Content Creation: Visualization

CS 347 - Spr 2022
Maneesh Agrawala
Announcements

Project Brainstorm assignment has been returned

\textbf{Lots of great research ideas!}

Try to be even more specific about what you will do as you move towards the abstract

\textbf{What is the specific question? What will you implement? How will you evaluate?}

Is the project feasible in the time remaining?

\textbf{Coming up: Project Abstract due this Friday 9am}
Exports and Imports to and from all North America [Playfair 1786-1801]

User’s task:
Understand balance of trade between England and North America over time
Design Principles

Important information:
Historical differences between exports and imports

Design principles:
Superimpose line charts of exports and imports to show historical pattern
Shade differences between lines to highlight balance against/in favor
User’s task:
Understand overall proportion of research budget allocated to each disease
Compare proportion of research budget allocated to each disease
Important information:
Percentage of budget allocated to each disease

Design principles:
Encode budget using pie slices to emphasize part to whole relationships
Allow comparisons between diseases by comparing pie slices (angles or areas)
2012 PRESIDENTIAL RUN
GOP CANDIDATES
BACK PALIN 70%
63%
BACK HUCKABEE
BACK ROMNEY
SOURCE: OPINIONS
DYNAMIC

Fox News
47%
What is visualization?

“Transformation of the symbolic into the geometric” [McCormick et al., 1987]

“…finding the artificial memory that best supports our natural means of perception.” [Bertin 1967]

“The use of computer-generated, interactive, visual representations of data to amplify cognition.” [Card, Mackinlay, and Shneiderman 1999]
Data and Image Models
Data: Nominal, Ordinal, Quantitative

N - Nominal (labels)
Fruits: Apples, oranges, ...
Operations: =, ≠

O - Ordered
Quality of meat: Grade A, AA, AAA
Operations: =, ≠, <, >, ≤, ≥

Q - Interval (location of zero arbitrary)
Dates: Jan, 19, 2006; Loc.: (LAT 33.98, LON -118.45)
Like a geometric point. Cannot compare directly
Only differences (i.e. intervals) may be compared
Operations: =, ≠, <, >, ≤, ≥, −

Q - Ratio (location of zero fixed)
Physical measurement: Length, Mass, Temp, ...
Counts and amounts
Like a geometric vector, origin is meaningful
Operations: =, ≠, <, >, ≤, ≥, −, ÷

On the theory of scales of measurements
S. S. Stevens, 1946
From Phys. Type to N,O,Q Data Type

Physical type
  32.5, 54.0, -17.3, ...
  Floats

Conceptual model
  Temperature

Data type
  Burned vs. Not burned (N)
  Hot, warm, cold (O)
  Continuous range of values (Q)
**Image: Marks and Visual Variables**

**Marks:** geometric primitives

- points
- lines
- areas

**Visual Variables:** control mark appearance

- Position (2x)
- Size
- Value
- Texture
- Color
- Orientation
- Shape

Semiology of Graphics
J. Bertin, 1967
Visual Encoding

mark: lines
data $\rightarrow$ size(length)
**Visual Encoding**

- **Mark:** lines
  - Data $\rightarrow$ Size (length)

- **Mark:** points
  - Data$ _1 \rightarrow$ x-pos
  - Data$ _2 \rightarrow$ y-pos
Visual Encoding

mark: lines
data \rightarrow \text{size(length)}

mark: points
\begin{align*}
data_1 & \rightarrow x\text{-pos} \\
data_2 & \rightarrow y\text{-pos} \\
data_3 & \rightarrow \text{color}
\end{align*}
Encodings: Map Data to Mark Attr.

- **Mark: lines**
  - Data → size (length)

- **Mark: points**
  - Data₁ → x-pos
  - Data₂ → y-pos

- **Mark: points**
  - Data₁ → x-pos
  - Data₂ → y-pos
  - Data₃ → color

- **Mark: points**
  - Data₁ → x-pos
  - Data₂ → y-pos
  - Data₃ → color
  - Data₄ → size
Perception
Perception of Position

1. Distinct points are distinguishable
2. All three points are colinear
3. Can see BC is twice as long as AB

∴ Encode quantitative data (Q) well
Perception of Color

Value is perceived as ordered
∴ Encode ordinal data (O)

∴ Encode continuous data (Q) [not as well]

Hue is normally perceived as unordered
∴ Encode nominal data (N) using color
Bertin’s “Levels of Organization”

<table>
<thead>
<tr>
<th>Feature</th>
<th>N Nominal</th>
<th>O Ordered</th>
<th>Q Quantitative</th>
</tr>
</thead>
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<tr>
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<tr>
<td>Texture</td>
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<td>○</td>
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<td>Color</td>
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<tr>
<td>Orientation</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>N</td>
<td></td>
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</tbody>
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<td>N</td>
<td></td>
<td></td>
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</table>
Detecting Brightness

Which is brighter?
Detecting Brightness

Which is brighter?

(128, 128, 128)  (130, 130, 130)
JND (Weber’s Law)

\[ \Delta S = k \frac{\Delta I}{I} \]

• Ratios more important than magnitude

• Most continuous variations in stimuli are perceived in discrete steps
Compare areas of circles
Compare lengths of bars
Steven’s Power Law

\[ S = kI^p \]

\( p < 1 \) : underestimate
\( p > 1 \) : overestimate

[graph from Wilkinson 99, based on Stevens 61]
# Exponents of Power Law

<table>
<thead>
<tr>
<th>Sensation</th>
<th>Exponent</th>
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<tbody>
<tr>
<td>Loudness</td>
<td>0.6</td>
</tr>
<tr>
<td>Brightness</td>
<td>0.33</td>
</tr>
<tr>
<td>Smell</td>
<td>0.55 (Coffee) - 0.6 (Heptane)</td>
</tr>
<tr>
<td>Taste</td>
<td>0.6 (Saccharine) -1.3 (Salt)</td>
</tr>
<tr>
<td>Temperature</td>
<td>1.0 (Cold) – 1.6 (Warm)</td>
</tr>
<tr>
<td>Vibration</td>
<td>0.6 (250 Hz) – 0.95 (60 Hz)</td>
</tr>
<tr>
<td>Duration</td>
<td>1.1</td>
</tr>
<tr>
<td>Pressure</td>
<td>1.1</td>
</tr>
<tr>
<td>Heaviness</td>
<td>1.45</td>
</tr>
<tr>
<td>Electric Shock</td>
<td>3.5</td>
</tr>
</tbody>
</table>

[Psychophysics of Sensory Function, Stevens 61]
Relative Magnitude Estimation

Most accurate

Position (common) scale
Position (non-aligned) scale

Size

Slope

Angle

Area

Volume

Color hue-saturation-density

Least accurate
Chart Construction Algorithm
Encode most important data using highest ranking visual variable for the data type.

- Year (Q)
- Exports (Q)
- Imports (Q)

Algorithm for Chart Construction:

1. Year (Q)
2. Exports (Q)
3. Imports (Q)

Mark: lines
- Year → x-pos (Q)
- Exports → y-pos (Q)
- Imports → y-pos (Q)

- Most accurate:
  - Position (common) scale
  - Position (non-aligned) scale
  - Size
  - Slope
  - Angle
  - Area
  - Volume
  - Color hue-saturation-density

- Least accurate:

Automating the design of graphical presentation of relational information
J. Mackinlay, 1986
<table>
<thead>
<tr>
<th>Year</th>
<th>Exports</th>
<th>Imports</th>
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<tr>
<td>1700</td>
<td>170,000</td>
<td>300,000</td>
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<tr>
<td>1701</td>
<td>171,000</td>
<td>302,000</td>
</tr>
<tr>
<td>1702</td>
<td>176,000</td>
<td>303,000</td>
</tr>
<tr>
<td>1703</td>
<td>180,000</td>
<td>312,000</td>
</tr>
<tr>
<td>1704</td>
<td>187,000</td>
<td>319,000</td>
</tr>
</tbody>
</table>

**Data**

**Marks**

**Mappings**

- **Year** → **x-pos** (Q)
- **Exports** → **y-pos** (Q)
- **Imports** → **y-pos** (Q)
- **Exports** → **color** (N)
- **Imports** → **color** (N)
To learn more about visualization consider taking CS 448B: Fall 2022

- An understanding of key visualization techniques and theory, including data models, graphical perception and methods for visual encoding and interaction.

- Exposure to a number of common data domains and corresponding analysis tasks, including exploratory data analysis and network analysis.

- Practical experience building and evaluating visualization systems using Vega-Lite and D3.js.

- The ability to read and discuss research papers from the visualization literature.

Well designed visualizations capitalize on human faculties for processing visual information and thereby improve comprehension, memory, inference, and decision making. In this course we will study techniques and algorithms for creating effective visualizations based on principles from graphic design, visual art, perceptual psychology and cognitive science. The course is targeted both towards students interested in using visualization in their own work, as well as students interested in building better visualization tools and systems.

There are no official prerequisites for the course, but familiarity with the material in CS147, CS148 and CS142 is especially useful. Most important is a basic working knowledge of, or willingness to learn, web-programming, especially JavaScript, Vega-Lite and D3.js. While we will cover a little bit of Vega-Lite and D3.js in class, we will also expect students to learn some introductory material, especially about Javascript on their own, as necessary. Tutorials on Javascript are available on the web and we will help you find the relevant information as you need it.

*Contact us via Slack if you are worried about whether you have the background for the course.*

**Learning Goals**

The goals of this course are to provide students with the foundations necessary for understanding and extending the current state of the art in visualization. By the end of the course, students will have:

- An understanding of key visualization techniques and theory, including data models, graphical perception and methods for visual encoding and interaction.

- Exposure to a number of common data domains and corresponding analysis tasks, including exploratory data analysis and network analysis.

- Practical experience building and evaluating visualization systems using Vega-Lite and D3.js.

- The ability to read and discuss research papers from the visualization literature.

**Textbooks/Resources**


Your best bet is to order them online. Please order soon. Readings will be assigned in the first week of class.


SceneSkim: Searching and Browsing Movies Using Synchronized Captions, Scripts and Plot Summaries. Amy Pavel, Dan B Goldman, Bjoern Hartmann and Maneesh Agrawala. UIST 2015.
Frame-based representation forces users to navigate and edit video by timecode.
Design Principle

**Man:** Sure. Um, some of our customers, that have been working in the print for many, many years, are used to being able to express their ideas in, uh, very specific ways. They, they are used to being able to control exactly what goes on, on the page. They bring the story, they bring the images, and they bring the layout as well, which is a big part of making a story and, and communicating that story.

And, um, with the, the digital media and the tablets, that are used now to bring this content, uh, they've quickly run into some, uh, limitations with trying to express the same thing with the HTML and CSS.

People think of interviews in terms of content

**Goal:** Let users navigate and edit video using this higher-level transcript-based representation
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MAN: Sure. Um, some of our customers, that have been working in the print for many, many years, are used to be able to express their ideas in, uh, very specific ways. They, they are used to be able to control exactly what goes on, in the way where they choose the size they bring the images, and they bring the layout as well, which is a big part of making a story and, and communicating that story. And, um with the the digital media and the tablets that are used now to bring this content, uh, they've quickly run into some, uh, limitations with trying to express the same thing with the HTML and CSS. So what we're trying
MAN: So what we're trying to do, is to bring, to our customers, this, the tools that will allow them to express the same kind of, uh, sophisticated layout and to bring, part of the story, uh, to the, digital media, which is the the fine control for the the layout. They have control over the story, they have control over the images, but now they will also be able to control exactly how everything is displayed on the page.

MAN: When, when you think, uh, the impact, that, you know, it's just a little extension to CSS and HTML, but the impact it can have...
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Jump cuts (in red)
Our result: hidden transitions in blue, pauses in green.

Comp. time:
- clusters: 22m
- hidden: 5s
- pauses: 9s
Content-Based Audio Editing

Julia

(He's not just a fan. Whenever Bullwinkle makes an appearance these days, that's Keith Scott behind...)

(He's not just a fan. Whenever Bullwinkle makes an appearance these days, that's Keith Scott behind the antlers.)

He took over as the official voiceover guy in the early '90s. And unofficially, he's the closest thing to a Bullwinkle historian. He's the author of "The Moose That Roared," a book that tells the saga of "The Rocky and Bullwinkle Show."

In episode one, Bullwinkle sets off an international incident when a pie he's making turns out to be the recipe for a super powerful jet fuel. Which naturally attracts the attention of super spy Boris Badenov.

In real life, the doomsday clock may have been edging towards midnight, but on Saturday mornings in Frostbite Falls, Minnesota, it boiled down to Boris and Natasha coming up with their fiendish plots to kill moose and squirrel.

"Plucky and innocent."
Design Principles

Maintain natural sounding speech
Add breaths and pauses between edits

Use best take of speech
Group similar takes so producer can find best voicing

Re-compose music to emphasize multiple points in speech
Align multiple music change points with emphasis points (retargeting)
Content-Based Audio Editing

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"Plucky and innocent."
Non-Linear Viewing

Media for Thinking the Unthinkable

Bret Victor

April 4, 2013
MIT Media Lab
Non-Linear Viewing

Media for Thinking the Unthinkable

Designing a new medium for science and engineering
Bret Victor / April 2013

Introduction (2 min)

This talk is about a particular kind of media, which is "media for thinking in," and it's about a particular kind of thinking, which is understanding systems.

"Science" is understanding a system in the world. "Engineering" is building a system in the world, where the challenge is often understanding what's being built.

Media are our thinking tools. Our representations of a system are how we understand it.

To understand or build new complex systems, we need powerful new representations, and we need a powerful new medium in which to work with these representations.

Today's representations were designed for the medium of paper. This talk will show examples of new representations for systems, and offer hints as to what a new medium might be like.

Demo 1 — Seeing behavior (8 min)
About 10 years ago, I took on the task to teach global development to Swedish undergraduate students. That was after having spent about 20 years together with African institutions studying hunger in Africa. So I was sort of expected to know a little about the world. And so I started in my medical university, Karolinska Institute, an undergraduate course called Global Health.

But when you get that opportunity, you get a little nervous. I thought, these students coming to us actually have the highest grade you can get in Swedish college systems so, I thought, maybe they know everything I'm going to teach them about. So I did a pre-test when they came. And one of the questions from which I learned a lot was this one: Which country has the highest child mortality of these five listed? And I put them together, so that in each pair of country, one has the twice the child mortality of the other. And this means that (p) it's much bigger a difference than the uncertainty of the data. (p) I won't put you at a test here, but it's Turkey, which is highest there, Poland, (p) Russia, Pakistan (p) and South Africa. (p) And these were the results of the Swedish students. I did it so I got the confidence intervals, which is (p) pretty narrow, and I got happy, of course (p) a 1.8 right away out of five possible. That means that there was a place for a professor of international health (Laughter) and for my course. But one late night, when I was compiling the report, I really realized my discovery. (p) I have shown (p) that Swedish top students (p) know (p) statistically significantly less about the world than the chimpanzees. (p) (Laughter) Because the chimpanzees would score (p) half right (p) if I gave them two bananas with Sri Lanka and Turkey. They would be right half of the cases. (p)

But the students are not there. (p) The problem for me was not ignorance it was preconceived ideas. (p) I also did an (p) unethical study of the professors of the Karolinska Institute (p) (Laughter) that holds out the Nobel Prize in Medicine, and they are on par with the chimpanzees there. (Laughter) This is where I realized that there was really a need to communicate, because the data (p) of what's happening in the world and the child health of every country is very well aware. (p) We did this software which displays it like this (p) every bubble here is a country. (p) This country here over (p) is China. This is (p) India. (p) The size of the bubble (p) is the population, (p) and on this axis here (p) I put (p) fertility rate. (p) Because my students, (p) what they said (p) when they looked upon the world, and I asked them, What do you really (p) think about the world? Well, first discovered that the textbook was Tintin, marx, (p) (Laughter) (p) And they said, The world is still "we" and "them". (p) And we is Western world and them (p) is Third World. (p) And what do you mean with Western world? I said, (p) Well, (p) that's long life and small family, and Third World (p) is short life and large family. (p) So (p) this is what I could display. (p) I put fertility rate here (p) number of children per (p) woman over, two, three, four, up to about eight children per woman. (p) We have very good data (p) since 1962 1962 about (p) on the size of families in all countries. The error margin is narrow. (p) Here I put expectancy at (p) birth, (p) from 30 years in some countries (p) up to
About 10 years ago, I took on the task to teach global development to Swedish undergraduate students. I thought, maybe they know everything I'm going to teach them about. So I did a pre-test when they came. And one of the questions from which I learned a lot was the one which country has the highest child mortality of these five pairs? And I put them together, so that in each pair of country, one has (p) twice the child mortality of the other. And this means (p) that (p) is much (p) bigger a difference than the uncertainty of the data. (p) I won't put you at a test here, but it's Turkey, which is highest there, Poland, Russia, Pakistan, and South Africa. (p) And these were the results of the Swedish students. I did it so I got the confidence interval, which is (p) pretty narrow, and I got happy, of course I was right, right answer out of five possible. (p) That means that there was a place for a professor of international health (Laughter) and for my course. But one last right, (p) when I was compiling the report I really realized my discovery, (p) I have shown (p) that Swedish top students (p) know (p) statistically significantly less about the world than the chimpanzees. (p) (Laughter) Because the chimpanzees would score (p) half right (p) if I gave them two bananas with Sri Lanka and Turkey. They would be right half of the cases. (p)

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About 10 years ago, I took on the task to teach global development to Swedish undergraduate students. (p) That was after having spent about (p) 20 years together with African institutions studying hunger in Africa. (p) So I was sort of (p) expected to know a little about the world. And (p) I started in our medical university, Karolinska Institute, an undergraduate (p) course called Global Health. (p) But when you get that opportunity, you get a little nervous. I thought, (p) these students coming to us actually have the highest grade you can get in Swedish college systems so, I thought, maybe they know everything I'm going to teach them about. (p) So I did a pre-test (p) when they came. And one of the questions (p) from which I learned a lot was this one: Which country has the highest child mortality (p) of these five pairs (p)? (p) And I put them together, so that in each (p) pair of country, one has (p) twice the child mortality of the other. (p) And this means (p) that (p) it's much (p) bigger a difference than the uncertainty of the data. (p) I won't put you at a test here, but it's Turkey, which is higher than Iran, Poland, (p) Russia, Pakistan (p) and South Africa. (p) And these were the results of the Swedish students. I did it so I got the confidence interval, which is (p) pretty narrow, (p) and I got happy, of course (p) it's a right answer out of five possible. (p) That means that there was a place for a professor of international health (Laughter) and for my course. But one late right, (p) when I was compiling the report, I really realized my discovery. (p) I have shown (p) that Swedish top students (p) know (p) statistically significantly less about the world than the chimpanzees. (p) (Laughter) Because the chimpanzee would score (p) right half right (p) if I gave them two bananas with Sri Lanka and Turkey. They would be right half of the cases. (p) But the students are not there. (p) The problem for me (p) was not (p) ignorance it was preconceived ideas. (p) I did also an (p) unethical study of the professors of the Karolinska Institute (p) (Laughter) that hands out the Nobel Prize in Medicine, and they are on par with the chimpanzees here. (Laughter) This is where I realized that there was really a need to communicate, because the data (p) of what's happening in the world and the child health of every country is very well aware. (p) We did this software which displays it like this (p) every bubble here is a country. (p) This country over here (p) is China. This is (p) India. (p) The size of the bubble (p) is the population, (p) and on this axis here (p) I put (p) fertility rate. (p) Because my students, (p) what they said when they looked upon the world, and I asked them, What do you really (p) think about the world? (p) Well, I first discovered that the textbook was Tintin, mainly, (p) (Laughter) And they said, The world is still (p) 'we' and 'them'. (p) And we is Western world and them (p) is Third World. (p) And what do you mean with Western world? I said, (p) Well, (p) that's long life and small family, and Third World (p) is short life and large family. (p) So (p) this is what I could display here. (p) I put fertility rate here (p) number of children per (p) woman, one, two, three, four, up to about eight children per woman. (p) We have very good data (p) since 1950 1960 about (p) on the size of families in all countries. The error margin is narrow. (p) Here I plot expectation at (p) birth, (p) from 30 years in some countries (p) up to
The Best Stats You've Ever Seen (20 min)

Hans Rosling

Subtitle (19 min 33 sec)

The best stats you've ever seen - Hans Rosling

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The best stats you've ever seen - Hans Rosling

Medicine, and they are on par with the chimpanzees there. [Laughter] This is where I realized that there was really a need to communicate, because the data is of what's happening in the world and the child health of every country is very well aware. (p) We did this software which displays it like this. (p) Every bubble here is a country. (p) This country over here is China. This is (p) India. (p) The size of the bubble (p) is the population, (p) and on this axis here (p) is fertility rate. (p) Because my students, (p) what they said (p) when they looked upon the world, and, and I asked them, What do you really (p) think about the world? (p) Well, I first discovered that the textbook was Tintin, mainly. (p) [Laughter] And they said, The world is still white and them. (p) And we are in Western world and them (p) is Third World. (p) And what do you mean with Western world? I said. (p) Well, (p) that's long life and small family, and Third World (p) is short life and large family. (p) (p) This is what I could display here. (p) I put fertility rate here (p) number of children per (p) woman, two, three, four, up to about eight children per woman. (p) We have very good data (p) since 1962-1980 about (p) on the size of families in all countries. The error margin is narrow. (p) Here I put life expectancy at (p) birth, from 30 years in some countries (p) up to about 70 years. And in 1962, (p) there was really a group of countries here that was industrialized countries, (p) and they had (p) small families (p) and long lives. (p) And these were the developing countries they had large families (p) and they had relatively short lives. (p) Now what has happened since 1962? (p) We want to see the change. (p) Are the students right? (p) Is it still two types of countries? (p) Or have these developing countries got smaller families and they live here? (p) Or have they got longer lives and live up there? (p)

Let's see. We stopped the world then. This is all U.N. statistics that have been available. (p) Here we go. (p) Can you see there? (p) It's China there, moving against (p) better health there, improving there. (p) All the green Latin American countries (p) are moving towards smaller families. (p) Your yellow ones here are the Arabic countries, and they get larger families, but they no, longer life. (p) But not larger families. The Africans are the green down there. They still remain here. (p) This (p) is Indonesia. Indonesia's moving on pretty fast. (Laughter) And in the '60s here, (p) you have Bangladesh still among the African countries there. (p) But now, Bangladesh it's a miracle that happens in the '80s the marriage start to promote family planning. They move up into that corner. (p) And in '90s, (p) we have the terrible HIV epidemic (p) that takes down (p) the life expectancy of the African countries, (p) and all the rest of them move (p) up into the corner, where we have long lives (p) and small family, (p) and we (p) have a completely new world. (Applause) Let me make a comparison directly between the United States of America and (p) Vietnam. 1964 (p) America had small families and long life (p) Vietnam had (p) large families (p) and short lives. (p) And this is what happens (p) the data (p) during the war (p) indicate (p) that (p) even with all the death, there was an improvement of life expectancy. (p) By the end of the year, the family planning started in Vietnam and they went for smaller families. (p) In the United States up there is getting for longer life, keeping family size.
Let’s see. We stopped the world then. This is all U.N. statistics that have been available. (g) Here we go. (g) Can you see there? (g) It’s China there, moving against (p) better health there, improving there. (p) All the green Latin American countries (p) are moving towards smaller families. (p) Your yellow ones here are the Arabic countries, and they get larger, but they no, longer life. (g) But not larger families. The Africans are the green down here. They still remain here, (p) This (g) is India. Indonesia’s moving on pretty fast. (Laughter) And in the 80’s here, you have Bangladesh still among the African countries there. (g) But now, Bangladesh it’s a miracle that happens in the 80’s the iams start to promote family planning. They move up into that corner. (p) And in the 80’s, (g) we have the terrible HIV epidemic (g) that takes down (p) the life expectancy of the African countries (g) and all the rest of them move (p) up into the corner, where we have long lives (p) and small family, (p) and we (g) have a completely new world. (Applause) Let me make a comparison directly between the United States of America and (g) Vietnam. 1984 (p) America had small families and long life (g) Vietnam had (p) large families (p) and short lives. (p) And this is what happens (g) the data (p) during the war (p) indicate (p) that (p) even with all the death, there was an improvement of life expectancy. (p) By the end of the year, the family planning started in Vietnam and they went for smaller families. (p) And the United States up there is getting for longer life, keeping family size. (p) And in the 80’s now, (p) they give up (p) communist planning and they go for market economy, and it moves faster even than social life. (p) And today, (p) we have in Vietnam the same (p) life expectancy (p) and the same family size (p) here in Vietnam, 2003, (g) as in United States, (g) 1974, by the end of the war. (p) I think we (p) all if we don’t look in the data we underestimate the tremendous change in Asia, which was in social change (p) before we saw (p) the economical change. (p) Let’s move over to another way here (p) in which we could (p) display (p) the distribution (p) in the world of the income. (p) This is the world distribution of income (p) of people. (p) One dollar, (p) 10 dollars or 100 dollars per day. (p) There’s no gap (p) between rich and poor any longer. This is a myth. There’s (p) a little hump here. (p) But (p) there are people all the way. (p) And (p) if we look where the income (p) ends up (p) the (p) income this is 100 percent the world’s annual income. (p) And (p) the richest 20 (p) percent, (p) they take out of that (p) about (p) 74 percent. (p) And (p) the poorest 20 percent, (p) they take (p) about (p) two (p) percent. (p) And this shows that the concept of developing countries is extremely doubtful. (p) We think about (p) aid, (p) like (p) these people here (p) giving aid to these people here. (p) But (p) in the middle, (p) we have most the world population, (p) and (p) they have now 24 percent of the income. We heard it in other forms. (p) And who are these? (p) Where (p) are the different countries? (p) I can show you Africa. (p) This is (p) Africa. (p) 10 percent the world population, most in poverty. (p) This is OECD. The (p) rich country, The country club of the U.N. (p) And they are over here on this side. We can overlap (p) between Africa (p) and OECD. (p) And this is Latin America. It has on this Earth, from the poorest to the richest, (p) in Latin America.
The Best Stats You've Ever Seen (20 min)

Hans Rosling

Subtitle (3 min 13 sec)

Provide a summary of the corresponding video segment.

Western world
Long life in small family
Third world
Short life in large family

Subtitle (2 min 44 sec)

Provide a summary of the corresponding video segment.

About 10 years ago, I took on the task to teach global development to Swedish undergraduate students. That was after having spent about 20 years together with African institutions studying hunger in Africa. So I was sort of expected to know a little about the world. And so I started in our medical university, Karolinska Institute, an undergraduate course called Global Health. But when you get that opportunity, you get a little nervous. I thought, these students coming to us actually have the highest grade you can get in Swedish college systems. So, I thought, maybe they know everything I'm going to teach them about. So I did a pre-test to see if they came. And one of the questions was, from which I learned a lot was the one which country has the highest child mortality of these five countries? (p) And I put them together, so that in each of the pair of country, one has (p) twice the child mortality of the other. (p) And this means that in (p) it's much bigger a difference than the uncertainty of the data. (p) I won't put you at a test here, but it's Turkey, which is highest there, Poland, Russia, Pakistan and South Africa. And these were the results of the Swedish students. I did it so I got the confidence interval, which is (p) pretty narrow, and I got happy, of course (p) is a 1.8 (p) right answer out of five possible. (p) That means that there was a place for a professor of international health (Laughter) and for my course. But one last right, (p) when I was compiling the report I really realized my discovery, I have shown (p) that Swedish students (p) know (p) statistically significantly less about the world than the chimpanzees. (p) (Laughter) Because the chimpanzees would score 2.5 right if I gave them two bananas with Sri Lanka and Turkey. They would be right half of the cases. (p)

But the students are not there. (p) The problem for me (p) was not (p) ignorance it was preconceived ideas. (p) I did also an (p) unethical study of the professors of the Karolinska Institute (p) (Laughter) that hands out the Nobel Prize in Medicine, and they are on pair with the chimpanzees (Laughter). This is where I realized that there was really not to communicate, because the data (p) of what's happening in the world and the child health of every country is very well aware. (p) We did this software which displays it like this, (p) every bubble here is a country, (p) this country over here, (p) is China. This is India. (p) The size of the bubble is the population, (p) and on this axis here (p) I put (p) fertility rate. (p) Because my students, (p) what they said (p) when they looked upon the world, and I asked them, What do you really (p) think about the world? (p) Well, I first discovered that the textbook was Tirtho, many, many, (p) (Laughter) And they said, the world is still (p) we and them. (p) And we is Western world and my (p) is Third World. (p) And what do you mean with Western world? I said, (p) that's long life and small family, and Third World is short life and large family. (p) So (p) this is what I could display here. (p) I put this (p) fertility rate here (p) number of children per worker, two, three, four, up to about eight children per woman. (p) We have very good data (p) since 1960, 1960 about (p) on the size of families in all countries. The error margin is narrow. (p) Life expectancy at (p) birth, (p) from 30 years in some countries (p) up
About 10 years ago, I took on the task to teach global development to Swedish undergraduate students. That was after having spent about 20 years together with African institutions studying hunger in Africa. So I was sort of expected to know a little about the world. And I started in our medical university, Karolinska Institute, an undergraduate course called Global Health. But when you get that opportunity, you get a little nervous. I thought, these students coming to us actually have the highest grade you can get in Swedish college systems so, I thought, maybe they know everything I'm going to teach them about. So I did a pre-test when they came. And one of the questions was from which country is the highest child mortality of these five (pairs)? I put them together, so that in each pair of country, one has (p) twice the child mortality of the other. And this means that (p) it's much (p) bigger a difference than the uncertainty of the data. (p) won't put you at a test here, but it's Turkey, which is highest there, Poland, Russia, Pakistan and South Africa. And these were the results of the Swedish students. I did it so that I got the confidence intervals, which is (p) pretty narrow, and I got happy, of course (p) a 1.8 right answer out of five possible. That means that there was a place for a professor of international health (laughter) and for my course. But one last right, (p) when I was compiling the report, I really realized my discovery, (p) I have shown (p) that Swedish top students (p) know (p) statistically significantly less about the world than the chimpanzees. (laughter) Because the chimpanzees would score more than half right (p) if I gave them two bananas with Sri Lanka and Turkey. They would be right half of the cases. (p)

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The Best Stats You’ve Ever Seen (20 min)

Hans Rosling

Subtitle (3 min 13 sec)

About 10 years ago, I took on the task to teach global development to Swedish undergraduate students. Then I was 20 years together with African institutions studying hunger in Africa. So I was sort of a pro on how to talk about a lot of the world. But when you get the opportunity, you get a little nervous. I thought, these students coming to us actually have the highest grade you can get in Swedish college systems, so I thought, maybe they know everything, I’m going to teach them about... So I did a test on when they came. And we did a test on what country has the highest child mortality of these five pairs? And I put them together, so that in each pair of country, one has (p) twice the child mortality of the other. And this means that (p) it’s much (p) bigger a difference than the uncertainty of the data. I won’t put you at a test here, but it’s Turkey, which is highest there, Poland, (p) Russia, (p) Pakistan (p) and South Africa. And these were the results of the Swedish students. I did it so I got the confidence interval, which is (p) pretty narrow, and I got happy, of course (p) a 1.8 right answer out of five possible. (p) That means that there was a place for a professor of international health (Laughter) and for my course. But one late night, (p) when I was compiling the report I really realized my discovery. (p) I have shown (p) that Swedish top students (p) know (p) statistically significantly less about the world than the chimpanzees. (p) (Laughter) Because the chimpanzees would score (p) half right (p) if I gave them two bananas with Sri Lanka and Turkey. They would be right half of the cases.

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Hans Rosling

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About 10 years ago, I took on the task to teach global development to Swedish undergraduate students. That was after having spent about 20 years together with African institutions studying hunger in Africa. So I was sort of expected to know a little about the world. And I started in our medical university, Karolinska Institute, an undergraduate course called Global Health. But when you get that opportunity, you get a little nervous. I thought, these students coming to us actually have the highest grade you can get in Swedish college systems so, I thought, maybe they know everything I’m going to teach them about. So I did a pre-test when they came. And one of the questions from which I learned a lot was this one: Which country has the highest child mortality of these five (p)? And I put them together, so that in each of those five countries, one has (p) twice the child mortality of the other. (p) And this means (p) that it’s (p) much (p) bigger a difference than the uncertainty of the data. So I won’t put you at a test here, but it’s Turkey, which is highest there, Poland, Russia, Pakistan, and South Africa. And these were the results of the Swedish students. I did it so I got the confidence interval, which is (p) pretty narrow, and I got happy, of course (p) a 1.8 (p) right answer out of five possible. That means that there was a place for a professor of international health (Laughter) and for my course. But one late night, when I was compiling the report I really realized my discovery. I have shown (p) that Swedish top students (p) know (p) statistically significantly less about the world than the chimpanzees. (p) (Laughter) Because the chimpanzees would score (p) half right (p) if I gave them two bananas with Sri Lanka and Turkey. They would be right half of the cases. (p)

But the students are not there. (p) The problem for me (p) was not (p) ignorance it was misconceptions. (p) I did also an (p) unethical study of the professors of the Karolinska Institute (p) that hands out the Nobel Prize in Medicine, and they are on par with the chimpanzees there. (Laughter) This is where I realized that there was really a need to communicate, because the data (p) of what’s happening in the world and the child health of every country is very well aware. (p) We did this software which displays it like this (p) every bubble here is a country. (p) This country over here (p) is China. (p) This is (p) India. (p) The size of the bubble (p) is the population, (p) and on this axis here, (p) the fertility rate. (p) Because my students, (p) what they said (p) when they looked upon the world, and I asked them, What do you really (p) think about the world? (p) Well, I first discovered that the textbook was Trinitarian, mainly (p) (Laughter) (p) And they said, The world is still we and them. (p) And we as Western world and them (p) is Third World. (p) And what do you mean with Western world? I said, (p) Well, (p) a long life and small family, and Third World is short and large family. (p) (Laughter) So (p) this is what I could display here. (p) I put fertility rate here (p) number of children per (p) woman, two, three, four, up to about eight children per woman. (p) We have very good data (p) since 1962 1960 about (p) on the size of families in all countries. The error margin is narrow. (p) (Laughter) Life expectancy at (p) birth, (p) from 30 years in some countries (p) up
The Best Stats You've Ever Seen (expert) (20 min)

Hans Rosling

Global Development: The "Third World" and "Western World Myth (6 min 9 sec)

After 20 years studying hunger in Africa, I started teaching global development to undergraduate students.

I did a pretest with the students and found that they had incorrect preconceived ideas about the child mortality rate of countries in the world.

We need to be able to communicate global development data, so we created software to help explore this.

The students believe that a divide between a "Western World" (small family and long lives) and "Third World" (large families and short lives) still exists — but is this the reality?

If we examine the family size and life expectancy over time, we see that most "third world" countries are migrating towards having small families and long lives.

If we directly compare the family size and life expectancy of Vietnam and the U.S., we see that Vietnam is the same as the U.S. by 2003.

World Income Distribution (2 min 23 sec)

The worldwide income distribution shows that there is not an income gap between the richest and the poorest people.

Let's examine the income distribution for different regions: Africa, OECD, Latin America, East Europe, East Asia, and South Asia.
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Search Results

Star Wars: Episode IV - A New Hope

Luke Skywalker joins forces with a Jedi Knight, a rock pilot, a slave girl, and two droids to save Princess Leia, one of the leaders in the Rebellion against the Galactic Empire.

Princess Leia, before your execution I would like you to be my guest at a ceremony that will make this battle station operational. No star system will dare oppose the Empire now.

Star Wars: Episode V - The Empire Strikes Back

After the rebels have been brutally defeated by the Empire on their newly established base, Luke Skywalker takes a journey with Mark Hamill, who his friends are pursued by Darth Vader as part of his plan to capture Luke.

Well, it's Princess Leia, isn't she? She's been trying to get you on the communicator.


Star Wars: Episode VI - Return of the Jedi

Luke Skywalker and Han Solo leadedar group of rebels against the Galactic Empire.

Five stormtroopers come our way. Han Solo and I must take their place.

Movie

Curtis Armstrong, Joe Pesci

Script

STAR WARS

Episode IV

A NEW HOPE

From the JOURNAL OF THE WHILLS

by George Lucas

Revised Final Draft, January 15, 1976

LUCASA LTD.

A long time ago, in a galaxy far, far away...

A vast sea of stars serves as the backdrop for the main title. Star shimmers rise through the heavens as a rippling slowly crawls into infinity.

It is a period of civil war. Rebel spaceships, striking from a hidden base, have won their first victory against the evil Galactic Empire.

During the battle, Rebel spies managed to steal secret plans to the Empire's ultimate weapon, the Death Star, an armored space station with enough power to destroy an entire planet.

Pursued by the Empire's sinister agents, Princess Leia races home aboard her starship, custodian of the stolen plans that can save her people and restore freedom to the galaxy...

The awesome yellow planet of Tatooine emerges from a total eclipse, her two moons glowing against the darkness. A tiny silver spacecraft, a rebel Blockade Runner firing lasers from the back of the ship, races through space. It is pursued by a giant Imperial Stardestroyer. Hundreds of deadly laserbolts streak from the imperial battleship, causing the main body of the Rebel ship to burst into flames.

IMT: REBEL BLOCKADE RUNNER - MAIN PASSENGERWAY

An explosion rocks the ship as two robots, Artoo-Detoo (R2-D2) and See-Threepio (C-3PO) struggle to make their way through the shattering, burning passageway. Both robots are Columns of the Death Star: R2-D2 is a droid designed to assemble and operate the Death Star; C-3PO is a droid designed to assemble and operate the Death Star. They are members of the Rebel Alliance.

Did you hear that? They shut down the main reactor. We'll be destroyed for sure. This is madness.

Did you hear that? They shut down the main reactor. We'll be destroyed for sure. This is madness. They're being destroyed in this direction.

What are we going to do? We'll be sent to the spice mines of Kessel smashed into who knows what. Wait a minute. Where are you going? The Death Star planets are not in the main computer. Where are those transmissions you intercepted?
Video Takeaways

Choose the right representation
Transcript much better than frames for navigation and editing of interview video

Principle of congruence
For effective interfaces, structure of external representation should match structure of mental representation [Tversky 02] [Norman 86, 88]

What is appropriate representation for other types of video?