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Title

Swim Down: Finding Neurodivergent Identity in the Depths

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Swim Down: Finding Neurodivergent Identity in the Depths

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Peter Franks, PhD

Lisa Levin, PhD

Freya Hammar, MS

Signature:



Date: June 14, 2023

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Signature:



Date: June 16, 2023

Peter Franks, Scripps Institution of Oceanography, UC San Diego

Signature:



Date: June 14, 2023

Lisa Levin, Scripps Institution of Oceanography, UC San Diego

Signature:



Date: June 14 2023

Freya Hammar, Illustrator

Deliverable Website

Website: swimdown.neocities.org

Abstract/Executive Summary

A neurodivergent teenager's underwater journey through Monterey Submarine Canyon reveals that sensory differences are powerful adaptations, exploring how her sensitivities to light, noise, and touch correspond to deep sea conditions such as darkness, quiet, and pressure. The digital graphic novel is hosted online as a website, as well as a fully narrated, sound mixed, and captioned video version of the underwater arc of the story.

Background/Problem Statement

The two main subjects of my story are often misunderstood in society: The deep sea and neurodiversity. Although these topics have been explored individually, this is a narrative that links the two together.

Many stories that I've read or watched about autistic and other neurodivergent individuals rely on stereotypes, and/or are often written¹ or translated² by individuals who are not neurodivergent themselves. There is a need for thoughtfully-written disability representation by and for neurodiverse individuals that upholds and celebrates the traits that make us different from others instead of erasing them or characterizing them in a way that is not respectful.

In parallel, the deep sea is often misunderstood and mischaracterized, perhaps because the vast majority of people will never get to see it first-hand.³ Some of the creatures in the deep sea are described as strange and "alien" and are cast in a frightening or repulsive light based on surface-level evaluations of how different they are from other species that are more visible, charismatic, and relatable to humans. Science communicators have a duty to correct misconceptions about the deep sea and show people that this habitat, not just familiar terrestrial ones, is worth stewardship and protection. The vacuum of accurate information that is accessible to non-scientists is similar to the lack of positive media representation that celebrates neurodivergence from our own perspectives.

Project Goal

¹ Haddon, M., & Stephens, S. (2015). *The Curious Incident of the Dog in the Night-Time*. DoubleDay.

² Higashida, N., Yoshida, K., & Mitchell, D. S. (2014). *The Reason I Jump: One Boy's Voice from the Silence of Autism*. Sceptre.

³ Jamieson, A. J., Singleman, G., Linley, T. D., & Casey, S. (2020). Fear and loathing of the deep ocean: why don't people care about the deep sea? *ICES Journal of Marine Science*, 78(3), 797–809. <https://doi.org/10.1093/icesjms/fsaa234>

By combining narrative, art, emotion, personal perspective, and science, I highlight the link between the deep sea and neurodivergence to deepen understanding of both.

The story begins with the protagonist, Mari, on a field trip to a deep sea exhibit similar to the one at the Monterey Bay Aquarium. A triggering sensory event spurs the heroine to embark on an imagined deep sea journey she narrates herself, giving her a sense of agency. The narrative explores how Mari's sensitivities to light, noise, and touch correspond to deep sea conditions such as darkness, quiet, and pressure. To create this link, I show my character encountering different oceanic environments and physically transforming into some of the marine life she encounters.

After this journey, Mari returns to herself, and uses her new understanding of her strengths to advocate for herself. The story ends on a flash forward of my character working in marine conservation following a positive experience as she continues touring the aquarium.

The story is aimed at younger audiences, ranging from teenagers to young adults. This story is specifically for neurodivergent people. Some narratives may try to beautify or normalize disabilities with a message that everyone is fundamentally the same regardless of the challenges we face. Instead, I want this story to unapologetically celebrate the differences of neurodivergent individuals as strengths, not weaknesses.

Research Questions

- Which deep-sea adaptations correlate best to sensory differences in neurodivergent conditions, and how could they be designed in relation to humanoid features?
- Which 3-5 oceanographic and biological processes would be most interesting, engaging, and plot-relevant to drive the deep sea portion of the story?
- In science communications, what are the most effective ways to combine fascination with the subject matter, simplicity of a message, and scholarly accuracy?

Specific Objectives

- Create positive neurodivergent representation that makes autistic and other neurodiverse individuals with sensory differences feel empowered and seen.
- Inspire interest in the conservation field and show young neurodivergent readers that there is a place for them in marine science.
- Depict oceanic and marine biological processes in a way that is engaging for non-scientists. They will be scientifically accurate while still simple enough to depict visually and narratively in a way that is interesting and visually appealing.
- Address misconceptions and stereotypes about the deep sea and encourage human stewardship and protection of the ecosystem.

Methodology

In February, I was lucky to be invited to visit the facilities of the Monterey Bay Aquarium Research Institute, or MBARI, a scientific organization at the forefront of deep sea research and exploration. I toured MBARI's fleet of underwater vehicles, including the ROV *Doc Ricketts*, which inspired the final scene in the underwater arc of the story.

While I was visiting, I also took a trip to the Monterey Bay Aquarium itself, a place where I spent a lot of time in my childhood and that inspired my love for the ocean. There, I got to see the Into the Deep exhibit, which showcases living deep sea creatures, many collected by MBARI.

My chair, Dr. Charlotte Seid, provided weekly "assignments" to help me stay on track and deepen the scholarly aspect of my project, such as reading papers and books. I also had biweekly mentorship meetings with Dr. Peter Franks and attended his lab meetings on Mondays where I met with his extended network of scientists and PhD students to get advice from the group on my project.

Selection of Subjects

For hearing, I settled on the Dall's porpoise. My committee and I agreed to start with a mammal, a charismatic animal humans can easily relate to. In this scene I draw a comparison between sensitive hearing and echolocation as an alternate, more complex sense, which offers an interpretation of Mari's sensitivity to noise on land.

For vision, I selected the crystal amphipod, which is an intriguing animal that has gigantic eyes and can see in all directions. Taking in too many stimuli because of highly specialized and unique eyes conveys Mari's overwhelm in bright light and busy spaces. The invisibility of this amphipod is also a nod to her aversion to looking people in the eye.

Finally, the bloody belly comb's jelly is used to interpret Mari's sensitive skin, translating it into a fragile gelatinous body that is strong in a different environment. Additionally, high pressure like being "squished" or compressed is often very comforting to neurodivergent individuals.

Creation Process

Although I had a lot of ideas going into this project, my committee encouraged me to stay true to the heart of the story, which is the connection between neurodivergence and the ocean. They ensured I stayed focused on a few key senses: Hearing, vision, and touch.

I narrowed the focus of the story to the Monterey Submarine Canyon to guide my research. Then I selected the animal above to represent a progression deeper into the water column, to create forward movement as Mari transforms and learns more about herself.

To conduct this research I used resources including Fathomnet, the MBARI deep-sea guide, the Deep Ocean Stewardship Initiative newsletter, and NOAA's animal identification guides, along with the plethora of other resources found in the supplementary annotated bibliography.

Over the ten-week Winter quarter, I wrote the narration and storyboarded every panel of this story. Then I worked closely with illustrator Freya Hammar to translate my sketches into vivid illustrations. I worked with fellow MAS MBC student Mel Rodriguez, who lent her voice to the project and brought Mari's narration to life. I then spent hours sound mixing the final video to create a multimodal experience.

Conclusion

In terms of my professional growth, I have both expanded upon my existing strengths and learned many additional skills that will help me excel in the science communications field going forward. Some of these skills include project management, video editing and sound recording, applied scientific research, illustration, creative writing under a deadline, networking, and building relationships. As a result of this project I have also been invited to host a communications seminar at MBARI in August detailing the creation of Swim Down..

On a more personal level, I have learned to lead with my heart and bring my full self to a project that was deeply meaningful for me. Writing and creating this story here at Scripps has been an empowering, vulnerable, and incredibly fulfilling journey. I hope my neurodivergent readers will see their own strengths reflected back at them in Swim Down, and that some may even see themselves getting involved in marine science one day, boldly bringing their differences forward to be celebrated in a field where we belong.

Annotated Bibliography

Burton, E.J., L.A. Kuhnz, A.P. DeVogelaere, and J.P. Barry. 2017. Sur Ridge Field Guide: Monterey Bay National Marine Sanctuary. Marine Sanctuaries Conservation Series ONMS-17-10. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 122 pp.

- I used this website to research ecology and create the inspiration board and plot the panels for the Sur Ridge seafloor scene.

Choy, C. A., Haddock, S. H. D., & Robison, B. H. (2017). Deep pelagic food web structure as revealed by *in situ* feeding observations. *Proceedings of the Royal Society B: Biological Sciences*, 284(1868), 20172116. <https://doi.org/10.1098/rspb.2017.2116>

- This source, which I read over summer quarter, gave me background information on the biological and food web interactions in the deep sea.

DOSI - Deep Ocean Stewardship Initiative. (2022, January 5). DOSI.

<https://www.dosi-project.org/>

- This newsletter was founded by my committee member Dr. Lisa Levin and provided weekly inspiration and thoughts about the deep sea.

FathomNet. (2021). <https://fathomnet.org/fathomnet/#/>

- I used this website to comb through images and the locations of different deep sea creatures.

Filander, Z. (2023). *Where the Weird Things Are: An Ocean Twilight Zone Adventure* (Marine Life Books for Kids, Ocean Books for Kids, Educational Books for Kids). Simon and Schuster.

- This is a science communications picture book from a marine biologist aimed at younger audiences than mine but gave some ideas on simplification of concepts and a continuous narrative.

Grandin, T., & Panek, R. (2014). *The Autistic Brain: Helping Different Kinds of Minds Succeed*. Mariner Books.

- Temple Grandin, an autistic academic who provides insight on the strengths of autistic individuals and reframes perceived “weaknesses” in a new light.

Grant, M. (2018). *Into the Drowning Deep*. Orbit.

- This sci-fi/horror novel uses marine biology concepts to redefine the typical cultural perception of a mermaid. It also has an openly autistic character in the main cast.

Haddock, S. H. D., Moline, M. A., & Case, J. F. (2010). Bioluminescence in the Sea. *Annual Review of Marine Science*, 2(1), 443–493.

<https://doi.org/10.1146/annurev-marine-120308-081028>

- I read this article to get general background information on bioluminescence and how it works, informing my bioluminescent stinging scene.

Imbler, S. (2022). *How Far the Light Reaches: A Life in Ten Sea Creatures*. Little, Brown and Company.

- In autobiography, the author frames vignettes from her life around different marine animals, demonstrating a personal narrative and how the ocean can tie into human storytelling.

Jamieson, A., & Linley, T. (2023, March 13). The Deco-Stop: Neurodiversity in Science. Armatus Oceanic.

<https://www.armatusoceanic.com/podcast/deco-stop-002-neurodiversity>

- I listened to this podcast episode in which a neurodivergent host interviews an array of neurodivergent guests in the marine biology, oceanography, and engineering fields.

Jamieson, A. J., Singleman, G., Linley, T. D., & Casey, S. (2020). Fear and loathing of the deep ocean: why don't people care about the deep sea? *ICES Journal of Marine Science*, 78(3), 797–809. <https://doi.org/10.1093/icesjms/fsaa234>

- This article details common misconceptions of the deep sea and inspired some of my ideas around engaging readers on a personal level.

Lenharo, M. (2023). Comb jellies' unique fused neurons challenge evolution ideas. *Nature*. <https://doi.org/10.1038/d41586-023-01381-7>

- During the process of creating my narrative, this review discussed a recently published study, which represented a breakthrough in the way comb jellies evolved in a unique and independent way than other animals, and thereby bolstered its inclusion in a story about uniqueness and “divergence” in a literal sense.

MBARI's Deep-Sea Guide. (2015). <http://dsg.mbari.org/dsg/home>

- I used this website to narrow down my choices for the animal transformations, particularly the depth ranges of animals that occur in the Monterey Canyon.

Miller, L. (2020). *Why Fish Don't Exist: A Story of Loss, Love, and the Hidden Order of Life*. Simon & Schuster.

- This autobiography is a stellar example of science communications– weaving personal narrative, science, history, and the complexities of life and people in a masterful way.

Monterey Bay Aquarium Research Institute (MBARI). (2022, August 31). Revealing the secrets of Sur Ridge. MBARI.

<https://www.mbari.org/know-your-ocean/revealing-the-secrets-of-sur-ridge/>

- This article has excellent ROV video footage that I included to help guide Freya’s illustration of the Sur Ridge scene

NOAA Ocean Exploration Benthic Deepwater Animal Identification Guide. Available from

http://oceanexplorer.noaa.gov/oceanos/animal_guide/animal_guide.html.

- This is another source that helped me narrow down the ecology I showed in the benthic environment.

Redniss, Lauren. (2011). *Radioactive: Marie & Pierre Curie, a Tale of Love & Fallout*. It Books.

- This is one of my favorite science communication graphic novels that integrates the content into the body and form of the book – it even has a glow-in-the-dark cover that reflects the radioactivity described in the narrative.

Scales, H. (2022, September 14). Discovered in the deep: the crustacean with eyes for a head.

The Guardian.

<https://www.theguardian.com/environment/2022/sep/14/discovered-in-the-deep-the-transparent-crustacean-with-enormous-eyes-cystisoma>

- This article helped me decide to use the crystal amphipod as one of my transformation subjects and how Freya and I portrayed its unique vision.

Seeing Sur Ridge: New animation transforms deep-sea mapping data to reveal the majesty of an underwater oasis. (2022). MBARI.

<https://www.mbari.org/news/seeing-sur-ridge-new-animation-transforms-deep-sea-mapping-data-to-reveal-the-majesty-of-an-underwater-oasis/>

- This article provided more information on Sur Ridge, plus the intricacies of AUV and ROV exploration of the area by MBARI.

Tamm, S. L. (2014). Cilia and the life of ctenophores. *Invertebrate Biology*, 133(1), 1–46.

<https://doi.org/10.1111/ivb.12042>

- I read this article to give me more background comb jellies and how they move.

Underwood, E. (2017, January 5). The Master of Disguise of the Ocean Reveals Its Secrets.

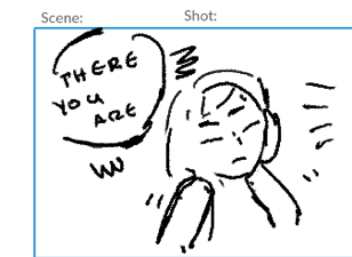
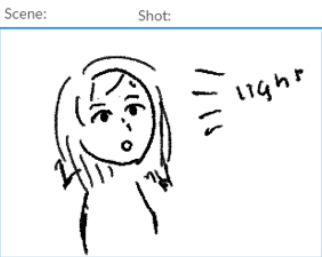
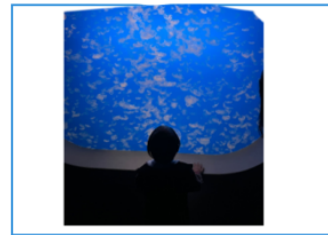
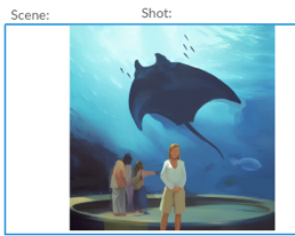
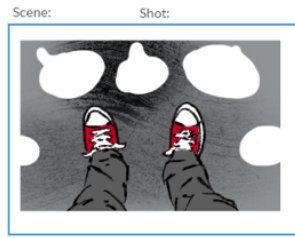
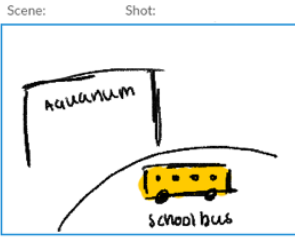
Smithsonian Magazine.

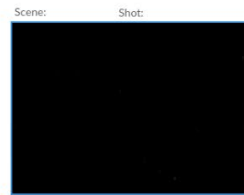
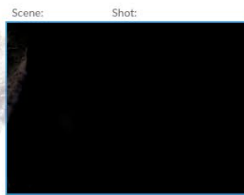
<https://www.smithsonianmag.com/science-nature/master-disguise-cystisoma-ocean-reveals-secrets-180961426/>

- This is another article describing the crystal amphipod which had a simple but effective description of the science behind its vision.

Swim Down: Finding Neurodivergent Identity in the Depths
Storyboards

By Lilianna Watson





I've always been different than other people.
Lights are too bright.
Noises are too loud.

I don't like to look at other people's faces. I don't like it when they look at me. And I really don't like it when they touch me.



But underwater, everything is different. The ocean fills my ears and drowns out all the white noise I hear on land.

And I hear something clearly in the water. An echoing song ringing out from the depths, and maybe from somewhere inside me too:



Facing the surface, the light still burns through my eyelids.

So I listen to the voice



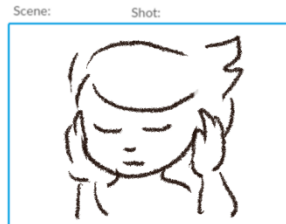
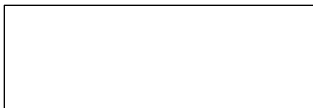
Turn my face to the darkness

Open my eyes

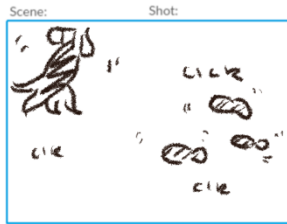
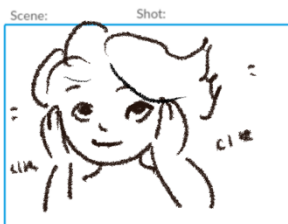
And swim down.



What I hear next is a chorus of calls

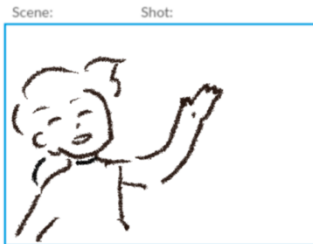


On land, I often cover my ears to dull my hearing



But here, I don't need to

Suddenly I can hear everything. Each sound is shape and movement.



As they pull away, I wave goodbye in the fading light



And I know they can hear it



As I swim down, the water comes alive

Light has always been harsh on me

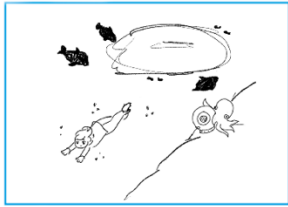
But here there are small lights I can play with



Flitting through my hands and glimmering while I flap my hands

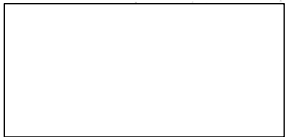
They're like the fireworks I feel when my joy is too big to contain

And the ocean dances along

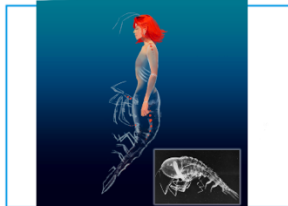
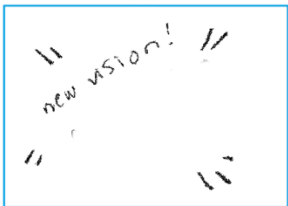


The deeper I swim down, the closer I look at my surroundings

I notice small creatures who disappear into the water



On land I try to block out my vision as much as I can to feel safe



But when I look through these crystal eyes

I seen in new ways, in all new directions

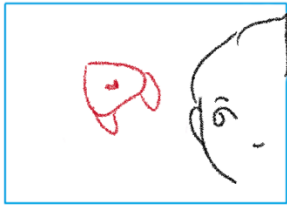
Details that would be lost in the light



So maybe I'm meant to see what others can't

And in the cover of this darkness

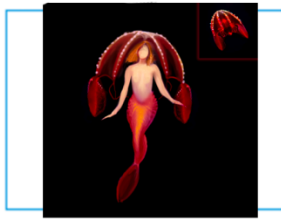
I am seen



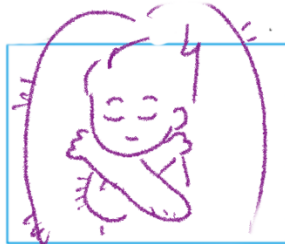
Now, the light is gone. I'd expect everything to be black.

And yet here I find brilliant red

We fade into nothing together



The slightest vibrations guide me through the water

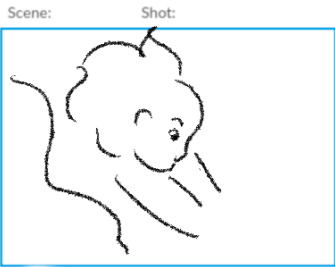


My skin feels gentle and fragile, as it always has been

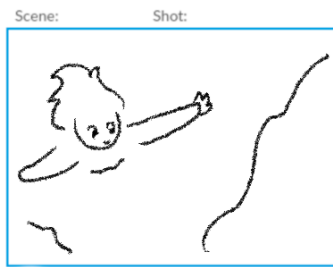
And it keeps me safe under the pressure



My sensitivity is a strength in a world apart from what most people know



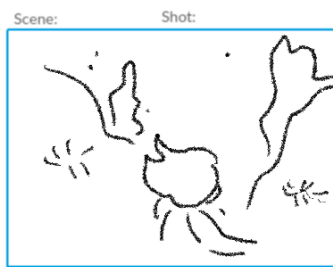
I can't swim down any further



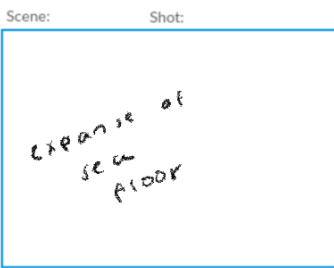
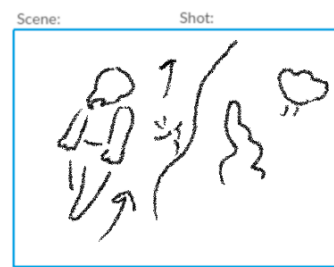
What was I expecting?



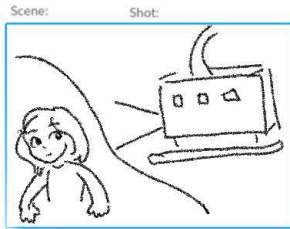
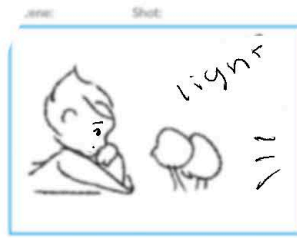
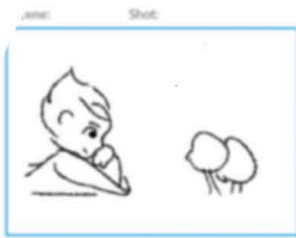
Loneliness?



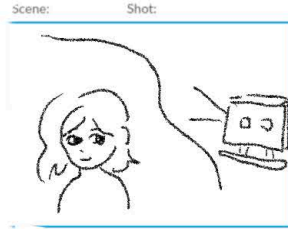
It's a world adapted to challenges most people don't understand.



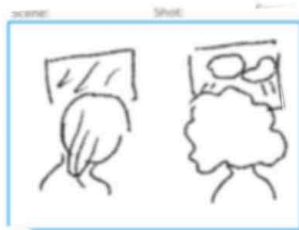
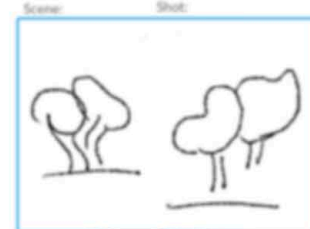
But I think I do.



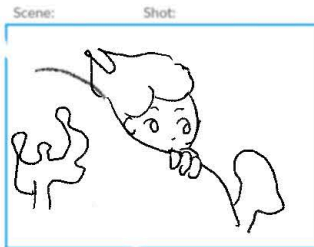
Suddenly, a light washes over me.



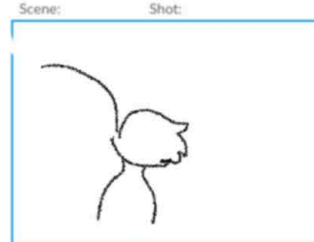
I'd expect to be scared, but this time...



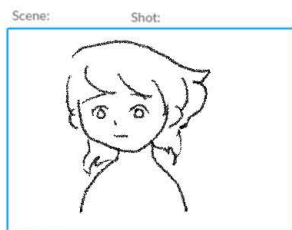
I see that people are trying to understand this world



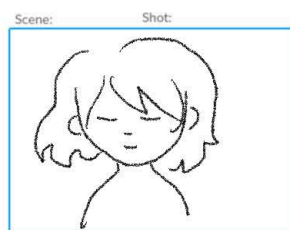
To understand me.



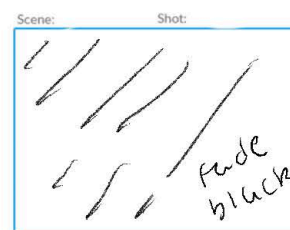
So maybe...

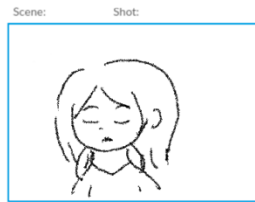


I'm ready...

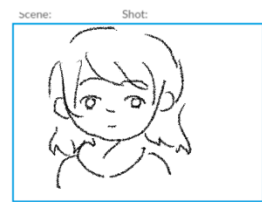


To be seen.

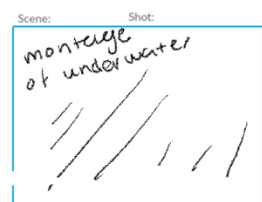
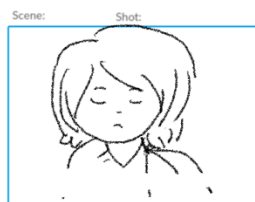




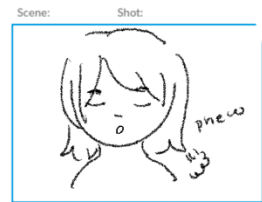
Mari! Mari!



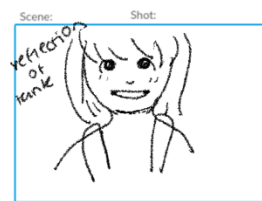
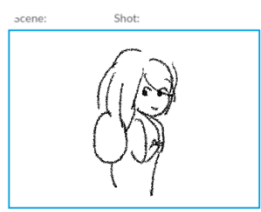
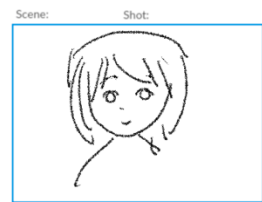
We were so worried! Are you ok?



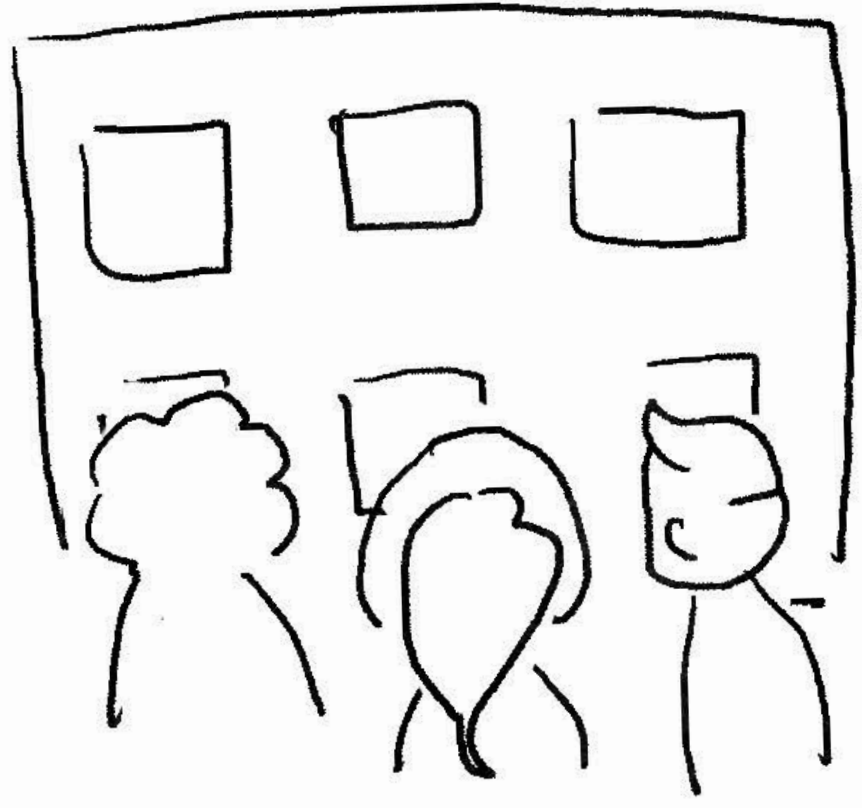
Yes, but please don't touch me without asking again.



O-of course... I'm so sorry...



screen



↑ center

pretty
incredible
en man?

yes. it is.