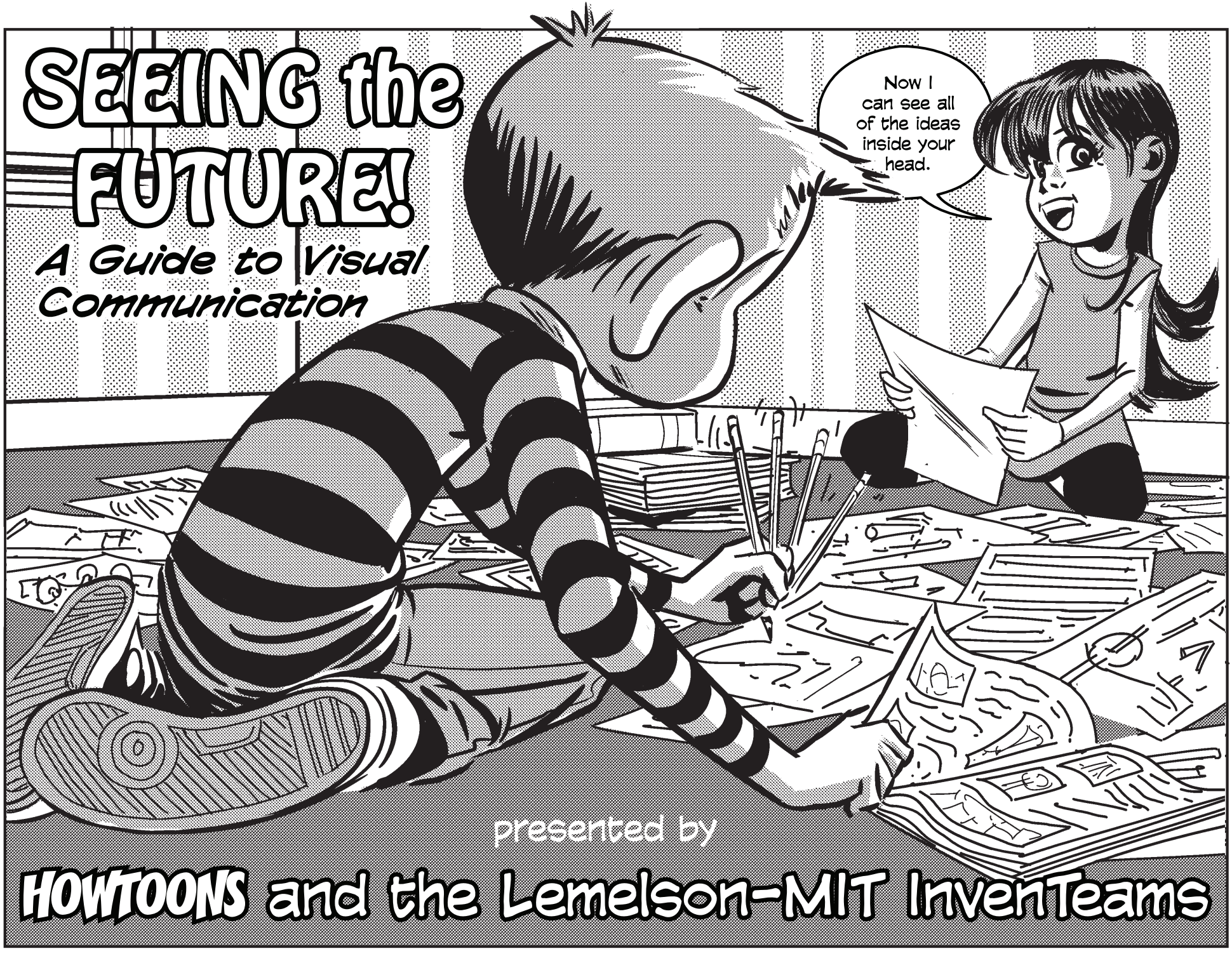

SEEING the FUTURE!
A Guide to Visual Communication
Now I can see all of the ideas inside your head.
presented by
HOWTOONS and the Lemelson-MIT InvenTeams

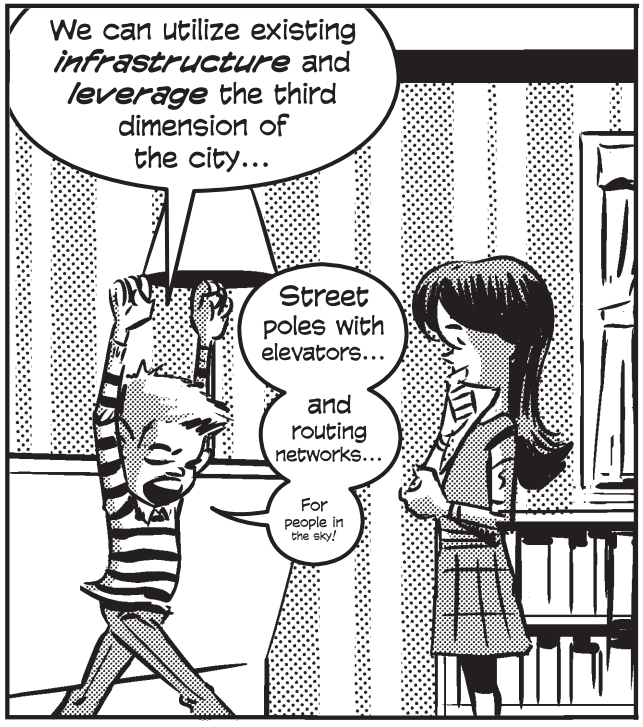
SEEING the FUTURE!

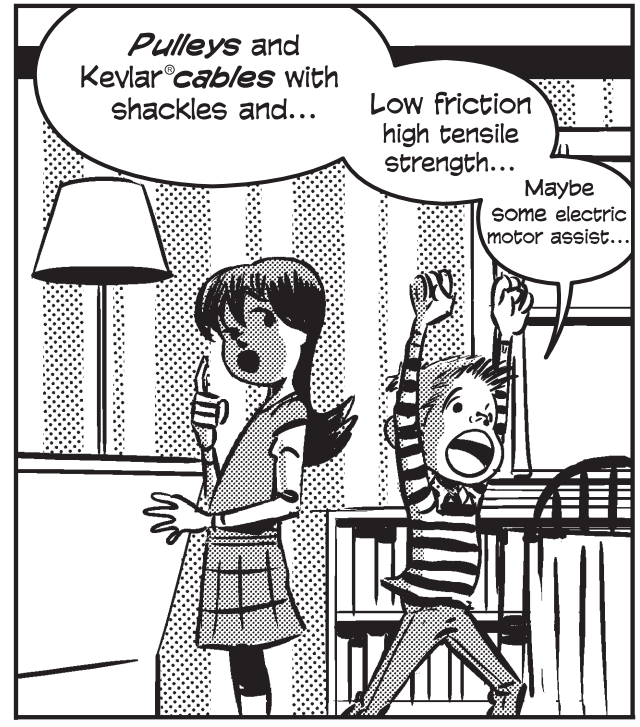
A Guide to Visual Communication

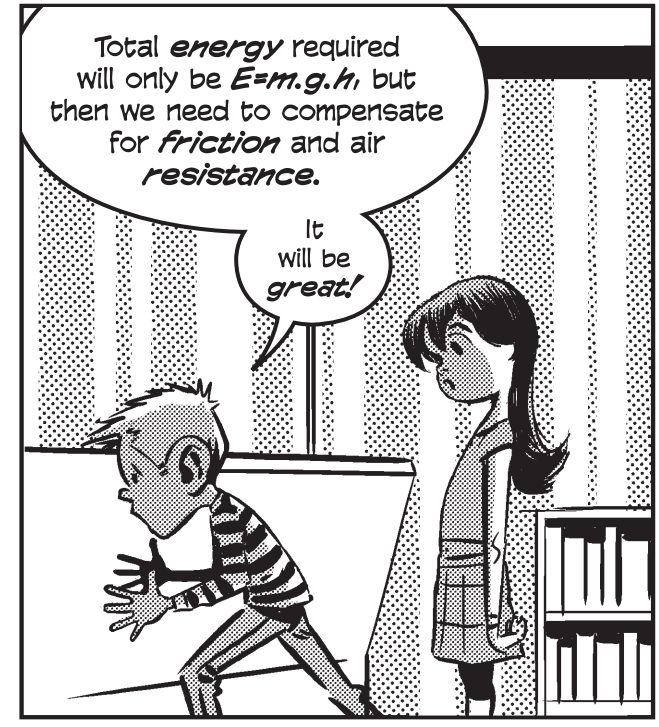
(OR... HOW TO GET THOSE BIG IDEAS DOWN ON PAPER!)

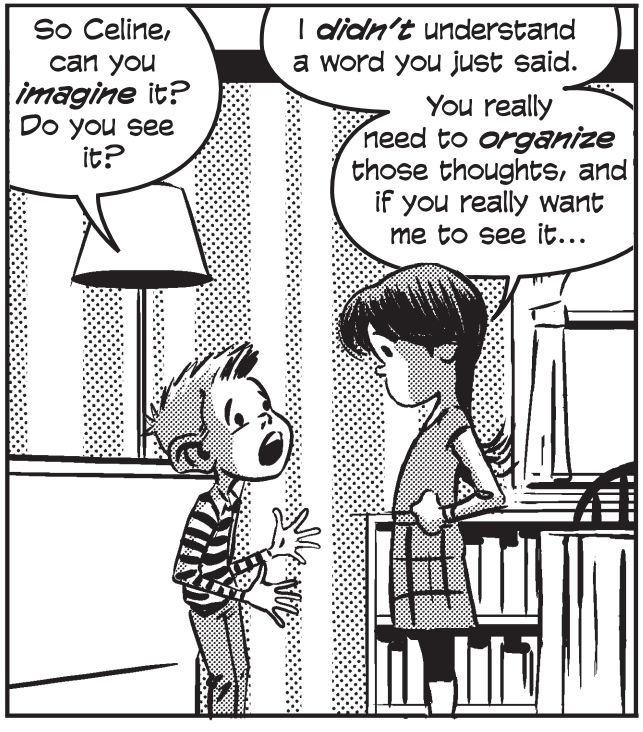
CREATED BY HOWTOONS AND THE LEMELSON-MIT INVENTEAMS

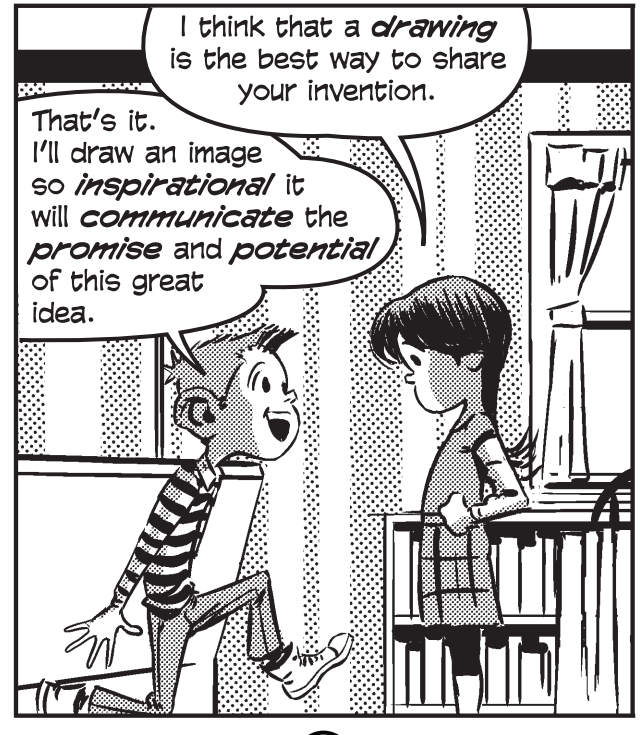

In my *head* I hold the *answer* to a *cleaner future!*
I'm going to *revolutionize* the way we travel!
From this moment forward *gravity* will be my friend, not my enemy. *Everywhere* I go, I'll go by *zip line!*
It'll be an interconnected *network* of catenary lines.
I'll phase out the big ol' stinking school bus of yesterday!


We can utilize existing *infrastructure* and *leverage* the third dimension of the city...
Street poles with elevators...
and routing networks...
For people in the sky!

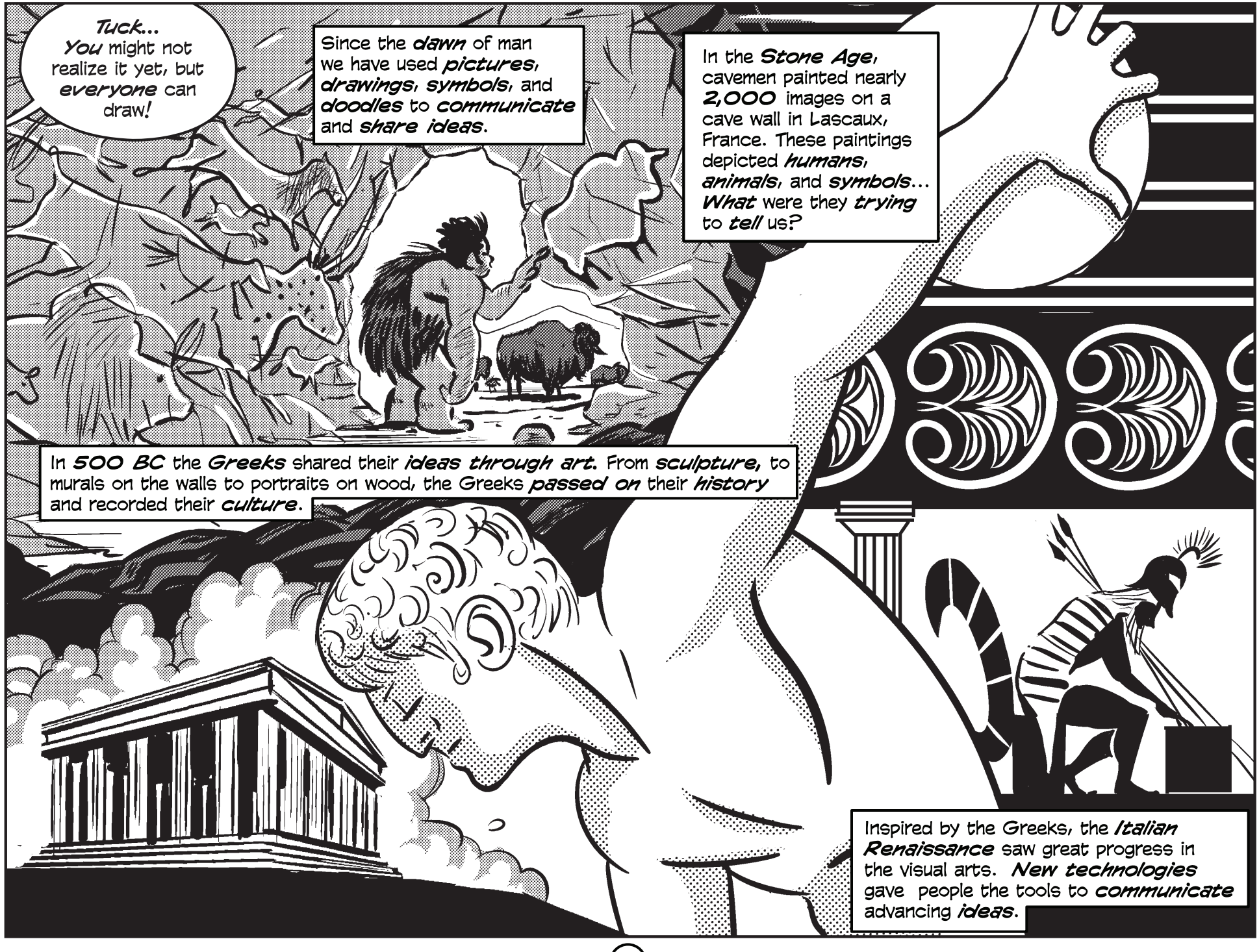

Pulleys and Kevlar®*cables* with shackles and...
Low friction high tensile strength...
Maybe some electric motor assist...

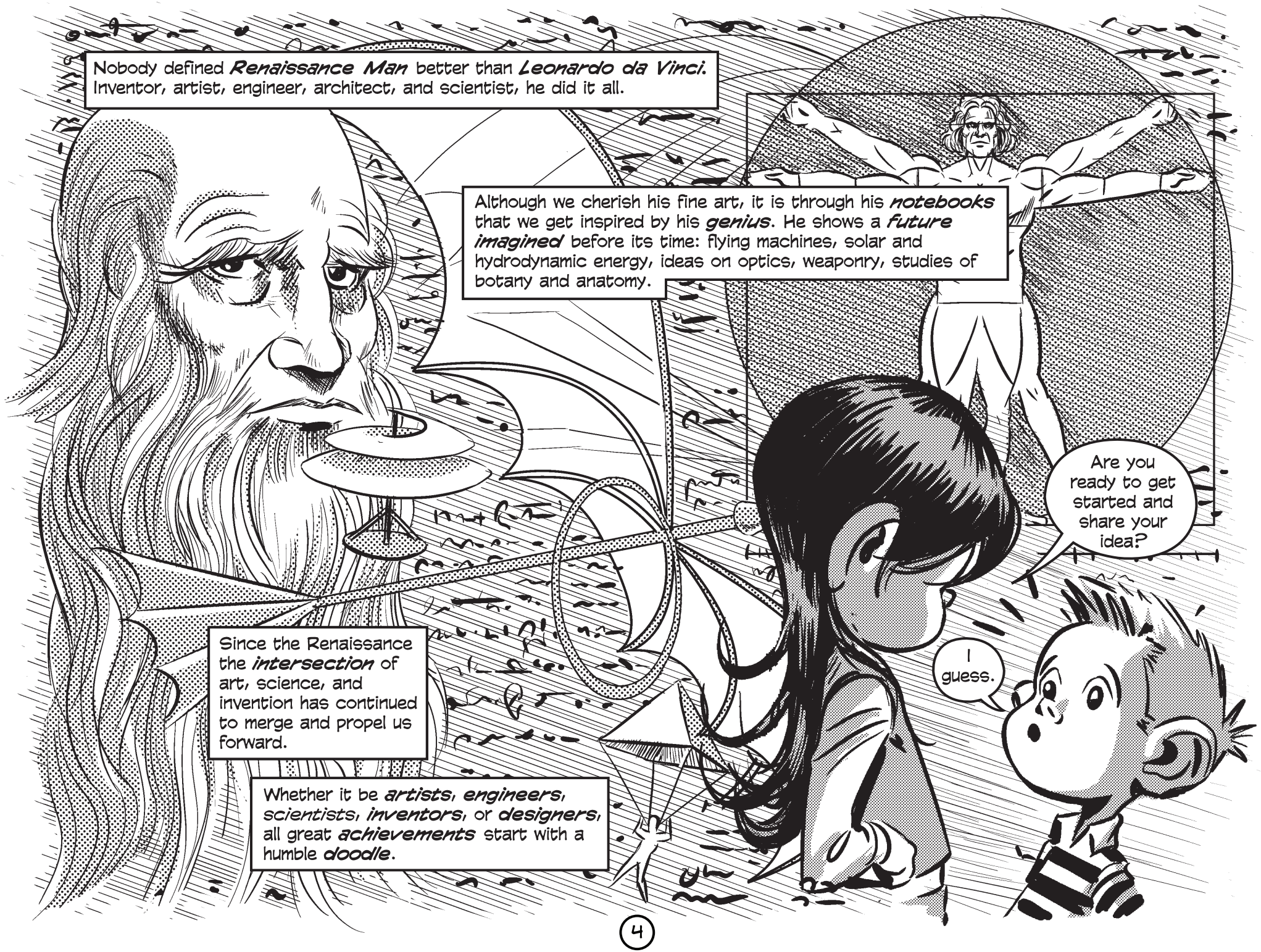

Total *energy* required will only be *E=m.g.h*, but then we need to compensate for *friction* and air *resistance.*
It will be *great!*

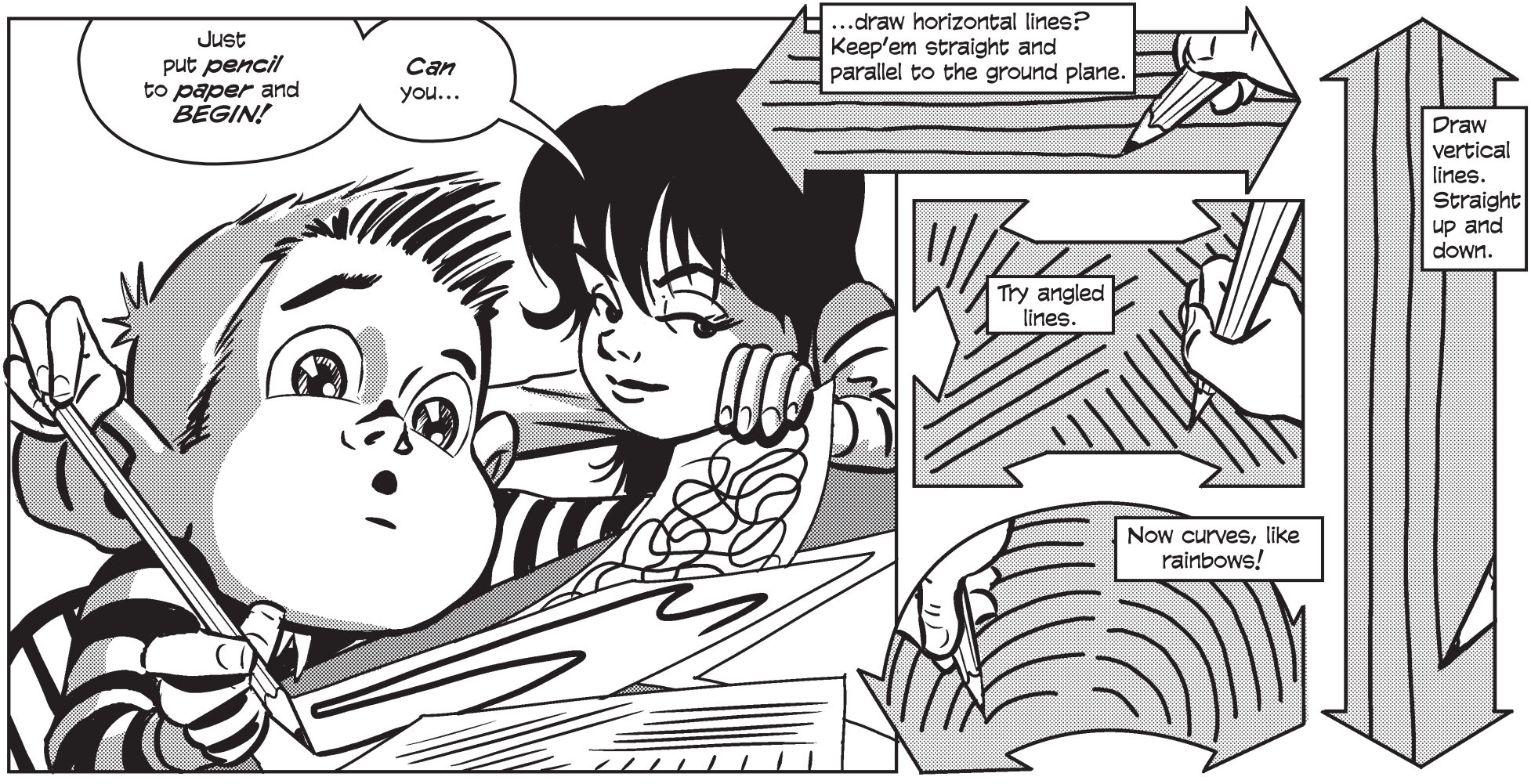

So Celine, can you *imagine* it? Do you see it?
I *didn't* understand a word you just said.
You really need to *organize* those thoughts, and if you really want me to see it...


I think that a *drawing* is the best way to share your invention.
That's it. I'll draw an image so *inspirational* it will *communicate* the *promise* and *potential* of this great idea.

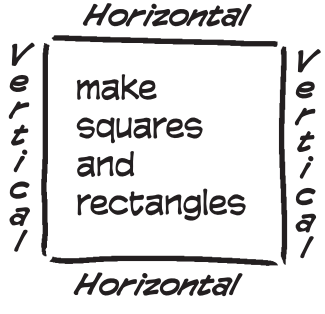

But there's only one problem...
I can't *draw.*

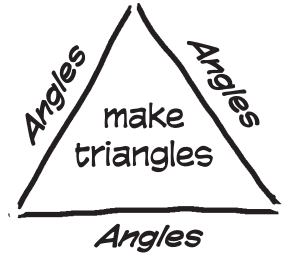

Tuck... You might not realize it yet, but everyone can draw!
Since the dawn of man we have used pictures, drawings, symbols, and doodles to communicate and share ideas.
In the Stone Age, cavemen painted nearly 2,000 images on a cave wall in Lascaux, France. These paintings depicted humans, animals, and symbols... What were they trying to tell us?
In 500 BC the Greeks shared their ideas through art. From sculpture, to murals on the walls to portraits on wood, the Greeks passed on their history and recorded their culture.
Inspired by the Greeks, the Italian Renaissance saw great progress in the visual arts. New technologies gave people the tools to communicate advancing ideas.

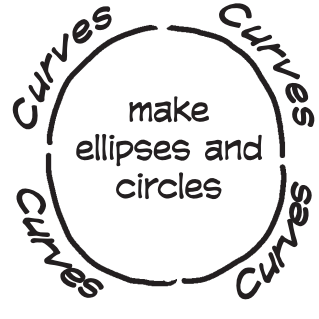

Nobody defined *Renaissance Man* better than *Leonardo da Vinci*. Inventor, artist, engineer, architect, and scientist, he did it all.
Although we cherish his fine art, it is through his *notebooks* that we get inspired by his *genius*. He shows a *future imagined* before its time: flying machines, solar and hydrodynamic energy, ideas on optics, weaponry, studies of botany and anatomy.
Are you ready to get started and share your idea?
I guess.
Since the Renaissance the *intersection* of art, science, and invention has continued to merge and propel us forward.
Whether it be *artists*, *engineers*, *scientists*, *inventors*, or *designers*, all great *achievements* start with a humble *doodle*.

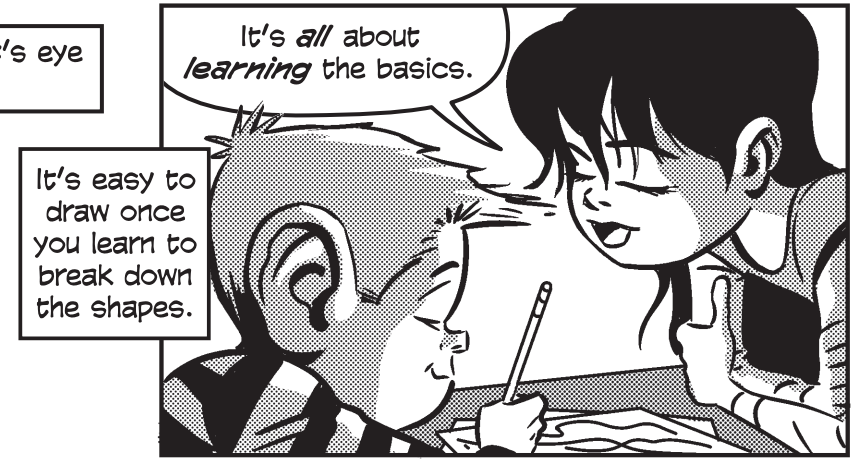


These lines can work together in a variety of ways. By training your artist's eye we can draw them to communicate, like the shapes below.

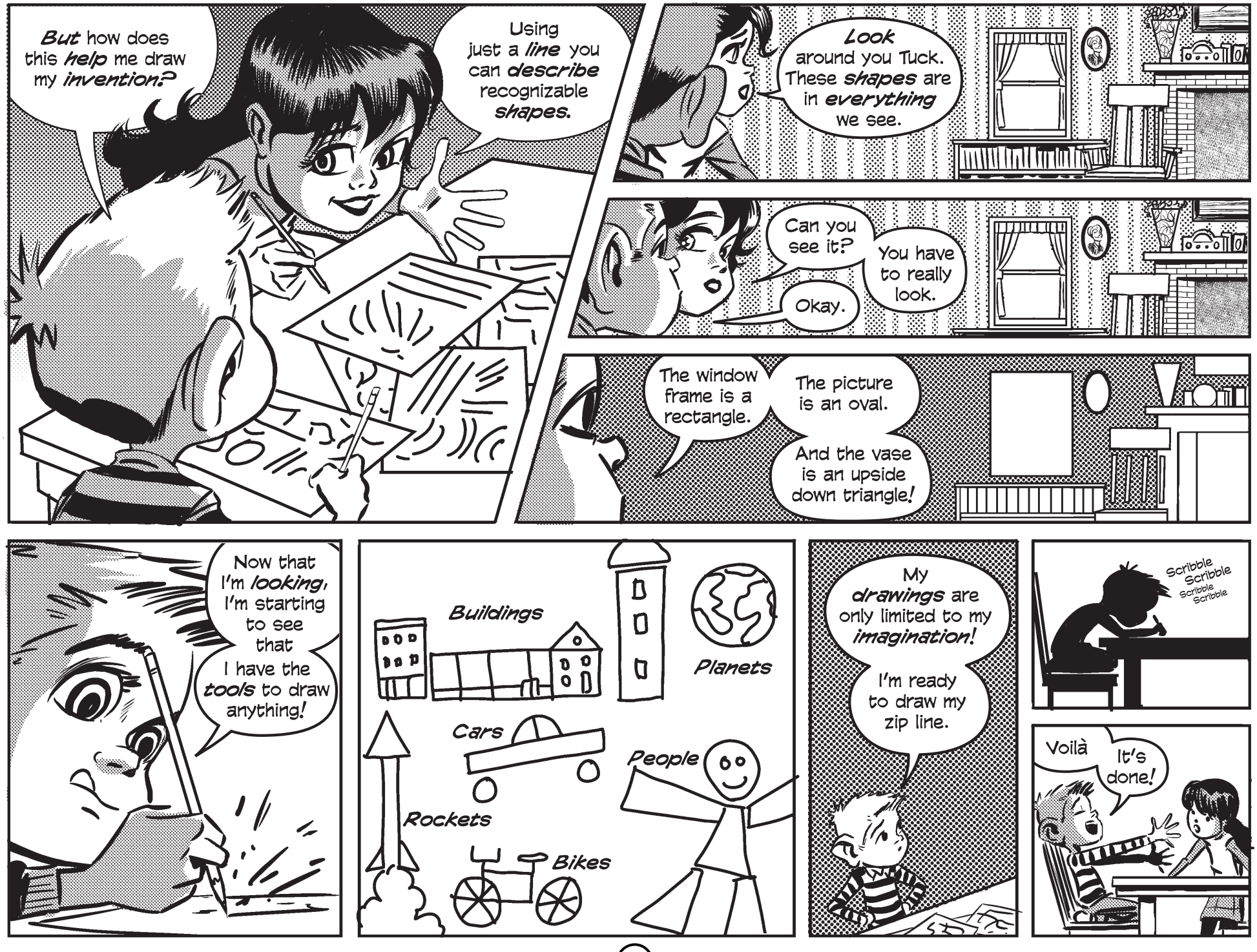






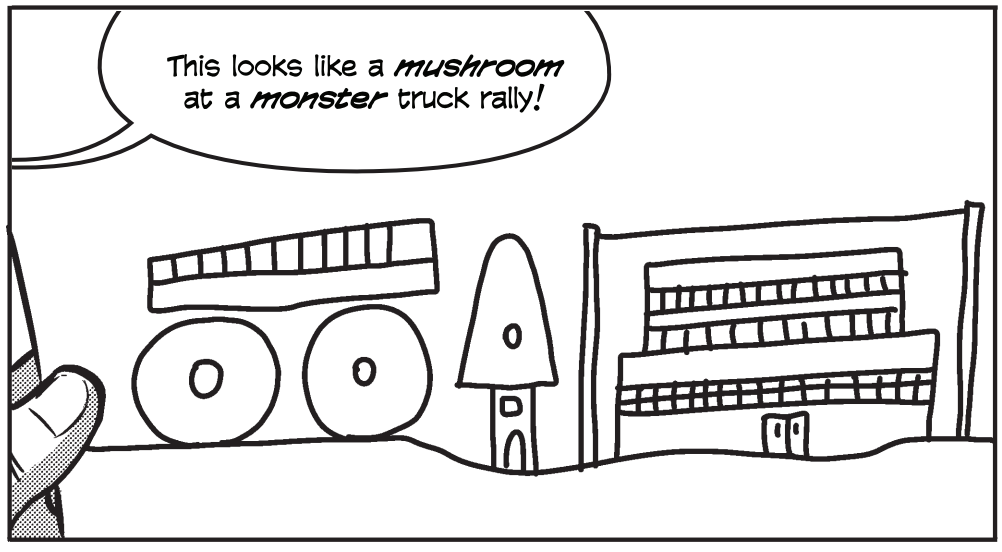


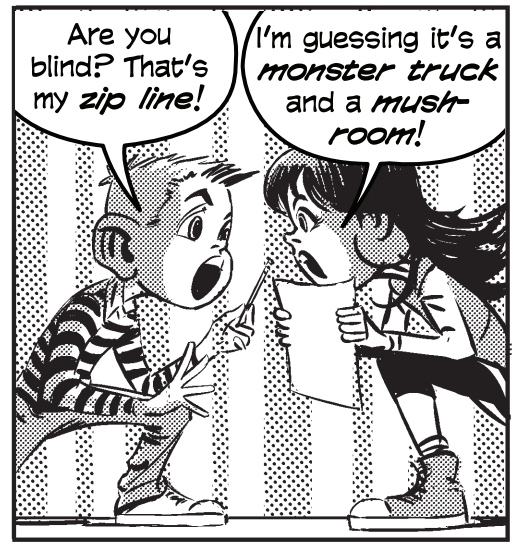
"Now ***you*** try! Start by drawing ***lines*** and ***curves***. Then put them together to make ***shapes*** like s***quares***, ***rectangles***, ***triangles***, and ***circles*** of all sizes. ***Don't*** make mindless ***scribbles***. Make marks with a ***purpose***. All real inventors use graph paper. The guide lines are great for helping you write those equations neatly so they're easy to follow and capture the scale of things. Practice how straight you can draw those lines. How smooth can you draw those curves? Have ***fun*** and get ***loose!***"

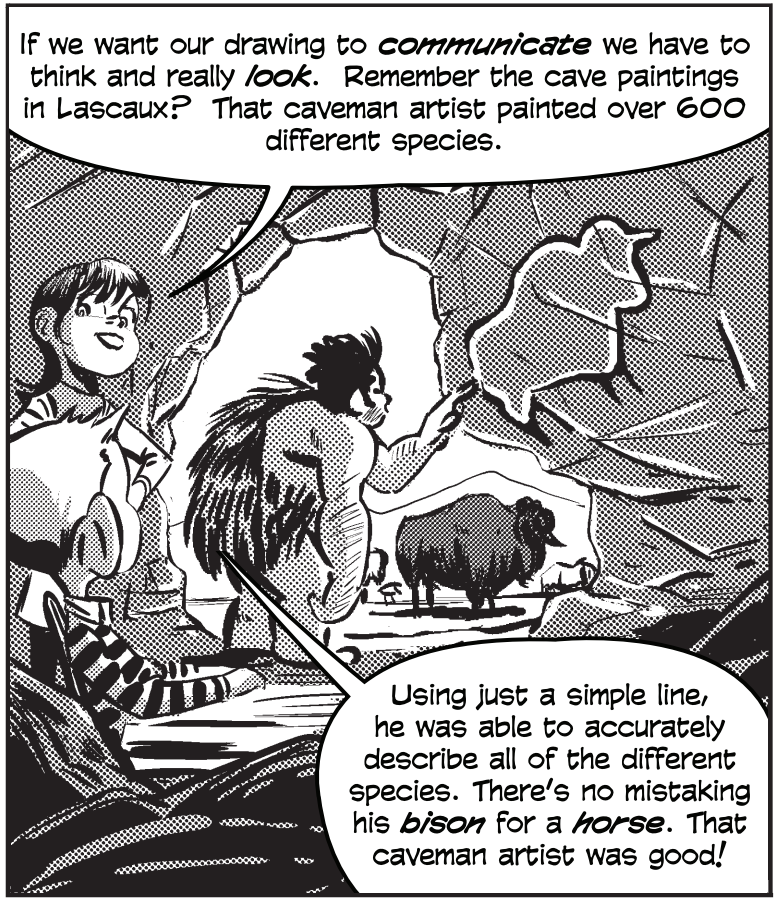

But how does this help me draw my invention?
Using just a line you can describe recognizable shapes.
Look around you Tuck. These shapes are in everything we see.
Can you see it?
Okay.
You have to really look.
The window frame is a rectangle.
The picture is an oval.
And the vase is an upside down triangle!
Now that I'm looking, I'm starting to see that I have the tools to draw anything!
Buildings
Planets
Cars
People
Rockets
Bikes
My drawings are only limited to my imagination!
I'm ready to draw my zip line.
Scribble Scribble Scribble Scribble
Voilà
It's done!

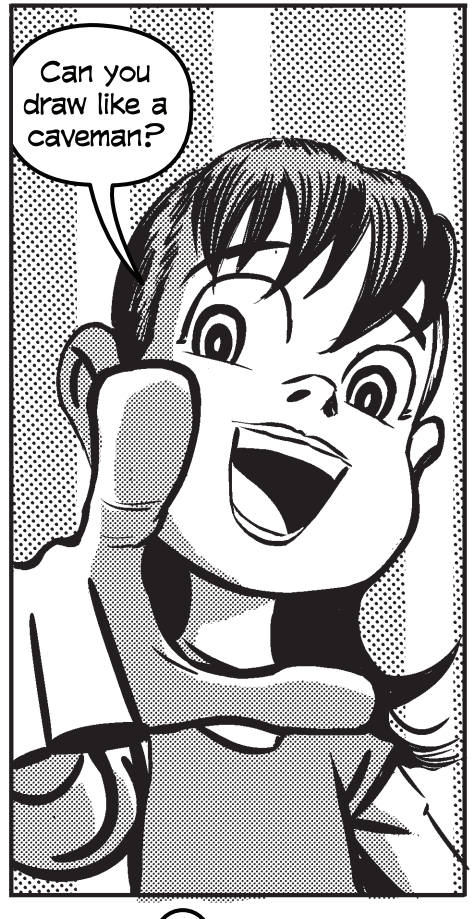
"Now *you're* just getting *started*. What's your *big idea* for an *invention?* *Draw it!* Break down the *shapes* of what you *see* in your head and *visually record it* on the *paper* with your *pencil*."

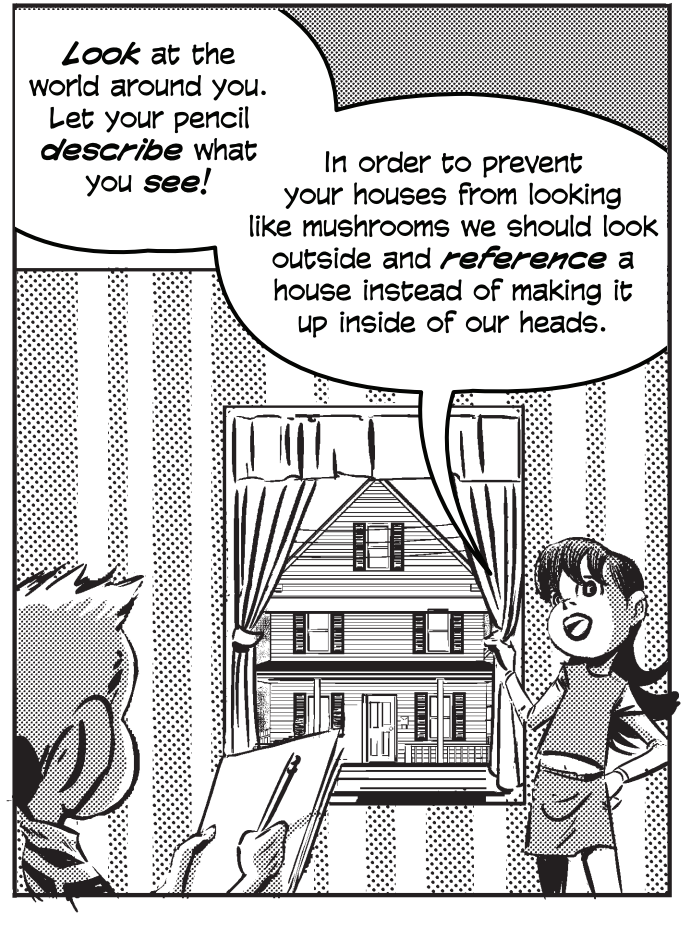

This is your *zip line*?
Isn't it great?

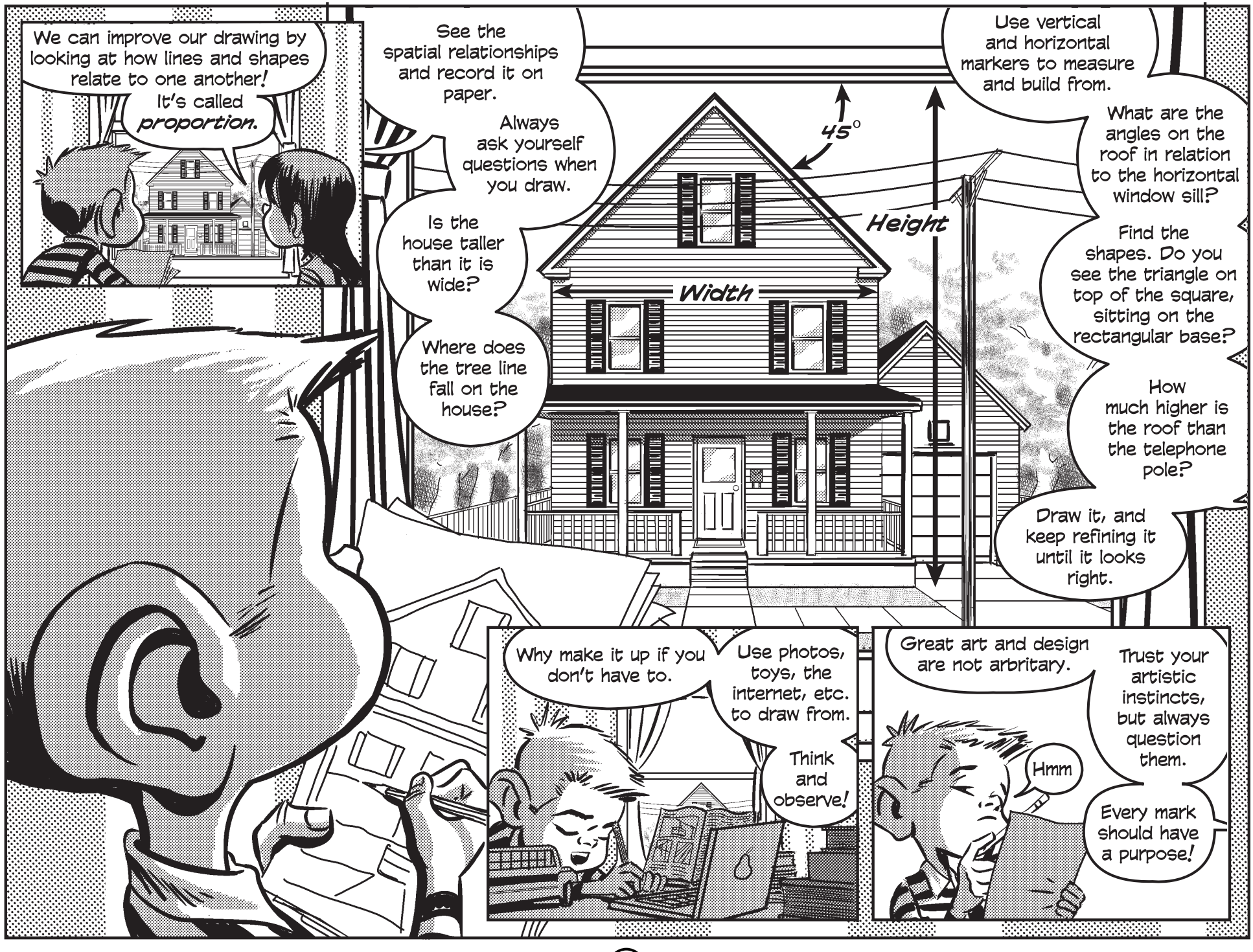

This looks like a *mushroom* at a *monster* truck rally!


Are you blind? That's my *zip line*!
I'm guessing it's a *monster truck* and a *mush-room*!

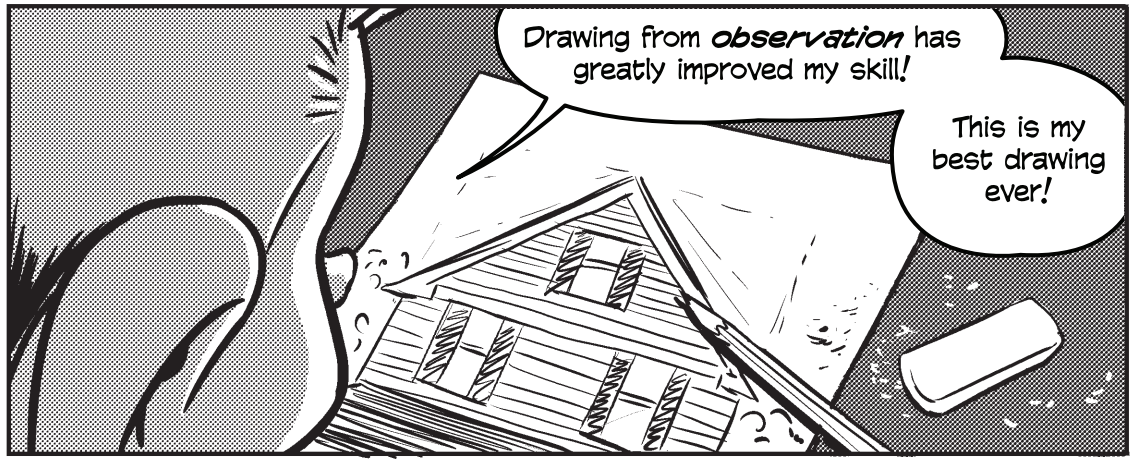

If we want our drawing to *communicate* we have to think and really *look*. Remember the cave paintings in Lascaux? That caveman artist painted over 600 different species.
Using just a simple line, he was able to accurately describe all of the different species. There's no mistaking his *bison* for a *horse*. That caveman artist was good!

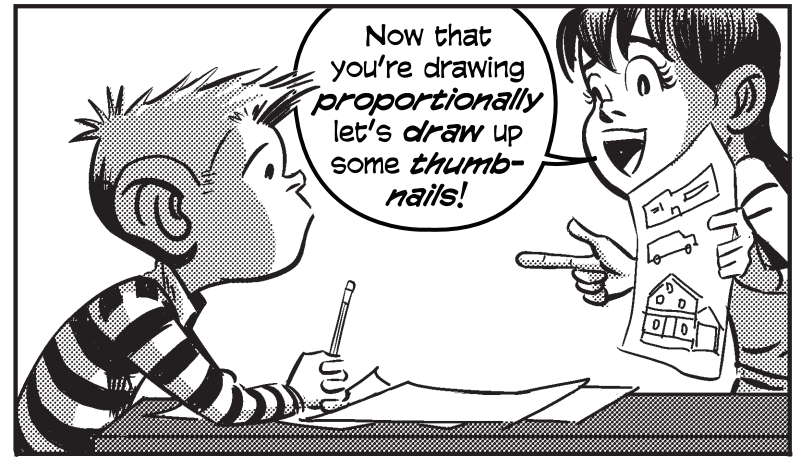

Can you draw like a caveman?

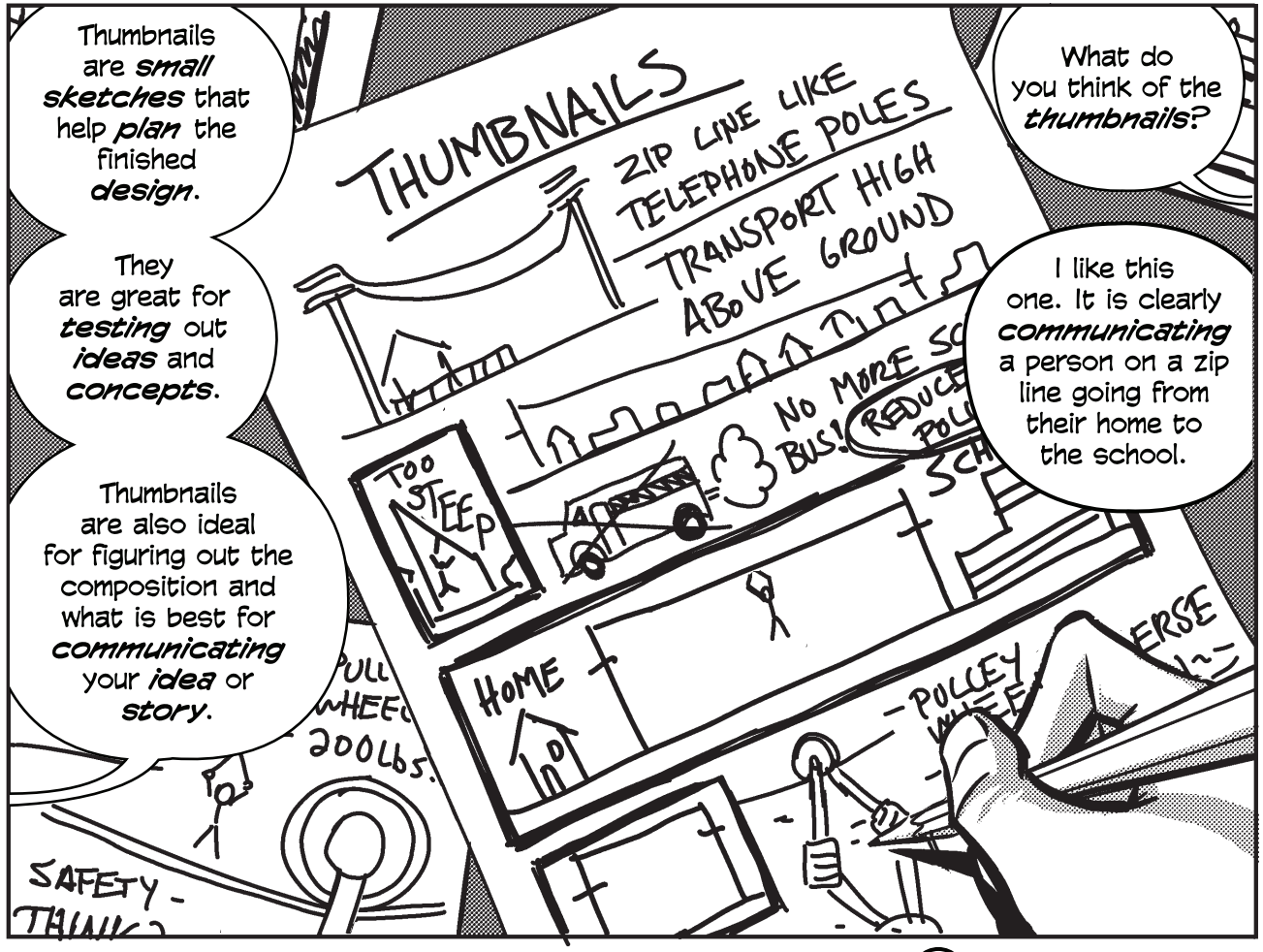

Look at the world around you. Let your pencil *describe* what you *see*!
In order to prevent your houses from looking like mushrooms we should look outside and *reference* a house instead of making it up inside of our heads.

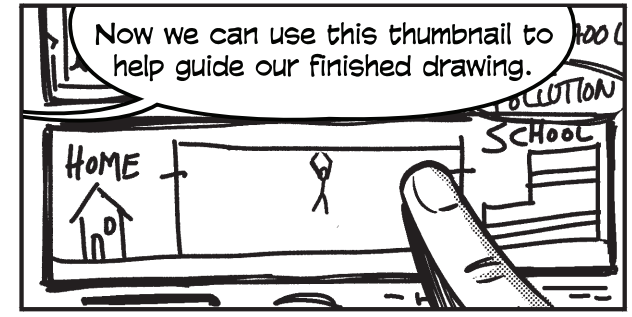

We can improve our drawing by looking at how lines and shapes relate to one another!
It's called proportion.
See the spatial relationships and record it on paper.
Always ask yourself questions when you draw.
Is the house taller than it is wide?
Where does the tree line fall on the house?
45°
Width
Height
Use vertical and horizontal markers to measure and build from.
What are the angles on the roof in relation to the horizontal window sill?
Find the shapes. Do you see the triangle on top of the square, sitting on the rectangular base?
How much higher is the roof than the telephone pole?
Draw it, and keep refining it until it looks right.
Why make it up if you don't have to.
Use photos, toys, the internet, etc. to draw from.
Think and observe!
Great art and design are not arbritary.
Trust your artistic instincts, but always question them.
Hmm
Every mark should have a purpose!

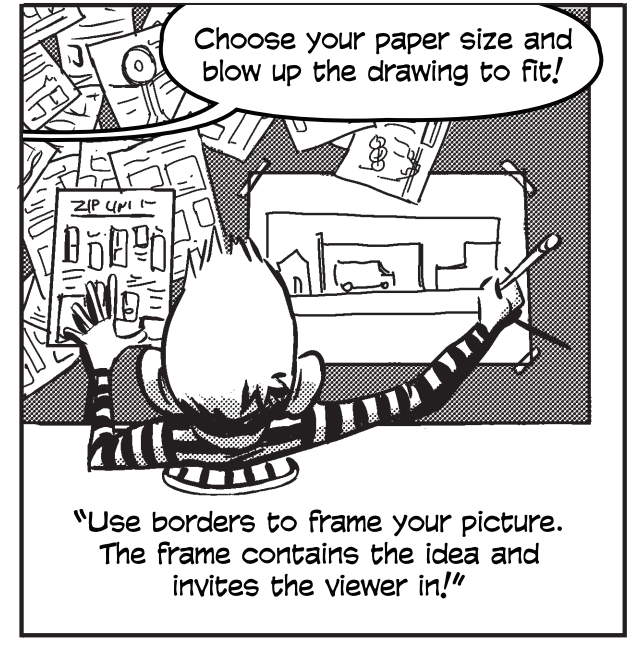
"It's your turn to ***draw*** from ***life!*** Look around you and try, as ***accurately*** as possible, to draw what you see. ***Don't*** make anything up for this one. ***Copy*** and ***reference*** anything at your disposal. Look at books, pictures on the internet, and most ***importantly*** look at the ***world*** around you. Ask yourself, why you're making each mark, what purpose does it serve?"

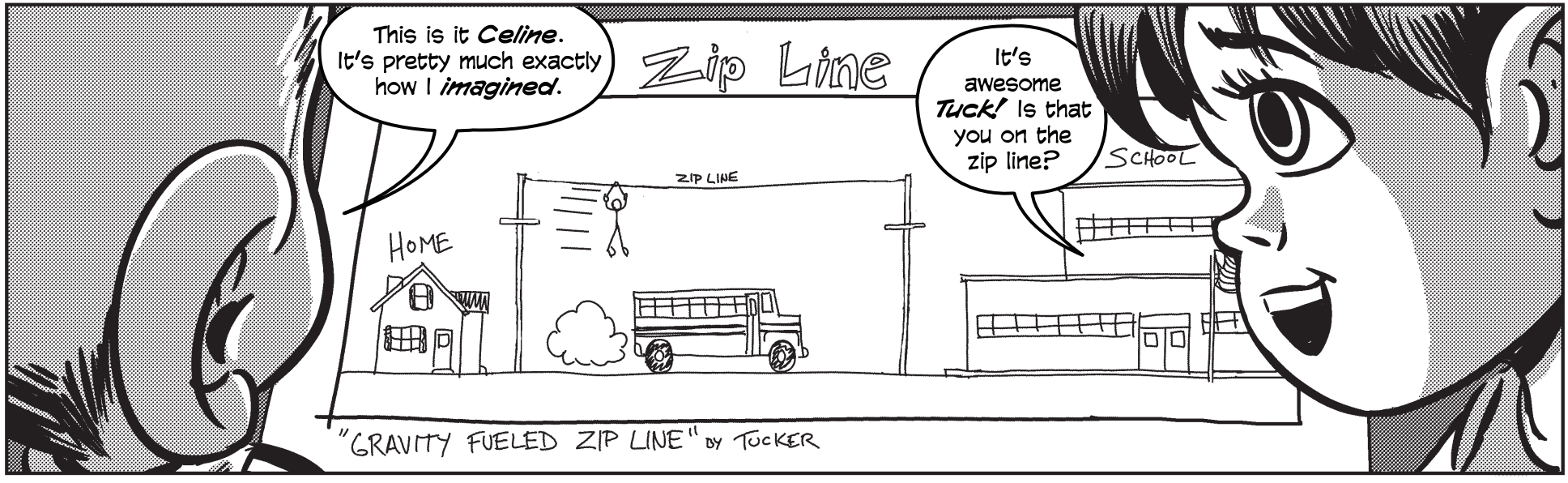

Drawing from *observation* has greatly improved my skill!
This is my best drawing ever!


Now that you're drawing *proportionally* let's *draw* up some *thumbnails*!

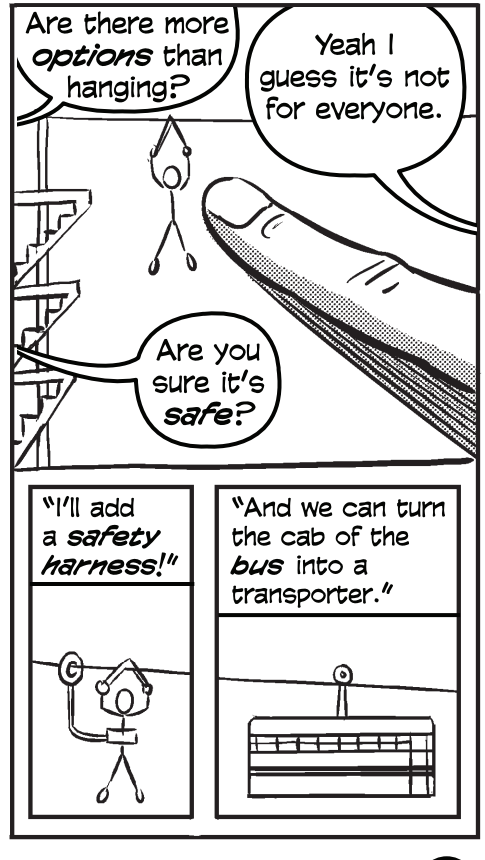

Thumbnails are *small sketches* that help *plan* the finished *design*.
They are great for *testing* out *ideas* and *concepts*.
Thumbnails are also ideal for figuring out the composition and what is best for *communicating* your *idea* or *story*.
THUMBNAILS
ZIP LINE LIKE TELEPHONE POLES
TRANSPORT HIGH ABOVE GROUND
NO MORE BUS!
TOO STEEP
HOME
POLLEY WHEEL
200Lbs.
SAFETY -
What do you think of the *thumbnails*?
I like this one. It is clearly *communicating* a person on a zip line going from their home to the school.

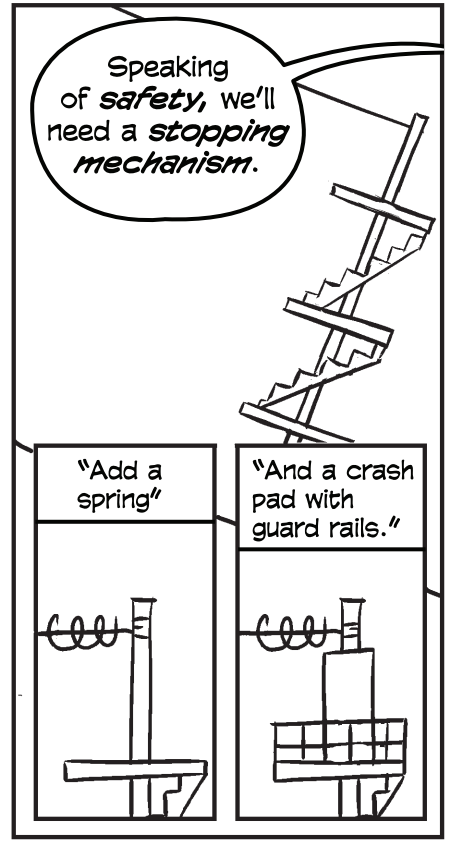

Now we can use this thumbnail to help guide our finished drawing.
HOME
SCHOOL

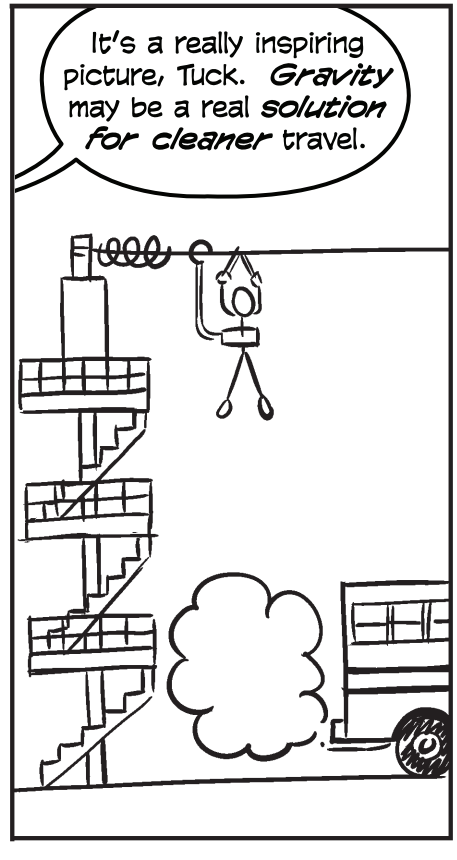

Choose your paper size and blow up the drawing to fit!
"Use borders to frame your picture. The frame contains the idea and invites the viewer in!"

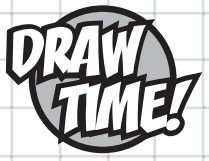

This is it Celine. It's pretty much exactly how I imagined.
Zip Line
It's awesome Tuck! Is that you on the zip line?
ZIP LINE
HOME
SCHOOL
"GRAVITY FUELED ZIP LINE" BY TUCKER


It's so cool how did you get up there?
Good question. I didn't think of that.
Let's try... A staircase?
Hmm, that takes up a lot of land.
A spiral staircase will be a more efficient use of space.

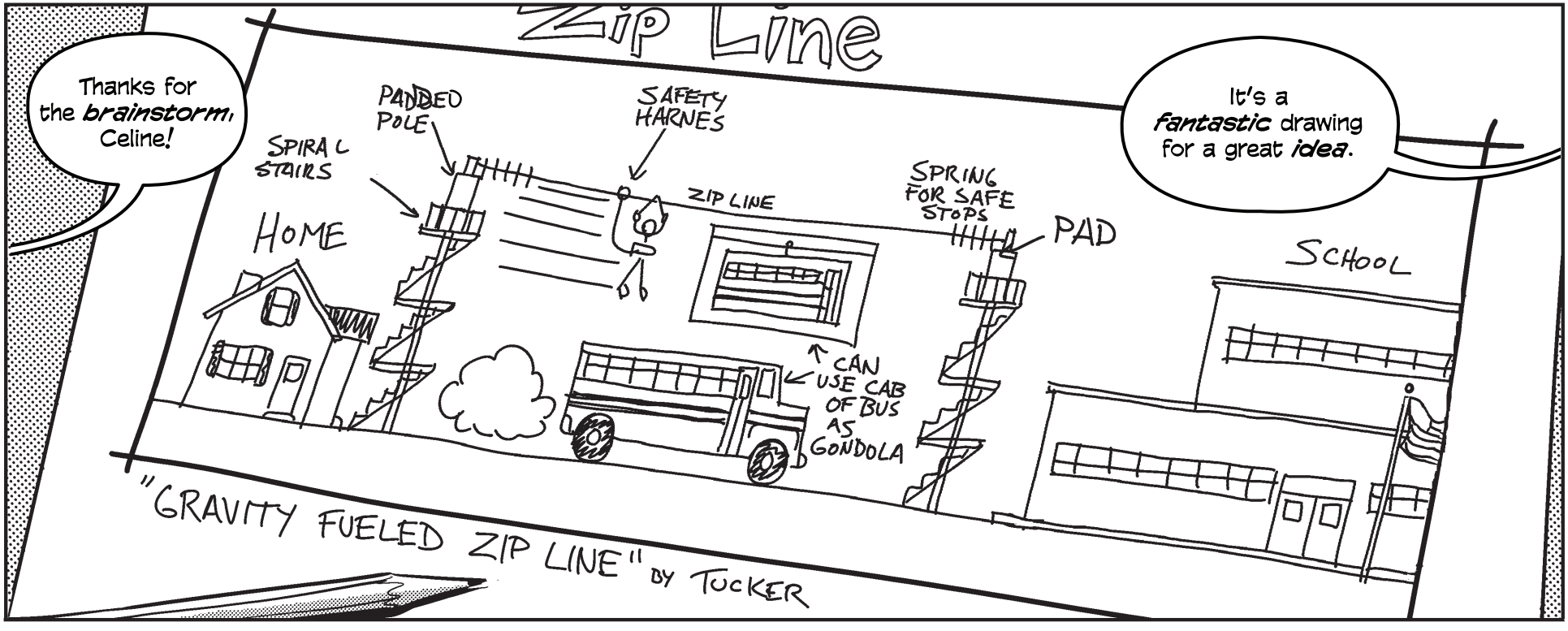

Are there more options than hanging?
Yeah I guess it's not for everyone.
Are you sure it's safe?
"I'll add a safety harness!"
"And we can turn the cab of the bus into a transporter."

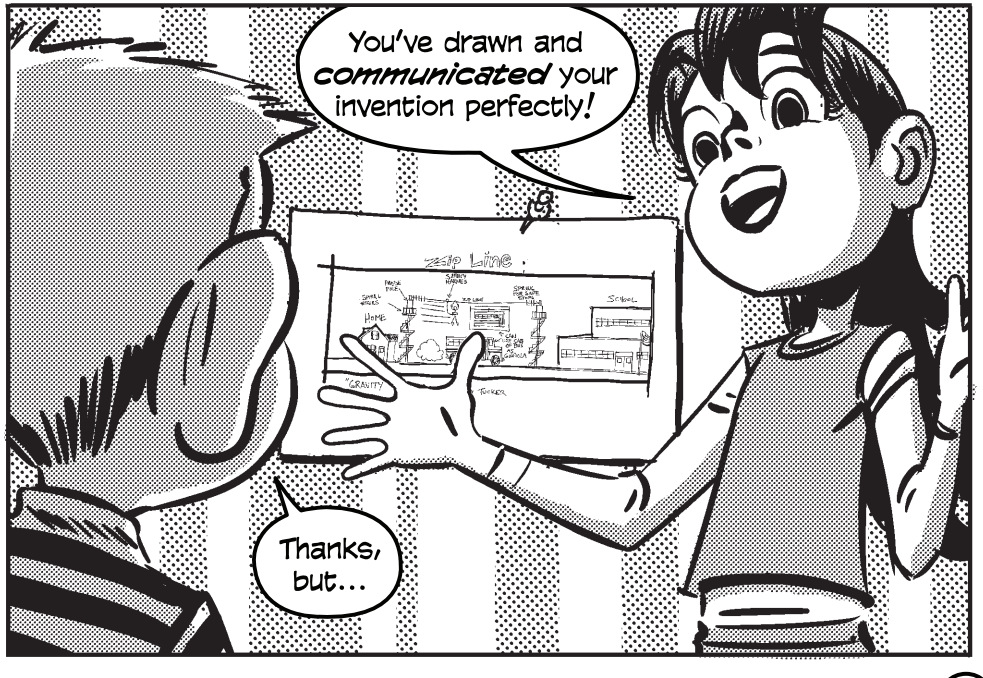

Speaking of safety, we'll need a stopping mechanism.
"Add a spring"
"And a crash pad with guard rails."

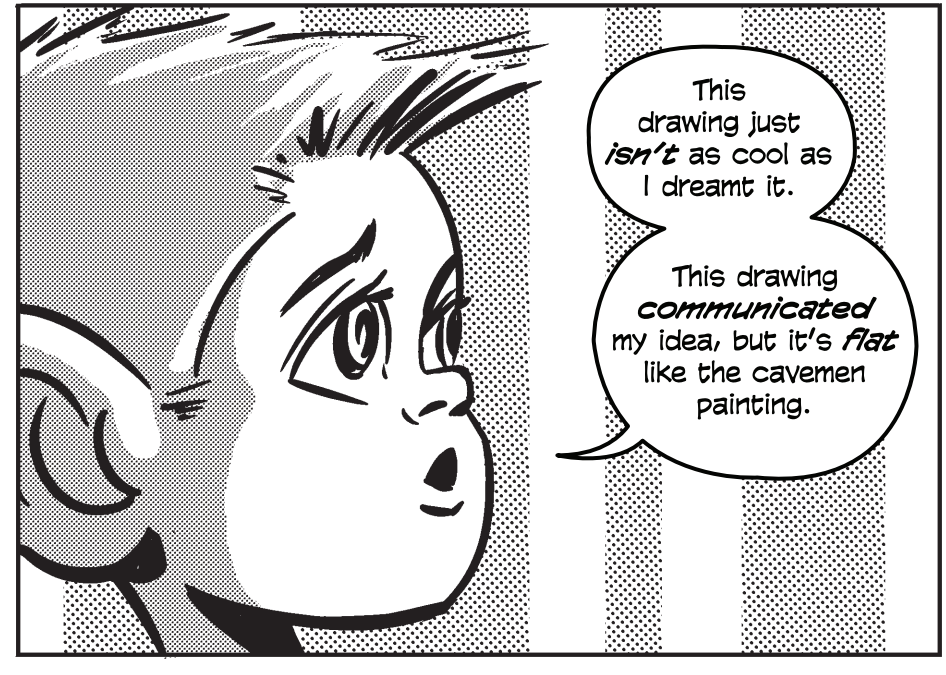

It's a really inspiring picture, Tuck. Gravity may be a real solution for cleaner travel.

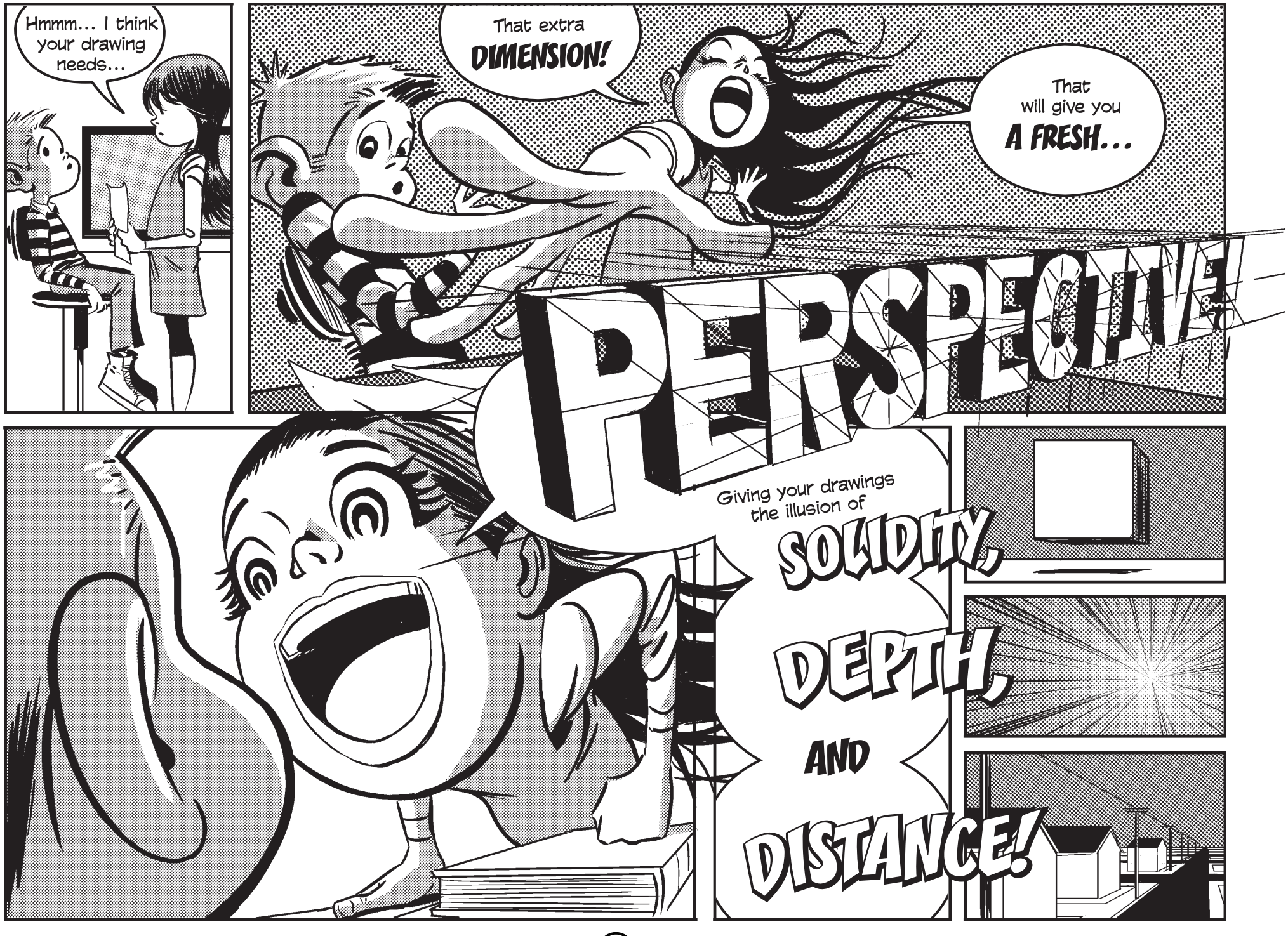


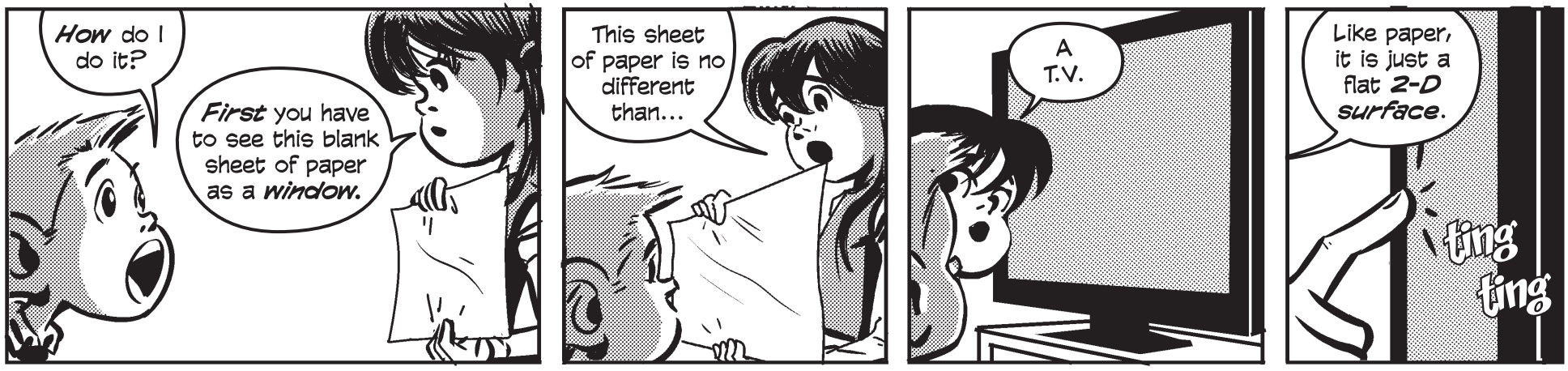
"*Alright,* now it's time for ***you*** to really think about and plan out that big idea. ***Using*** your pencil, generate some ***thumbnails*** in the smaller frames. ***Think*** about the different options for working out your idea. Remember ***thumbnails*** are ***loose*** concept sketches, ***don't*** get carried away with detail. ***Choose*** the best ***thumbnails, refining*** and ***thinking*** to make the finished fully realized drawing of ***your*** invention below!"

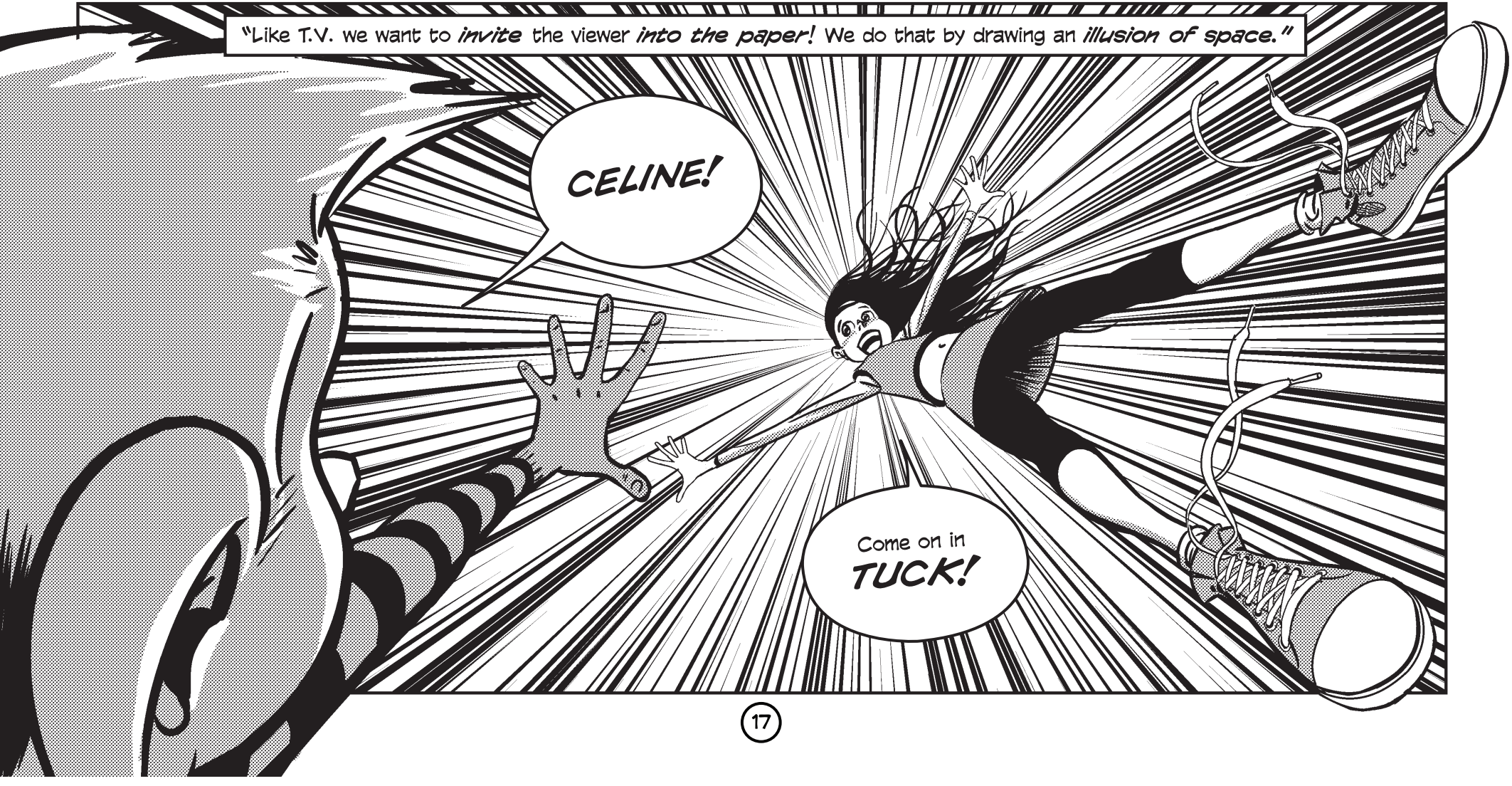

Zip Line
Thanks for the brainstorm, Celine!
PADDED POLE
SAFETY HARNES
SPIRAL STAIRS
ZIP LINE
SPRING FOR SAFE STOPS
HOME
PAD
SCHOOL
CAN USE CAB OF BUS AS GONDOLA
It's a fantastic drawing for a great idea.
"GRAVITY FUELED ZIP LINE" BY TUCKER

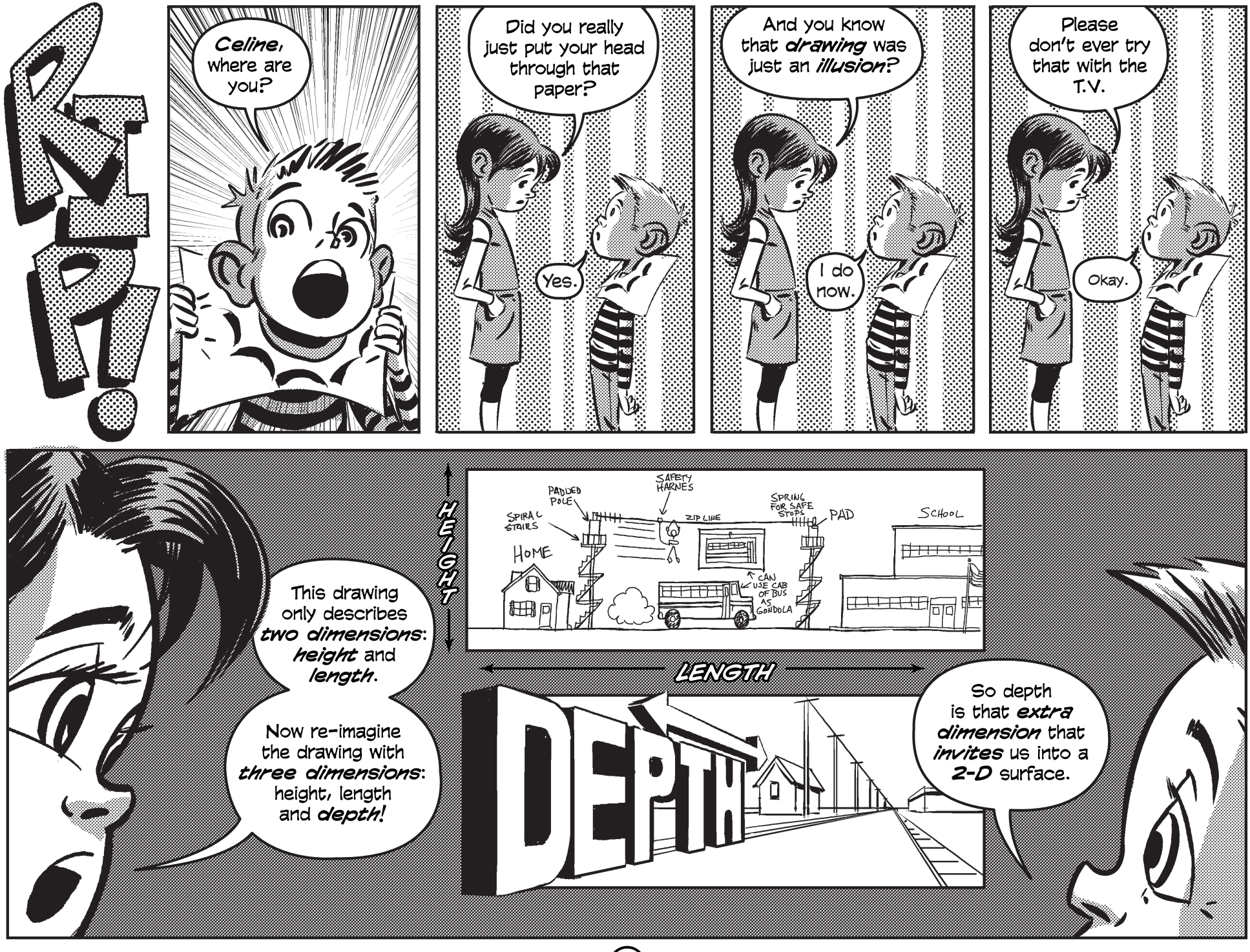

You've drawn and communicated your invention perfectly!
Thanks, but...


This drawing just isn't as cool as I dreamt it.
This drawing communicated my idea, but it's flat like the cavemen painting.


Hmmm... I think your drawing needs...
That extra DIMENSION!
That will give you A FRESH...
PERSPECTIVE!
Giving your drawings the illusion of
SOLIDITY,
DEPTH,
AND
DISTANCE!


How do I do it?
First you have to see this blank sheet of paper as a window.
This sheet of paper is no different than...
A T.V.
Like paper, it is just a flat 2-D surface.
ting ting


"Like T.V. we want to invite the viewer into the paper! We do that by drawing an illusion of space."
CELINE!
Come on in TUCK!


Celine, where are you?
Did you really just put your head through that paper?
Yes.
And you know that drawing was just an illusion?
I do now.
Please don't ever try that with the T.V.
Okay.
This drawing only describes two dimensions: height and length.
Now re-imagine the drawing with three dimensions: height, length and depth!
HEIGHT
LENGTH
DEPTH
PADDED POLE
SAFETY HARNES
SPIRAL STAIRS
ZIP LINE
SPRING FOR SAFE STOPS
PAD
SCHOOL
HOME
CAN USE CAB OF BUS AS GONDOLA
So depth is that extra dimension that invites us into a 2-D surface.

"*Depth* is crucial in *creating* the *illusion* of believable *space* on paper."

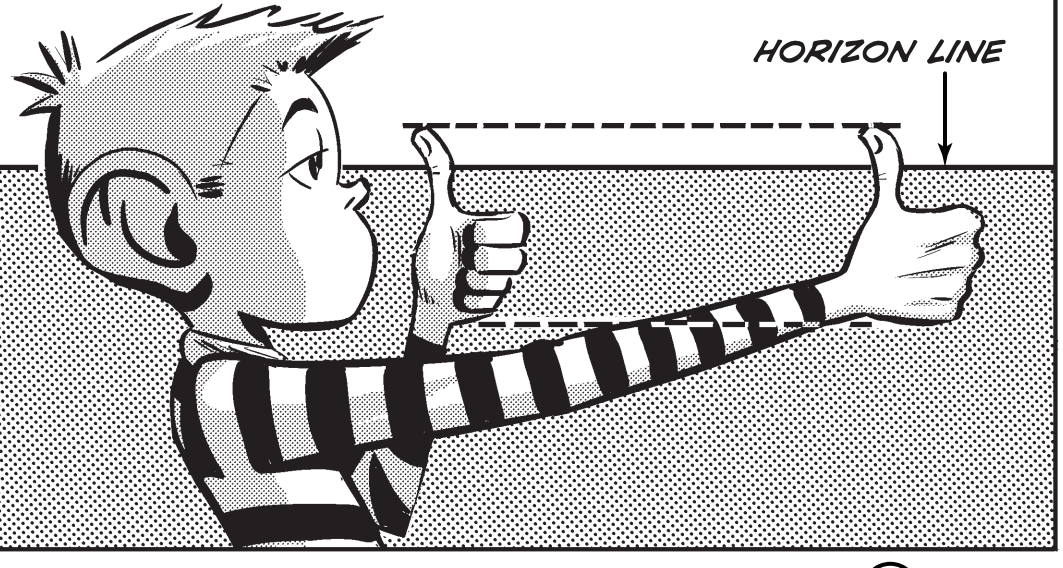
"And artists use *perspective* to draw that *believable space*."

So what *exactly* is *perspective*?

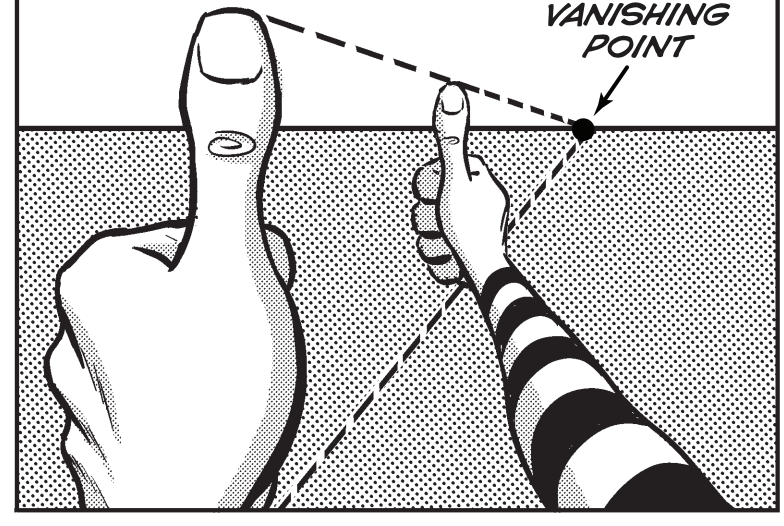
Perspective is a *tool* artists use to accurately *draw objects* as they *appear* in *space*.

How do I *see* it?

"Hold your *thumbs* up at eye level. From my viewpoint your thumbs are the same size. There is *no depth!* Your thumbs are *parallel* to the picture plane. We can illustrate that by drawing parallel lines above and below your hands."



"If we change the *viewpoint* to your *perspective,* the closer thumb is twice the size of the distant thumb. From your viewpoint there is *depth!* The *parallel lines* framing your hands now *converge* at a *vanishing point* on the *horizon line* creating the *illusion of distance*."



Let's give your drawing some ***dimension***.

Start by giving each object ***depth***.

HOME

ZIP LINE

SCHOOL

"First, establish a ***horizon line***. The horizon line is the most important line in perspective. The ***horizon line*** is ***always*** at the ***ARTIST'S eye level***. It is where the ***sky*** meets ***earth***."

SKY

HORIZON LINE

EARTH

"By placing a vanishing point on the horizon line we can draw objects in space correctly and relative to the viewpoint. In this case there is one vanishing point, making it a ***one-point perspective drawing.***"

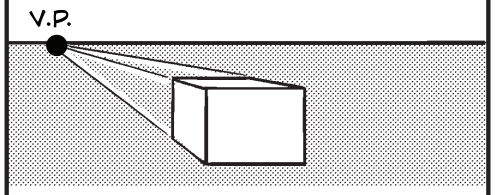
Vanishing points always fall on the horizon line!

"All things get ***smaller*** the ***farther*** they get ***from us***. The goal is to create ***realistic depth*** and ***distance***."

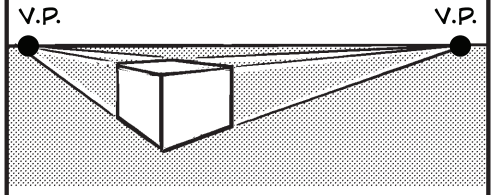
VANISHING POINT

"We can change the angle of the view by adding vanishing points. Two is usually all we need."

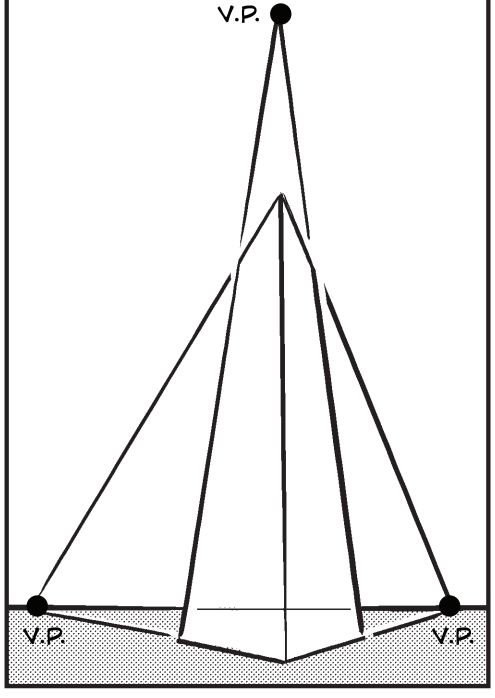
ONE-POINT PERSPECTIVE



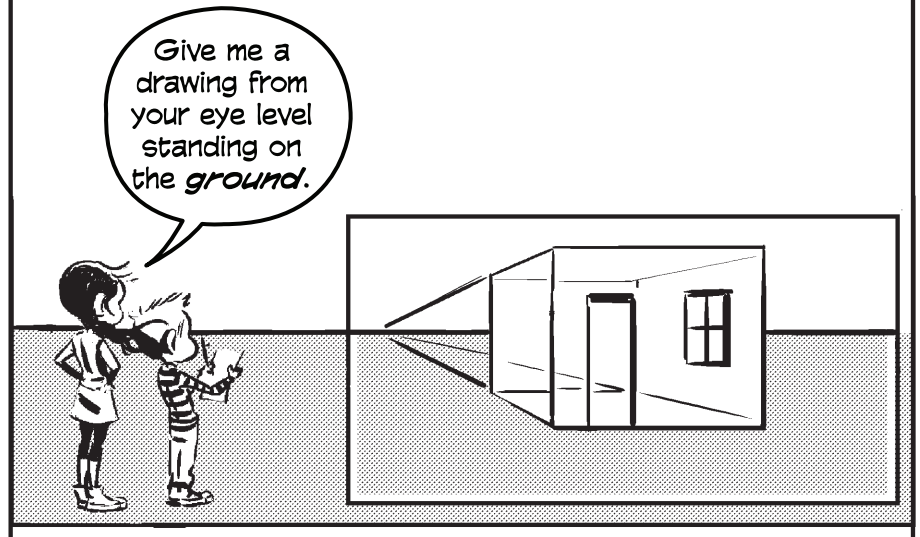
TWO-POINT PERSPECTIVE

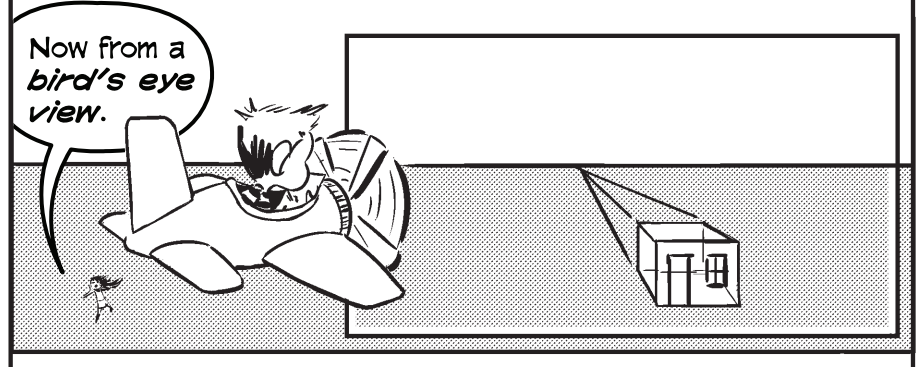


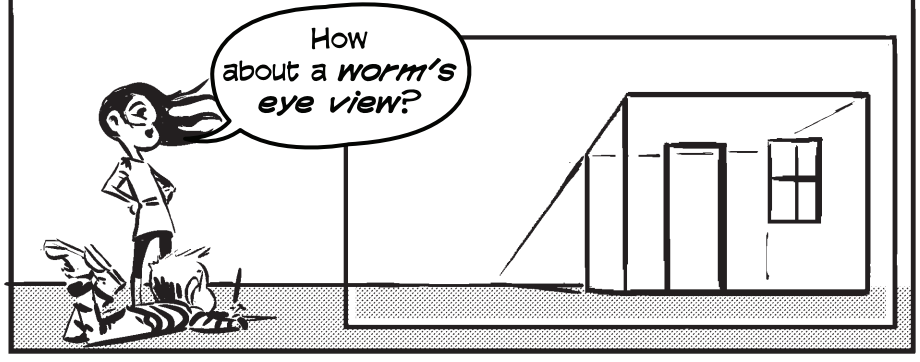
THREE-POINT PERSPECTIVE

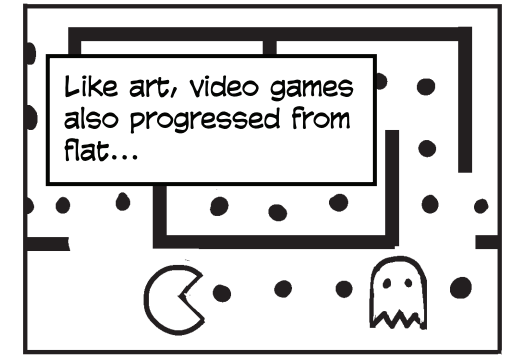


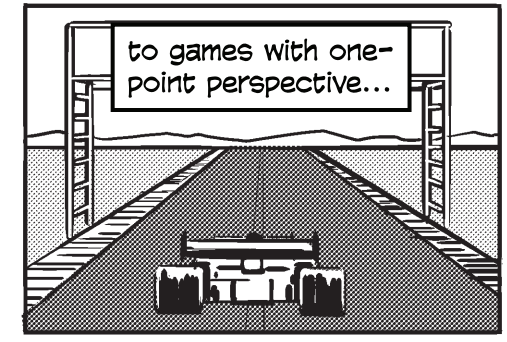
Look at how dramatic the effect is when we move the horizon line (the artist's view point). Like a movie director, you choose the shot that is best for your drawing.

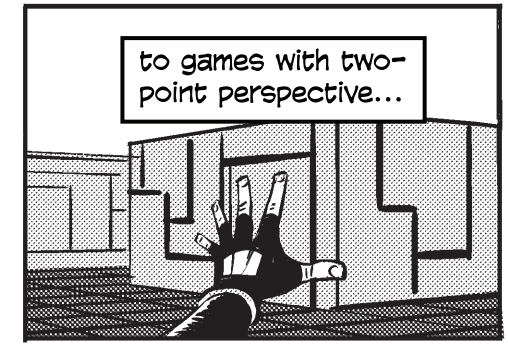


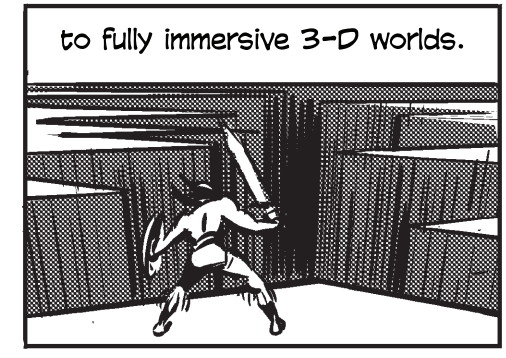












Are you ready to put your drawings into one-point perspective? Perspective drawing is one of the harder skills to master. Follow the steps below to get started. Trace the gray lines as guides for your first try.

1. Draw a horizon line. This creates the viewers eye level.
2. Establish a vanishing point.
3. Draw various squares. From the corners of those squares draw lines back to the vanishing point.
4. Finish forms and erase interior lines that normally would not be seen.

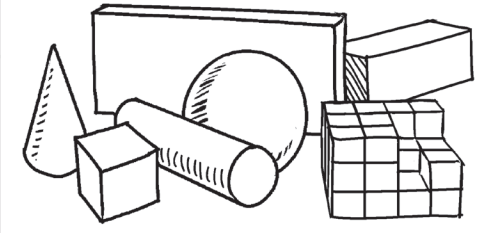
1

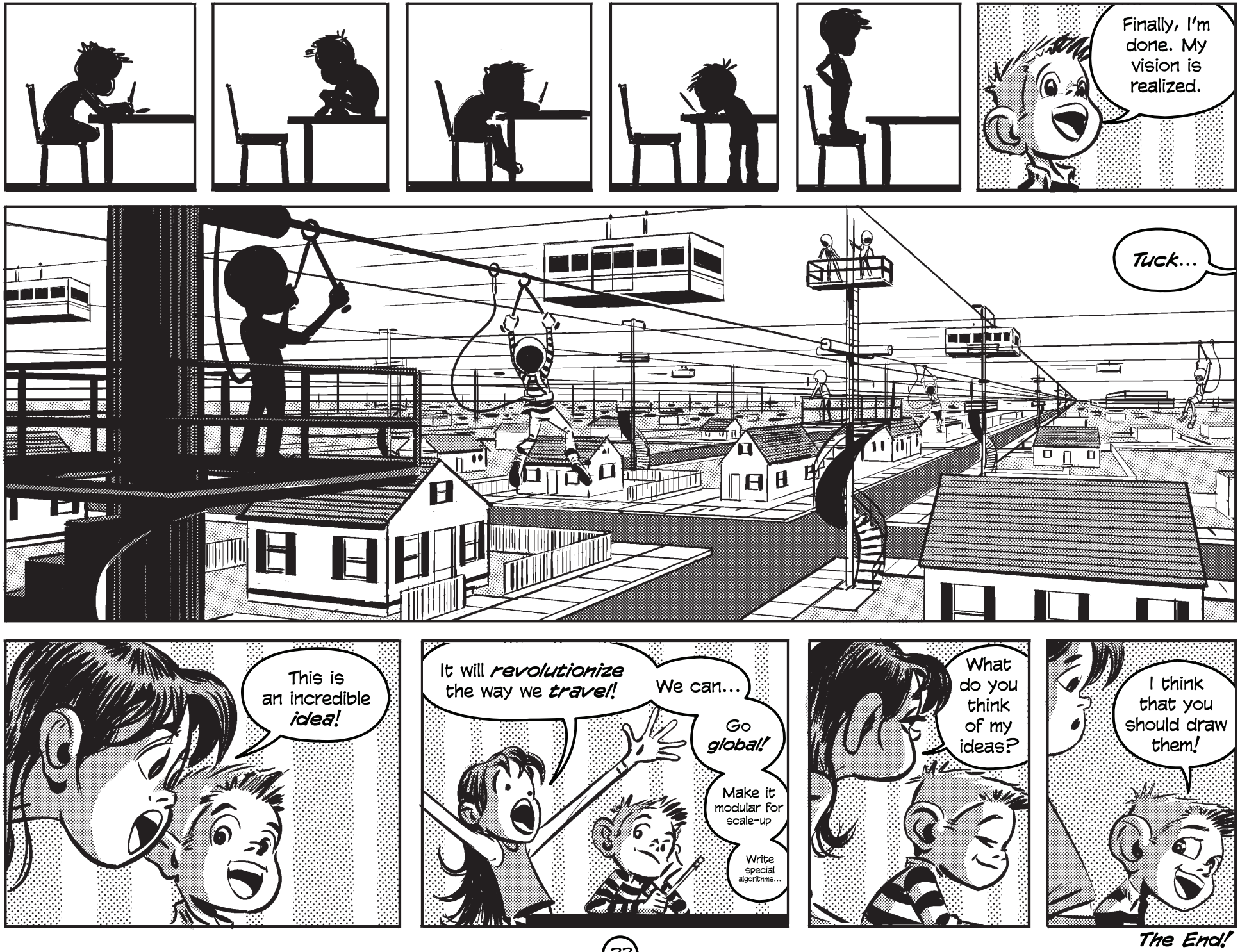
2

3

4

"All objects can be broken down into simple geometric shapes: spheres, cubes, cones, cylinders, or a combination thereof. If you remember this rule and keep in mind how they relate to the horizon line (perspective) you will be able to draw anything."




Finally, I'm done. My vision is realized.
Tuck...
This is an incredible idea!
It will revolutionize the way we travel!
We can...
Go global!
Make it modular for scale-up
Write special algorithms...
What do you think of my ideas?
I think that you should draw them!
The End!

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Contact at inventeams@mit.edu