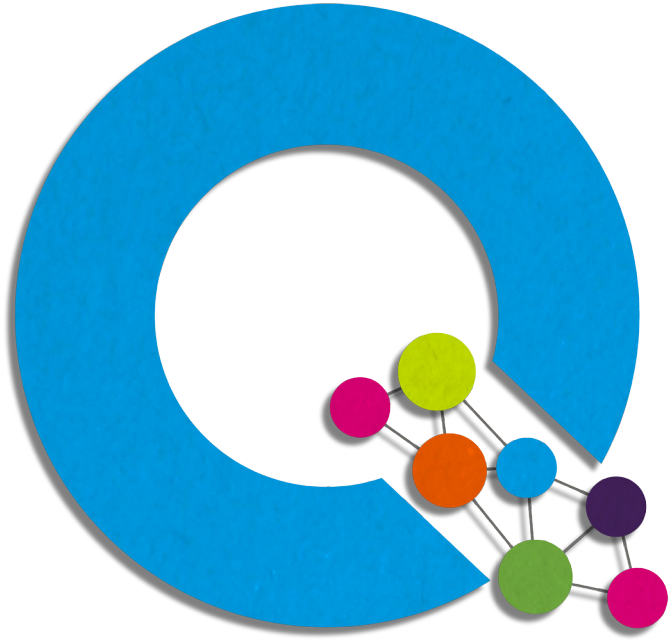

quarky.

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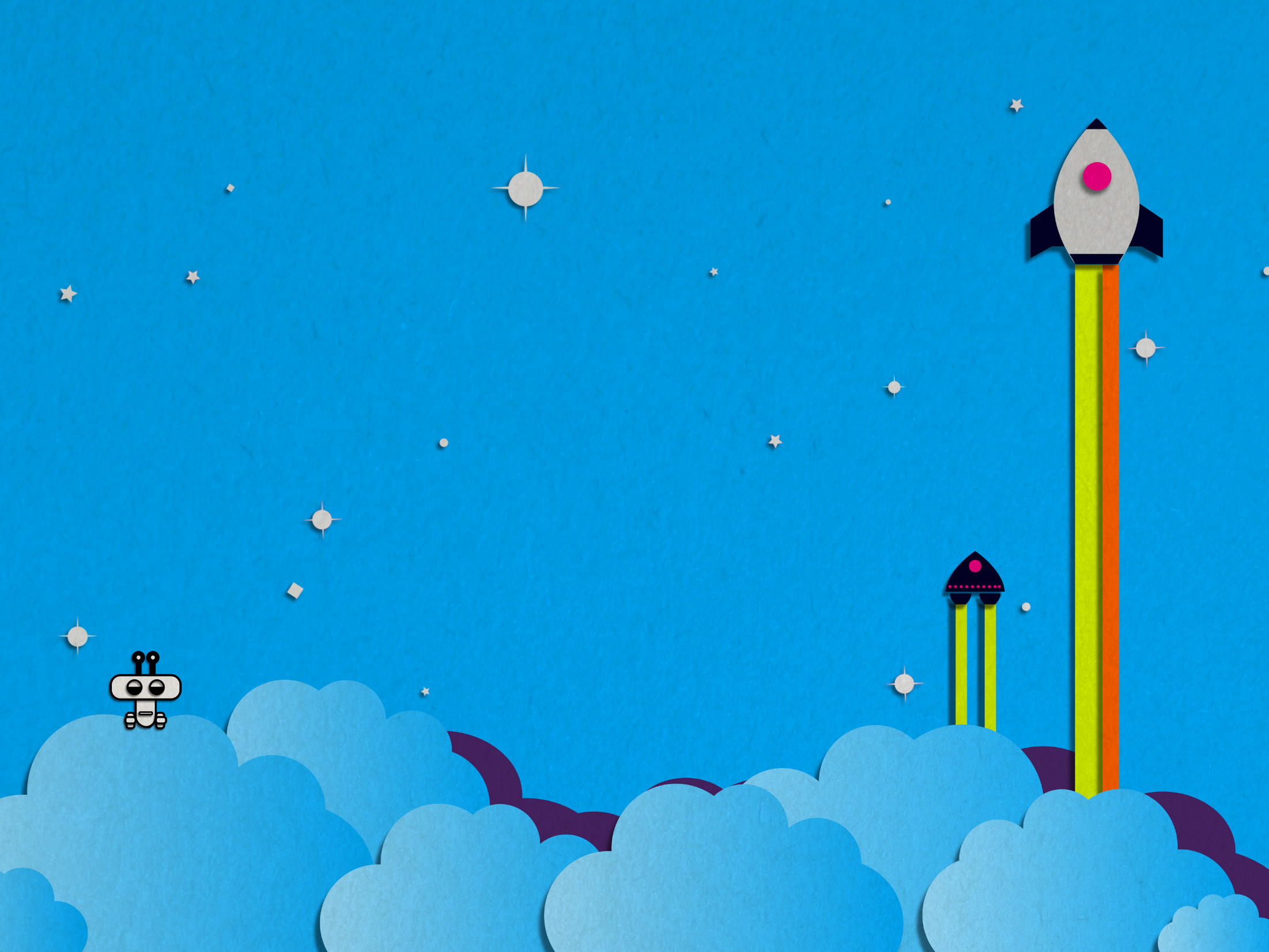

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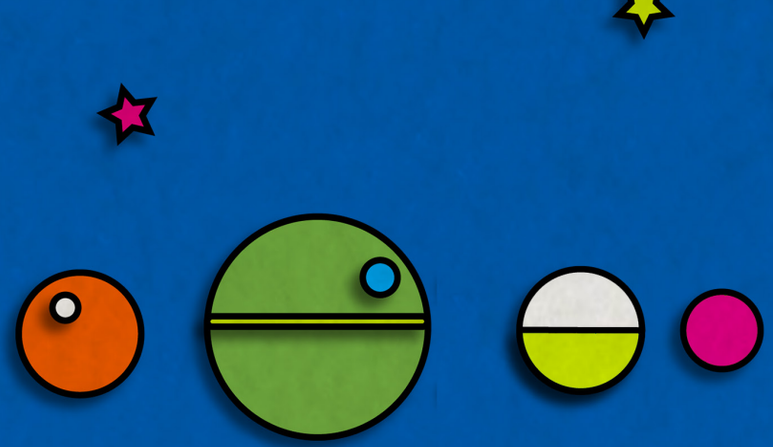
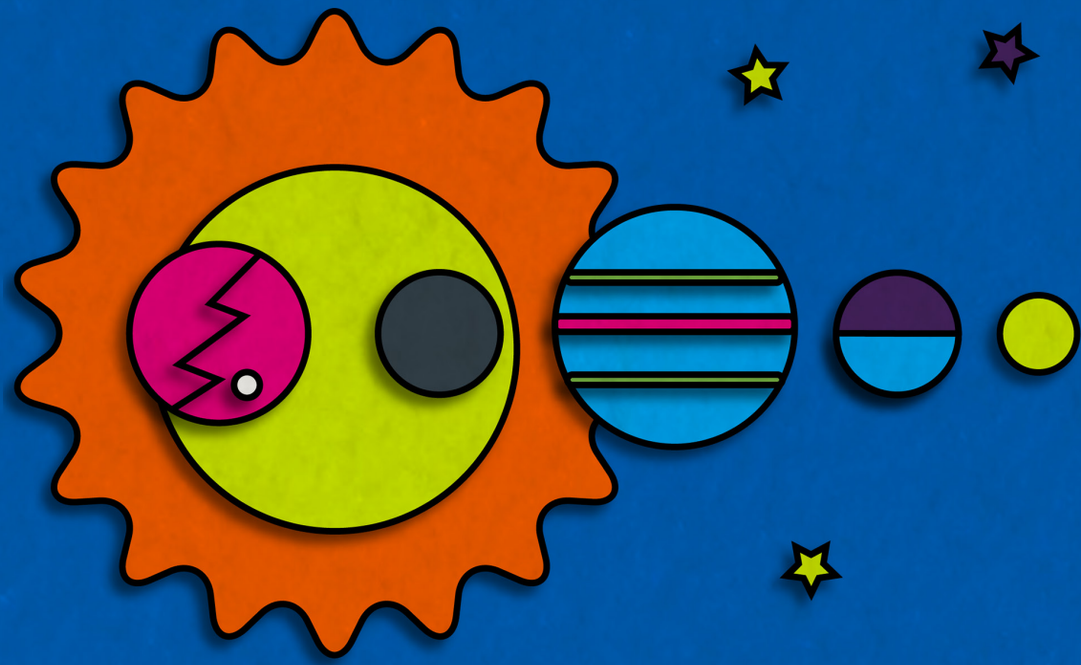
1.0

our story

Quarky makes learning about Einstein's theories as fun as playing Pac-Man.

Quarky is a tablet, gaming experience that empowers young girls to ignite their curiosity and creativity, to explore the world of science and all of its magic and wonders.





the author, age 9

I was that annoying child who continually asked, "Why?" Luckily, my parents would supply me with answers until I gave up asking or they successfully changed the subject. Today, I would be dubbed a member of the “curious class,” but then, I was just a child learning, and learning how to learn.

In college, I chose to study Astrophysics — mostly out of pure curiosity for something I had never studied before. I was blown away: I got to study extra-terrestrial objects. I was learning in four dimensions. Every discovery was a question that led to many answers.

Science (especially space) still intrigues me. It taught me how to think, how to solve complex problems, how to embrace this complexity, and then translate it into concepts that others might understand and use. Science was my brain trainer.

As I continued to study science, the older I became the more often I was the only woman in the room. I was used to it, but it was difficult to ask questions, even to find a study group. I ended up pursuing another career, and I would often joke that in order to stay in Astronomy, I’d have to grow a beard.

While I didn’t see myself reflected in the scientific community, I used my curiosity and my ability to solve complex problems to reach for new goals, and to create my own success.

Science made me who I am today, and without my family and my eccentric teachers, I am not sure I would have had the stamina to succeed in the male-dominated areas in which I chose to work.

I want science to be fun and engaging to all, and I want girls to have an alluring place to learn and be curious about it. This is why I created Quarky, so that children will always have the opportunity to ask ”Why?”

At Quarky, we want to change the way that girls view and interact with science, in the hope that this next generation of young women will alter the way society views both science and the part women can play in it. Quarkies take tremendous pride in always being:

CURIOUS. We explore science into the realm of the unknown, the bizarre, and the unexpected.

ADORKABLE. We want to be both geek chic and playfully dorky, embracing our intelligence and having fun with it.

INCLUSIVE. Science can take any form, and our network should be open to anyone and in any format.

SAVVY AND SASSY. We are in the know in tech, tweens, and science, bridging the trendy with the intellectual.

CEASELESS. Science and tweens are changing non-stop, and so should Quarkies. We are relentless in our pursuit of the interesting.

COLLABORATIVE. We learn best when we are a team — with our friends, our mentors, even our parents.

We continue to ask the question "Why?" over and over again, and for the goal of quenching our curiosity and understanding how the world works. We respect failure, because discovery is a process of trial and error.

We are Quarkies, we are Scientists, and we will change the World.

"Scientists fail all of the time. We just brand it differently. We call it data."

Ainissa Ramirez,
Science Evangelist, *Save our Science*

"One of the things that I really strongly believe in is that we need to have more girls interested in math, science, and engineering. We've got half the population that is way underrepresented in those fields and that means that we've got a whole bunch of talent...not being encouraged the way they need to."
President Barak Obama, February 2013 [1]

Science is all around us. We live in a world where change is the norm and technology rules our lives. Advances in science have given us smartphones, robotics, augmented reality, and wearables. It is also on the forefront of global politics — climate change and the space race. Studying science spurs creativity, problem solving, and collaboration. An essential part of existence, the fields of science still have a large problem: gender diversity.

why science?

Quarky began with an initial problem: science education in the United States is often boring and unrelatable. Science is taught through rote memorization of facts coupled with abstract lessons about problem solving and inquiry. Since the introduction of the Common Core and No Child Left Behind, science has also lost its place in the forefront of elementary education — there are testing standards for math and reading, but science standards are secondary, if they exist at all.

Science is inherently fascinating, and children are natural scientists — constantly attempting to figure out how the world works.[2] However, often when children enter school, this innate sense of wonder it drowned out of them.

The President's Council of Advisors on Science and Technology (PCAST) has calculated that "if the United States is to maintain its historic preeminence in the fields of science, technology, engineering, and mathematics (STEM)...then it must produce approximately 1 million more STEM professionals over the next decade."[3] This equates to a 34% increase in professionals over the next 10 years.

Even if students don't choose to practice in science-related fields it can help them with other skills. Currently, the most in-demand skills in the workplace involve problem solving, collaboration, critical thinking, and creativity — all of which can be learned and practiced through studying science.[4]

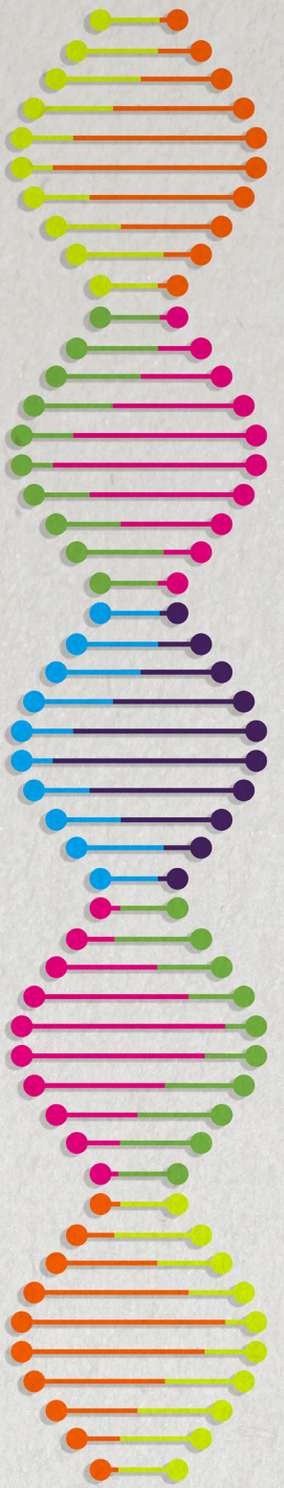
Unfortunately, in today's US political environment science education is even at more risk. STEM became an integral focus of the Obama Presidency: Obama is often referred to as the Nerd in Chief and is a self-described Trekkie.[5]

Obama created PCAST in April 2009, and one of the group's first reports was on K-12 education in STEM (published in September 2010). In 2010, Obama also created the first White House Science Fair showcasing the country's most innovative and unique STEM students.

The President also announced an "Educate to Innovate" Campaign in 2009 that includes Change the Equation: a non-profit organization "dedicated to mobilizing the business community to improve the quality of STEM education in the United States."[6] Since its creation, the Campaign has raised over $700M in public-private partnerships dedicated to promoting STEM education and educational resources, although its future may not be entirely secure.

STEM has become such a big push in the US recently, that it has even received some backlash, and is often renamed STEAM to include the arts, as science education should not be at the expense of arts education.

The current administration has a wildly different take on science and education: Betsey deVos, the Secretary of Education, has long been a supporter of creationism over evolution.[7] This coupled with the attack on the EPA, NASA, the National Park Service, and several climate change initiatives exemplifies how important it is for the private sector to lead the charge in promoting STEM.



“Science is a human endeavor. People do science. And people come in all shapes, sizes, and genders.”

Summer Ash,
Astrophysicist, *Star Talk Radio*

"Why aren't women getting these science-related jobs? The root causes of the disparity goes back to our culture and our education system. It does appear that on many, many different human attributes — overall IQ, mathematical ability, scientific ability — there is relatively clear evidence that there is a difference in the variability of a male and a female population." Lawrence H. Summers, Harvard President, January 2005[8]

lack of women in the science workforce

According to the National Science Foundation, while women make up half of the college-educated workforce within the United States, they remain underrepresented in the science-related workforce. When these occupations are classified by science specializations, we see that women are more concentrated in social sciences (62%) and environmental/biological sciences (48%), while the gender disparities in engineering (only 15%) and computer and mathematical sciences (25%) are rather large. However, gender diverse companies are more likely to outperform their peers on a financial basis by over 15%,[9] and recent headlines across Silicon Valley (including Google being sued by the US Labor Department) exemplify strong gender disparities especially in computer science. [10]

Gender-specific marketing may have increased sales of toys and books for kids, but it also reinforces negative stereotypes. The “pinkification” and “princess-ization” of traditional boys’ toys reinforces the belief that girls couldn’t possibly have an interest in science (or construction kits) unless those kits are used to enhance their femininity.[11] For instance, Barbie became a computer scientist in 2011, but she had a pink computer and needed the boys’ help to actually create the code. On the positive side, LEGO has added more women to its science kit, including female lab techs, astronauts, NASA scientists, and oceanographers.[12]

influence of parents

One reason for the lack of women in science relates to the feedback that girls tend to receive from the adults in their lives. Girls often mature faster and are better able to follow directions, while boys of the same age often have difficulty just paying attention. As a result, girls are often praised for their good behavior where boys are told to try harder. The implications are far-reaching — girls may grow up to see their abilities as innate and unchangable.[13] One study also observed that mothers are more likely to interact and encourage their sons than their daughters in science museums.[14] While parents have high hopes for their children, “Google searches suggests that contemporary American parents are far more likely to want their boys smart and their girls skinny.” They are 2.5 times more likely to search about their son’s intelligence than their daughter’s.[15]

influence of teachers

Teachers have also been found to have unconscious biases toward girls — boys are rewarded for asking questions, while girls are commended for being quiet. Teachers in effect expect less from girls, and "just believing that a student has aptitude for something, the teacher makes it more likely to be true."[16] Teachers of science are often unprepared to inspire students — only 30% of elementary science teachers felt well prepared to encourage female students, and only 5% of elementary science teachers held a degree in the field.[17]

If adults are treating girls differently whether unconsciously or not, where do these behaviors come from?

pressures from society

On average, American tweens (8-12 year olds) spend about 6 hours a day watching their screens for entertainment,[18] not including time spent on education or homework. Effectively, kids are spending the majority of their waking hours in front of a screen, and as a result, unconscious biases are formed by watching what the entertainment world produces. Unfortunately, the media has been historically biased against women, and often shows women scientists in a poor light.

In September 2016, *Boys' Life* magazine featured the headline "Explore your Future" and *Girls' Life* magazine featured "Your Dream Hair." This caused a social media firestorm, but girls buy magazines about beauty, while modern society expects them to be focused on personal success. The mixed messages for girls — what society expects, what the media shows them, and how to fit in — are continual and confusing.

According to the American Association of University Women, "women and men are exposed to the same stereotypes about women in math and science in U.S. culture and, on average, acquire the same implicit or unconscious 'science/math=male' biases by age 7 or 8."[19] While we may believe that we are not gender-biased, we still maintain an unconscious belief that affects how we talk to children, how we pick toys for them, how we teach them in school.[20]

impact on young girls

"Empowering women and girls offers the single biggest opportunity for human development and economic growth. It goes without saying, it's crucial for business. The World Economic Forum's latest Gender Gap Report notes that we may not achieve economic equality among men and women for another 170 years. That's just not good enough."
Unilever's Chief Executive Officer, Paul Polman, 2017 World Economic Forum[21]

Lin Bian, a psychologist at the University of Illinois, recently published a study that shows that girls start to doubt their own intelligence at age 6! "At an age when girls tend to outperform boys at school, and when children in general show large positive biases toward their own in-groups, the girls became less likely than boys to attribute brilliance to their own gender."[22]

These girls also tend to steer clear of games and books that require "innate brilliance," which in turn leads away from STEM fields. Even more surprising, the subconscious bias "causes girls to perform poorly on academic tests as a result of stereotype threat, or the fear of proving a negative stereotype correct, further proving to girls that math and science just isn't for them."[23]

game-based learning

"If you can hold the attention of children, you can educate them."
Malcolm Gladwell, *The Tipping Point*[24]

Games are inherently fun, and children love to win. Game-based learning has been shown to be a judgment-free zone, where failure is an option, and students can achieve many small wins over time, building their knowledge base and their confidence.[25]

Game-based learning has even brought Sesame Street to partner with IBM to develop a suite of customized apps for pre-school education, because "not enough kids have access to the right level of education at the right time in their lives." [26]

conclusions

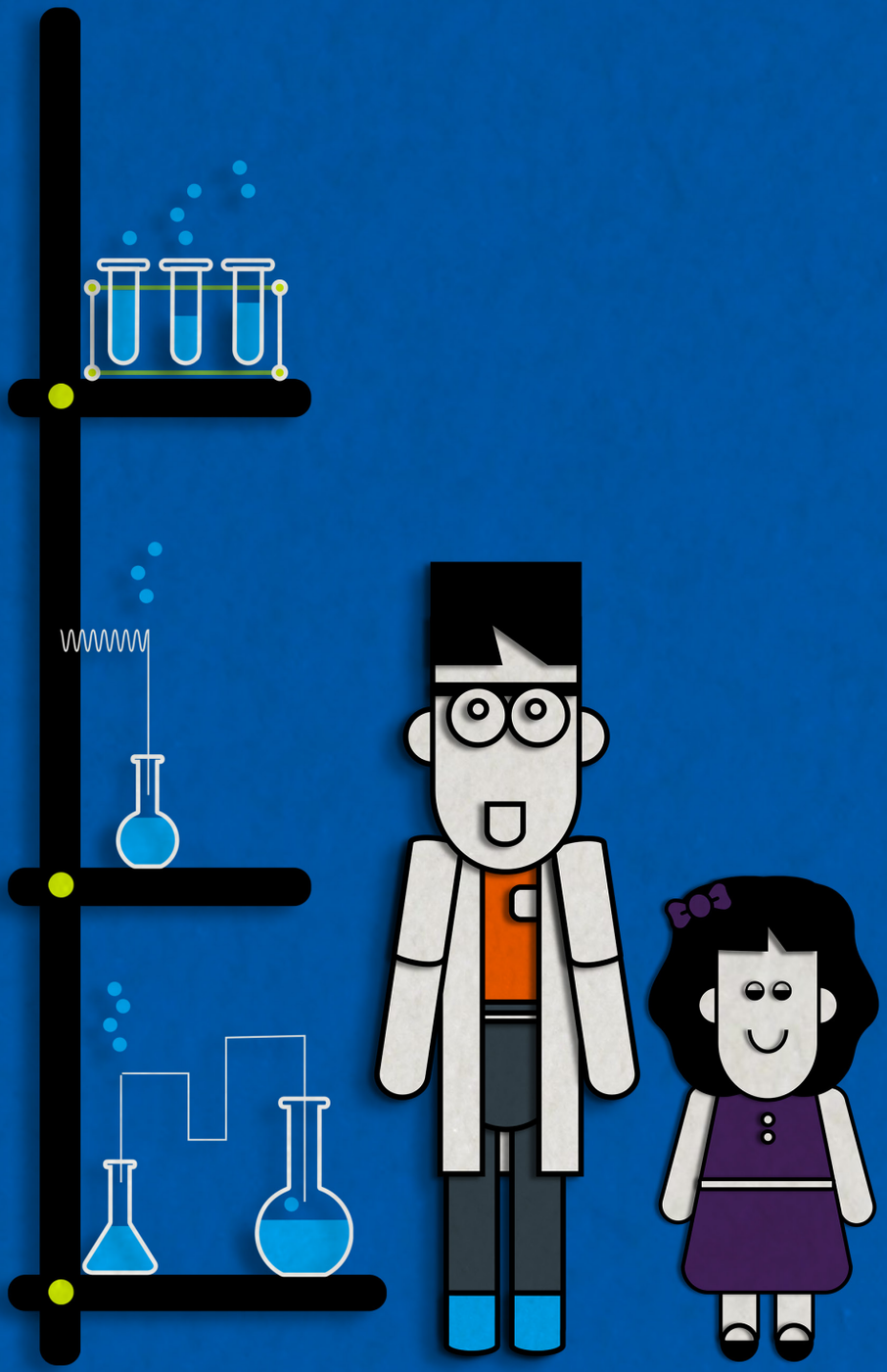
While women have made great strides in fighting for equality and also bringing awareness to the problems of wage inequality and gender bias, we still have a lot of work to do. Social media and women's networks have helped to spur activism and awareness, and have given women an outlet to speak out about the issues they face.

In general, Americans care about science: 59% of adults say that they are interested in science and technology topics.[27] If we can give girls an excuse to engage with science in a positive and playful manner, they may feel empowered to break the stereotypes and choose science. Hopefully, in the future, they won't always be the only woman in the room.

"The traditional academic skills of reading, 'riting, and 'rithmetic must be replaced with creativity, curiosity, critical thinking and problem solving, and collaborative and communication skills in order to solve the complex problems of tomorrow."
Ainissa Ramirez, Science Evangelist, 2013 [28]

"The traditional academic skills of reading, 'riting, and 'rithmetic must be replaced with creativity, curiosity, critical thinking and problem solving."

Ainissa Ramirez,
Science Evangelist, *Save Our Science*



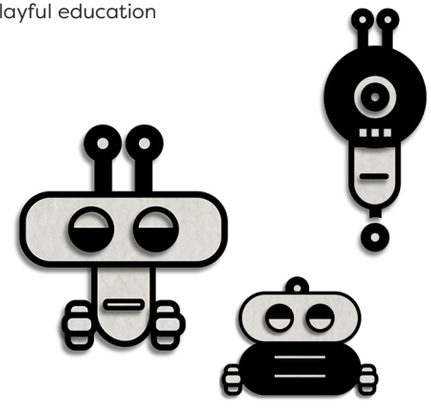
2.0
the product

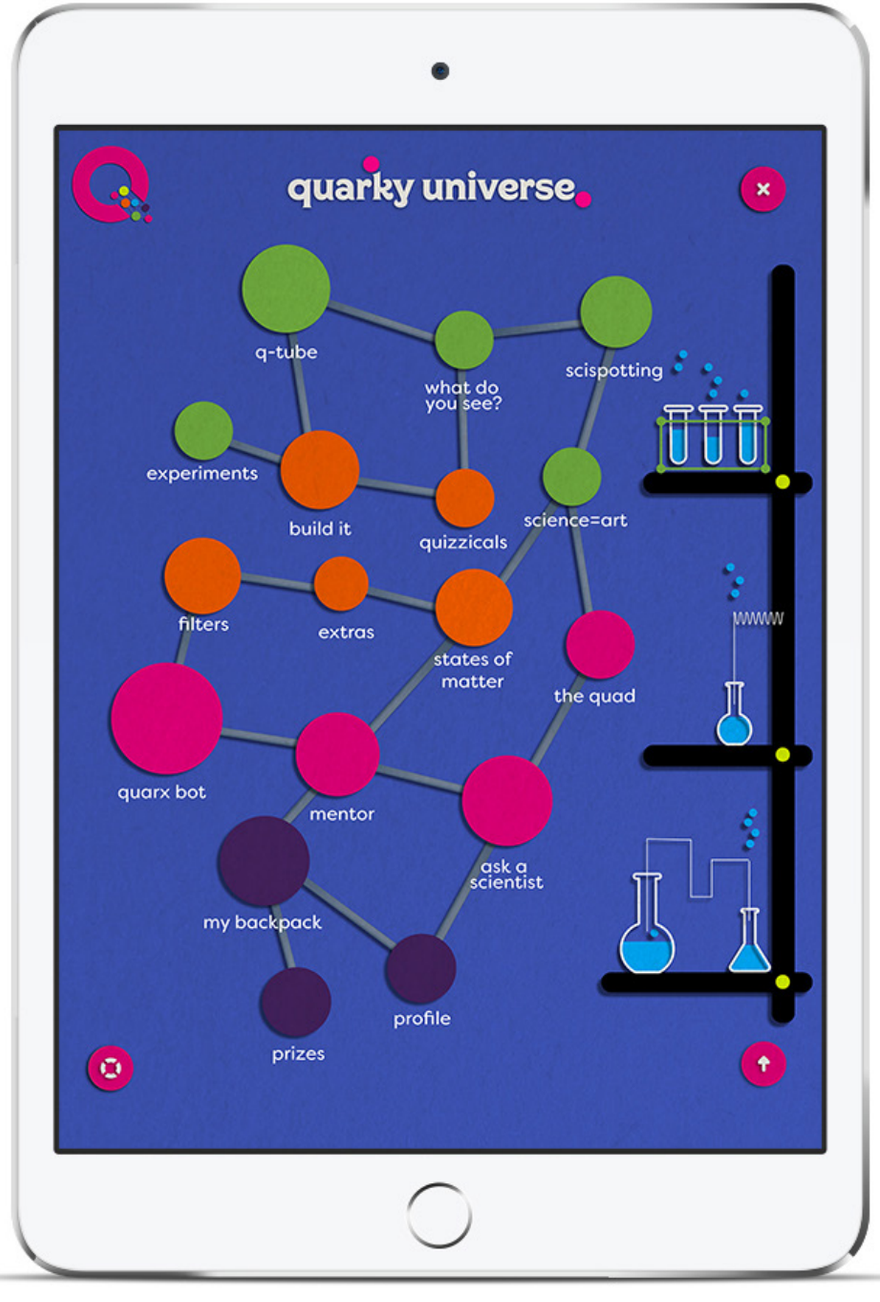
Quarky gamifies science. The experience amplifies a sense of wonder by including storytelling and game play around science-based topics.

Quarky is an adventure game in which a player completes a series of puzzles in a story that spans 7 chapters (or levels). The first of which is space. Our short form videos are interspersed throughout the game, so that users must watch the videos in order to advance. After a video, they'll participate in a game that relates to it. Quibit, our Quarky mascot, narrates the experience offering insights and hints, giving our players an education while they play.

Quarky aims to keep our users within our own ecosystem — if we keep them within the game, they'll be both educated and entertained. Quarky aims to provide the catalyst that will foster a life's worth of interest and curiosity in science.

Quarky's main goal is to fight unconscious bias in society and allow our players to see themselves in the world of science, and hopefully, they'll get some playful education on the side.





key product features

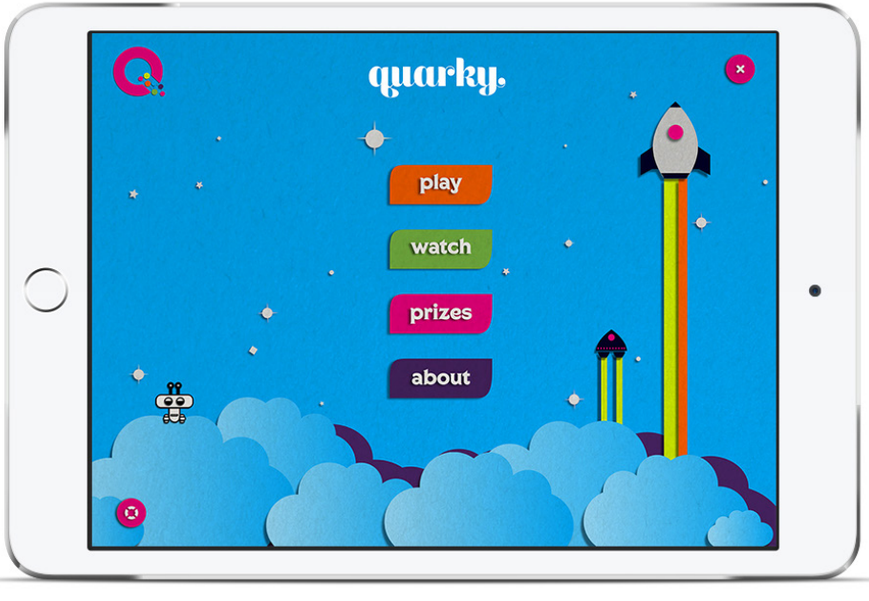
- **Gamifying Science:** Quarky is an adventure game told through a story. The story has seven chapters beginning with space. Users solve science-based puzzles in order to advance through the game.

- **Alluring Content:** Quarky uses eye-catching headlines in order to get players into the game. Our short-form videos are interspersed throughout the game and help to advance the story and content.

- **Community:** Quarky allows players to interact with mentors and scientists, so that they can see themselves in the world of science.

- **Users Own Language:** Quarky uses the laguage of social media, talking to our players in this language, using a comfortable and known set of interactions, and meeting them where they already are.

- **Celebrating Achievements:** We incorporate prizes and rewards that allow our players to share and celebrate their achievements.



interactions built for kids

Quarky is built to be both entertaining and educational. With so many technological choices out there, Quarky's experience has to be engaging and parent-approved.

Children have grown up with technology ever present in their lives, and as a result their brains are uniquely wired. "They see technology as a tool for expression, experimentation, and communication."[29] As a result, the interactions within Quarky are designed specifically for how a child of today learns: through play.

Children prefer visual and auditory feedback whenever they do anything in a visual space.[30] They also like to be rewarded for their accomplishments. Instead of reading directions, they prefer to have gentle reminders or hints as "failure" markers, so that they can move to the next step without getting frustrated or wasting time.

Thus, Quarky has built-in animations with a purpose, combined with a reward system, and hidden "easter eggs" of extra content that can be unlocked by the player.

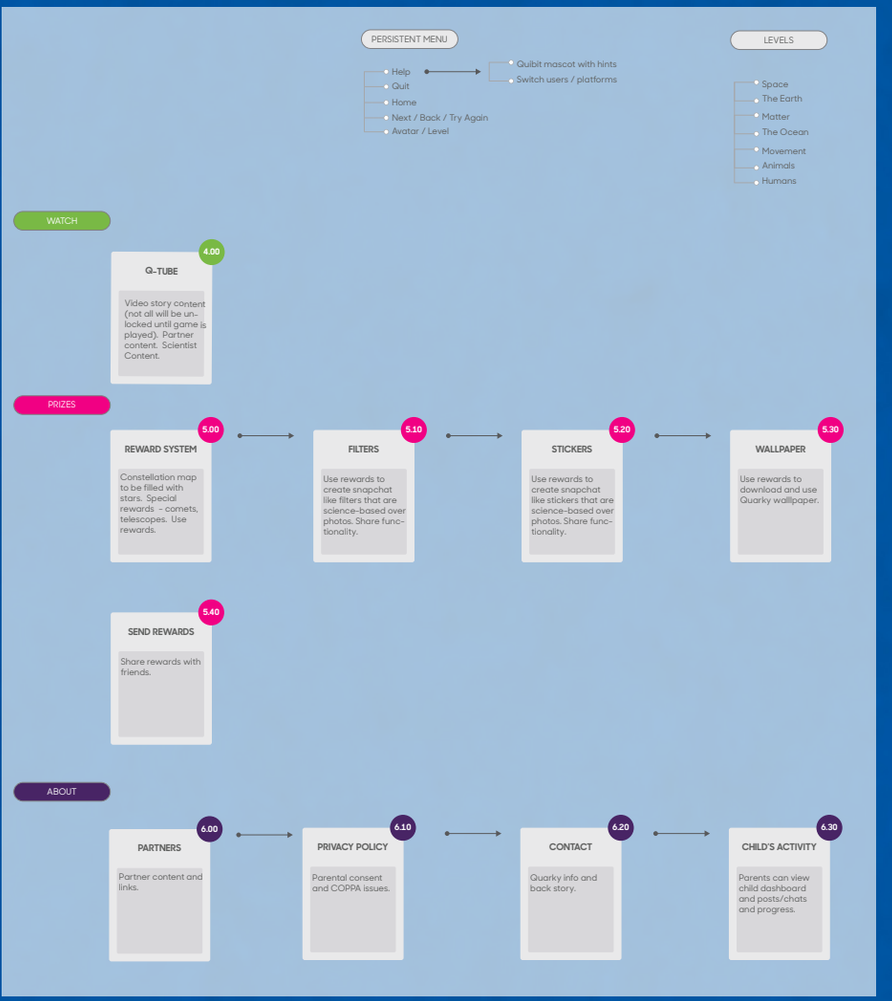
Since Quarky is judgment-free, although users can message, comment, and interact with each other, there are no systems of likes or votes.

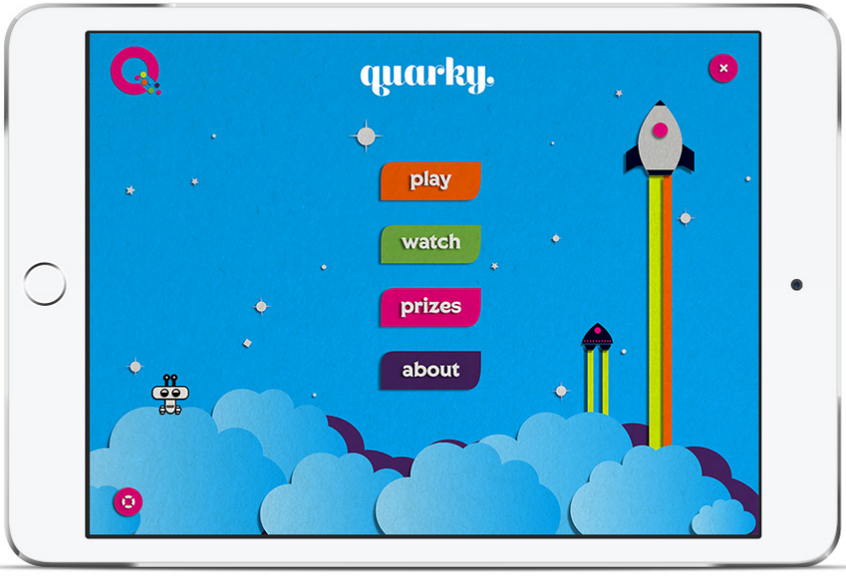
In the end, we discovered that our players like to:

- watch videos
- color / draw
- build things
- look at visually dynamic images
- collect rewards
- share

Our game play is derived from these behaviors.


1.10
HOME
Main User Menu:
Play
Watch
Prizes
About
1.20
STORY
Quibit asks for the players help in navigataing the clouds and a scavenger hunt
1.30
SIGN IN
Use the Quibit Chat interface to sign in.
1.40
DASHBOARD
Avatar, level, prizes, friends, notifications, videos watched.
PLAY
2.00
MAKE YOUR AVATAR
Choose mascot, color, name Request parental permission Introduce Quibit (Quarky help desk mascot)
2.10
PICK YOUR TEAM
Choose a friend, the quarx bot, a mentor, or a scientist. Team members can chat or IM.
2.20
LEVEL ENTRY
Enter into Levels with short intro story about the topic.
2.30
BUILD IT GAME
Build a rocket to get into space. Simple game mechanics of drag and drop with restrictions and hints.
2.40
VIDEO STORY
Short form video with science hook, and AVOD Several video interludes throughout the level.
2.50
QUIZZICAL
Trivia/topic based quiz from video content. Can request hints, or chat with team,
2.60
EXPERIMENTS
Hands on learning experiences that must be documented. Can be skipped.
2.70
WHAT DO YOU SEE
Visual thinking strategies of unusual images.
2.80
STATES OF MATTER
Candy crush like game using iconography from the level's major topic.
2.90
SCIENCE = ART
Visual matching game to discern if something is made by an artist or by science.
2.95
SCI-SPOTTING
Science IRL documented.
2.99
GAME COMPLETE
Congratulations with prizes. Choice to try again or move on to next module. Follows each game. Share functionality.
CHAT
3.00
QUARX BOT
Activated through the game. Can ask about game or science.
3.10
MENTOR
Activated through the game.
3.20
ASK A SCIENTIST
Video content about what the scientist does each day, and why they picked the field.
3.30
QUAD
Chat with friends within the quarky universe


PERSISTENT MENU
Help
Quit
Home
Next / Back / Try Again
Avatar / Level
Quibit mascot with hints
Switch users / platforms
LEVELS
Space
The Earth
Matter
The Ocean
Movement
Animals
Humans
WATCH
4.00
Q-TUBE
Video story content (not all will be unlocked until game is played). Partner content. Scientist Content.
PRIZES
5.00
REWARD SYSTEM
Constellation map to be filled with stars. Special rewards - comets, telescopes. Use rewards.
5.10
FILTERS
Use rewards to create snapchat like filters that are science-based over photos. Share functionality.
5.20
STICKERS
Use rewards to create snapchat like stickers that are science-based over photos. Share functionality.
5.30
WALLPAPER
Use rewards to download and use Quarky wallpaper.
5.40
SEND REWARDS
Share rewards with friends.
ABOUT
6.00
PARTNERS
Partner content and links.
6.10
PRIVACY POLICY
Parental consent and COPPA issues.
6.20
CONTACT
Quarky info and back story.
6.30
CHILD'S ACTIVITY
Parents can view child dashboard and posts/chats and progress.



welcome screen

Quarky's tablet app opens with an animated splash screen, presenting the mascot, the animation style, and the world of Quarky. Users can then choose to enter the game, watch QTube videos, see the prizes they have generated or find out more about the platform.

QTube

Our signature content is our short-form videos, and players can watch the videos without entering the game, although they can unlock more while playing. If they choose to watch, they'll be taken to our QTube channel.

the story: entering the game

If the user chooses to play and enter the game, they meet Quibit, our mascot, who has been lost in the clouds, and asks for help on a scavenger hunt. Quibit narrates the entire game, offering helpful hints and insights during play, and can also be summoned by using the help button.

avatar

New users to the game are directed to choose an avatar, color it, name it, and finally ask for parental permission to play. Users can play before parents have accepted, but they can not post to the platform or interact with other players (including mentors) until parents have signed off. They are then directed to choose their team if they want to be in a multi-player game: teammates can be friends, mentors, or even our bot, Quarx.

backpack: user dashboard

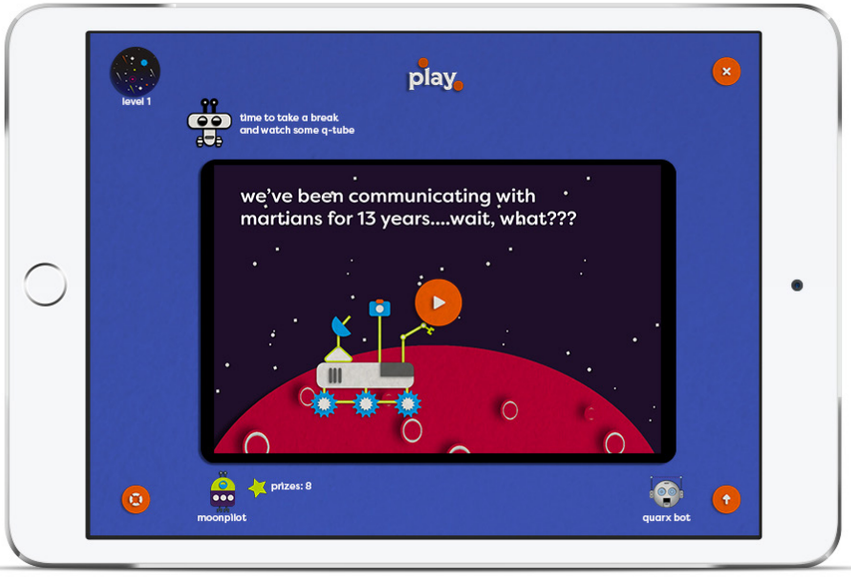
Previous players to the platform are directed to their dashboard (or back-pack) after the home page, so that they can check in with their friends and mentors, and see their achievements. They can jump back into the game or into a chat from this screen.

levels

Players enter the game by choosing the level they want to play. Our first level is Space, followed by the Earth, Matter, the Ocean, Movement, Animals and Humans.

build it

If the player choses to go to space, she needs a spaceship in order to get there. Quibit directs her to build a vehicle from the provided materials.



video interlude

Since our player is ready to learn about space, she watches a video that advances the story. (This video is about all of the Rovers on Mars, which have lasted on the planet much longer than NASA ever expected.) Our QTube videos are interspersed throughout the game in order to educate and entertain.

games of motion

Following the video, players use the knowledge they have learned to play another game: this one is called the Sky Crane Maneuver, which takes its name and mission from the real Curiosity Rover landing.

game complete

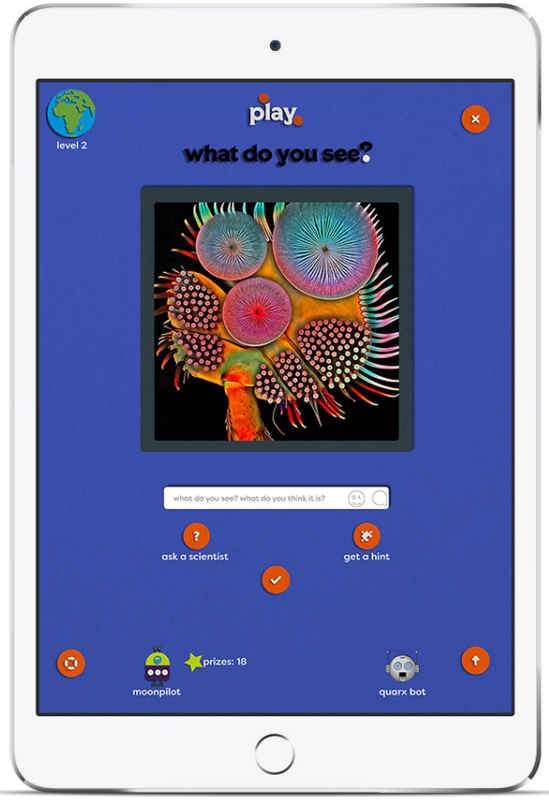
After each game, our players are rewarded with prizes, so they can celebrate their individual achievements.

breadcrumbs

Players can check in and see where they are within the game, what is coming up next, and switch levels if they prefer different subject matter.

quizzical

Quarky includes a series of quizzes that are also derived from our QTube videos. Players can chat with their team in order to figure out the answer, ask a scientist or get a hint from Quibit.

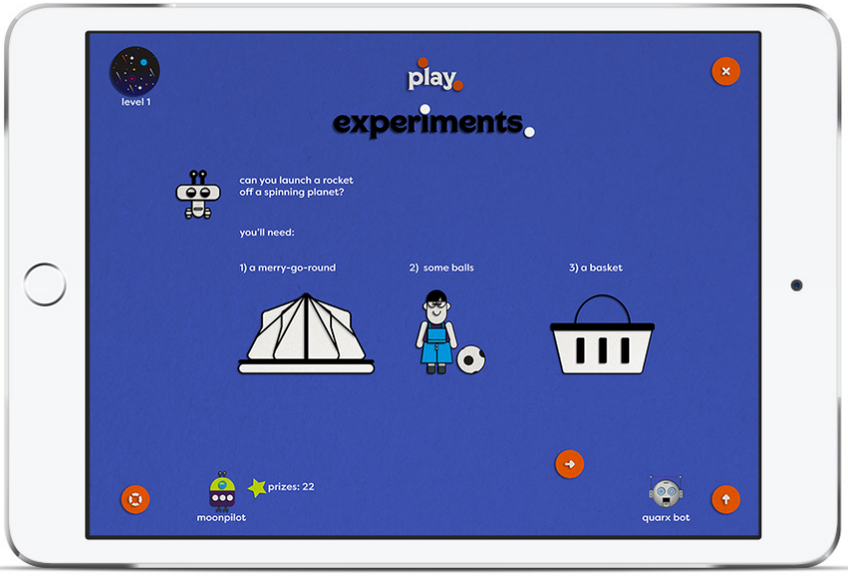


what do you see?

This is our visual learning strategies game. Players have to figure out what these dynamic images actually are, and they can also ask for help.

states of matter

We have another challenge game that let's players explore states of matter. This games explains how black holes capture matter through gravitational attraction.

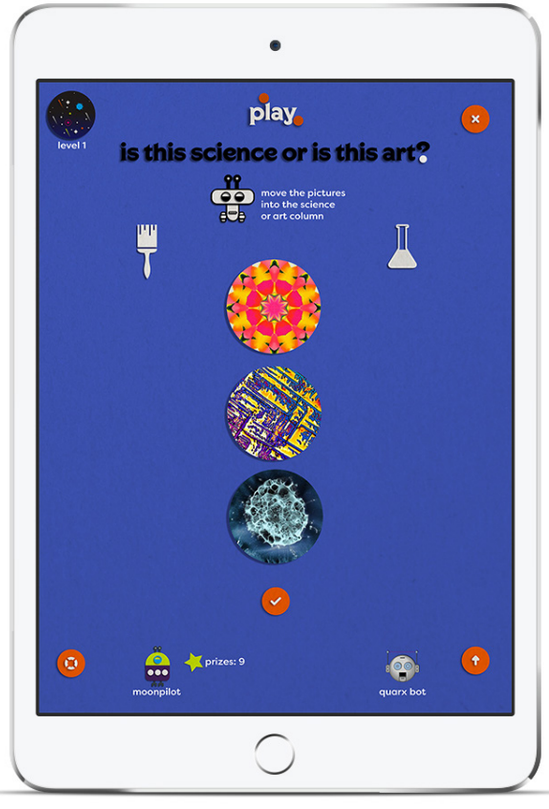


experiments

Quarky also directs players to get their hands dirty by trying science experiments outside of the game. The players gain points once they post their results. This game is about centrifugal force, using a merry-go-round and some balls to mimic a spinning planet.

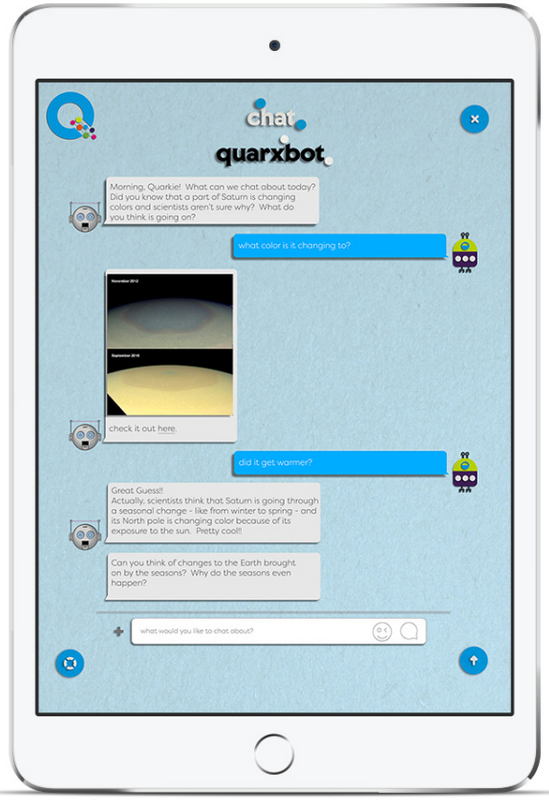
sci-spotting

Quarky wants our players to find science in the every day, so we ask them to play a "collection/bingo" game where they recount the science in real life that they encounter. This also demonstrates that science isn't just conducted in a lab, but can be seen in simple, everyday encounters.



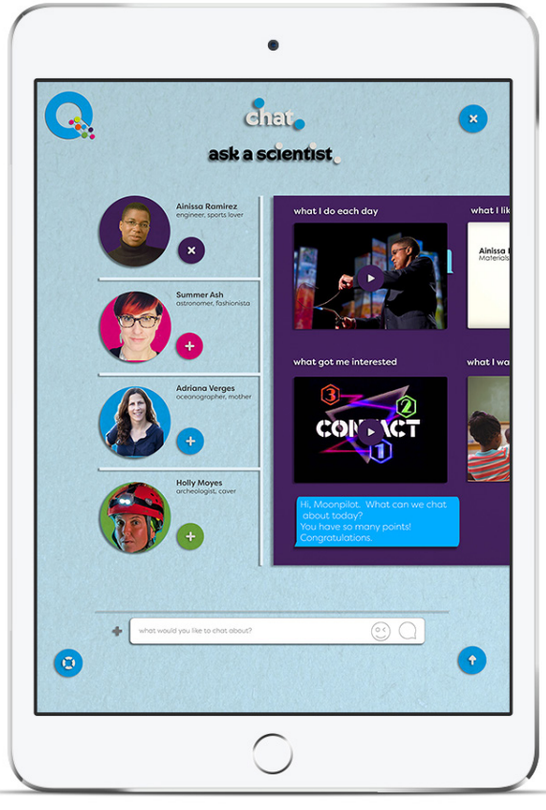
science = art

Our players often think science and art are mutually exclusive. This matching game allows users to figure out whether something is made by science or by an artist (and often they can be labeled as both).



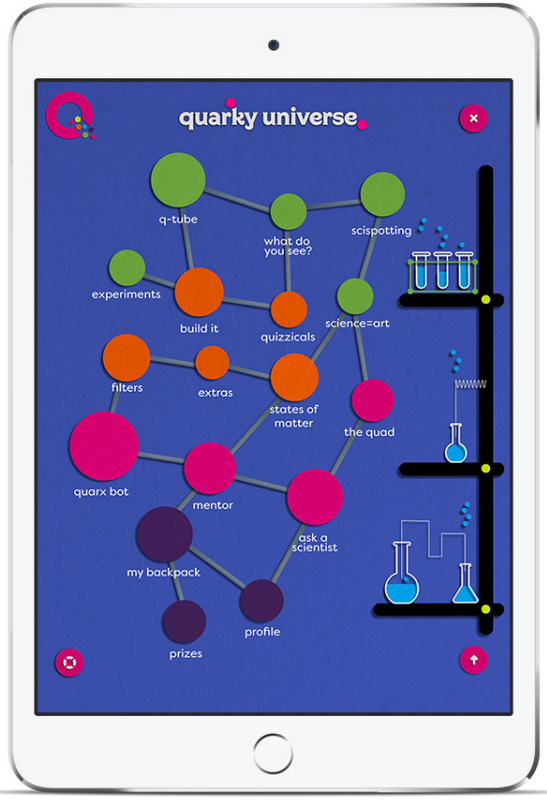
quarx bot

Players can choose to chat with our bot throughout the game, whether the questions are about the game or any other science matter.



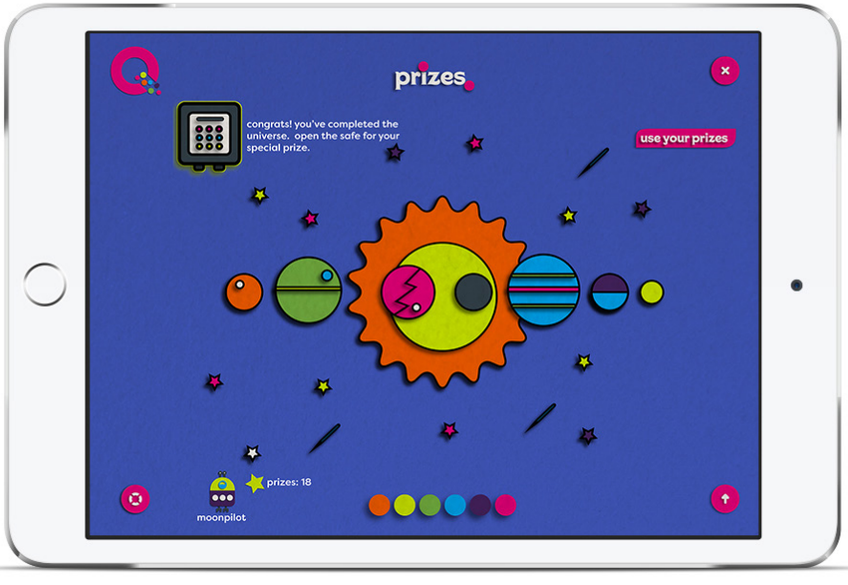
ask a scientist

We want our players to see themselves in the world of science, so we allow them to interact with female scientists, by chatting with them or watching videos about their work and how they spend their days.



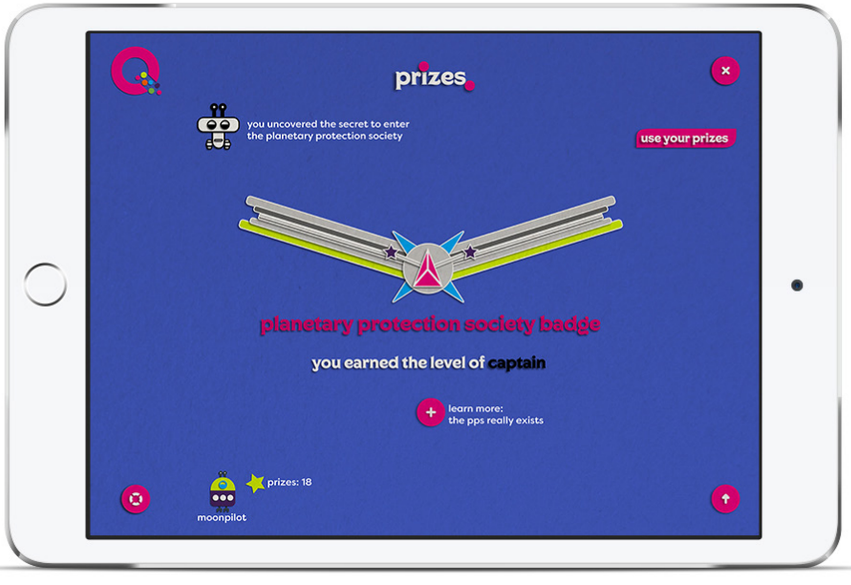
quarky universe

Players can always see the full universe of functions within the platform by clicking on the Quarky logo that takes them to this menu.



prize safe

Players can unlock secret prizes by coloring in the universe, and depositing their prizes within the safe.



secret prizes

This is a badge for the Planetary Protection Society (that really does exist). Players can earn this badge by unlocking the safe, and they get to learn about how scientists attempt to keep from contaminating other worlds.

use your prizes

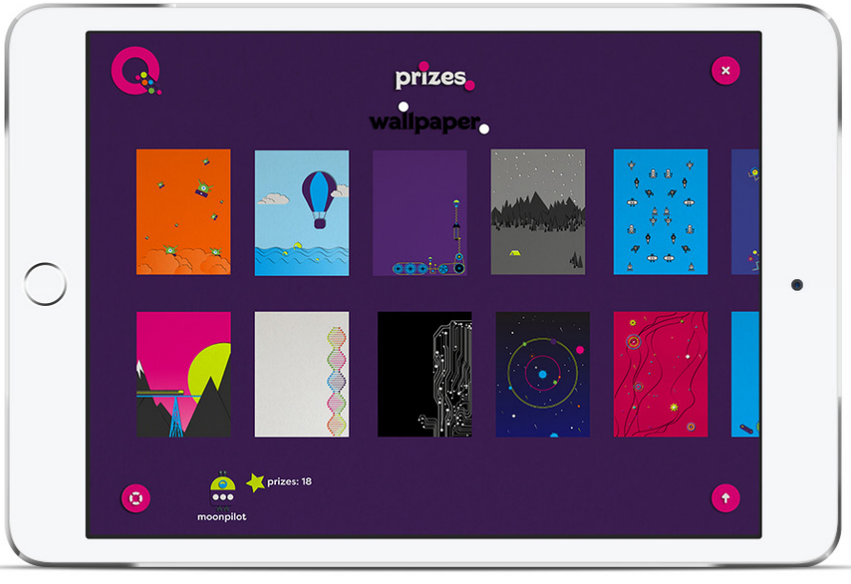
Our players can use their prizes for a variety of activities, all of which are suited for social sharing.

prizes: filters

Quarky has a series of photo filters that puts users into scientific environments, like outer space, a jungle and underwater.

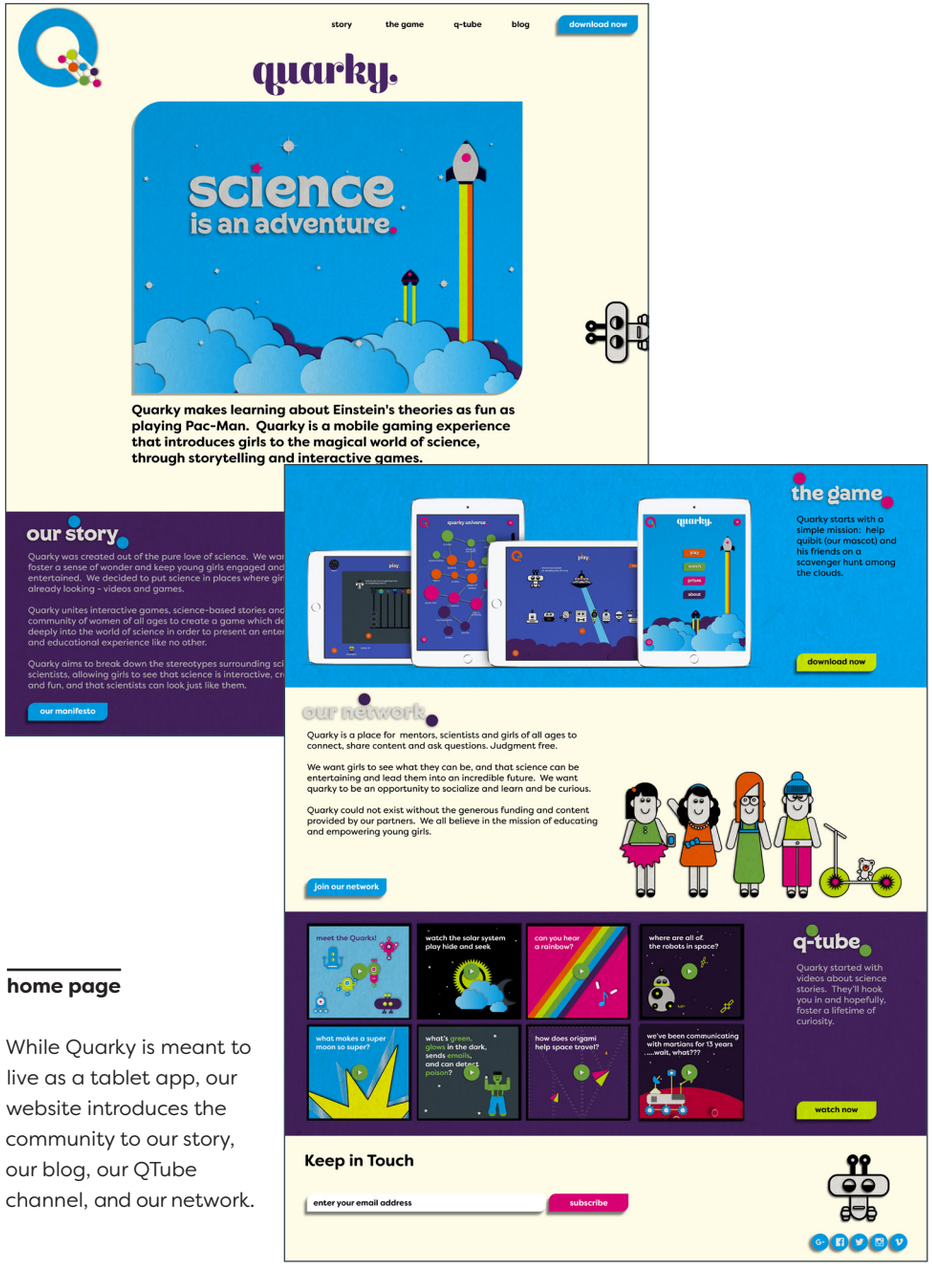
prizes: stickers

Players can trade in their prizes for digital stickers, which they can use in chats, messages, or drawings. They can edit the stickers or create their own.



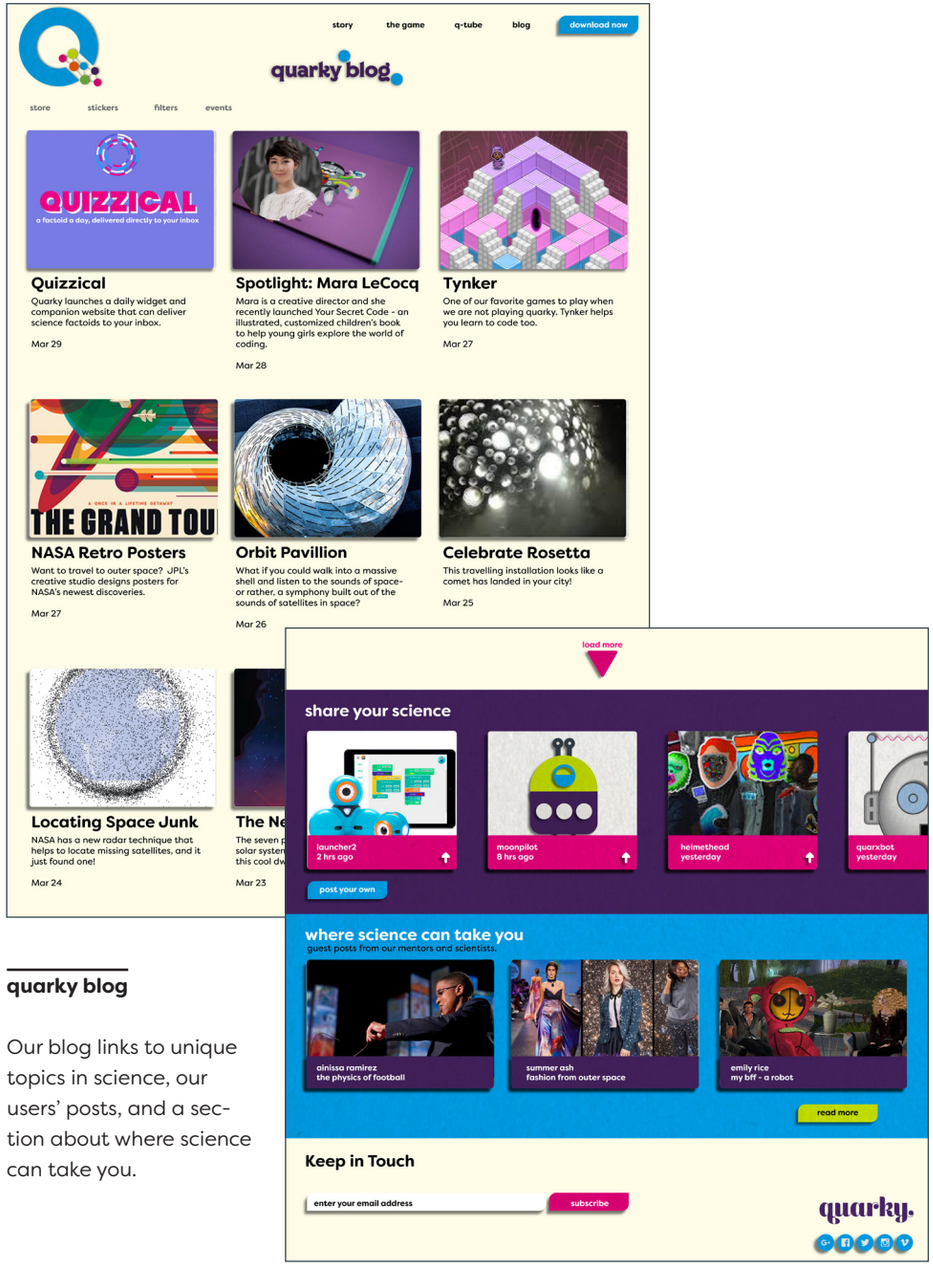
prizes: wallpaper

Players can download our wallpaper for their personal use.



home page

While Quarky is meant to live as a tablet app, our website introduces the community to our story, our blog, our QTube channel, and our network.



quarky blog

Our blog links to unique topics in science, our users' posts, and a section about where science can take you.

Quarky began as an initial reaction to two problems within the United States: science is thought of as inherently boring, and girls are often discouraged from participating in the sciences. In order to combat these issues in an effective and coordinated manner, I started by focusing on the target audience's current habits: if I could mimic the delight and obsession they have with other online content or apps, maybe Quarky could pull them into the world of science with the same hook.

The multiple user tests we conducted took place over several months with a variety of girls (and boys), ages 6-12, and mostly in groups of 4-6, at Girl Scout meetings and after-school play dates.

phase 1.0 bite-sized content

Tweens are fast thinkers — they "blink, share, laugh, forget."[31] They are also visual communicators. Girls like to share and create online content, but they tend to have a short attention span (8 seconds). Once they find something interesting they can be captivated, focused, and look even deeper.[32] As a result, in order to effectively engage this audience, the initial iteration of Quarky used bite-sized, visual content that was meant to mimic social media stories (Snapchat and Instagram), and that was both educational and entertaining.

key testing takeaways

- Video length: although the videos were under 2 minutes long, they did not hold the attention of the testers.
- Call to action: just asking the viewers a question wasn't enough to keep them watching or get them to watch another video.

phase 2.0 content options

Science is about experiencing the world around us, and we often learn best when getting our hands dirty. While Quarky's main product would live online, we added more science-based content and interactions, and attempted to engage users by allowing them to create content (hopefully, in the real world) and collaborate with others.

key testing takeaways

- Visuals and Tone: Quarky's aesthetic was too juvenile, cartoonish. Quarky needed to be aspirational in both experience and content. Talking down to our audience pushed them further away.
- Connections: users responded to the idea of a safe place to ask questions, and were particularly attracted to interacting with a chatbot (also for the novelty and anonymity). They didn't mind asking adults or college students questions, but they didn't want to be hazed or bullied by girls close to their own age. While they might not want to feel too smart, they certainly didn't want to be perceived as dumb.

phase 3.0 content and mentors

Quarky's next phase was a full-blown multi-media platform, with user generated content, messaging platforms, a mini-curriculum, science content and a personal network including college-age mentors. We threw everything a parent might think their daughter would want into the interface and repackaged it using today's social media technology. We also wanted to expose girls to the fact that women could have roles in science — "if they can see it, they can be it."[33]

key testing takeaways

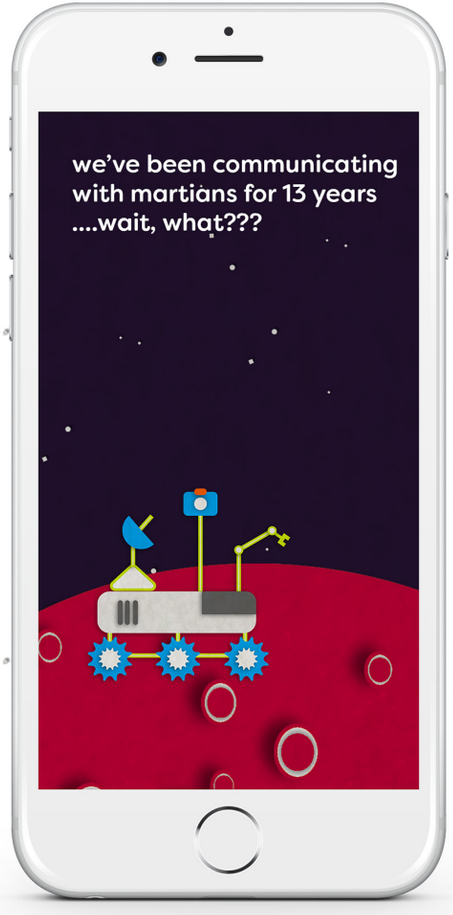
- Content: while the instinct to feed a user's need to connect and create was correct, the seemingly, never-ending choices of mini-apps was overwhelming. Quarky had over 21 mini-apps, and the girls just didn't know where to go.
- Hooks ("click-bait"): Our videos succeeded in gaining traction with unique titles and subjects that were meant to ignite their curiosity — using characters and rainbows as a starting off point got them to push play, and watch more than one video. However, attention spans were still short: after 45 seconds, they moved on.
- Games and Prizes: Our users wanted to watch videos and play games. They skipped over any content that wasn't interactive. They wanted to build things, to draw, to take pictures, and to chat. They also wanted to be rewarded for their achievements.

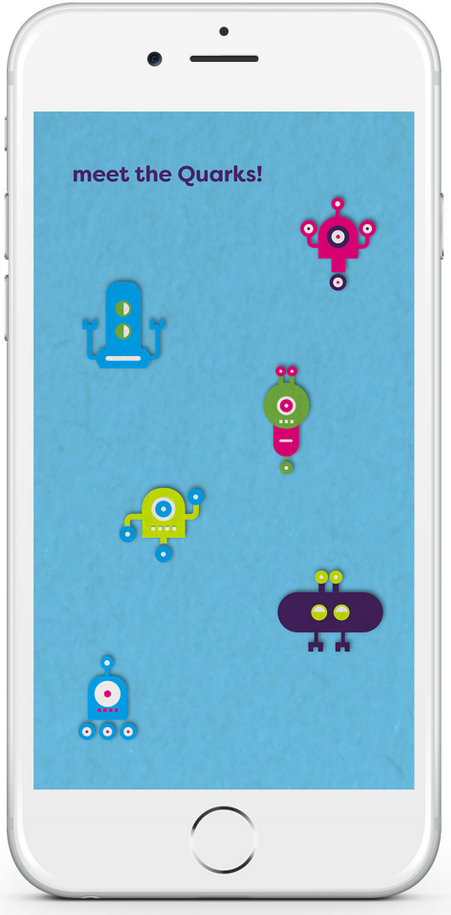
phase 4.0 combining games and videos (and a little science education in the process)

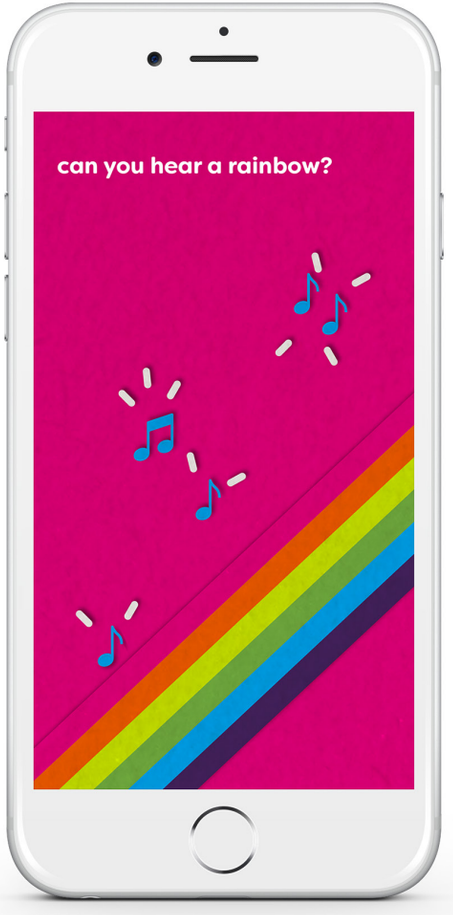
Quarky's current incarnation attempts to keep our users within the world of science by using storytelling and game-based learning. We wanted to be more subtle in framing the content and more engaging.

key testing takeaways

- Keep the user within the game: while we wanted to inundate the users with content and choices, the goal should be to keep them within the game, and move them through the content with different and more challenging activities. They inherently prefer entertainment over education.
- Storytelling: although our stories are linked by a mascot and one overarching topic, Quarky needs more suspense, more drama, more wonder — a reason to complete the path.
- Content: users like to build and draw and share. Bright and unique visuals were the most compelling.
- Biases: players mentioned many times that we should show that you don't have to be a genius to be a scientist. They wanted to know about "regular people" with extraordinary or even accidental discoveries.
- Mentors: parents were concerned about online interactions with adults, despite COPPA best practices.





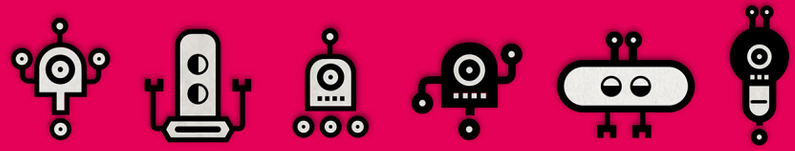


3.0

the visuals

quark |kwärk|
noun
any of a number of subatomic particles carrying a fractional electric charge, postulated as building blocks of the hadrons (aka protons and neutrons). Quarks have not been directly observed, but theoretical predictions based on their existence have been confirmed experimentally. There are 6 types of quarks: up, down, strange, charmed, top and bottom.

quirky |'kwerkē|
adjective
characterized by peculiar or unexpected traits.



SOURCE: New Oxford American Dictionary

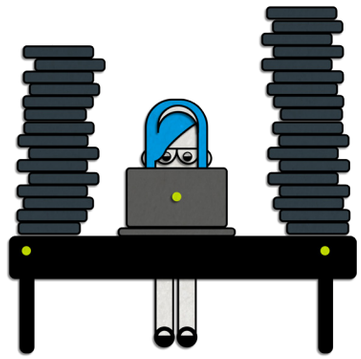
Quarky is derived from combining the words quark and quirky. We decided to keep the word "science" out of the name of the brand, so that if a child was already intimidated by science, the product itself wouldn't be off-putting. We wanted to keep out any preconceived notions around learning and science, so the name is purposefully made-up. We also wanted to emphasize the game rather than the education.

We wanted a name that was playful but also reminded one of science — and thus, Quarky was born.

Quarky is visually based on the belief that kids are aspirational in their desire to interact with technology, and they communicate and learn through play. We also recognize that kids' cognition varies greatly depending upon the age group. We have strategically chosen to make Quarky as user-friendly and inviting as possible for 8-10 year olds for the initial phase.

The Quarky aesthetic is meant to look like cut paper — we wanted the platform to have texture, to appear as if you could touch and feel it. We think science is best learned by getting your hands dirty, and since we are using a digital platform, we wanted the science and the characters to come to life by using this technique.

Our QTube videos are made through animating cut paper. We purposefully left things slightly unsettled and imperfect: we want users to feel comfortable posting to the community regardless of their skill level, and we thought it added a level of charm.



brand drivers

- science
- entertaining
- educational
- engaging
- inspiring
- human network
- playful

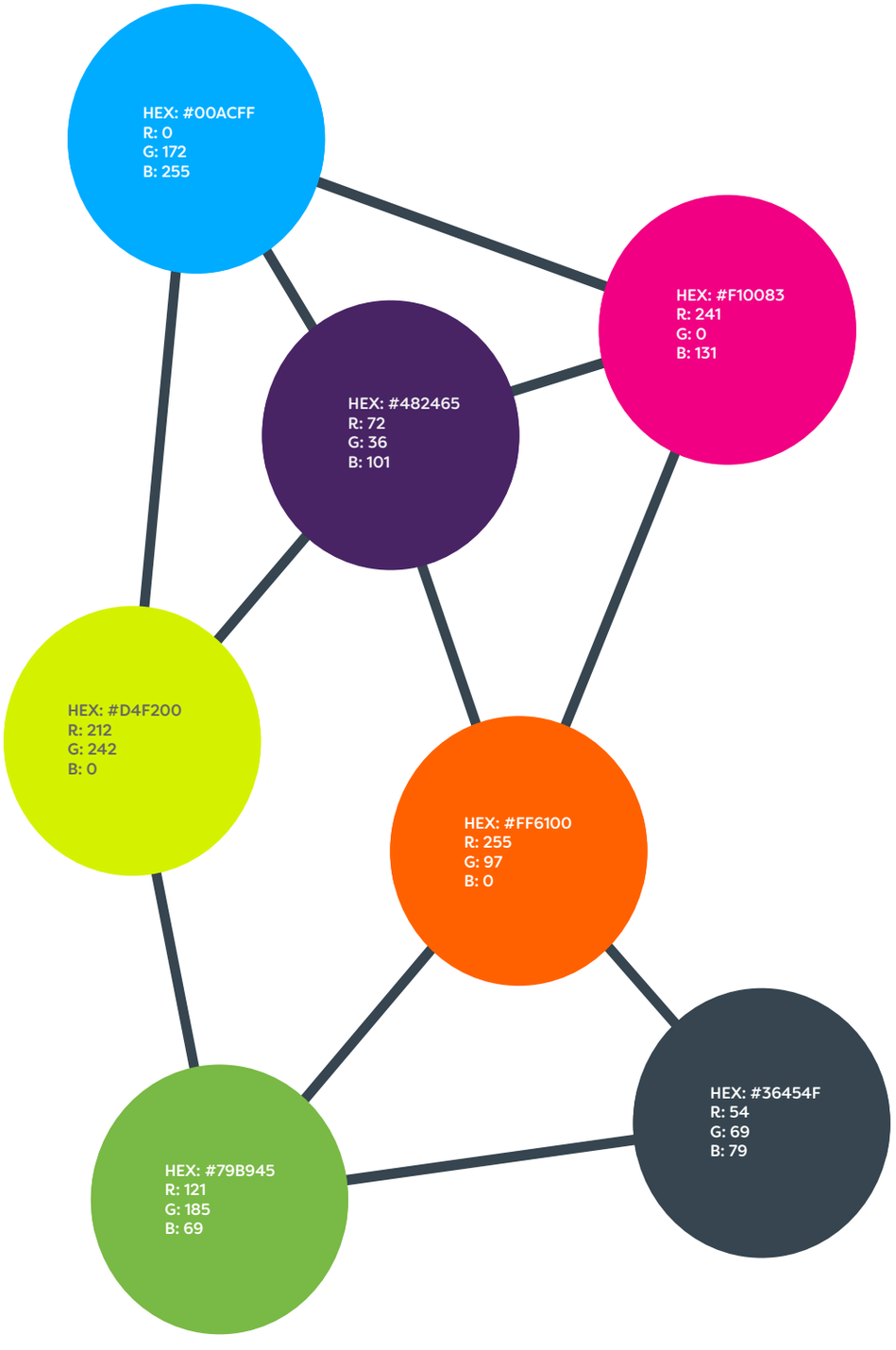
design drivers

- bright
- kinetic
- quirky
- enthusiastic
- authentic
- ahead of the curve

The concept behind the Quarky logo is a letter “Q” combined with an atomic structure. We thought the atomic tail also mimicked connections, chemistry, and even social media sharing. Throughout our platform, the one item left digitized (not out of cut paper) is our logotype. We like the contrast and the hint toward the digital platform.

quarky.

Photo credits: please page 114



Quarky uses a palette that is meant to be bright and inviting, but not too bright as to appear neon. We chose to use a blue as our primary color, as we didn't want to "pinkify" science, but we still brought in tones that a curious tween would respond to.

The typefaces were chosen to be representative of the brand, in that they have a slightly feminine and adolescent touch, although they remain playful and legible.

The type in our logo was derived using Escafina. We wanted to add more ball terminals to mimic our atomic logo, and we played with the shape of the "q" and the "y" to add more consistency to the letters. We chose a script typeface for its flourish, femininity, and we thought it balanced the geometry of our mark.

logo typeface

Escafina High
1234567890abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

primary typeface

Filson Soft Book
Filson Soft Medium
Filson Soft Bold
1234567890abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

secondary typeface

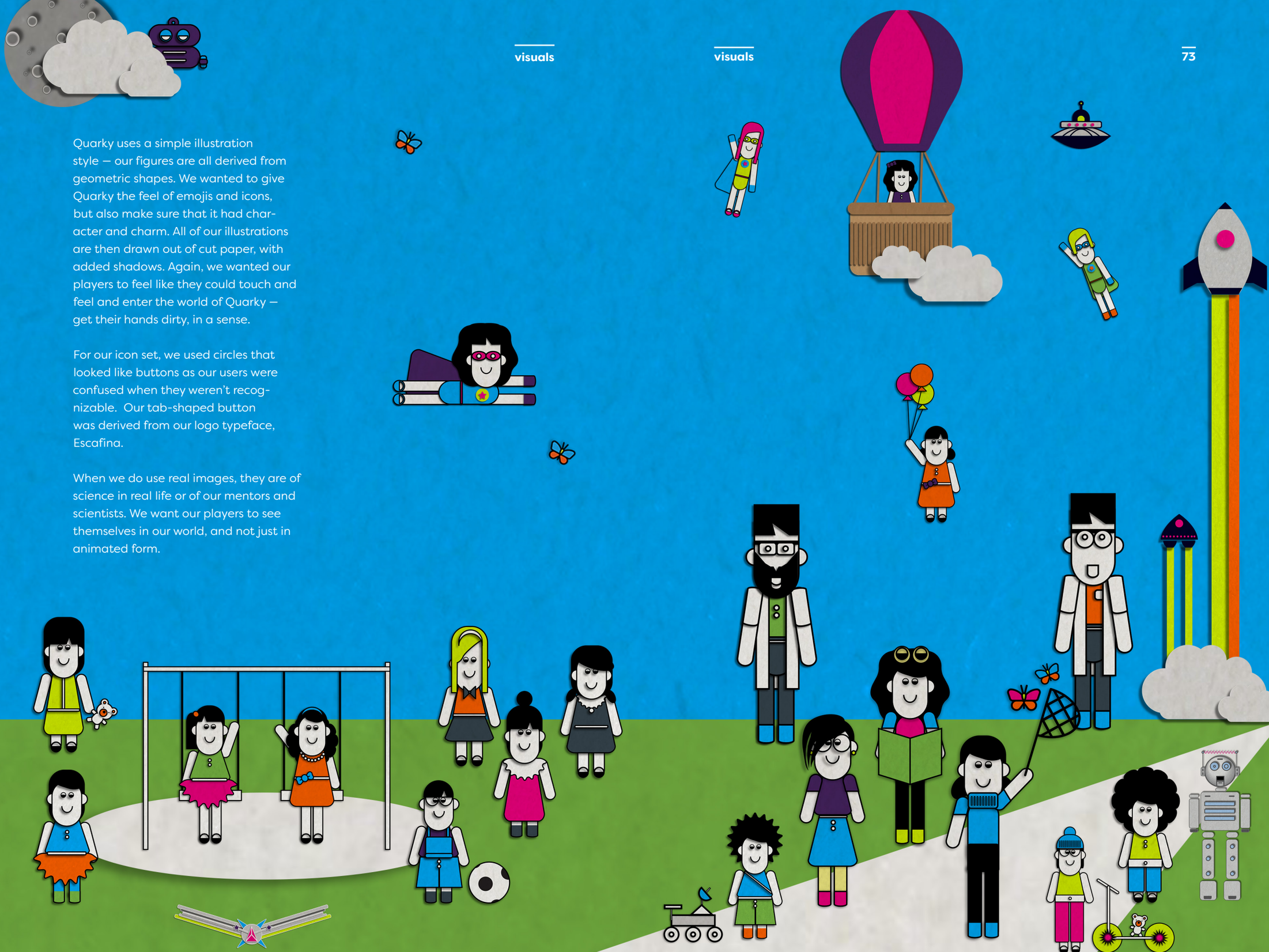
Regina Black Solid
1234567890abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

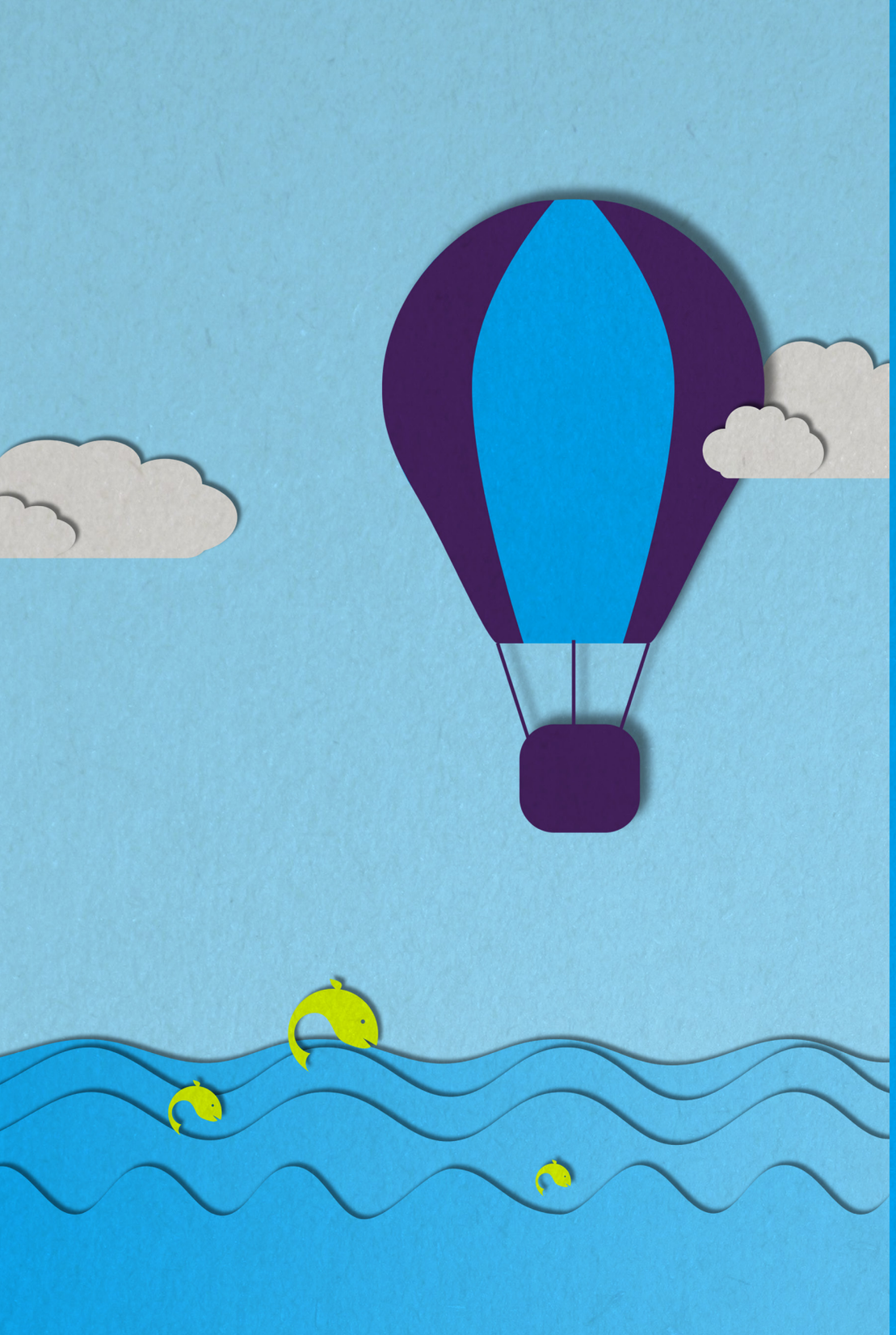
visuals

Quarky uses a simple illustration style — our figures are all derived from geometric shapes. We wanted to give Quarky the feel of emojis and icons, but also make sure that it had character and charm. All of our illustrations are then drawn out of cut paper, with added shadows. Again, we wanted our players to feel like they could touch and feel and enter the world of Quarky — get their hands dirty, in a sense.

For our icon set, we used circles that looked like buttons as our users were confused when they weren't recognizable. Our tab-shaped button was derived from our logo typeface, Escafina.

When we do use real images, they are of science in real life or of our mentors and scientists. We want our players to see themselves in our world, and not just in animated form.



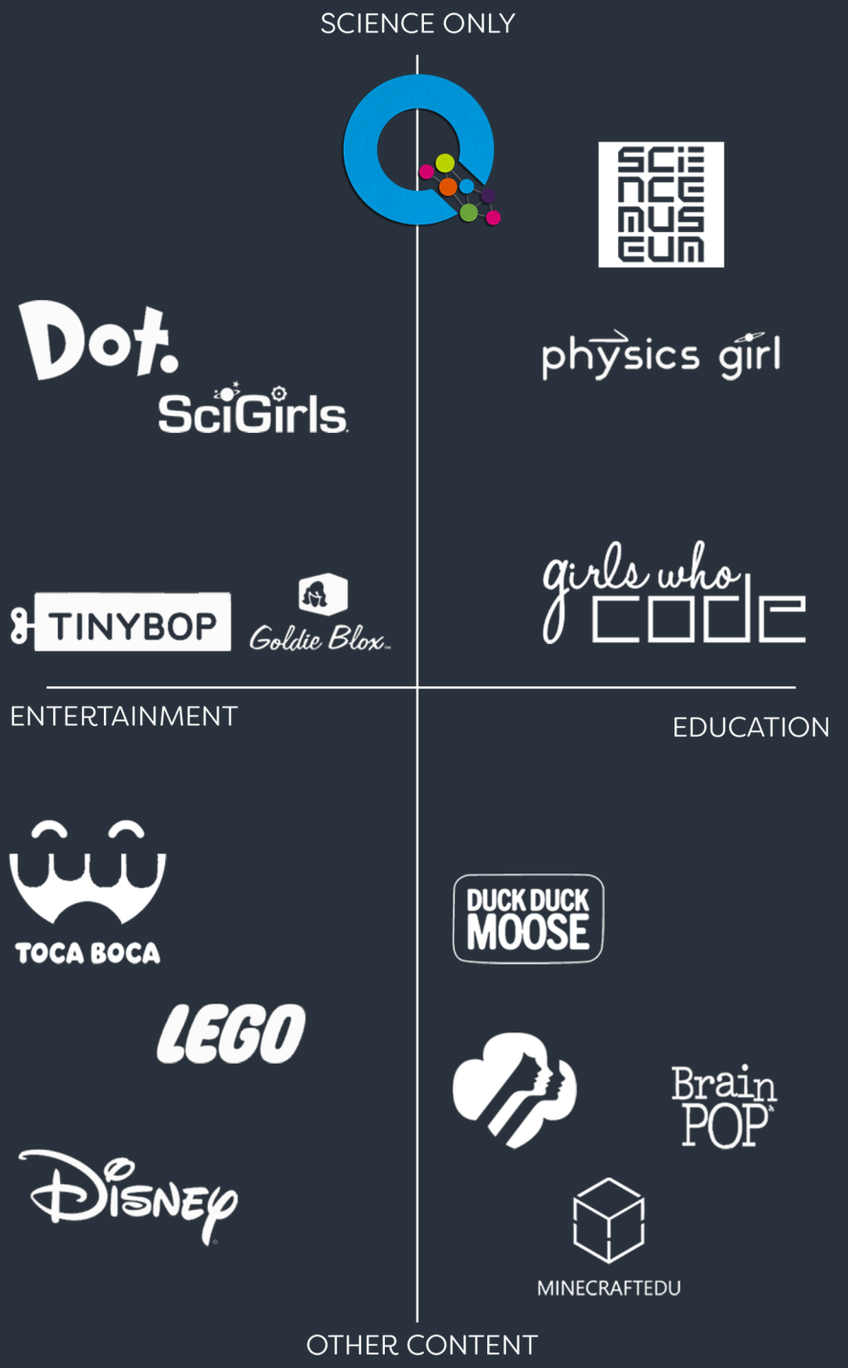


4.0
the market

competitive advantage

Outreach and programs for gender diversity in STEM fields and education are nothing new. However, Quarky will be a unique entrant into this marketplace for the following reasons:

- Quarky focuses solely on science education and is differentiated through its unique and specific content catering to one "field."
- Quarky targets its users where they already are by using content similar to Snapchat, YouTube, Instagram and other media platforms to take advantage of users' "muscle memory" for online content.
- Quarky is both entertaining and educational.
- Quarky combines storytelling with games and educational content.
- Quarky allows users to generate their own content — whether it is asking a question, posting a picture, or networking, users are engaged through their own creations.
- Quarky is a judgment-free zone.
- Quarky builds a network and shows girls that they are not alone in their curiosity. They can communicate with women who may not be stereotypical scientists — breaking down visual barriers to entry.
- Quarky explores science through the unexpected, the artistic, the unknown — science is real life and not just memorization of tables and facts.



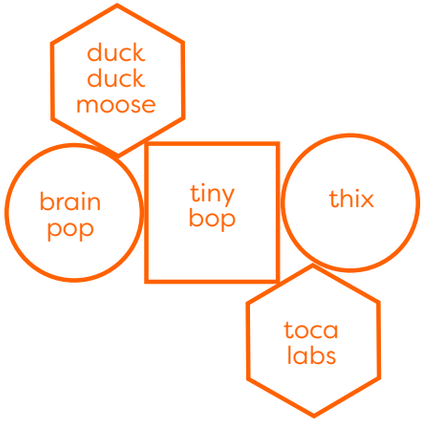
competition

The competitive landscape for Quarky can be divided into several groupings: educational apps, hands-on workshops, online media, toys and games, and outreach programs.

educational apps

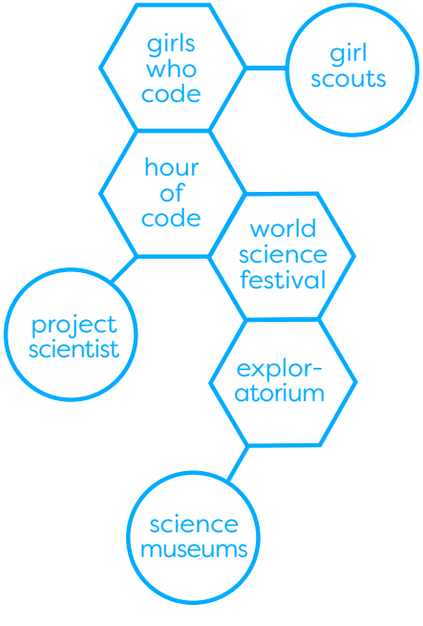
Most of the existing educational apps are targeted to a specific school curriculum (Brain Pop), or a younger age range. Khan Academy recently purchased Duck Duck Moose, and although most of their content is aimed at pre-schoolers, their Wizard School program attempts to combine social media habits and learning. Wizard School would be our most serious competitor, although the app was not focused on girls, did not bring in role models, and it also felt as if it was designed for parental approval, rather than child engagement. ABCMouse is the top-grossing educational app in the Apple App Store, but the app caters to a younger audience (2-8 year olds).

There are a few game-based app providers who market themselves as educational, but the education is often about hand-eye coordination as opposed to content (Toca, Tinybop, Thix).



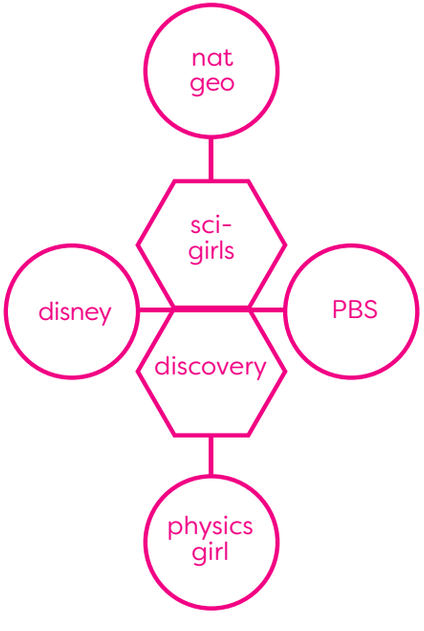
hands-on workshops

Hands-on workshops have been very successful in giving girls exposure to STEM projects, careers, and maker spaces. Some of the most successful programs have focused on computer science, while major museums across the country have been involved in after-school programs and camps for children in urban areas. A majority of these programs focus on children in under-served areas who may not have otherwise had exposure to STEM. The best examples of these experiences are Girls Who Code and the Girl Scouts. A majority of these competitors are also funded by grants and corporate sponsorships.



educational media

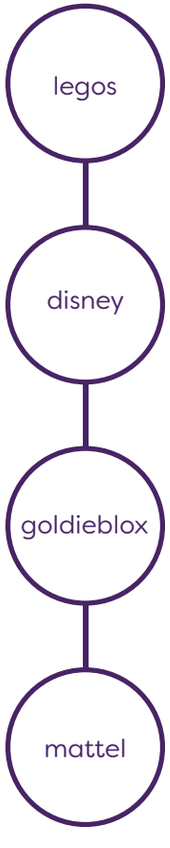
The media world is filled with educational content for a variety of age groups. Some of the best content is sponsored by PBS or other science-related media channels like NatGeo and Discovery. However, the tone of the content is quite varied — some speak down to children; some treat science as a pure game, while others are quite aspirational. Many of these platforms are also accompanied by apps or video content (even NASA has some apps targeted to very young explorers).



physical toys

Major toy makers have attempted to lure girls into science by creating girl-focused science kits — being empowering through inclusion. Some of the toys were developed after the continual prompting and requests by the girls themselves,[34] while others were created by female entrepreneurs. The toys still have room to improve (some still are wearing lipstick or are just pink), and the industry needs to recognize that Generation Z doesn't necessarily see gender as binary, but something that is inherently fluid.[35]

Legos and Mattel have made giant leaps in supporting girls and their intelligence. Legos' next mini-figure collection features the women of NASA, and Mattel released a series of Barbies that are shaped to look like real bodies (compared to their earlier STEM Barbie who still had high heels,geeky glasses and a pink computer).



market validation

outreach programs

With the recent push toward gender equality and STEM education, many organizations have evolved in the sector. Most of the outreach is focused on parents, funding scientists, or even global education of girls. These are some of the foundations dedicated to mentoring, raising funds, showcasing teachers, and opening the door for girls in STEM.

corporate sponsorship

Corporate philanthropy programs have been generous donors to both science education and science research. In 2016 alone, US corporations pledged over $2 billion to support science.[36]

The donor base ranges from companies, which are science-related in their own missions (Exxon, Intel, Texas Instruments) to foundations supported by technology companies and their founders (Bill and Melinda Gates Foundation, Bloomberg Philanthropies, and The Chan Zuckerberg Initiative).

Besides funding, many of the corporations have preached awareness and diversity within their own ranks:

- Microsoft sponsors YouthSpark and has created several targeted commercials that are launched on International Women's Day.[37]
- GE launched a commercial during this year's Super Bowl that featured Millie Dresselhaus, and asked "what if women scientists were treated like celebrities?" At the same time, GE launched an internal initiative to get 20,000 new women in technology positions by 2020, creating gender parity in their workforce.[38]
- Sesame Street and IBM's Watson have recently partnered to create game-based learning apps targeted at early childhood learning.[39]

"If we're going to out-innovate and out-educate the rest of the world, then we have to open doors to everyone. We need all hands on deck. And that means clearing hurdles for women and girls as they navigate careers in science, technology, engineering, and math."

Michelle Obama,
First Lady, September 2011

primary audience

Quarky's target audience is American girls ages 8 to 10, of which there are approximately 6 million in the United States.[40] Studies have shown that girls tend to lose interest in math and science when they hit middle school (or puberty).[41] Quarky wants to capture the curiosity and attention of these girls before they have time to second guess their interests.

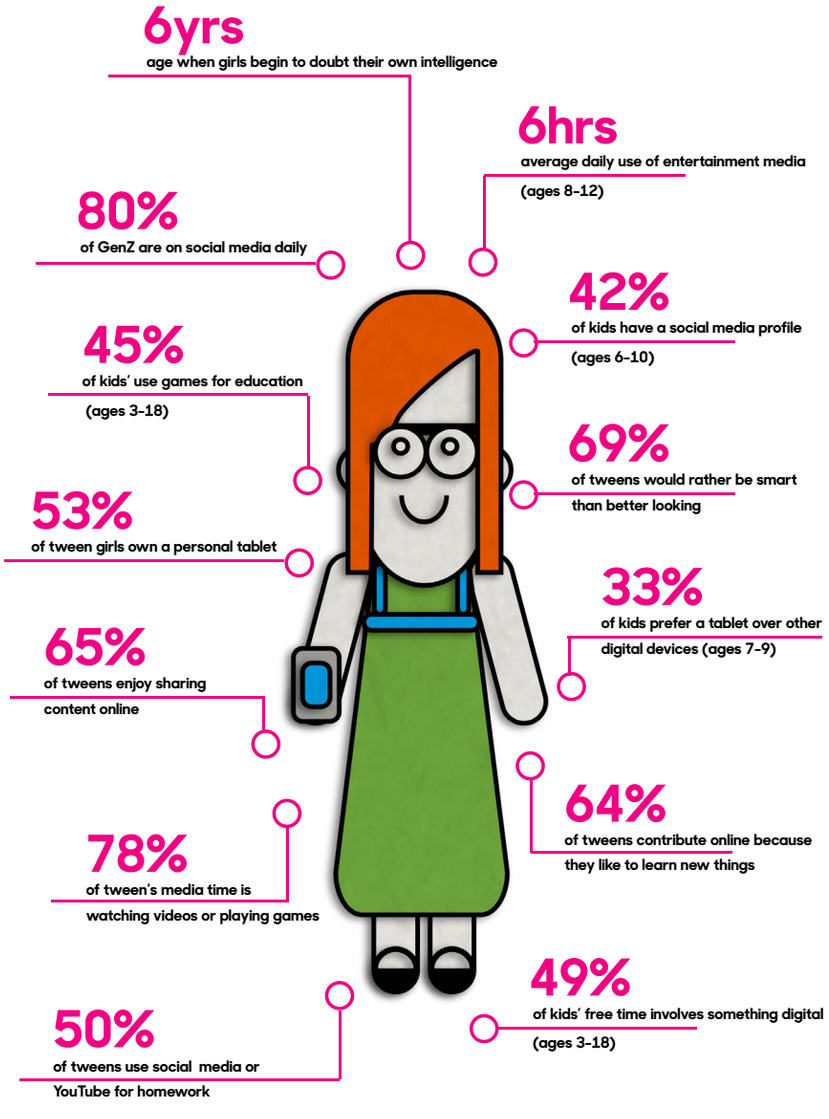
secondary audience

Since Quarky will be focusing on children under the age of 13, we'll need permission and consent from their parents. Quarky would also like the parents to be involved with experiments or solving the puzzles, or diving deeper into science.

Quarky also aims to build a network of mentors and content generators, who will most likely be adults in the sciences, and preferably women. We'll target college students initially, as our target audience is most comfortable asking questions of girls in this age group.

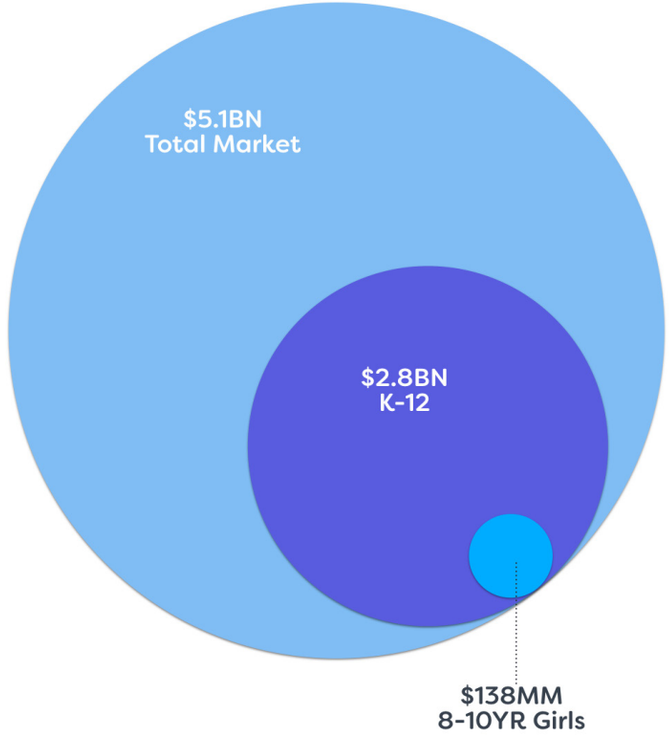
a user-testing session with arts and crafts and Quarky

anatomy of an American girl

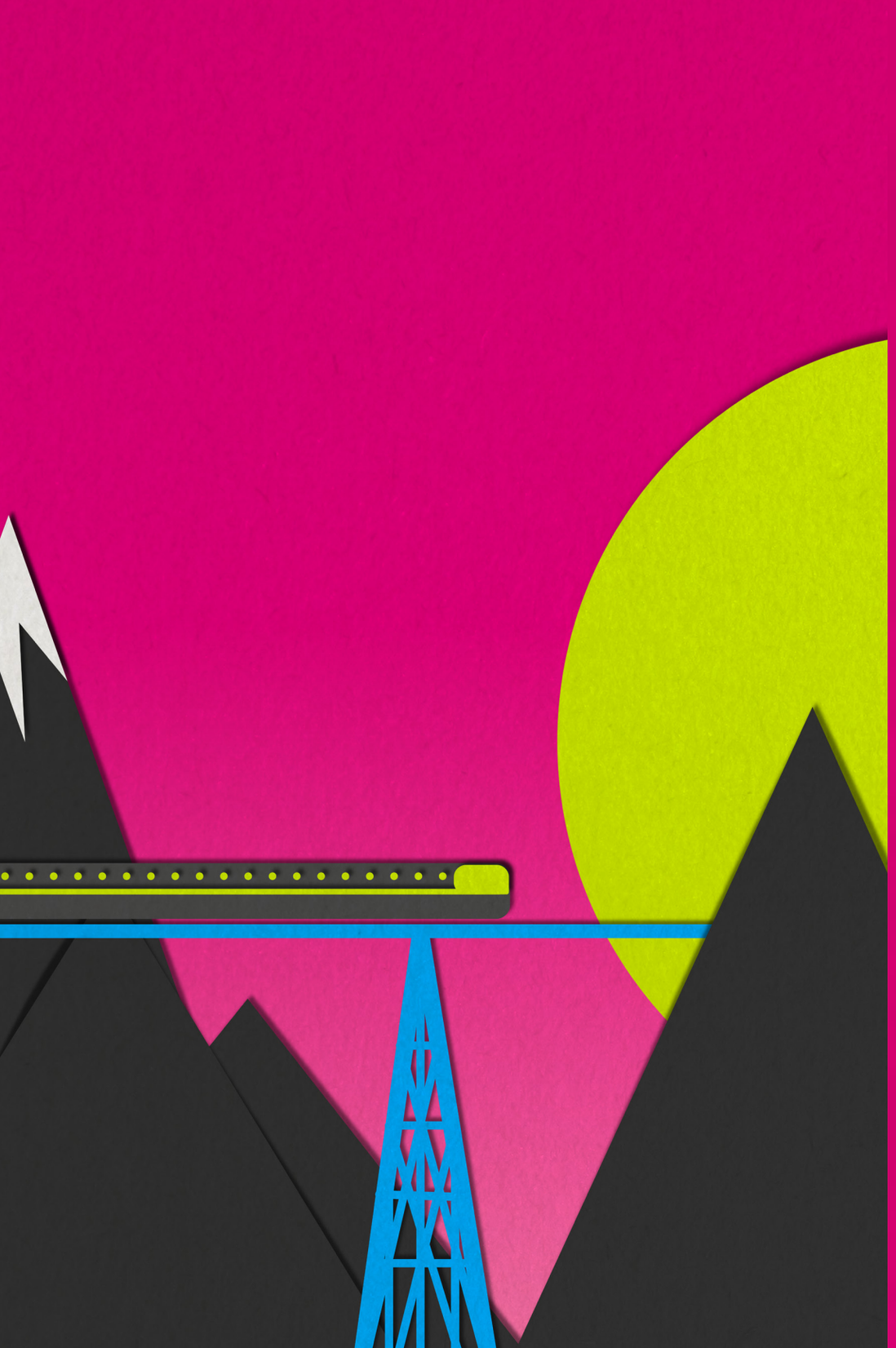


for infographic sources see endnotes 42-53

North American Mobile Education Market 2016



SOURCE: McKinsey & Company, *Transforming Learning Through mEducation*, 2012 | US Census 2014 | National Center for Education Statistics, 2013



5.0

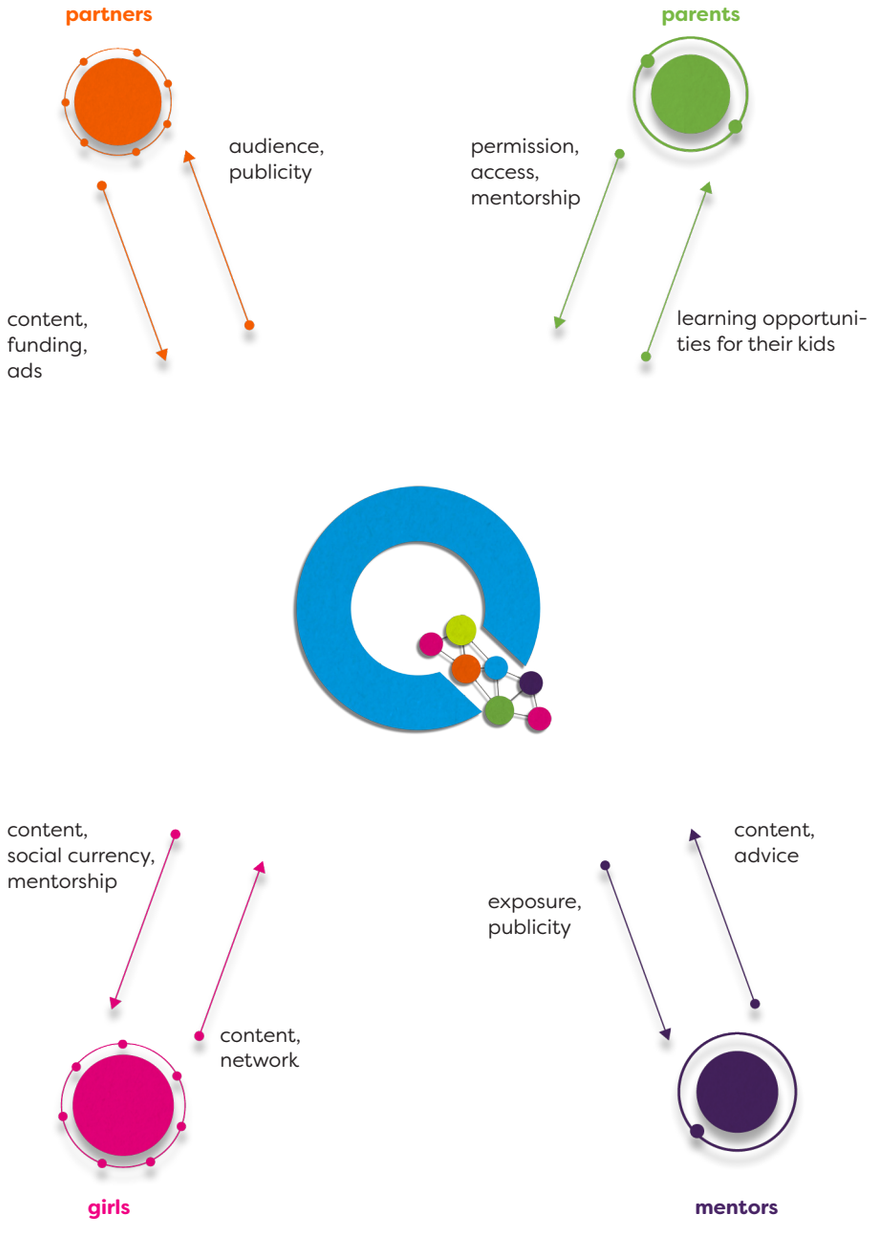
the business

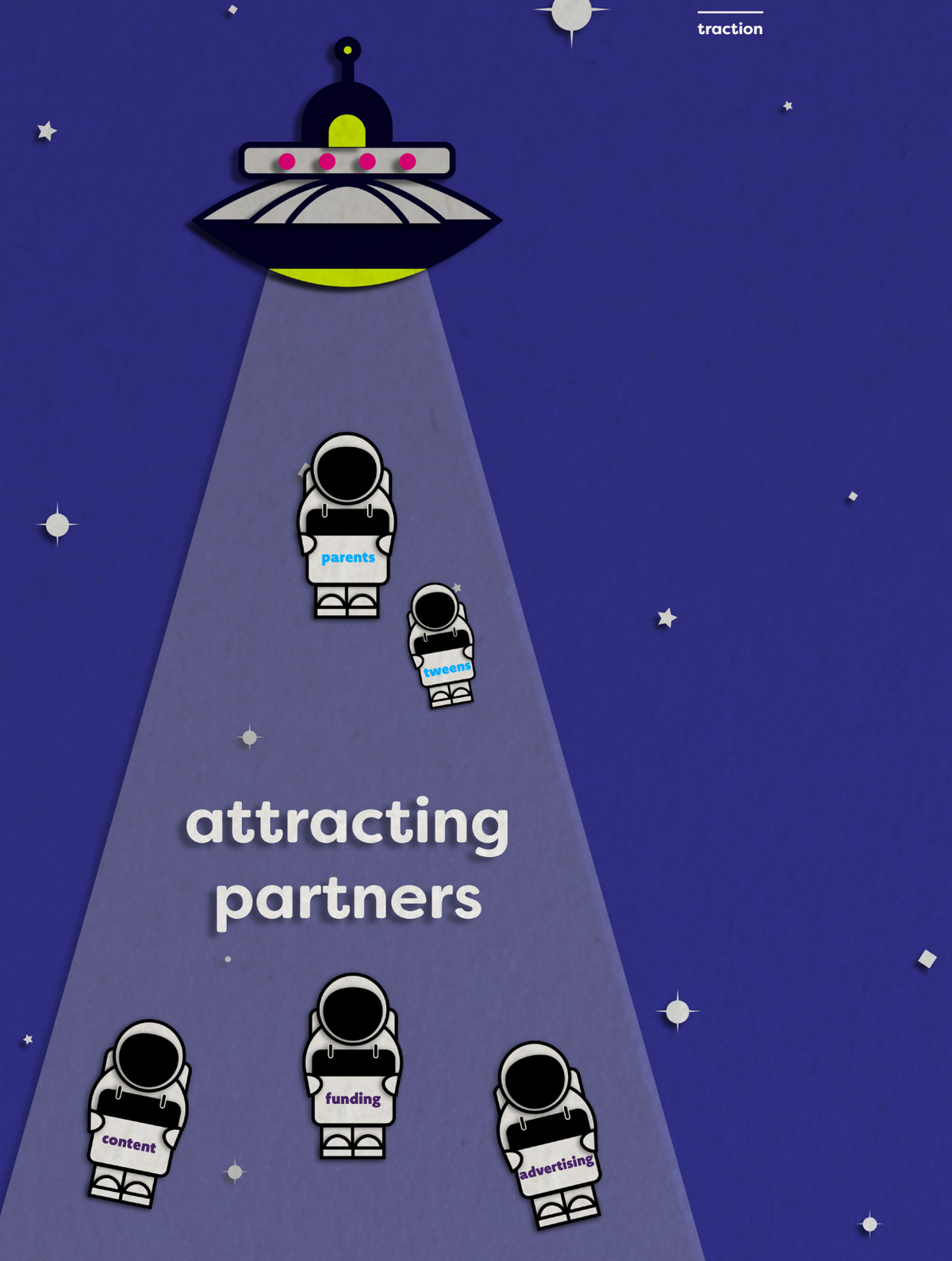
Quarky will operate as a B-corp (benefit corporation). The majority of Quarky's media platform will be run as a non-profit, allowing open access to the content platform and human network for anyone with access to the web. As Quarky grows and expands, we will create hands-on experiences, product licenses, and merchandise to provide scholarships for students, or to sell educational materials. These new phases may require a for-profit model — thus, the B-corp designation and certification.

By launching as a non-profit, Quarky has access to funding from a variety of foundations dedicated to STEM education. We'll also offset some of our costs by partnering with content providers for advertising on our Q-tube channel and video stories.

In the end, we expect that the majority of Quarky's cost will be in the initial build — app and game development. We'd hope to partner with a content provider or corporation who'd already have access to the content or the infrastructure to get our app off the ground quicker.

value exchange





attracting partners

Quarky's marketing will be focused on attracting tweens, their parents, and partners (for funding, content and advertising) through a variety of traction channels.

Email Referrals: Quarky will offer its users incentives to refer others by embedding a referral button in our email marketing. The incentives would include VIP access to new content, prizes within the games, and merchandise.

Customer Appreciation: Quarky will be mindful of its frequent users and initial customer base and will engage in an outreach campaign — personalized letters with access to customized stickers and spotlights of users and their stories on our blog.

Educational Microsites: Quarky will also have a microsite of science factoids, and we'll offer to email our customers these factoids on a daily basis, similar to a "word of the day" calendar.

Widgets: our microsites and stickers will be embeddable through code onto our partners' websites or newsletters

Content Partnerships: Quarky will reach out to blogs that focus on STEM content and childhood education. We'll offer to exchange content on our blog for their postings, in order to cross-pollinate our user bases.

Guest Blog Posts: Quarky has expertise in STEM subjects, and especially those with a sense of humor and a hook. We'll offer to contribute our expertise on newsletters and personal blogs that reach college students, parents, and even tweens.

Vimeo Updates: Quarky will continue to post content and video teasers on our vimeo page, in order to reach a larger audience and to be easily accessed.

Social Media Influencers: Quarky will reach out to social media superstars in science or childhood education to take over our social media feeds.

Social Media Contests: Quarky will run "hashtag" posting contests, since our user base loves to share on social media.

Special Days: Quarky will plan to launch new features or events on special days like Pi Day, International Women's Day, and even Halloween, keeping our content relevant and timely.

pilot & launch

The majority of our expenses in the pilot phase comes from game development and in providing for privacy considerations of our users. Our content will also be phased, starting with Chapter 1: Space. We've begun to grow our audience through traction channels, and to reach out to partners for content and funding. We are incorporating as a non-profit, so we are also looking to grant funding or angel investors.

We can measure Quarky's impact through pilot studies in Girl Scout troops and local schools through targeted interviews. Since building an audience will be key to proving Quarky's model, we need to spend on SEO and social media campaigns.

financials

FIXED COSTS	
App Development	$150,000
Web Development	$10,000
Grant Proposals	$6,000
Technology & Equipment	$4,000
Legal Services	$1,000
VARIABLE COSTS	
Rent	$3,000
Hosting & Maintenance	$7,000
Content Management System	$8,000
Technology Subscriptions	$2,000
Full-Time Salaries & Benefits	$108,000
Design Contractors	$30,000
Marketing & Advertising	$36,000
Legal Services	$6,000
Miscellaneous	$16,000
	$387,000

phase 2

In phase 2 we'll expand to more cities/ schools for user testing and impact considerations. We'll complete the full game build, and our video companion channels. Our expenses will continue to be dominated by development. We'll reach out to more partners for both funding and content.

financials

FIXED COSTS	
App Development	$200,000
VARIABLE COSTS	
Rent	$3,000
Hosting & Maintenance	$7,000
Content Management System	$8,000
Technology Subscriptions	$2,000
Full-Time Salaries & Benefits	$108,000
Design Contractors	$30,000
Marketing & Advertising	$24,000
Legal Services	$6,000
Miscellaneous	$16,000
	$404,000

phase 3

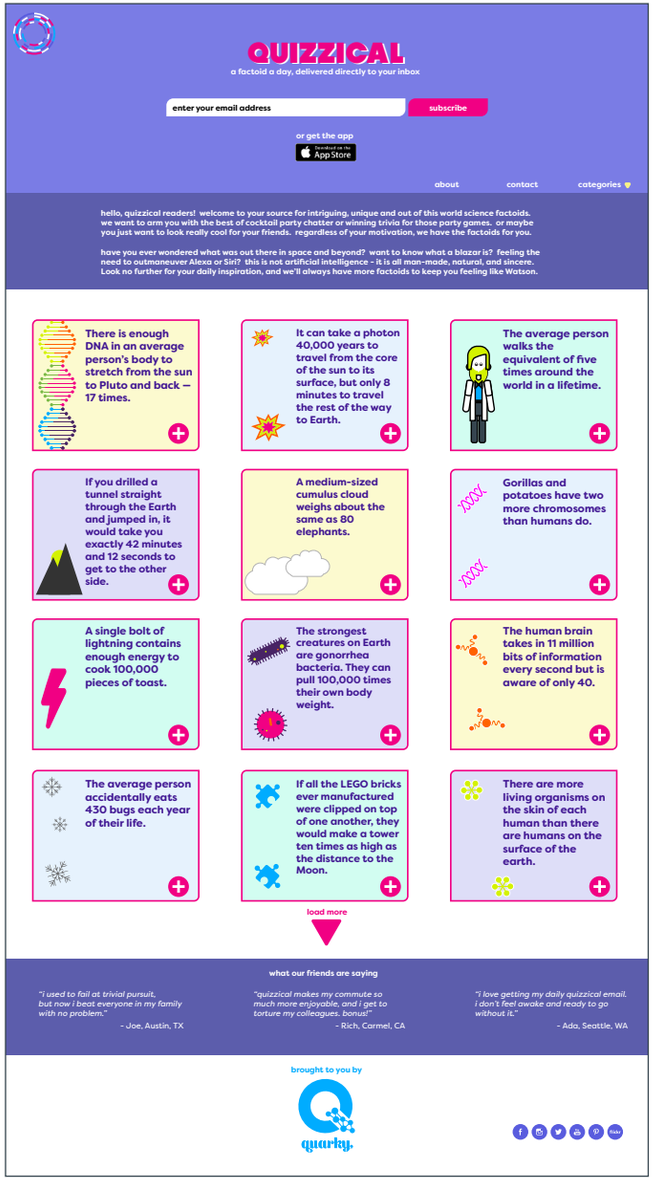
This phase will see the full build-out of our mentor network. We also expect to incorporate advertising and partner content into our QTube channel. We'd hope to transition to a B-Corp at this point. Our goal here would be to host or sponsor hands-on experiences.

financials

FIXED COSTS	
Legal Services	$8,000
VARIABLE COSTS	
Rent	$3,000
Hosting & Maintenance	$7,000
Content Management System	$8,000
Technology Subscriptions	$2,000
Full-Time Salaries & Benefits	$158,000
Design Contractors	$30,000
Marketing & Advertising	$50,000
Legal Services	$6,000
Miscellaneous	$16,000
	$288,000
REVENUE	
Advertising VOD	($12,000)
	$276,000

potential partners

Quarky will reach out to corporations, museums, media channels and foundations for content, funding, and advertising.



quizzical

Quizzical is our educational microsite of daily science factoids that can be directly delivered to your inbox.

vimeo site

All of our QTube videos are available on vimeo to gain traction and build an audience.

measuring impact

Quarky's main goal is to get young girls excited about science, so that in the future they will either continue within the field or use their science-related knowledge for future success. It will be difficult to measure our impact as it relates to our underlying goal due to its long time frame.

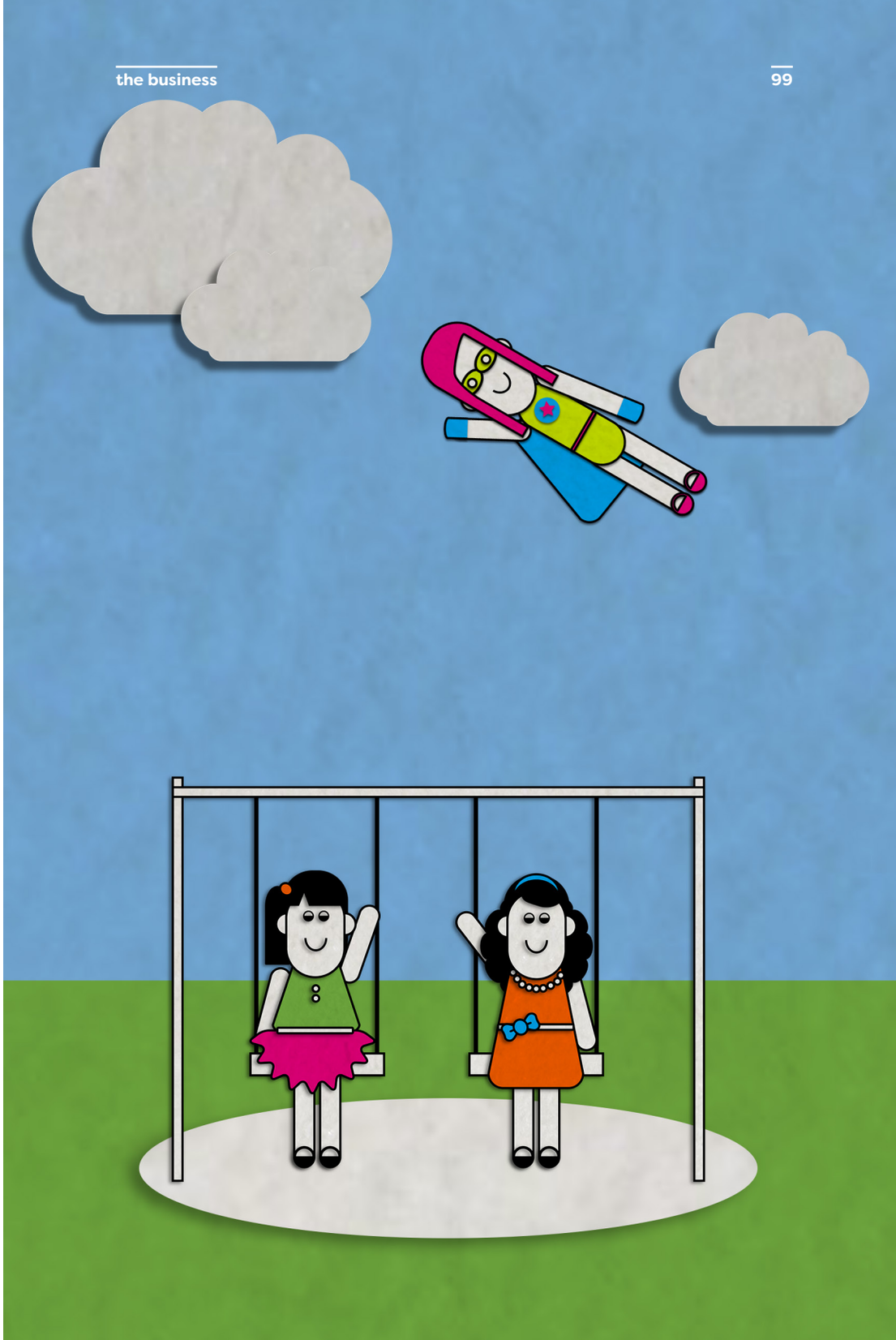
In the short term, we will look to measure impact both qualitatively and quantitatively in order to ensure that our product is on target.

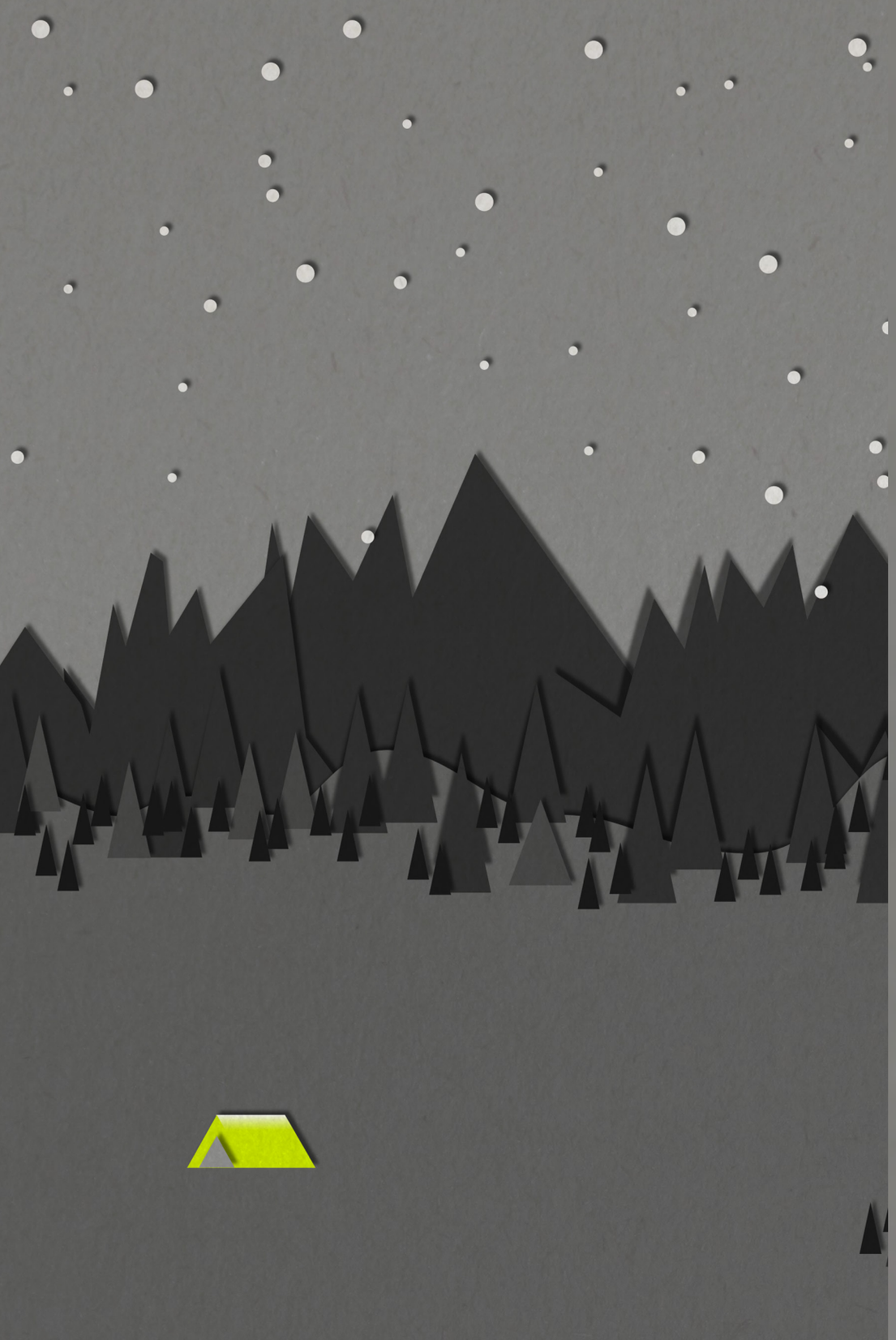
quantitative behaviorial KPIs

- time on the platform
- number of games played
- number of videos watched
- social shares
- chat conversations
- partner click-thrus
- user uploads
- return visits
- friends invited
- prizes used
- prizes shared

qualitative KPIs

- teacher interviews (changes in grades or questions)
- club member interviews (science clubs or Girl Scouts)
- parental/user commentary
- user to mentor movement
- mentor involvement





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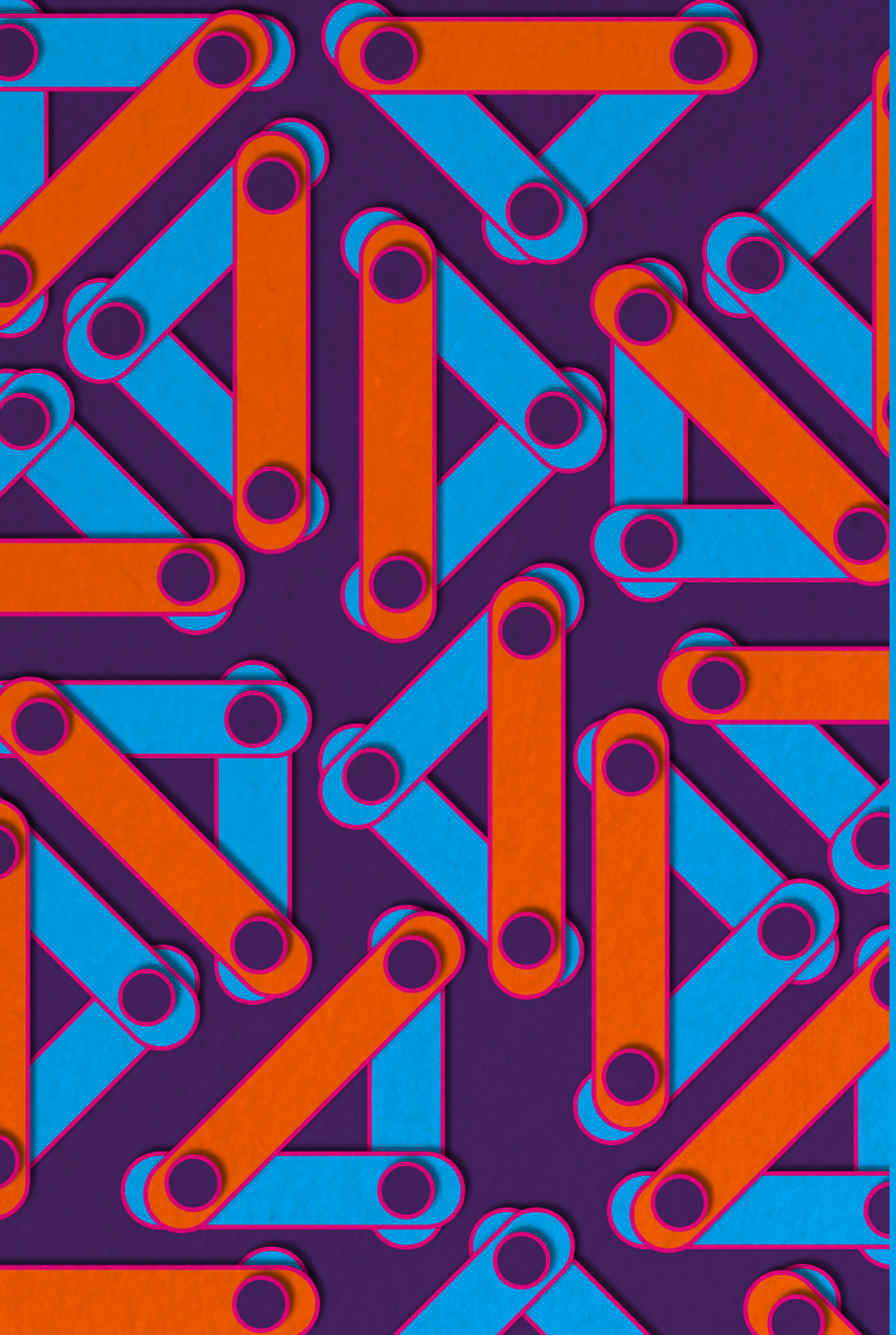

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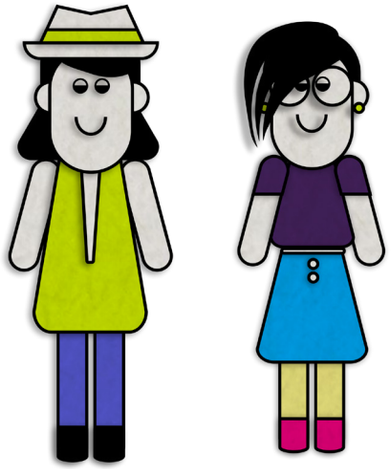

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DARE MIGHTY THINGS.

lauren eve cantor
MFA Design /
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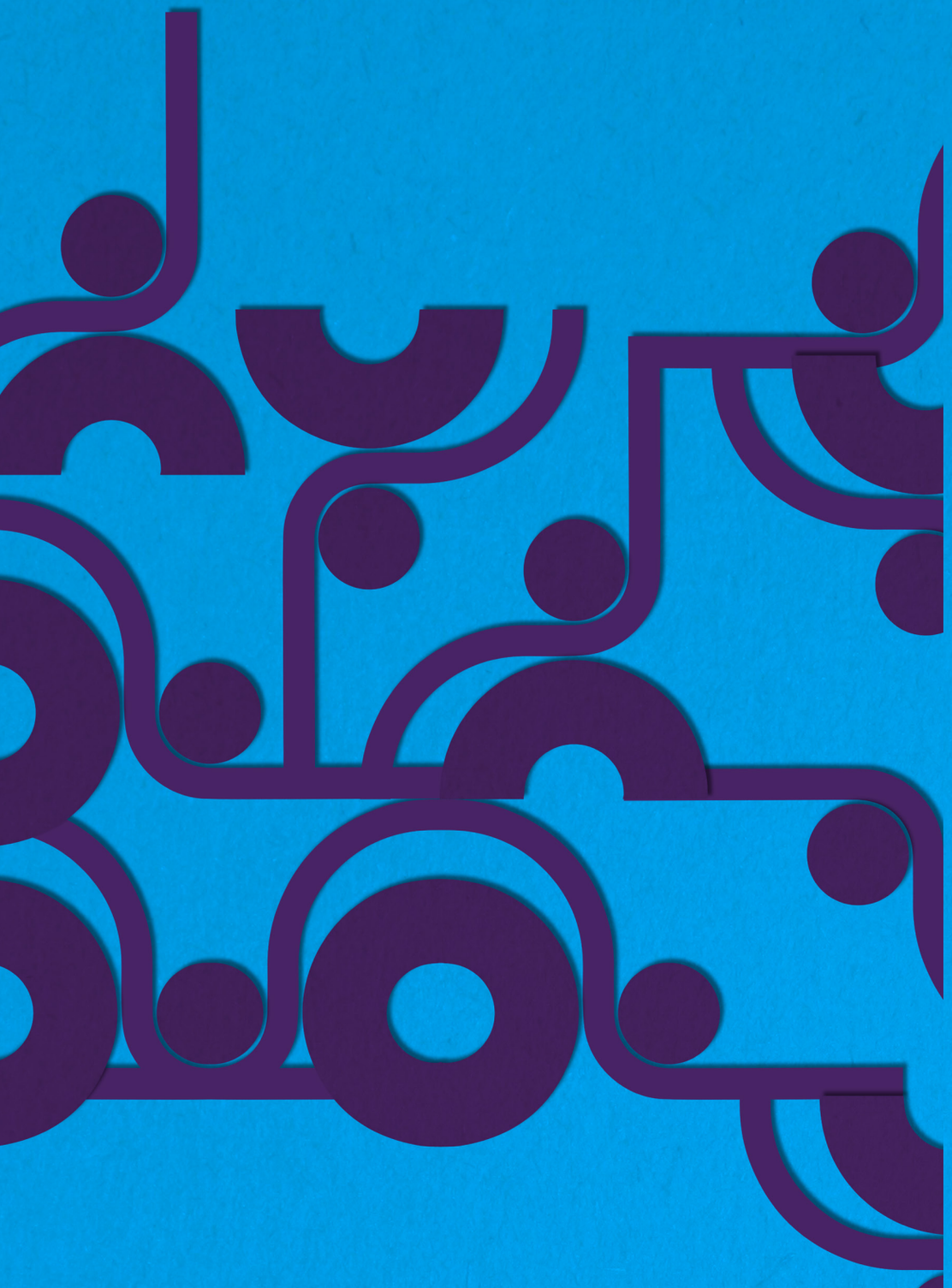
School of Visual Arts
Class of 2017



8.0
appendix

In order to gain an audience, we'll begin by targeting parents and STEM-focused blogs. We'll reach out to blogs to share content, promote our product, and look to post widgets (easy access to our content from third party sites). Below is a list of the blogs we aim to target initially:

Target Blogs

womenlovetech.com - a lifestyle technology magazine

girlboss.com - blog of the girlboss foundation

medium.com/@WomenOfSiliconValley - dubbed the "humans of new york" for women in tech

fromthelabbench.com - blog about all things science

blogs.scientificamerican.com - the blog of scientific american magazine

womenofscience.com - helping women navigate science academics

prettybrainy.com - from STEM to STEAM

blog.iat.com - education insider STEM blog

edutopia.org - part of the George Lucas Educational Foundation

itsokaytobesmart.com - a blog about science

staging.forgirlsinscience.org - created by the L'Oreal Foundation

teenlife.com - targeted at students, supporting teen success

howwegettonext.com - sponsored by the Bill and Melinda Gates Foundation

thekidshouldseethis.com - smart videos for curious minds

mentalflossr.tumblr.com - the blog of the magazine mental floss

scienceisbeauty.tumblr.com - connections of science and culture

quantamagazine.org - illuminating science

nautil.us - science connected periodical

We'll also approach traditional blogs, which focus on technology, venture funding, and apps for kids for reviews and promotion.

techcrunch.com - technology blog with a venture funding and startup component

commonsensemedia.org - non-profit that provides education and advocacy for parents

redef.com - blog and newsletter for the "curious" focused on new media

verge.com - Vox Media's blog focusing on technology and culture

Additional Funding Avenues

Patreon: Patreon is an on-line portal similar to Kickstarter, that allows users to support creators on an on-going basis. Several podcasts (StarTalk Radio, for instance) use Patreon as a means for funding, and for rewarding loyal consumers. Patreon does take a 5% commission on all subscriptions, but the channel is promoted widely (NPR) and compares nicely to a Netflix subscription. (patreon.com)

As we look to incorporate as a non-profit initially, we'll target grant funding specifically aimed at women entrepreneurs.

The Girl Boss Foundation Grants - grants aimed at women in design, fashion, music and the arts. Girl Boss also helps with promotion and outreach through their various media channels and events.

My LA2050 Grants Challenge - The Goldhirsh Foundation has an annual challenge that supports 12 non-profits in the Los Angeles area that seek to improve their local community. LA2050 aims to foster entrepreneurship, cultural diversity, and inclusivity by donating $1 million annually.

Case Foundation - Jean Case created the Case Foundation to support the power of interactive technology to "make the world better." The Foundation also promotes founders on several media channels, including *Fast Company*.

iFundWomen - a crowd funding platform specifically aimed at women entrepreneurs. The platform takes 20% of funding, but they also add an additional level of support including campaigns, coaching and media support.

37 Angels - a venture capital fund with a focus on female founders that hold a pitch forum every two months in NYC.

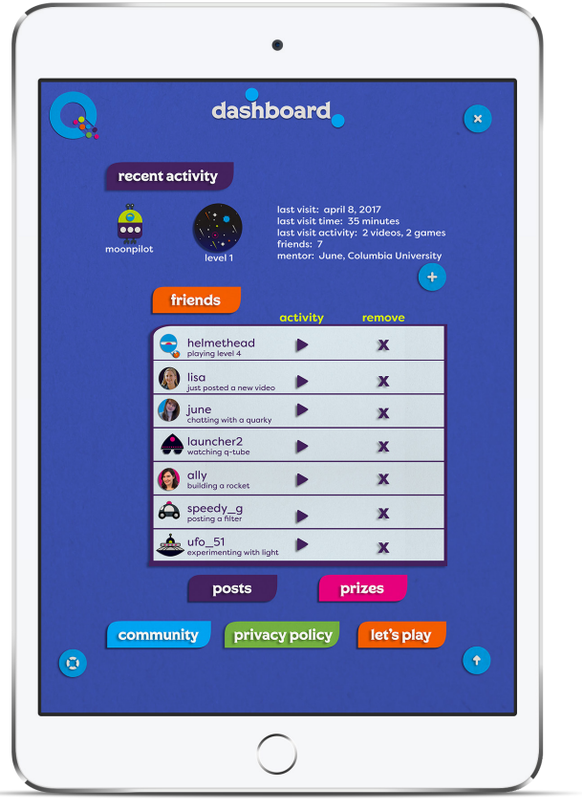
Rethink Impact - a venture capital fund that focuses on entrepreneurs in technology that are "ecosystems of change." Rethink also runs a $100 million fund sponsored by UBS for women-led ventures.

Melinda Gates - Melinda Gates announced in late 2016 that she was exploring a means to support more women in tech. She has yet to announce the projects she will be funding or if she will only be focused on computer science.

Women Moving Millions - a global philanthropic community aimed at catalyzing resources for the large scale investment in women and girls.

Quarky is targeting consumers under the age of 13, which triggers COPPA (The Children's Online Privacy Protection Act). As as result, Quarky will have additional layers of security, verification, moderation, and privacy.

- **Parental Verification**: Quarky will be collecting personal information from our user base (login information, videos, comments, artwork, etc). As a result, we'll require parental verification of user access. We will most likely follow the model created by Duck Duck Moose where parents must submit a video acknowledging their permission, and all accounts are set up under the adult's email address.
- **Parent Dashboard**: Quarky will give parents 100% control over their child's account through access to our dashboard, which allows for monitoring of activity, friends, and messaging.
- **Advertising:** Quarky needs advertising in order to survive, so our advertisers will be screened. The ads will be created using a specific aesthetic to both communicate in Quarky's visual language and to be appropriate for our audience.
- **Parental Gating:** The App store requires a method of determining that a user is actually an adult, such as performing complicated math or tests similiar to Captcha, which should be outside of a child's skill set. While our video authentification should suffice, we'll provide this gating prior to our video capabilities.
- **Mentors and Friends:** We want our players to have access to a multi-player game, whether their teammates are their friends or mentors. Thus, we'll need a system of two-factor authentication to make sure that the friends actually know each other, and that the parents approve. While our players will use avatars within the game, we want our mentors and scientists to use real photos — so our players can actually see women with the world of science.
- **Third Party Links**: Quarky will ask parents for permission to track their child's click-thrus, as we'll need the data for our advertising and supporters. We'd like to be able to verify that our players are interested in learning more about science.
- **Tracking Data**: Quarky will track our players' activity within the app — how many videos watched, how often within the game, how many games played, etc. — in order to provide a better user experience for our players.



parental dashboard

The dashboard allows parents to access their child's activity — friends (approve or remove), recent messages, posts, and prizes.

Companies with STEM Funding / Outreach

- White House - Educate to Innovate: $260M - Change the Equation
- Bloomberg Philanthropies
- Microsoft Philanthropies - Digigirlz, YouthSpark, Hour of Code, Minecraft
- Google - Made with Code, Black Girls Code
- Chevron - strategic partner of TechBridge Girls
- Dow Chemical - partner with the Smithsonian Science Education Center
- IBM - STEM mentors program
- ALCOA
- American Honda Foundation
- Bezos Family Foundation - K-12 STEM Education
- Boeing
- Carnegie Corporation
- Bill and Melinda Gates Foundation - $600MM to education, mostly high schools
- Intel Foundation - partners with Girls Who Code
- GE Foundation - promising to place 20,000 women in technical roles by 2020
- National Math and Science Initiative
- Northrop Grumman - sponsor of Cyber Patriot Games
- Alfred P. Sloan Foundation
- Toyota USA
- Walton Family Foundation
- Geena Davis Institute
- L'Oreal Foundation
- Let Girls Learn
- Clinton Foundation - No Ceilings
- National Girls Collaborative Project
- The Girl Scouts
- Texas Instruments
- Chan-Zuckerberg Initiative
- Google Philanthropies
- General Motors Foundation

Advertising VOD Market

- Total US Digital Advertising Spend in 2016: $72.1BN
- AVOD Spend in the US in 2016: $10.3BN
- AVOD Spend US by Media and Entertainment Companies in 2016: $1.09BN
- AVOD Spend US by Media and Entertainment Companies not given to top 5 media companies (not Facebook, Google, etc) in 2016: $447M

Game Based-Learning Market

- Global consumer spending in 2014: $1.262BN
- Revenue earned in the US in 2014: $437M
- Consumer based revenue (as opposed to enterprise software or sold to educational institutions): $328M
- Played on mobile or tablets: $283M
- Global investment in EdTech in 1Q15: $1.12BN
- Start-up funding for game-based learning in the US in 2016: $575M
- Market expected to grow 22% by 2021

Comparable Startups

- Monument Valley: 55 weeks to complete first game for $852,00
- Duck Duck Moose: $6M in seed funding for new platform
- TinyBop: $1M for seed funding
- Little Bits: $850,000 angel investor
- Girls Who Code: $1M seed funding

SOURCE: Pew Research Center | Emarketer "State of the News Media 2016"| Ambient Insights, *The 2016-2021 Global Game-Based Learning Market*, 2016 | Crunchbase.com | Angel.co

science is an adventure.

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