Make-a-Vis & Tavola

Andreas Bueckle
Ph.D. Candidate, Information Science

Cyberinfrastructure for Network Science Center
Intelligent Systems Engineering & Information Science
School of Informatics, Computing, and Engineering
Indiana University, Bloomington, IN, USA

*VISUALISE Conference | San Francisco, California | May 8-9 2019*

Investigating Data Visualization Literacy

- 273 subjects

- 3 US science museums

- 5 out of 20 different visualizations

- 5 questions per visualization

Source: Börner, K., Maltese, A., Balliet, R. N., & Heimlich, J. (2016). Investigating aspects of data visualization literacy using 20 information visualizations and 273 science museum visitors. Information Visualization, 15(3), 198-213.

"What do you call this type of data presentation?"
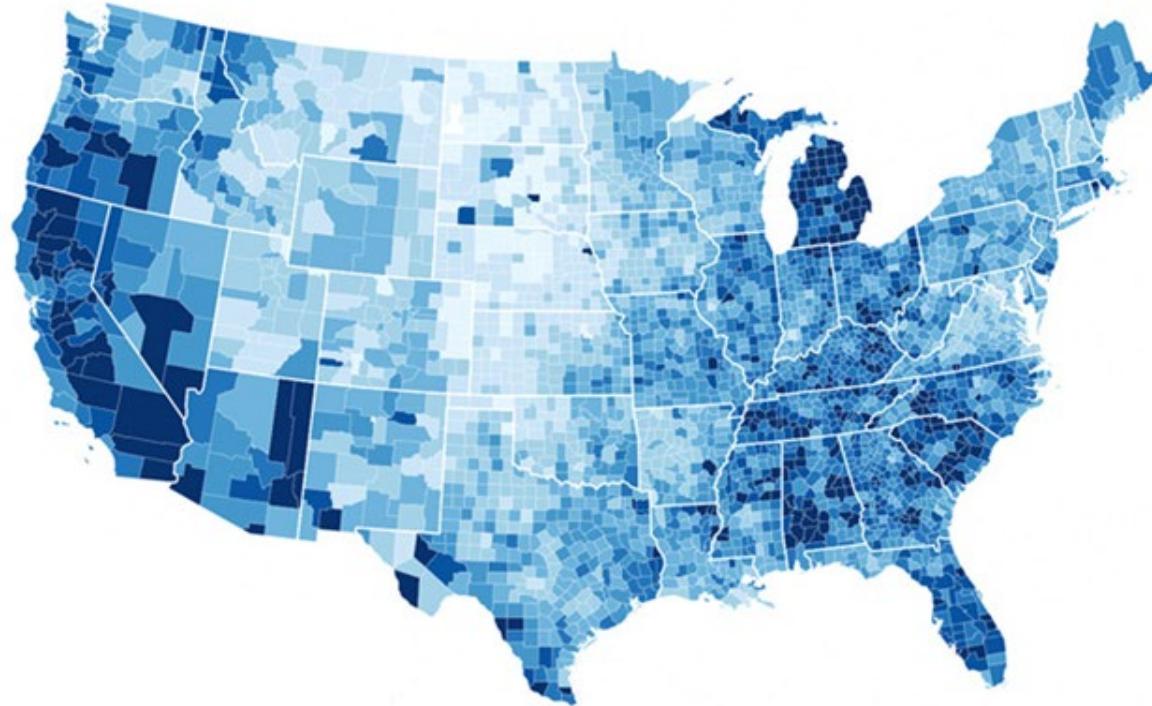
- "Choropleth map"
- "Density map"
- "Map"
- "A chicken"
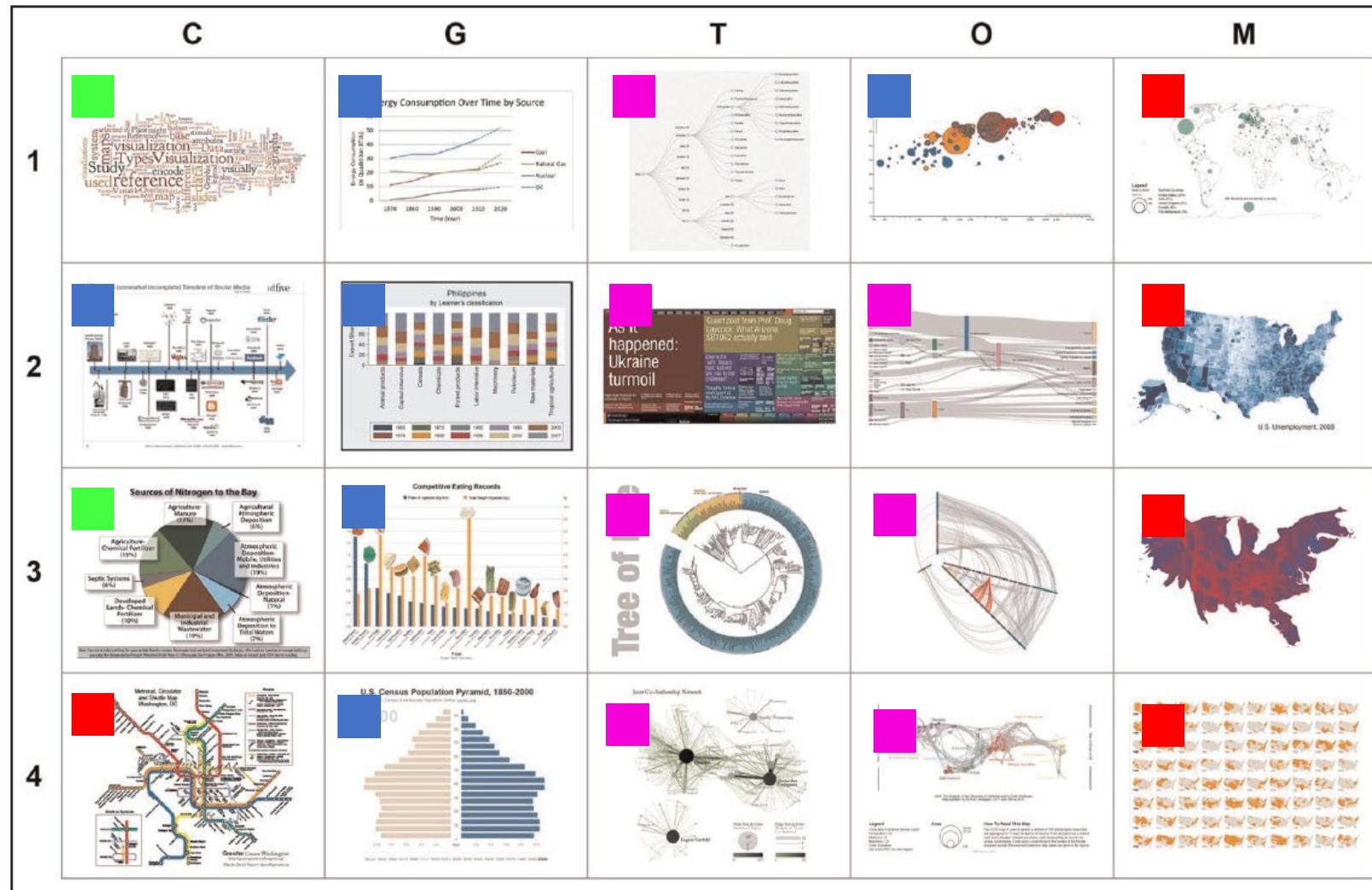
- Chart
- Graph
- Map
- Network layout

Results: "Does this type of data presentation look at all familiar?"
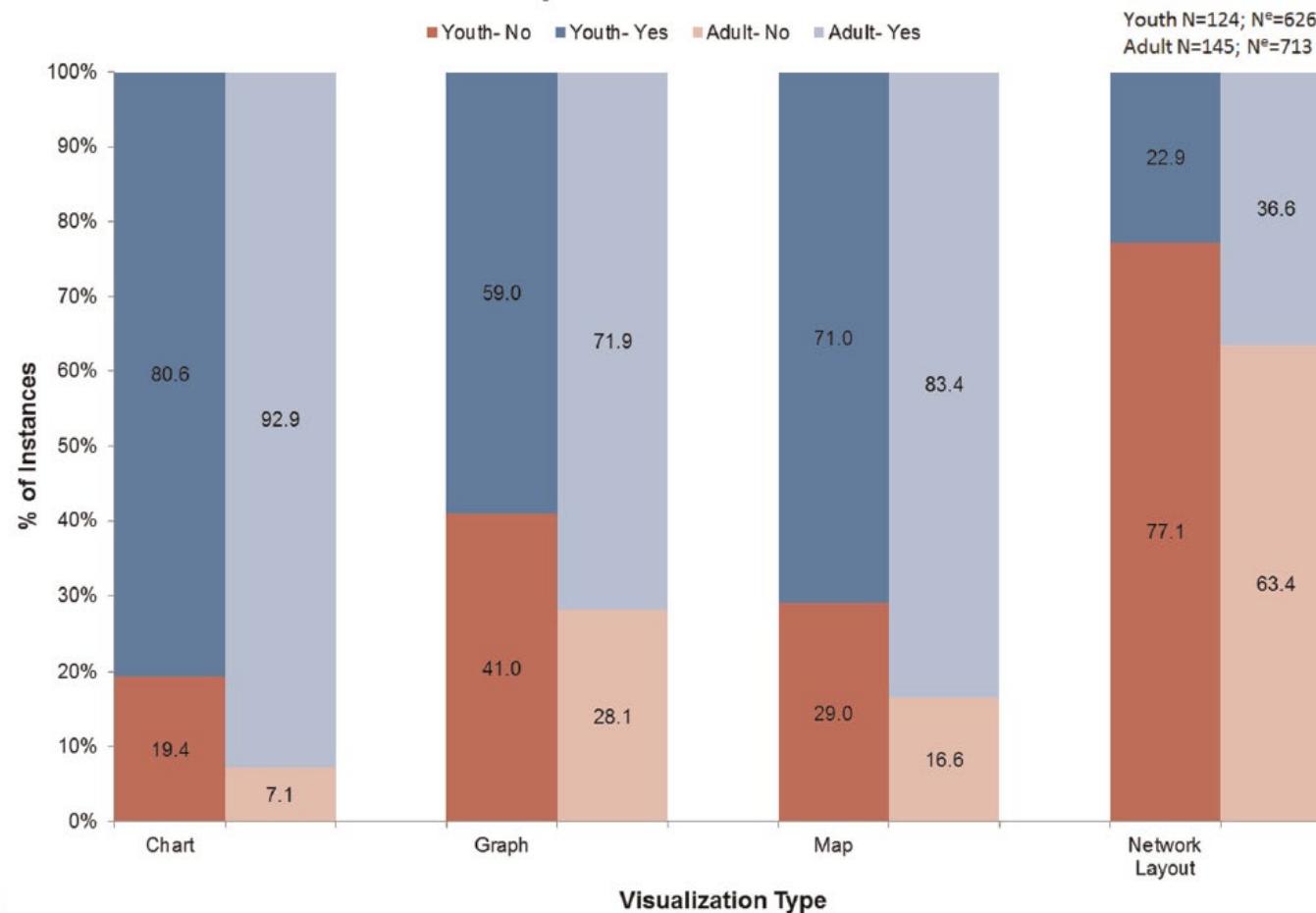
Key insight:
Subjects are less likely to be familiar with networks

Results: "What do you call this type of data presentation?"

Visualization Type (# Used in Study)	What would you call this?			
	Chart	Graph	Map	Network Layout
Chart (2)	63.5	31.1	5.4	0.0
Graph (8)	20.1	75.4	4.4	0.0
Map (5)	10.8	16.9	71.9	0.4
Network Layout (5)	36.0	40.4	21.1	2.6
All (20)	23.9	48.0	27.6	0.5

Key insight:
Subjects have trouble naming network visualizations

6

Visualization Frameworks

MANY frameworks and taxonomies have been proposed to

- help organize and manage the evolving zoo of 500+ different data visualization types,

- provide guidance when designing data visualizations, and

- facilitate teaching.

Source: Börner, K., Bueckle, A., & Ginda, M. (2019). Data visualization literacy: Definitions, conceptual frameworks, exercises, and assessments. Proceedings of the National Academy of Sciences, 116(6), 1857-1864.
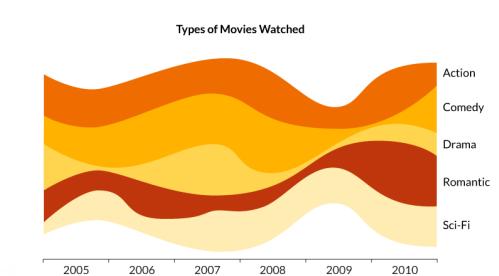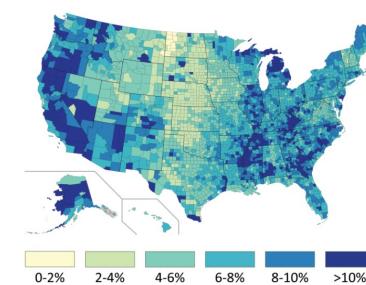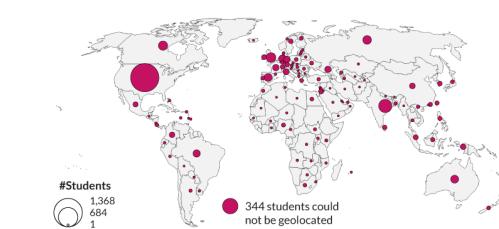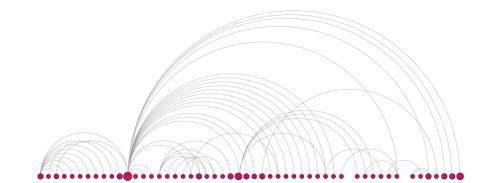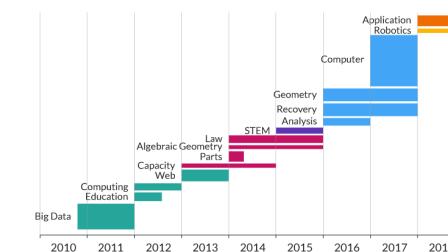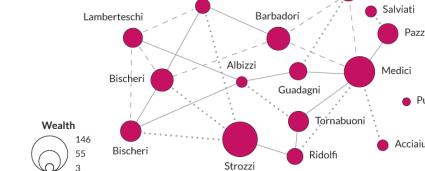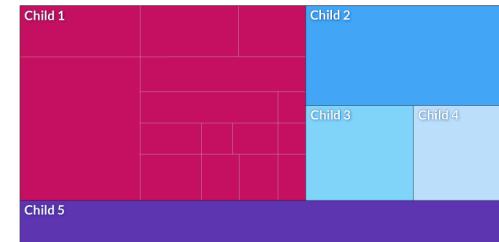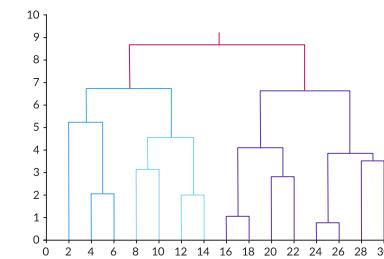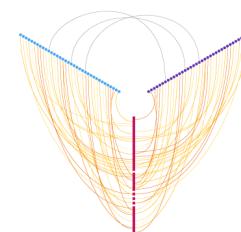
Data Visualization Literacy Framework (DVL-FW) Process Model
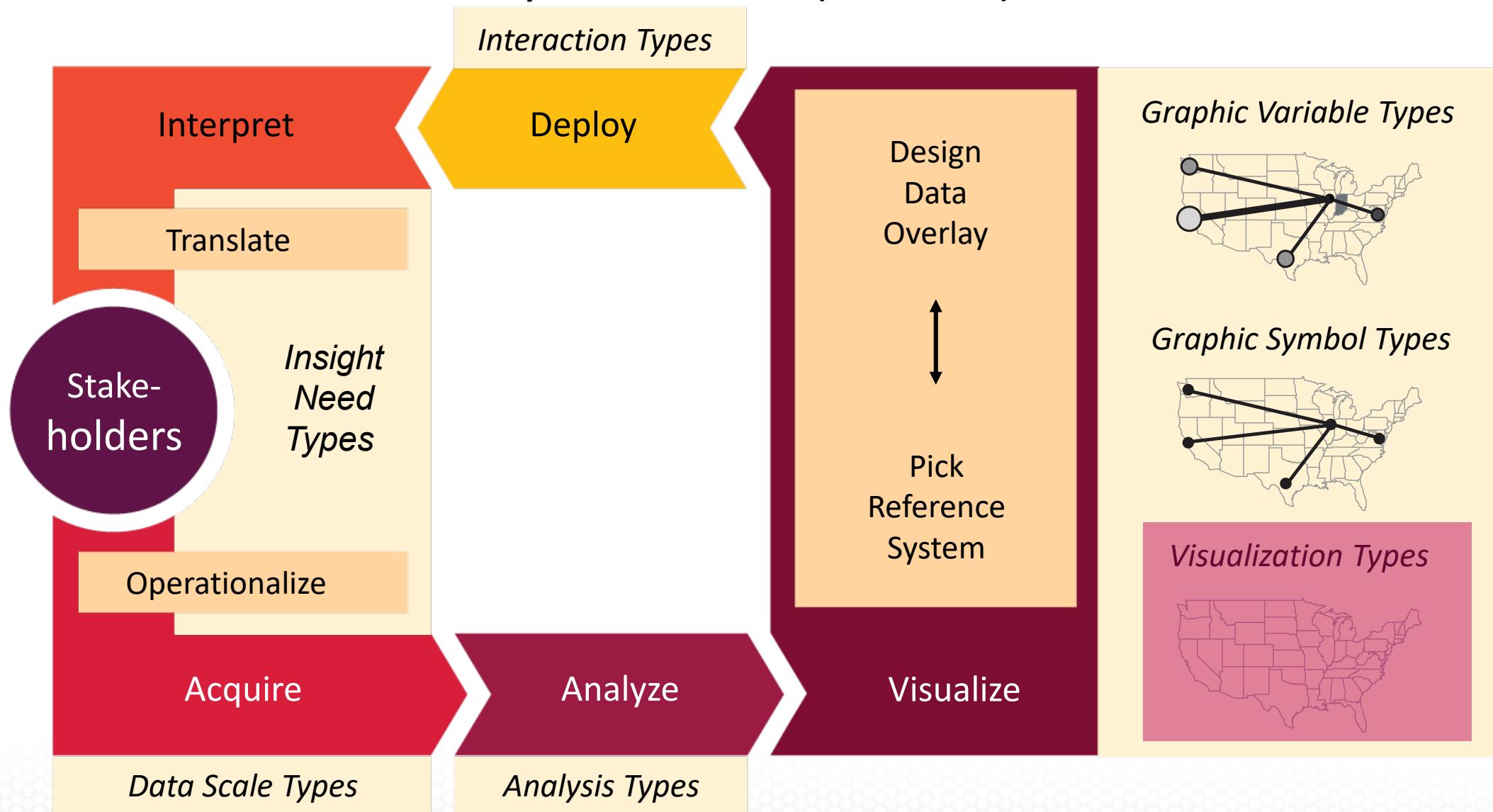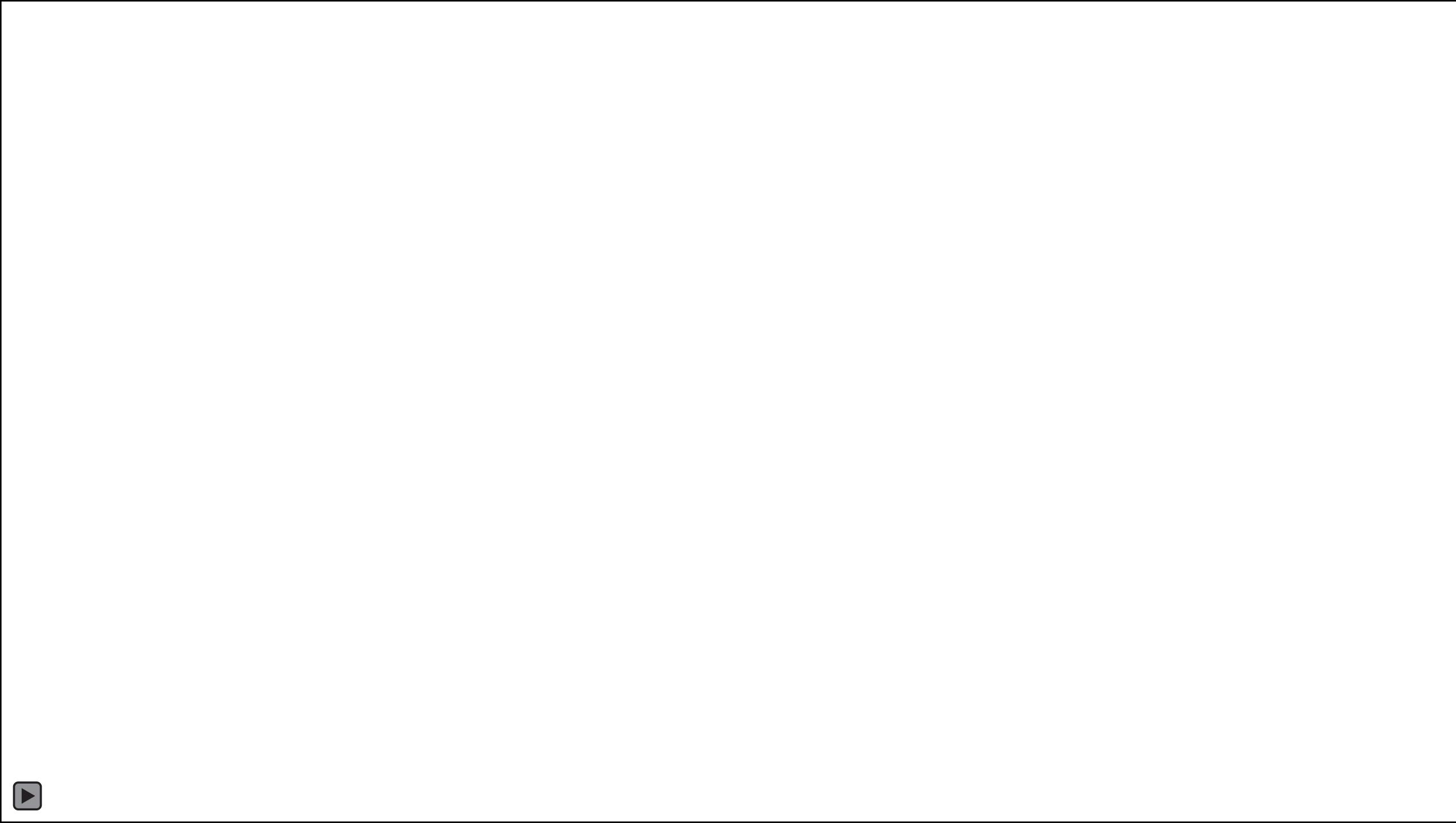
Data

NSF Awards: (mav-nsf-awards-AI-above_1m.nsf)

Title	Investigators	Start Year	En
BEACON: An NSF Center for the Study of Evolution in Action	Erik Goodman	2010	20
Center for Research in Cognitive Science	Aravind Joshi	1991	20
Spatial Intelligence and Learning Center (SILC)	Nora Newcombe	2011	20

1 - 3 of 64

Investigators: (from NSF Awards)

Name	# Awards	$Awarded	
Erik Goodman	1	43,035,209	2
Richard Lenski	1	43,035,209	2
Kay Holekamp	1	43,035,209	2

1 - 3 of 206

Co-PI Links: (from NSF Awards)

Investigator 1	Investigator 2	# Joint Awards	
Charles Ofria	Erik Goodman	1	2
Charles Ofria	Kay Holekamp	1	2
Charles Ofria	Richard Lenski	1	2

1 - 3 of 325

Scatter Graph ⊗   Geomap ⊗   Network ⊗   **Temporal Bar Graph** ⊗
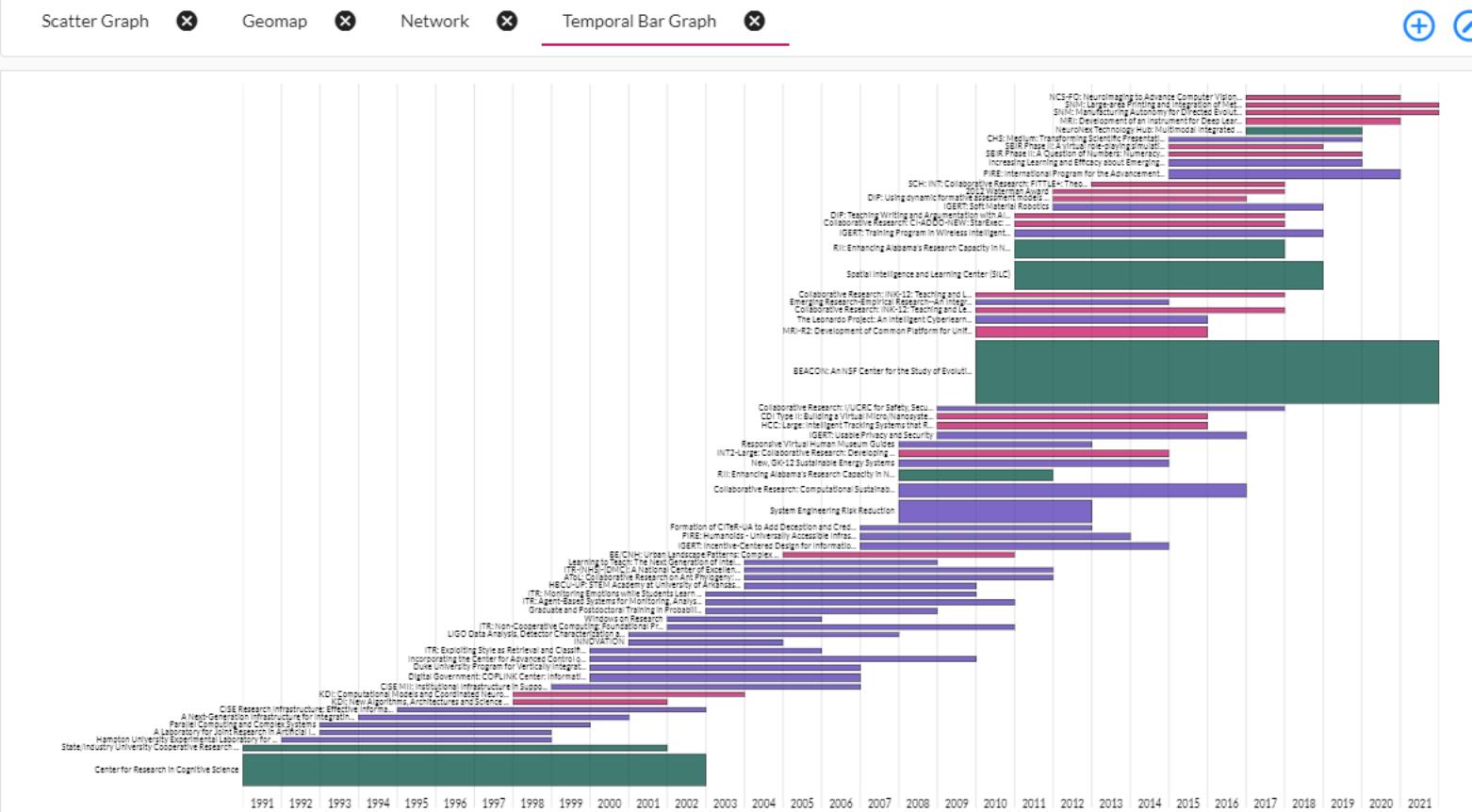
Learn about this Temporal Bar Graph

1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

Bars

Identifier	X-Axis Start	X-Axis End	Size	Color Hue	Label
NSF Award: ID	NSF Award: Start Year	NSF Award: End Year	NSF Award: $Awarded	NSF Award: Award Instrument	NSF Award: Title
ID	1991	2021	43,035,209 / 1,890,508 / 1,000,000	▪ Continuing Grant / ▪ Cooperative Agreement / ▪ Standard Grant	T

CNS Cyberinfrastructure for Network Science Center

Amatria (2018)
Luddy Hall, SICE, IU
Photo: Ann Schertz

POWER CABINET
SUSPENDED ABOVE MEETING ROOM

LARGE SPHERE SECTION

REBEL STAR DOUBLES

REBEL STAR SINGLES

SOUND SENSOR SCOUTS

GROTTO

CONTROL CLOSET

WEBCAM

SMALL SPHERE SECTION

BUILDING ETHERNET AND INTERNET ACCESS

MONITORING LINE

TIE IN #3   TIE IN #2   TIE IN #1

SUPERVISED BY IU AS AFFLIATE

120V AC SUPPLY

12V DC PSU x 13
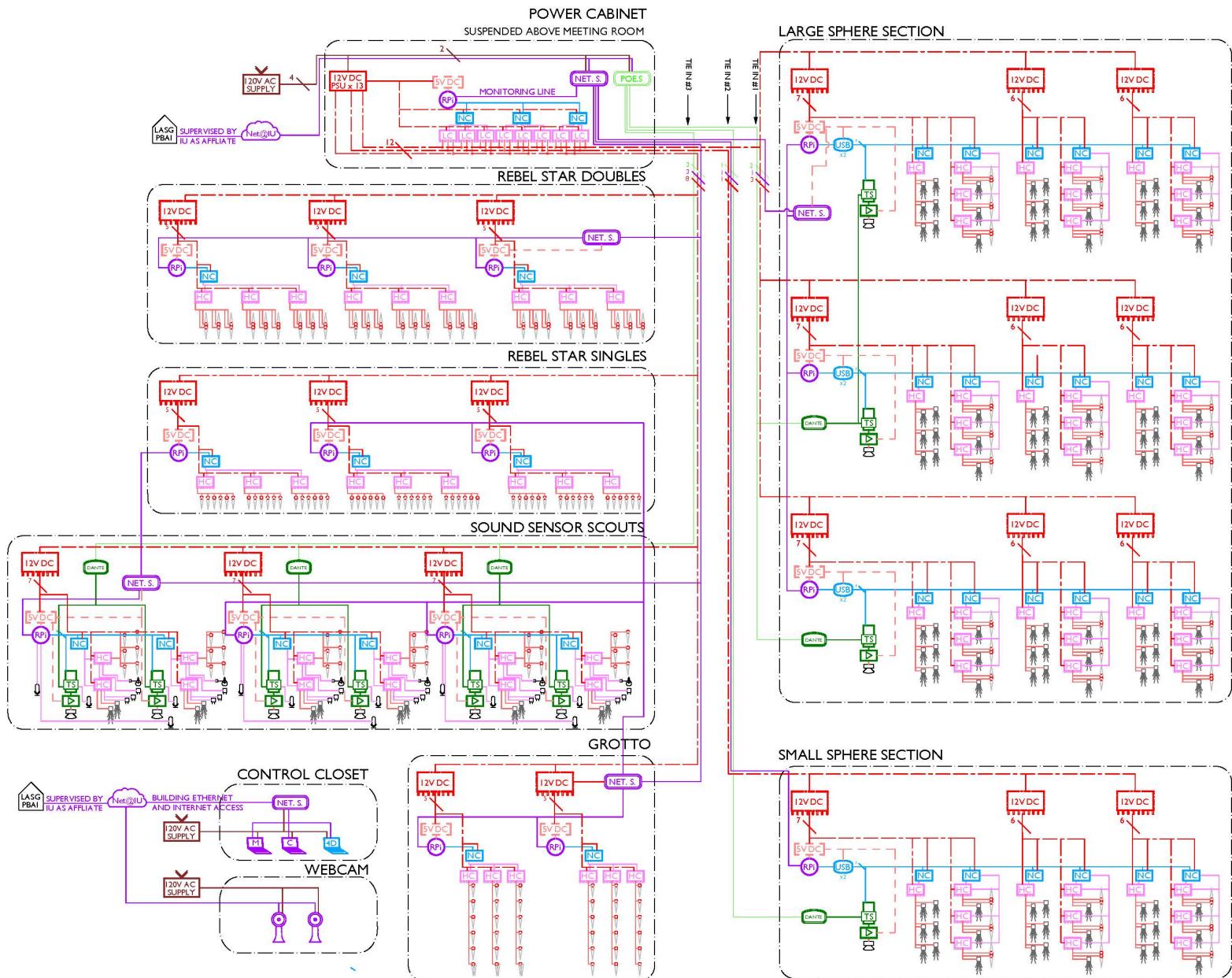
Living Architecture
Systems Group/
Philip Beesley
Architect Inc.

213 Sterling Road Suite 200
Toronto, Canada
M6R2B2
web: lasg.ca
tel: 416 766 8284

By	Date	Status	Rev By	Rev Date
MH	01/03/08	Draft		

DRAWING LEGEND

Toronto Studio	Powered USB Hub	Moth Actuator	120V AC Cable
IU Secure Network	Node Controller	Single Rebel Star	12V DC Cable
Control Laptop	High Current Device Module	Double Rebel Star	5V DC Cable
Monitor Laptop	Low Current Device Module	120 Volt 100 Amp Building Power	Ethernet Cable
4D Audio Laptop	Teensy Sound Unit	12 Volt DC Power Supply (x24)	POE Ethernet
Dante Adapters	Amplifier Module	12 Volt DC Splitter 8-Port	USB Cable
Network Switch	Speaker Module	5 Volt DC Power Converter	Comm Cable
POE Switch	Acetic Battery		Actuator Cable
Raspberry Pi Computer	IR Sensor	Webcam	Balanced Audio Cable
	Mic		

Phase
Design
Development

Project
17540 Luddy Hall

Drawing Title
Electronic Schematic

Sheet
IS103
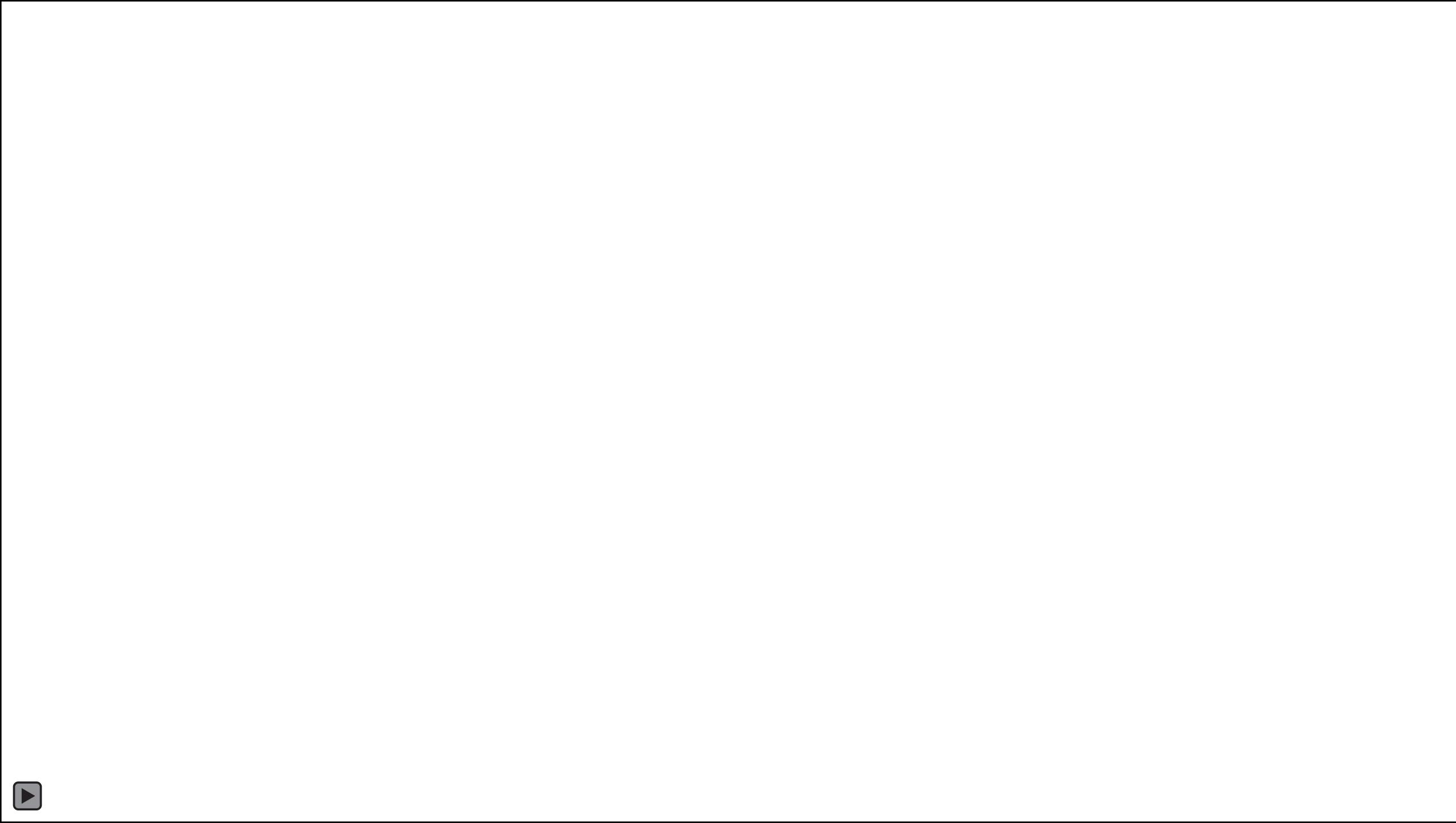
Table 1. Graphic symbol types vs. graphic variable types in scene 1 of Tavola.
* qualitative
** quantitative

		Graphic symbol types				
		Volume				
Graphic variable types	Shape*	Sphere: sensor		Cube: actuator		
	Color hue*	#EF5350 (red): IR sensor	#9575CD (purple): microphone sensor	#FFCC 80 (yellow) : light	#26A69A (green): speaker	#f06292 (pink): vibration motor
	Color intensity*	Opacity: 0%: graphic symbol turned off Opacity: 100%: graphic symbol turned off				
	x-position**	Location of sensor or actuator in 3D space				
	y-position**					
	z-position**					

Graphic Variable Types Versus Graphic Symbol Types

			Geometric Symbols					Linguistic Symbols Text, Numerals, Punctuation Marks	Pictorial Symbols Images, Icons, Statistical Glyphs
			Point	Line	Area	Surface	Volume		

Spatial

x	quantitative
y	quantitative
z	quantitative

Retinal — Form

Size	quantitative	NA (Not Applicable)			See Elevation Map, page 55	See Stepped Relief Map, pages 53-54	See Proportional Symbol Map, page 54	See Heights of the Principal Mountains ... page 67
Shape	qualitative	NA					Text Text Text Text Text	See also Life in Los Angeles, page 32
Rotation	quantitative	NA					Text Text Text Text Text	(alive) (dead)
Curvature	quantitative	NA				Some table cells are left blank to encourage future exploration of combinations.	Text Text Text Text Text	
Angle	quantitative	NA					Text Text Text Text Text	
Closure	quantitative	NA						

Retinal — Color

Value	quantitative						Text Text Text Text Text	
Hue	qualitative						Text Text Text Text Text	(alive) (dead)
Saturation	quantitative						Text Text Text Text Text	(shallow water) (deep water)

Retinal — Texture

Spacing	quantitative
Granularity	quantitative
Pattern	qualitative
Orientation	quantitative	NA						See Field Vectors at Random Positions, page 51
Gradient	quantitative

Retinal — Optics

Blur	quantitative
Transparency	quantitative
Shading	quantitative
Stereoscopic Depth	quantitative	Point in foreground ... background	Line in foreground ... background	Area in foreground ... background	Surface in foreground ... background	Volume in foreground ... background	Text in foreground ... background	Icons in foreground ... background

Motion

Speed	quantitative
Velocity	quantitative
Rhythm	quantitative	Blinking point slow ... fast	Blinking line slow ... fast	Blinking area slow ... fast	Blinking surface slow ... fast	Blinking volume slow ... fast	Blinking text slow ... fast	Blinking icons slow ... fast

Source: Börner, K. (2015). Atlas of knowledge: Anyone can map. Cambridge, MA: MIT Press.

16

https://visanalytics.cns.iu.edu