Science AMA Series: I'm Shiz Aoki, a Science Illustrator with National Geographic Magazine, Hopkins Medicine grad, and founder of Anatomize Studios Inc. AMA!

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Abstract

Hi reddit! Creating effective visuals to explain your research can be intimidating but also critical to communicating your ideas and findings. I'm passionate about science communication and I'm here today to share a few trade secrets on how to create better journal figures, science illustrations, presentation slides, graphical abstracts and more! All it takes is a few tips and tricks, some help from available tools (or experts!), and a little bit of patience. AMA! Brief bio: Shiz Aoki graduated from the Johns Hopkins University School of Medicine through the Art as Applied to Medicine program after obtaining a B.Sc. in pre-medical sciences, and a Bachelor of Fine Arts and Illustration from Queen's University in Kingston, Ontario. In 2010, she was hired straight out of school as a science illustrator for National Geographic Magazine at their HQ in Washington, DC. Having grown up in Toronto, she eventually moved back to the city where she continues to actively work for the magazine while operating her own biomedical communications company, Anatomize Studios. She has serviced other renowned clients including Scientific American, HHMI, NIH, McGraw Hill, Stanford University, and many others. Aoki hopes to democratize the process of visual science communication to scientists at all stages of their careers. Her team is currently creating new tools and resources for scientists to create science visuals (such as graphical abstracts, journal figures, presentation slides). Please email shiz@biorender.io if you're interested in participating or learning more about this new initiative! Follow her on Twitter: @ShizAoki Learn more at www.biorender.io EDIT: Thanks everyone for all the great questions! This was a lot of fun. I'll glance back in a few days but if you want to chat, please feel free to email me!

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SHIZ_AOKI R/SCIENCE

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What's the biggest mistake that you see scientists regularly making when it comes to figures/illustrations?

Speaking more broadly, are there any ways that science communication as a whole could get better about visual communication? Things like changes to journal policies or format, or integration of video into online articles?

rslake

This is a great question, and is kind of what prompted myself and a few colleagues to bring up this topic! Broadly speaking, I'd say that the biggest mistake is *not* removing oneself from the subject enough (this actually goes for any field of study). If your non-science colleagues can't read back what the figure/illustration is trying to describe (even if it's terms like "this thing looks like it's swooping in to remove this thing, and then we zoom in to see a closer view of this other thing") it's actually a strikingly good indicator that even your expert colleagues might not grasp it at first glance. As far as journal policies, I think the requirement should be to move toward a standardization of how biomedical 'things' are visualized (ie, perhaps we can decide on how a T-cell receptor should be illustrated, instead of

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showing it 50 different ways, similar to how we've come to decide on universal fonts). Video is a fantastic idea, and I think that as technology improves, compression becomes faster, and visualization methods become democratized, more labs and individuals will be able to afford adding videos/animations into online versions of articles.

Edited: on a minor, more technical level, the most common design mistakes I find that scientists make are in the labeling (font is too small to be legible, multiple and improper export makes text blurry, labels are too close to the key image or too close to the margins). This might sound really minor but are easy fixes that can make or break the legibility (and credibility) of the image! :)

Apparently time crystals are a thing. How would one illustrate such a concept given its temporal (rather than spatial) nature?

philipjeremypatrick

Anything that brings in temporal variables makes it a great candidate for animation or video! A low-resolution GIF can be surprisingly effective in showing repetitive motion, and also easy to share on the web / social media. If you're looking to keep it as a still image, then careful placement of arrows to suggest movement is key. For something as complex as time crystals, I would definitely use a more relatable analogy (I think I saw a nice explanation of this in an article by Ryan Mandelbaum from Gizmodo yesterday using jump ropes and arm movements!)

I'm a huge fan of the graphics and illustrations in National Geographic. As a statistician in genetics, I often have to make plots and visualizations of complex topics for colleagues and papers. I find the visualizations in NG to be very informative and inspiring! My question is, when you meet a new dataset or scientific concept, what are some of the steps you take to find the best way to communicate it? Thank you!

asymptoticallynormal

I'm glad to hear that the graphics inform even experts such as yourself! The illustrations we create at NatGeo are a big team effort. We gather researchers from around the globe to help understand (and thus explain) the complex science to a broader audience. I'd say the bulk of the workload is actually on the back-end; reading tons of literature, thinking of ideas to best analogize the topic, supplementing with graphs, using size charts, maps, and mostly figuring out what to *leave out*. Sometimes we get so excited about a topic that we get carried away with the tangential information (this is where a great Art Director or CD will come in to steer the team back on course :))

Sorry for all the questions, this one might be a little too specific. I noticed on your website that you went to the Johns Hopkins Medical and Biological Illustration program. What was your experience like with the program, and how did it prepare you for working in the field? As a side, do you know anything about the Biomedical Communications program at the University of Toronto?

RhyDonCorleone

The experience I gained while at Hopkins was invaluable! They do an excellent job of teaching you transferrable skills that apply to the 'real world.' This includes software training, interacting with clients (profs), drafting contracts and negotiating terms, and even some of the ethical concerns of working in patient-centered environments. The medical art students actually attend all the same anatomy and dissection classes as the Hopkins students (and take all the same exams!). We also get access and sketch in operating rooms with top surgeons in the field to observe procedures for surgical illustrations.

When visualizing concepts and data, the type of visuals used can slant or filter the original meaning of the source material. What processes (formal or otherwise) do you employ to help ensure loyalty to the original content?

Related: Can you share any examples where you disagreed with the original authors or other collaborators?

Thank you for sharing your time and experience.

robot_ankles

Hi robot_ankles (great name btw!). That's a great point, and is something us visual communicators strive to get right. I would say there is no real formal process in ensuring loyalty to the original content, however, the audience is what drives the decision-making process. If we're speaking to the general public, sometimes it does require *filtering* the original meaning of the source material ever-so-slightly to be able to communicate something really complex, whether that's through analogy or omission of detail. One rule of thumb is to deduce the 'original meaning' of the concepts/data to 25 words or less, to it's absolute core message. Then, if you embellish this with images or paragraphs, hand it off to a 3rd party, and they can relate it back to the core message, then we'll always be on the right track.

How do you decide on how detailed to get - like what info can you exclude and what NEEDS to be shown? Fantastic examples on your web site BTW :)

fireking99

Thank you for the kind words! Level of detail to include depends on several things including: - audience (ie: will they understand it all?) - space restrictions (ex: is this going on an 8-page poster or a 700px instagram post?) - context (ie will this image accompany an animation, in which case the details will be explained therein) - client / purpose (I hesitate to say this, but sometimes if the client *really* wants something included that might not best suit it, but has other purposes for being included, ie company logo or favourite color, we'll find a compromise)

I (science undergrad) just started getting interested in this career path recently, and I'm curious as to which computer programs are relevant. What are the big studios/contractors that I should be keeping track of and what kind of experience are they looking for in new hires (e.g. science-related, general graphic art, previously published pieces, etc.)? Are there certain cities or hubs for this kind of thing?

RhyDonCorleone

Hey there - welcome to the dark side! (jk). This list is not comprehensive, but if you're interested in learning how to make the glossy, 3D illustrations you see in a lot of molecular or anatomical images, I would recommend learning 3D modeling and rendering software such as Cinema 4D, 3D studio max, Maya, mudbox, Zbrush, Blender, etc. You can also get your feet wet by using free variations of these. If you're interested in more of the 2D look (think Frank Netter, Da Vinci anatomy, NatGeo posters, or animation storyboarding), then much of it is hand-drawing with a mixture or Adobe Photoshop and Illustrator. I use both real pencil and a 'digital pencil' (Wacom Cintiq) that acts like a writing surface to mimic hand-drawing.

How does one gets into "science illustration"? It seems like a field that needs a lot of people (looking at some tschool textbooks)

citizenofgaia

Thanks for your question! Getting into science illustration (and doing well in the field) requires a combination of both an aptitude in the sciences and a strong art portfolio. Some people come into the field with no art background but a strong science base (or vice versa) and compensate the former half by taking courses and learning through projects or internships. As mentioned previously, you might also consider applying to a program specifically tailored to teach you skills in scientific/medical/biological illustration (whether that's an undergad degree, masters degree, certificate, or continuing ed). It is definitely a field that is in high demand, and is only becoming more important as technology rapidly evolves and the divide between science experts and the general public gets wider!

I noticed that a lot of work in pharmaceutical ads are 3D and not always accurate (to scientists' standards). Are these not trained artists or does the pharma industry have 'artistic license' to make things look 'snappier' than they really are? I just think it's a big responsibility for the visuals to accurately reflect reality... curious on your take...

Jar_of_Yeast_Fluoro

Excellent observation. What you're seeing could be one of a few things: * the images have been outsourced to studios/artists who do not have sufficient training in the scientific subject matter to accurately communicate the science (but can make a beautiful picture!) * there may have been some artistic license taken to convey a very specific message, thereby omitting some details and losing some accuracy in the process. Sometimes this is a byproduct, or is done consciously by the artist or client to suit the branding or specs of the ad campaign.

Is it possible to enter the field of scientific illustration/visualization without a degree specifically in science, but rather solely a fine arts degree?

blue0rchid

Yes! I have many colleagues who entered the field this way. I actually started out in Fine Arts and took science courses on the side (I thought I wanted to pursue solely medicine so I ended up doing the whole degree, but it certainly wasn't necessary). I should also mention that there are many 'branches' of science illustration/visualization. For example, I know illustrators who focus on plant biology, veterinary medicine, entomology, medical devices, ornithology, or other another narrow field. This works well if you have a great client-base or become well-known in that field of work, but could be tricky to obtain enough clients to sustain a practice early on. Typically, medical illustrations can also demand higher prices, but this is not always the case. Long answer short - take the basic science courses like anatomy, biology, physiology, and see if you like them! If you find you're really struggling in the science courses, I would recommend pursuing a job that might require less of the science-heavy work and more of the visual component (such as commercial illustration or creating 3D medical models/animating within a larger company).

About how many people per year apply to the Johns Hopkins medical illustration program and how many get accepted?

blue0rchid

In my year, I believe there were about 40-50 applicants (I'll have to verify this #) and they accepted 6 students.

Thank you for taking your time for this AMA, this is a very interesting topic.

1) What languages or programs would you recommend for scientists to learn how to use to begin making scientific art/infographics?

2) How should someone begin to tackle potentially making a start in this field, assuming one has a high degree of scientific training but little programming experience?

TheQuick1

Thanks for the question! I guess my answer depends on the level of time/commitment you'd like to invest in learning:

1) For the intermediate/advanced artist or graphics software user, my go to programs I use are:

- Adobe Photoshop (mostly for drawing/rendering, not for its photo editing capabilities),
- Adobe Illustrator
- Adobe After Effects (for animation, not really needed for still image work)
- pencil & paper (still relevant!)

I know that Adobe software can be very time-intensive to learn, so if you're already comfortable using things like Powerpoint or Google Drawing, please refer to the previous answer I gave on design tips and things to avoid!

For **infographics**, much of the 'secret sauce' is in the design work and how everything is laid out. For this, I recommend using/downloading templates online that use tried and true design principles. Here's a nice example (im not associated, just found it online). You can then download individual images from Shutterstock or other stock sites to swap into the infographic to fit your needs!

2) Another great question! I touched on this in previous posts, but I'll summarize here (and it sounds like you're interested in more of the digital science graphics rather than hand-drawn). I would look for some great online courses (such as through Lynda.com or youtube) and pick up some software training in programs like Photoshop or Illustrator that teach both 'drawing' and 'design' skills. You don't really need much programming skills unless you are looking to do web design or gamification of 3D animation (many of my colleagues use Unity3D for this).

As a bioengineer, I am terrible at drawing and make my figures using PowerPoint and Excel (we currently have GraphPad too, but I haven't used it yet for a paper). What are some good tools for making figures that explain a process (usually described as a cartoon)?

What do you recommend when a figure is relatively boring? Such as one picture is dark and the next is lit up and that's a positive result the author is trying to show.

Thank you!

engineerme9

Thanks for your question! You're right, Powerpoint and Excel are the most popular choices but definitely have their limitations. If you are willing to put some hours into learning Adobe Illustrator, I'd say it's a better alternative to creating those clean, schematic-type illustrations, but the software can be intimidating (I learned a ton through online tutorials like Lynda.com and youtube). You can actually achieve decent images in Powerpoint or your preferred software if you follow a few design principles that apply to any science field - here's a few but this list is not exhaustive:

- avoid drop shadows and thick outlines (makes it look dated)

- avoid using black for text - dark grey gives it a cleaner, modern finish
- avoid rounded edges on text boxes (also looks dated)
- avoid using lots of stark colors (like bright yellow next to bright blue)
- vary your text size (don't make labels same font size as titles and subtitles)
- don't overlap arrows (ie don't criss-cross or confuse lines)
- keep a nice border of space around your image (ie dont have anything touching the edge of the image border)
- avoid the dreaded gradients that Powerpoint and Word default adds to most shapes! Keep it 1 solid color
- use the rule of opposites for text on shapes (dark font on light background, light font on dark background)
- a great trick is to bring your completed image into photoshop and convert it to black & white (grayscale). If some of your text or images blend into each other and disappear, that means you should bump up the 'darkness' or 'lightness' of some of the colors!
- walk away from the image you created and come back to it hour(s)/day(s) later. the first thing that jumps out at you as weird/awkward is what you're audience will notice. Change it!

(I'll come back and add more as I think of them!) Edited: I've added a few more to the list :)

Thanks for doing this AMA! I just recently received my acceptance letter from UIC for their medical illustration program. Any advice/insight for someone looking to also eventually operate their own business after graduation?

Get_it_together_dawg

Congrats! UIC is a great program! I'm sure you'll learn a ton during your time there, and when you figure out a niche that you really gravitate toward, I would focus on that and start to seek clients while you're at an academic institution (tons of clients in that area). If possible, I'd also look to try and do an internship or short gig at a medical illustration studio or journal (depending on the type of work you want to get into) to familiarize yourself with the whole process of seeking clients, negotiating terms, working on multiple deadlines, collaborating with writers/designers/editors, and getting used to the general pace of graphics (which you'll find is much faster than graduate school deadlines!). Feel free to email me along the way if you have any questions that pop up :)

Have you been looking into using VR or AR technologies for easier understanding of scientific concepts?

thelathaIII

I'd love to use it more! I've created assets (ie 3D graphics and storyboards) for companies that are incorporating AR/VR into their offerings, but I have not directly produced them in-house. I personally think that the technology has to improve (ie cordless head-sets, resolution, price of hardware) in order for it to become valuable enough to be used on a broader scale, outside of the usual trade-show booths. It's still faster for people to just read something on paper or google a video on youtube!

Amazing and beautiful illustrations! You originally did a premed degree at Queens. I'm assuming you originally were considering medical school; what made you ultimately change your mind if you don't mind me asking.

I'm also interested to know if you're ever tempted to create more fantastical/fictional works of art. I can only imagine how someone like you would be able to draw from your vast repertoire of knowledge in

science and anatomy and create something totally original.

computerpoop

Thank you for the kind words, and for the great questions! I did originally consider going into medicine (wrote the MCAT, did quite well, accepted to a few schools, but saw how drained my colleagues in medicine were, some even switching out of medicine after residency..). I think I took for granted how lucky I was to have found a career that I loved and could take full control of!

And yes to more fictional art! I actually started out in fine arts so had spent the majority of my early 20's doing huge (8ft) oil paintings that were a lot more conceptual and a bit controversial. I think that's where universities and academic fine art will lead you. I had to "unlearn" a lot of the theoretical art stuff and "learn" to become an illustrator, which is a totally different way of communicating (very little to do with how I felt about the subject, everything to do with how the image would be understood!).