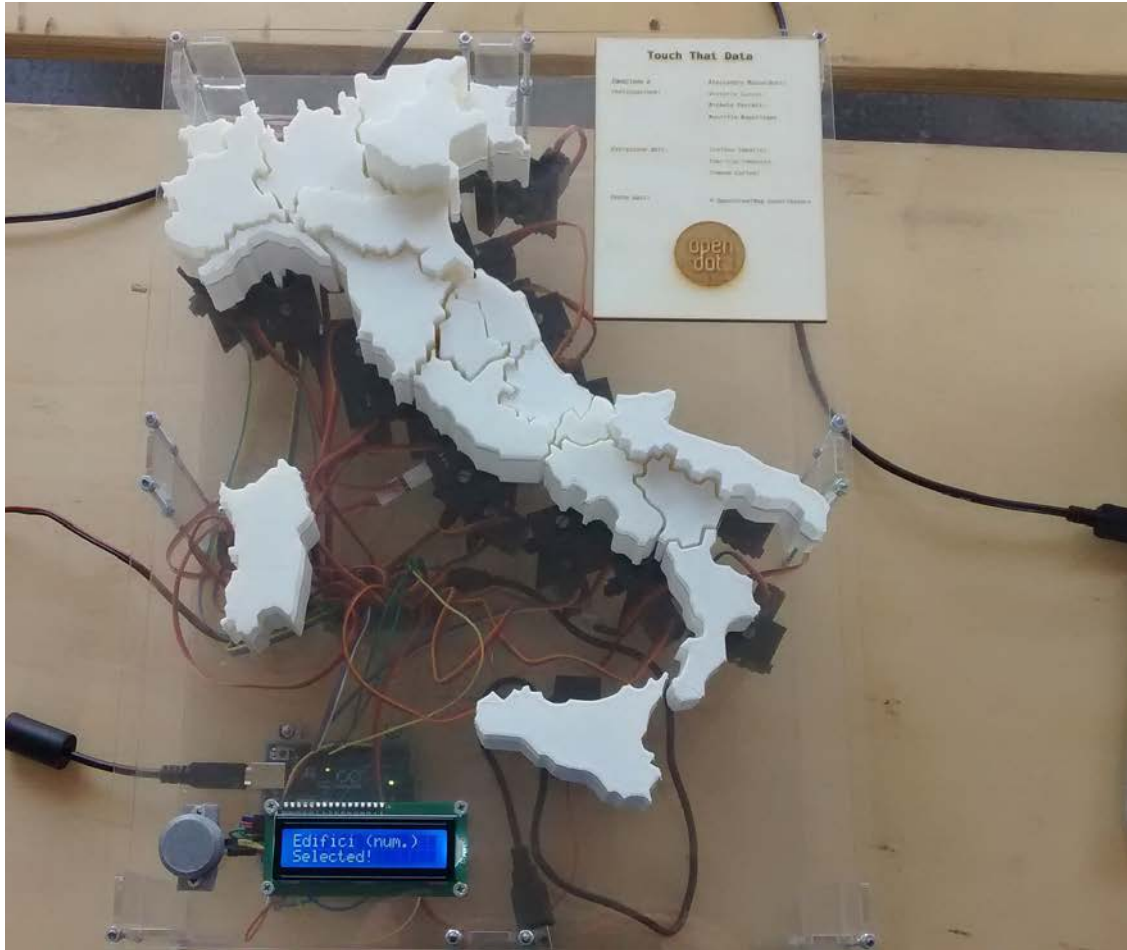


temperature measurements in Helsinki from  
May 2009 to May 2010.

each row is one week long.

[Miska Knapek; dataphys.org, 2023]

# 2016 – Actuated Prism Map of Italy



actuated prism map

[Alessandro Masserdotti, 2016; dataphys.org, 2023]







# Uses and Benefits

# Uses of physicalizations

Physicalization for Analytics

Physicalization for Communication and Education

Physicalization for Accessibility

Physicalization for Self-Reflection and Self-Expression

Physicalization for Enjoyment and Meaning-Making

# Benefits of Physical Visualizations

**Experience**

Memorability

Efficiency

Support Communication of  
Statistical Data

Motivate Physical Activity



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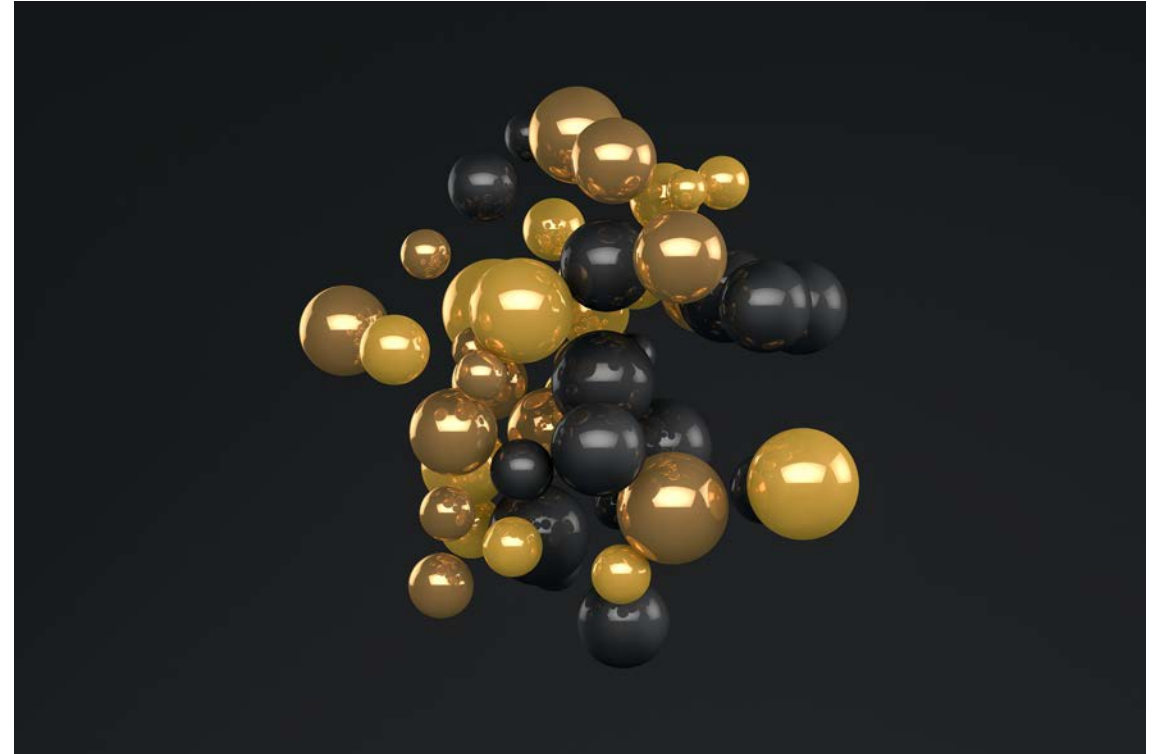
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# Constructive Visualization Exercise