

# Welcome!

## Considering Physical Variables for Data Physicalization

Trevor Hogan, Uta Hinrichs, Samuel Huron, Bettina Nissen

6th workshop (series): VIS'14, CHI'15, TEI'16, DRS'16, DIS'17 & DRS'18 (VIS'18)

# Today's schedule

**11:00 – 11:40**

**Introduction**

Who are we?

Who are you?

What is Physicalization?

**11:40 – 12:45**

**Physicalization Activity: Group forming, Ideation & Design**

*12:45 – 1:30pm*

*Lunch break*

**1:30 – 2.45pm**

**Physicalization Activity: Design & Making**

**2:45 – 4.00pm**

**Presentation of the physicalization**

**Discussion & Conclusion**

**4pm**

**End of Workshop**

**RECORDING:**

**We will record audio-visual footage during the workshop, for potential publication this will be anonymised. If you prefer not to be recorded, let us know.**

# Trevor Hogan

Lecturer in Interaction Design  
Crawford College of Art and Design, CIT, Ireland

## Human-Data Interaction Group

*“Extending the use representational modalities and extending evaluation criteria, methodologies and audience”*

### Interests

- # Physicalization & Multisensory Data Representations
- # Tangible Interaction
- # Data Experience
- # Design & Evaluation Methods

[www.tactiledata.net](http://www.tactiledata.net) [hello@tactiledata.net](mailto:hello@tactiledata.net) @tactiledata



# Samuel Huron

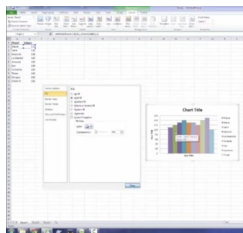
Associate professor  
Design, Infovis, HCI

University of Paris Saclay  
Telecom Paris-Tech  
I3 - UMR 9217 CNRS

Twitter : @cybunk

## Interests:

- # Construction of vis
- # Information visualization
- # Design methods in Research
- # Design paradigms



Understanding how physically **building** information representation **impact** the construction of people **understanding**.

Making visualization authoring **accessible** for “non visualization experts”

# Bettina Nissen

Research Associate | Design Informatics  
University of Edinburgh, UK

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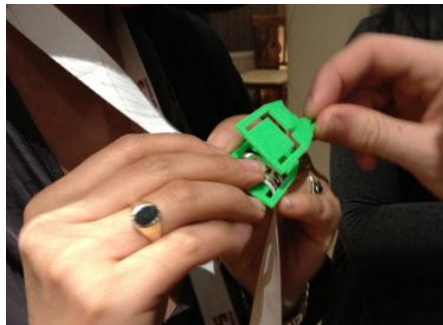
[www.data-things.com](http://www.data-things.com)

[@bettinanissen](https://twitter.com/bettinanissen)

design  
informatics

## Interests

Data Engagement  
Digital Fabrication  
Public Data Making  
Data Craft Practices  
Materiality



# Uta Hinrichs

Assistant Professor in Human-computer Interaction & InfoVis

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SACHI Research Group; University of St Andrews, Scotland

<http://sachi.cs.st-andrews.ac.uk>

## Interests

# information visualization

# physical data representations

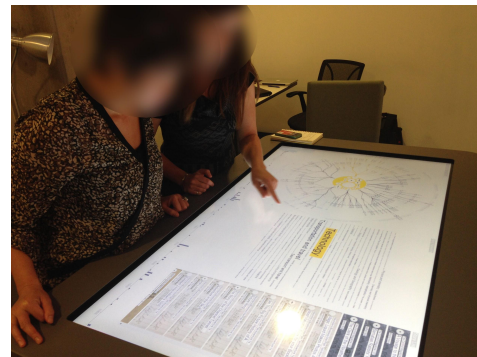
# interface design

# studying experiences with visualization

# visualization as a method to engage & facilitate a dialogue



University of  
St Andrews



# Who are you?

Name

Affiliation

Domain

Why are you interested in  
physicalization?

In 20 seconds :-)

# What is Physicalization?

→ Mapping data to visual / physical properties / material / forms



# DATA

Example: Going out with friends

| Date       | How many people | Costs (\$) | Where | How enjoyable |
|------------|-----------------|------------|-------|---------------|
| 11/03/2016 | 5               | 45         | Bar   | **            |

Diagram illustrating the data types associated with the example:

- dates & time (points to Date)
- numbers (points to How many people and Costs (\$))
- categories (points to Where)
- ordered items (points to How enjoyable)

# COLOUR



Image courtesy Alice Thudt  
<http://alicethudt.de/>

# MAPPING DATA TO COLOUR

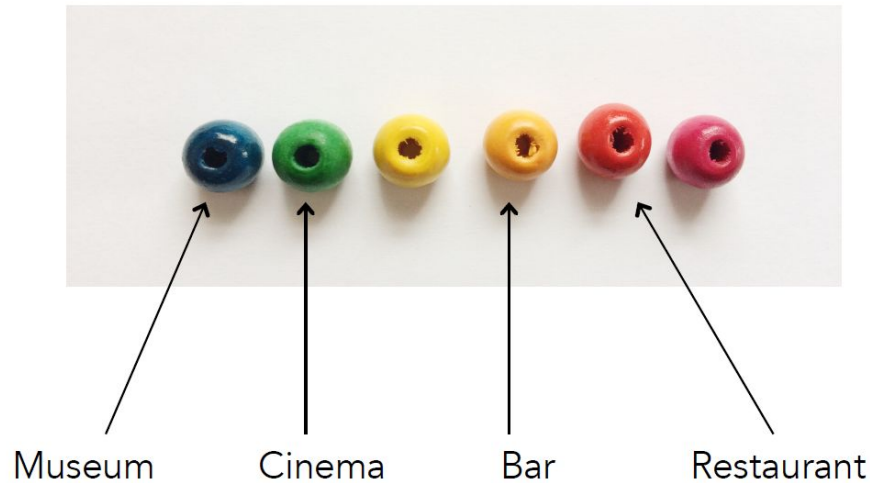


Image courtesy Alice Thudt  
<http://alicethudt.de/>

# SIZE

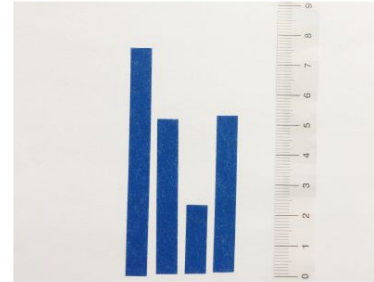
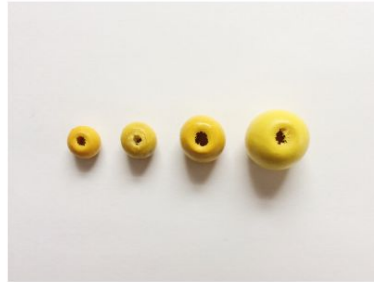
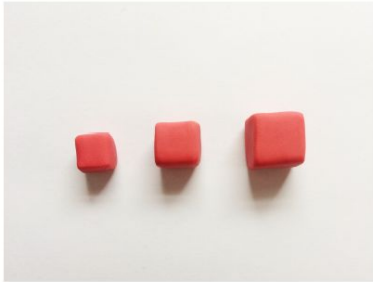


Image courtesy Alice Thudt  
<http://alicethudt.de/>

# MAPPING DATA TO SIZE

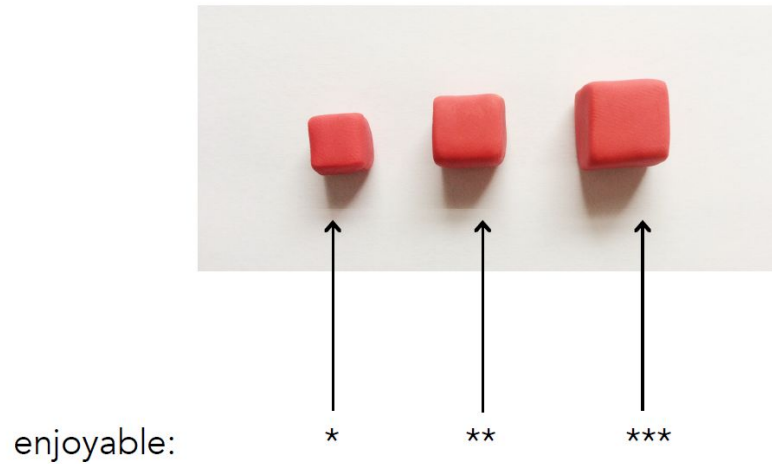


Image courtesy Alice Thudt  
<http://alicethudt.de/>

# POSITION

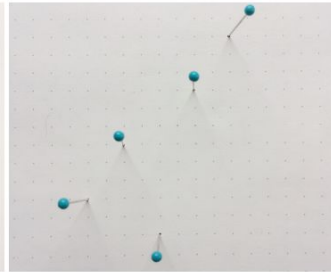
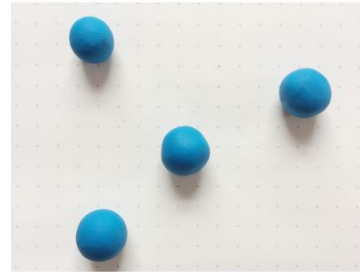
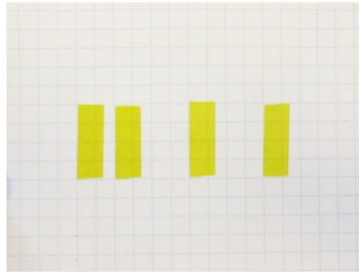
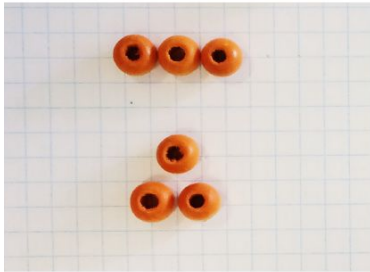


Image courtesy Alice Thudt  
<http://alicethudt.de/>

# MAPPING DATA TO POSITION

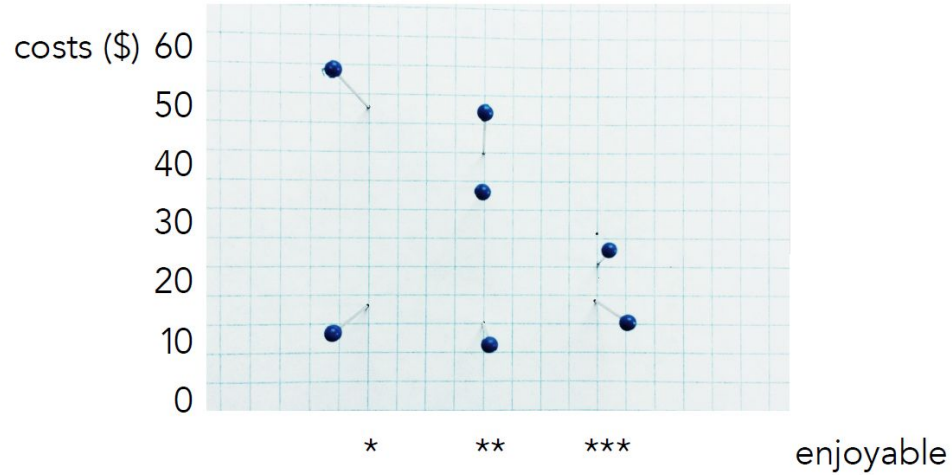


Image courtesy Alice Thudt  
<http://alicethudt.de/>

# COUNT

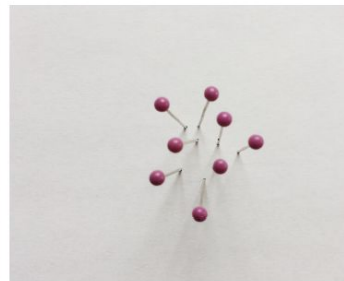
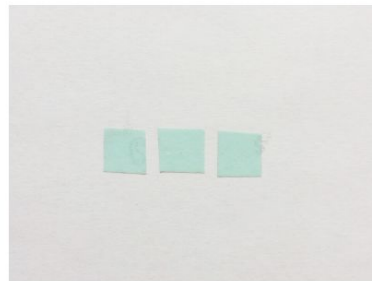


Image courtesy Alice Thudt  
<http://alicethudt.de/>



# MAPPING DATA TO COUNT



1 bead  $\longrightarrow$  1 person

Image courtesy Alice Thudt  
<http://alicethudt.de/>

# SHAPE

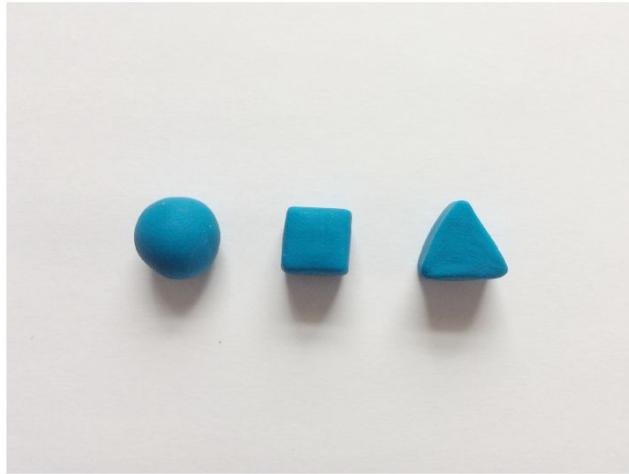


Image courtesy Alice Thudt  
<http://alicethudt.de/>

# MATERIAL

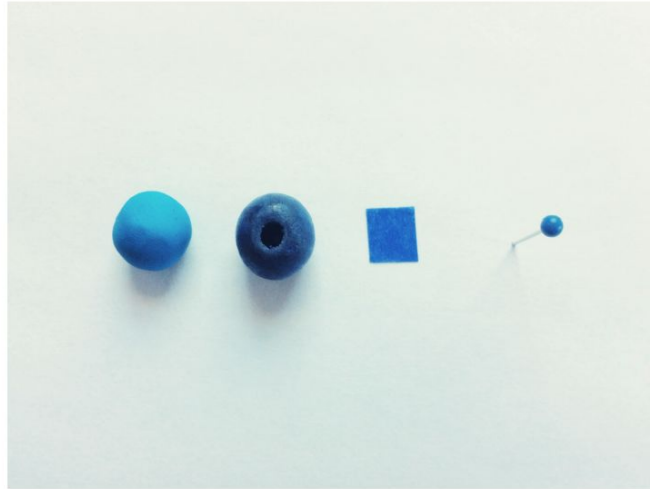


Image courtesy Alice Thudt  
<http://alicethudt.de/>



|                        | <i>Points</i> | <i>Lines</i>                           | <i>Areas</i>     | <i>Best to show</i>                               |
|------------------------|---------------|--|------------------|---|
| <i>Shape</i>           |               | <i>possible, but too weird to show</i> | <i>cartogram</i> | <i>qualitative differences</i>                    |
| <i>Size</i>            |               |  | <i>cartogram</i> | <i>quantitative differences</i>                   |
| <i>Color Hue</i>       |               |  |                  | <i>qualitative differences</i>                    |
| <i>Color Value</i>     |               |  |                  | <i>quantitative differences</i>                   |
| <i>Color Intensity</i> |               |  |                  | <i>qualitative differences</i>                    |
| <i>Texture</i>         |               |  |                  | <i>qualitative &amp; quantitative differences</i> |



# Go beyond

the previous variables and explore

Haptic / Feel / Touch

Dimensionality

Sensorial experience

|                 | Points | Lines                                  | Areas            | Best to show                                      |
|-----------------|--------|--|------------------|---|
| Shape           |        | <i>possible, but too weird to show</i> | <i>cartogram</i> | <i>qualitative differences</i>                    |
| Size            |        |  | <i>cartogram</i> | <i>quantitative differences</i>                   |
| Hue             |        |  |                  | <i>qualitative differences</i>                    |
| Color Value     |        |  |                  | <i>quantitative differences</i>                   |
| Color Intensity |        |  |                  | <i>qualitative differences</i>                    |
| Texture         |        |  |                  | <i>qualitative &amp; quantitative differences</i> |
| ...             |        |  |                  |   |

# **Hands-on activity**

Make your own physical representation of data!

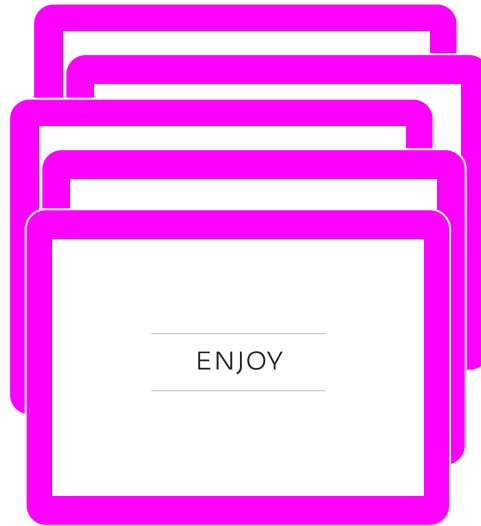
# Hands-on activity

constraint-driven design of data physicalization

## Scenarios



## Activities



## Data

A stack of blue-bordered cards representing data. The top card displays a table titled "MEAN APPROPRIATENESS RATINGS" with columns for activities and rows for various contexts.

|               | Kiss | Eat  | Fight | Cry  | Laugh |
|---------------|------|------|-------|------|-------|
| Class         | 2.10 | 4.23 | 1.21  | 2.21 | 6.23  |
| Date          | 8.73 | 7.79 | 3.58  | 3.04 | 8.00  |
| Bus           | 4.27 | 5.48 | 1.52  | 3.08 | 7.10  |
| Family dinner | 4.92 | 8.44 | 1.67  | 3.21 | 7.13  |
| Park          | 7.71 | 8.13 | 3.06  | 5.21 | 8.10  |
| Job interview | 1.08 | 1.73 | 1.04  | 1.37 | 5.88  |
| Bar           | 5.17 | 7.67 | 1.90  | 3.44 | 8.23  |
| Elevator      | 4.79 | 5.10 | 1.58  | 3.48 | 6.77  |
| Restroom      | 2.81 | 2.35 | 1.77  | 4.79 | 5.90  |

## Questions to guide activity

- How would you describe the **physical properties** of your physicalization? Which of these are directly related to data?
- How would you characterize **your design process** when mapping your data to physical properties/form/material?
- What is the role of **performance / interaction / narrative** in your physicalization?
- What **types of materials** did you choose for your physicalization and why? How did your choice of materials influence the **modality of your physicalization**?
- What is the intended **type of experience** you wish to facilitate with your physicalization?
- Can you explain the **semiotic connection** (symbolic, metaphor, analogy, allegory, designation...) between the data and your physicalization?



# Let's physicalise!

How to express your data in different media / materials?

Examine your data!

Explore the materials!

Consider the audience of your context!

Sketch out some ideas!

**Record design decisions on post-it notes**

## Questions to guide activity

- How would you describe the **physical properties** of your physicalization? Which of these are directly related to data?
- How would you characterize **your design process** when mapping your data to physical properties/form/material?
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- Can you explain the **semiotic connection** (symbolic, metaphor, analogy, allegory, designation...) between the data and your physicalization?

# Presentations

# Reflections

What types of materials did you choose for your physicalization and why?

How did your choice of materials influence the modality of your physicalization?

Can your physicalization be appreciated without generating any data insight?

How important is aesthetics in your physicalization?

Can your physicalizations be read without touching it?

# References

**Let's Get Physical: Promoting Data Physicalization in Workshop Formats.** S Huron, P Gourlet, U Hinrichs, T Hogan, Y Jansen. Pictorial at ACM DIS 2017, June, Edinburgh.

**Constructing visual representations: Investigating the use of tangible tokens.** S Huron, Y Jansen, S Carpendale. IEEE transactions on visualization and computer graphics 20 (12), 2102-2111

**Constructive visualization.** S Huron, S Carpendale, A Thudt, A Tang, M Mauerer. Proceedings of the 2014 conference on Designing interactive systems, 433-442

**Data Sensification, beyond representation modality, toward encoding data in experience.** T Hogan, Proceedings of the 2018 DRS.

**Pedagogy & Physicalization: Designing Learning Activities around Physical Data Representations.** T Hogan, U Hinrichs, Y Jansen, S Huron, P Goulet, E Hornecker, B Nissen. Proceedings of 2018 DIS.

**Data-Things: Digital Fabrication Situated within Participatory Data Translation Activities,** B Nissen, J Bowers. Proceedings of the 2014 conference on CHI, 2467-2476.