Emerging Trends in Visual Science Communication: How to create informative and inspiring graphics for journals and presentations

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Science illustrator, National Geographic Magazine

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TODAY’S TALK (60 min):

Brief background
What is science/medical illustration?
Tools & techniques (and common mistakes!)
Q&A

Giveaway
(1 free customized science graphic, at end of talk, valued at $500)
WHY SCIENCE VISUALIZATION?
VALUE OF A GOOD SCIENTIFIC GRAPHIC:

- Communication - peer to peer, or to the public
- Publication
- Presentation slides
- Investors (VC pitch decks)
- Self-evaluation
- Promotional / Social media
### Most Shared Posts from Facebook Pages Worldwide, March 2014

<table>
<thead>
<tr>
<th>Type</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo</td>
<td>87%</td>
</tr>
<tr>
<td>Link</td>
<td>4%</td>
</tr>
<tr>
<td>Album</td>
<td>4%</td>
</tr>
<tr>
<td>Video</td>
<td>3%</td>
</tr>
<tr>
<td>Status</td>
<td>2%</td>
</tr>
</tbody>
</table>

Note: Among the top 10% of posts in raw interactions from 30,000+ Facebook pages.
Source: Socialbakers.com as cited in company blog, April 8, 2014

### Twitter

- Hashtag: 16%
- Digit: 17%
- Quote: 19%
- Video URL: 28%
- Photo URL: 35%

Source: Twitter Media Blog, Get the data, Embed this chart
'Eight reasons I rejected your article'

1. **It fails the technical screening.**

Before they even go to the editor-in-chief, articles are checked for technical elements. The main reasons they are rejected are:

- The article contains elements that are suspected to be plagiarized, or it is currently under review at another journal. (Republishing articles or parts of articles, submitting to one or more journals at the same time or using text or images without permission is not allowed. See our ethical guidelines.)
- The manuscript is not complete; it may be lacking key elements such as the title, authors, affiliations, keywords, main text, references and all tables and figures).
- The English is not sufficient for the peer review process,
- **The figures are not complete or are not clear enough to read.**
- The article does not conform to the Guide for Authors for the journal it is submitted to.

https://www.elsevier.com/connect/8-reasons-i-rejected-your-article
BACKGROUND
BACKGROUND

BSc. Life Science
Queen’s University, Kingston ON

BFA, Fine Art
Queen’s University, Kingston ON

MA, Medical Illustration
Johns Hopkins University School of Medicine, Baltimore, MD
BACKGROUND

National Geographic Magazine HQ, Washington, DC
BACKGROUND

National Geographic Magazine HQ, Washington, DC
PEAK INTO THE PROCESS
HOW THE WASTE DISPOSAL SYSTEM WORKS

Clean Fluid in Around the Artery
Arterial pulsatility drives cerebrospinal fluid down along the donut-shaped tunnel surrounding the vessel, into the brain, where it dilates the vessel walls. As it exits the vessel, the pressure inside the vessel is lower than the pressure outside, allowing fluid to flow out through the venous network.

Dirty Fluid out Around the Veins
The venous system returns the fluid back to the heart, completing the cycle.

Most of the fluid in the cerebrospinal fluid is made up of protein and glucose. This fluid helps to nourish the brain and spinal cord, providing a constant supply of nutrients.

In the brain and spinal cord, the fluid is contained within a network of blood vessels and capillaries. This network allows for the exchange of nutrients and waste products between the blood and the brain tissue.

The cerebrospinal fluid is produced by the choroid plexus, a network of blood vessels located in the brain and spinal cord. The fluid is then transported to the arachnoid space, where it is collected and returned to the blood stream.

The fluid also helps to provide a cushioning effect for the brain, protecting it from damage in case of trauma.

Scientists have long known about the existence of the cerebrospinal fluid space, but they have not been able to measure its size or its function in maintaining brain health. Recent research shows that the fluid plays a crucial role in maintaining the brain's health by providing a buffer against changes in pressure and providing a constant supply of nutrients.
Hippocrates observed that the brain is suspended in fluid, but the functions of that cerebrospinal fluid (CSF) vital to brain function have only been slowly revealed. Francois Magendie compared the brain suspended in CSF to the fetus suspended in amniotic fluid, and indeed, CSF does provide mechanical support for the brain. Since the brain is neutrally buoyant in this environment, CSF provides protection of neural tissue from the force of gravity and from sudden changes in velocity during head impact. The production of CSF by the choroid plexus in the lateral ventricles, its transit through the third and fourth ventricles, its egress into the subarachnoid space of the brain and spinal cord, and its ultimate resorption at the arachnoid granulations in the large draining veins was not fully described until the early 1900s (Figure 1A and ref 1).

Into the soup

Virtually every cell throughout the body is surrounded by interstitial fluid, which plays critical roles in cellular homeostasis, including maintaining osmotic gradients, providing environmental stimuli, including maintaining osmotic gradients, and equilibrating the interstitial fluid concentrations of molecules by diffusion.

The hypothesis that brain processes an "interstitial fluid" system with the same physicochemical functions, but with different capabilities that found throughout the remainder of the body, was initially proposed by the observations that CSF is removed from the neonatal brain by the venous system in the cranial cavity contains only few arachnoid granulations and, additionally, that CSF flow is directly and unidirectionally along the arachnoid pia mater in the nose, which has no arachnoid granulations. In addition, labeled albumin into the CSF found that half of the albumin tracer enters the systemic circulation (Figure 1).

Conflict of Interest: The author has declared that no conflicts of interest exist.

Citation for this article: "J Clin Invest. 2010;1172: JCI98411." The Journal of Clinical Investigation.
Decrease prominence of skull and outer layers (skew perspective)

Increase # of astrocytes and foot projections

Change direction of flow
Left to Right

Astrocyte

Peri-arterial space

Subarachnoid space

Artery

Vein

Skull

DRAFT for Scientific American - 'Giymphatics'
©S AOKI | Anatomize 2016
Scientists knew about the existence of the perivascular space but until very recently had not identified any specific function for it. Thirty years ago, we didn’t even know how the interstitial fluid was being moved around the brain for the rapid transport of fluid through the brain.
**First Impressions**

As early as seven weeks after fertilization, fetuses start to move. As they grow, they swing their umbilical cords, climb the walls of the amniotic sac and stick their limbs in their mouth. Much of this activity could be randomumbling, but recent 4-D-scanning studies suggest that by 24 weeks fetuses anticipate these motions, opening their mouth before bringing their hands toward it, for example. And their coordination improves as they grow.

**Hearing and Language**

A fetus begins to hear between 24 and 27 weeks. It has been known for a decade that fetuses learn general features of their native language, such as rhythm and intonation, but two studies in 2013 confirmed that they also pick up distinct words and syllables. Brain activity of newborns in one of those studies revealed that they recognized three-syllable nonsense words that had been repeatedly played in their environment prior to birth, whereas newborns never exposed to the words were indifferent.

**Smell and Taste**

By the 19th week of pregnancy, a fetus’s taste buds have formed. The olfactory cells in its nose are working around the 24th week. Studies in the past decade have shown that newborns prefer flavors and odors, such as garlic, anise and carrot, that they grew accustomed to in the womb. Other work with rats in the past couple of years suggests that the foods a mother eats can mold a fetus’s brain in unhealthy ways, too. Baby rats whose mothers ate a diet of junk food were born with brains primed to crave such foods.

**Vision**

Of all the senses, vision takes longest to mature. A fetus does not open its eyes until its 28th week, and researchers debate what it can see, if anything. New evidence from animal studies indicates, however, that light filtering through the womb is crucial for eye development: when deprived of light, a mouse fetus will grow too many neurons and blood vessels in its eyes, causing damaging pressure to build up.
Barcelona’s Natural Wonder

Financially supported through private donations and tourist revenue, the Sagrada Familia is inching closer to completion. A look at the church’s layout and design reveals a marvel of imagination and expressionistic engineering.

Symbolic Towers

The towers symbolize the church’s primary purpose: the worship of God and the sanctity of the temple. The four towers represent the four evangelists—St. John, St. Matthew, St. Luke, and St. Mark. The tallest structure, the Nativity Facade, for example, represents the birth of Jesus Christ.

Giant Facades

The Nativity Facade, or Passions Facade, represents the life of Jesus Christ, while the towers contain symbolic religious images. These facades are the most famous works of Gaudi’s career, and include mosaics, sculptures, and glasswork.

An Inner Forest

The church is a “forest” of columns and spires, each representing a person. The columns are arranged in a specific order and contain symbolic images of people throughout the church.

A Work in Progress

The church is still under construction, and as such, the world’s greatest church is evolving and growing. While the Nativity Facade and towers are complete, the Passion Facade and towers are still under construction. The church is estimated to be completed in 2026.
ALL ABOUT THE BENJAMINS

ORGANIC GROWTH

INITIAL self-funded INVESTMENT: $45,000

TRIPLED REVENUE EVERY YEAR

7000%↑ REVENUE INCREASE IN LAST 2 YEARS

2010 2011 2012

3 WEEKENDS WORKED

NUMBER OF INVESTORS TURNED DOWN

90%

COMPANIES LAUNCHED

{ CLEVERFOX TBA
  TBA TBA

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Cytokines (TNF, IL1)

Cytokine receptors

Endocrine effects

Local effects

Eicosanoids

G-Protein coupled receptors

MAP Kinases

COXII/COX2

LOX

NF-kB

IKK

MAP p38 kinase

PKC

PI3 kinase

Arachidonic acid

Phospholipids

Adhesion, invasion, tissue destruction, angiogenesis, hyperproliferation, atherogenesis, etc.

MMPs 1, 3, 13, sPLA2, ICAM, iNOS, COX2, IL8, IL1b

DNA

Nucleus
TOOLS & TECHNIQUES
HARDWARE

Wacom tablet
- Wacom Intuos series (tablet)
- Cintiq series (screen/tablet)

Macbook and iMac - iOS (all wacom products and most software compatible on both PC and Mac)
SOFTWARE

- Adobe Photoshop & Illustrator (80%)
- Adobe After Effects
- Screenflow (‘whiteboard’ type animations)
- ToonBoom (storyboarding)
- Google Drive (Google Drawing)
- Dropbox Paper (share ideas)
- Powerpoint (with a grain of salt…)
- QuteMol (free, beautiful 3D renders of Pymol or pdb files)

- Others (I have not tried but have been recommended)
  - Graph Pad
  - Mind the Graph (infographics online)

- Tutorials: Lynda.com, YouTube
- Squarespace.com (Easy website for startups, labs, products)
TECHNICAL BASICS

Lines, arrows, fonts, margins

- Watch your margins! Equal on all sides
- Pick 1 or 2 fonts!
- Fonts - kerning (in Photoshop/Illustrator, select “Optical”)
- Keep arrow strokes thinner than the text thickness
- Don’t use dropshadows or rounded edges! (dated)
VISUAL DESIGN CHOICES - ‘Kerning’

No kerning

Kerning applied
VISUAL DESIGN CHOICES - ‘Kerning’

The cat in the hat
The cat in the hat

The cat in the hat
The cat in the hat
key lime tarts
8.6 oz. (245 g)
Color and Grayscale

- Don’t use black, use dark grey
- Pick ONE accent color for slides and design
- Be careful of color “values”
VISUAL DESIGN CHOICES - Color and “Value”
VISUAL DESIGN CHOICES - Color and "Value"
VISUAL DESIGN CHOICES - Color and "Value"
Science behind colors (use complementary hues)

Red + green
Orange + blue
Purple + yellow
VISUAL DESIGN CHOICES - Color and “Value”
TECHNICAL BASICS

THINGS TO AVOID:

- Word Art
THINGS TO AVOID:

- Gradients (defaults on powerpoint)
THINGS TO AVOID:

- Gradients (defaults on powerpoint)
TECHNICAL BASICS

(Don’t do this)
TECHNICAL BASICS

Format your photos

- Crop tightly to area of interest
- Adjust “levels” in photoshop or any image editing app
- Remove backgrounds more easily using the “magic wand” tool in photoshop
- Expand and live trace photos in Illustrator to convert to vector
The urge for good design is the same as the urge to go on living.
FINAL TIPS

- Start on paper
- Test print
- Fresh eyes
- Consult with a science/medical illustrator!
THANK YOU!
Giveaway

(one free customized science graphic)

Email: aoki@anatomize.com

Subject: NNLM Webinar