

Due Date: Wednesday, April. 14, 2021

Reflections on peer editing and creating assignments

I am glad to include this assignment in my portfolio! I went into this week knowing nothing about the difference between sensing learners and intuitive learners. I first found out that I am a sensing learner. I believe this is very accurate. In my mathematics classes, I love visualizing the material in any way that I can and I always do small and specific examples before diving into an abstract or general proof. I see these all as characteristics of a sensing learner.

I decided to choose the story “-And He Built A Crooked House” by Robert A. Heinlein because I personally enjoyed the story and believe that, while it may be challenging for grade ten students, the challenge can be minimized by introducing mathematical or visualization activities to the reading of the story. It also touches on topics that high school students may not be exposed to often, such as dimension and perspective theory.

While creating the questions and activities, I certainly found it easier to come up with activities for other sensing learners. I was able to come up with some art activities and step by step instructions that would help with the visualization of the shapes in the story, which would serve sensing learners well. Coming up with more open-ended questions for intuitive learners became my challenge, as I would certainly prefer a more step by step approach. For intuitive learners, I picked questions which required the students to think about and explain “why” they made the choices they did. Whereas, for sensing learners, I tried to stick with hands on activities and visualization. Instead of reading about the characters building shapes out of Plasticine, the students can play along. I also added in some simple math questions to help the students understand the mathematics presented in the story. For sensing learners, I stuck with specific step-by-step examples, whereas for intuitive learners, I stuck with more general and abstract formulae. I was able to use these ideas to make suggestions on some of my classmates work, as well as give them compliments on where I thought their work really held true to the two different learning styles. I also received some very nice reassurance on my work.

My chosen story and peer editing assignments are presented below:

Due Date: Sunday, Feb. 7, 2021 by 11:59pm

1. **Do this activity BEFORE reading the story “-And He Built a Crooked House”**

Recalling Shapes and Dimension Take a moment to reflect on what it means for a shape to be “2-D”. What about “3-D”? In groups of any size, talk to your classmates about what came to mind.

Here are some guiding ideas for your discussions:

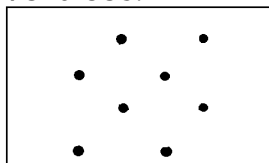
Try drawing:

- A square
- A circle
- A cube
- A sphere

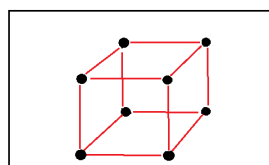
Are these shapes considered “2-D” or “3-D”? What does the “D” stand for?

The Cube You may have drawn a cube in the previous step, but now draw one using the following steps on a separate piece of paper:

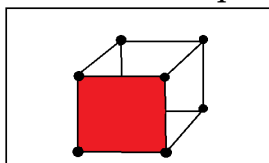
- Draw dots to represent the 8 corners. Take note that these dots are called **vertices**:



- Connect the dots together in the fashion of the cube. Take note that these lines are called **edges**:



- Note that the cube is composed of many “2-D” objects, in this case, squares. We call each square a **face**. Point to the faces on your cube drawing:



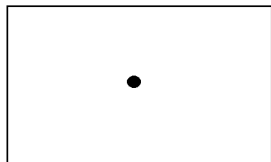
Use what you learnt above to answer the questions about the cube:

- How many **vertices** does the cube have?

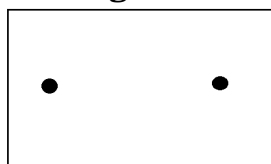
- How many **edges** does the cube have?
- How many **faces** does the cube have?

Dimensions Follow along with the instructions and draw the appropriate edges on each picture:

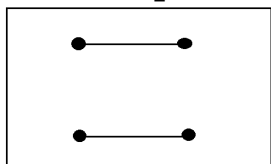
0 dimensions We begin with one vertex. There is nothing to connect here.



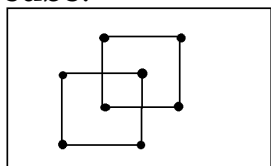
1 dimension Now we have two vertices. Connect them with 1 edge to make a **line segment**:



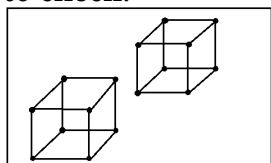
2 dimensions Now we have two line segments. Connect them with 2 edges to create a **square**:

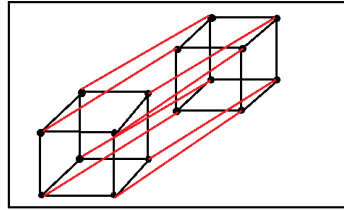


3 dimensions Now we have two squares. Connect them with 4 edges to create a **cube**:

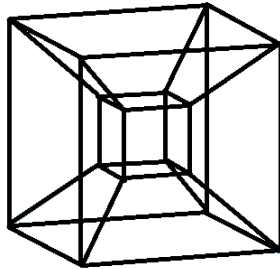


4 dimensions Now we have two cubes. Connect them with 8 edges to create a **hypercube**. This may be difficult, as this shape is most likely unfamiliar to most of us. Try your best first, then you can look at the image on the next page to check.





You have just drawn a representation of a 4-dimensional object on a 2-dimensional piece of paper! This 4-dimensional hypercube is called a **tesseract**. It is usually drawn like this:



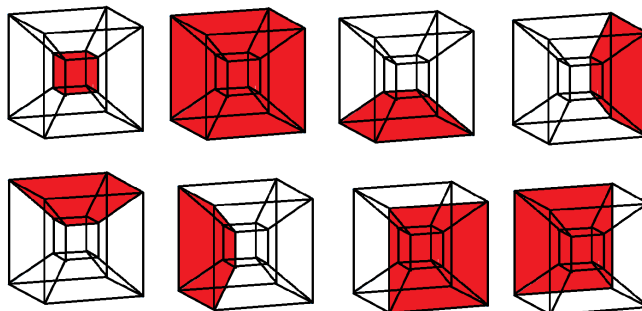
Read “-And He Built A Crooked House” to the break on page 4, then stop and do the next part.

2. Do this activity after reading the description of the tesseract in “-And He Built A Crooked House”

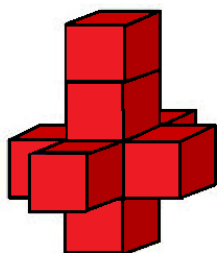
The Tesseract You have just read the descriptions of the three shapes that Teal made for Bailey. They may have been difficult to visualize with only the descriptions in the story. The first shape Teal makes is the hypercube you drew by beginning with two cubes. The second shape that Teal makes is the traditional tesseract shown above. Use the Plasticine and different sized toothpicks provided to make your own tesseract just like Teal.

Tips: Use Plasticine balls for the vertices and the toothpicks for the edges. It is best to make the smaller inner cube first.

Eight Cubes The tesseract is often represented as eight cubes. The images below show the “eight cubes” of the Tesseract. See if you can point to them all on the Tesseract you just made. Note: As Bailey noticed, some of these “cubes” will look more like “crooked cubes” than cubes you are used to seeing.



The third shape Teal makes is this next one, which ends up being his design for Bailey's house. Count the cubes:



Perspective Let's pay closer attention to these "crooked" cubes.

"Yeah, I see 'em. But they still aren't cubes; they're whatchamucallems—prisms. They are not square, they slant." -Bailey

Sometimes we want to represent a 3-dimensional object in only 2-dimensions. Think about the 3-D cubes you have been drawing on 2-D paper!

Try this:

- Do your best drawing of a hallway. Make it seem like the audience is looking down the hallway. How did you go about doing this?
- Think about the world map you are used to seeing. Perhaps you want to find one in the classroom to look at or do a quick google image search for one. Now compare that map to the size accurate version in this article:

Click **HERE**

Or copy and paste into your browser:

<https://www.pri.org/stories/2017-03-20/bostons-public-schools-have-adopted-new-more-accurate-world-map>

How can two maps exist that are so different? Why is it so difficult to represent our world on a flat map?

Now consider Teal's answer to the "crooked cube" question again. Does it connect to the idea of the hallways or the map?

"That's just the way you look at it, in perspective. If you drew a picture of a cube on a piece of paper, the side squares would be slantwise, wouldn't they? That's perspective. When you look at a four-dimensional figure in three dimensions, naturally it looks crooked. But those are all cubes just the same." -Teal

3. After Reading the full story

Nothing While exploring the house in this new and unfamiliar dimension, things get strange. Teal and Bailey look out the third window and see "nothing, nothing at all. What color is nothing? Don't be silly! What shape is it? Shape is an attribute

of something. It had neither depth nor form. It had not even blackness. It was nothing.”

What did you visualize while reading this part? What would it be like to look at “nothing”? There are no right or wrong answers here.

4. **Homework** Teal is more than just your typical architect. He wants to design a house which has never been designed before: He is an inventor. Take a walk around your room/house/school/neighborhood and find an object you enjoy or find particularly useful. Take a picture of it.

Research when the object was first invented and find 3-5 interesting facts about its debut or progression over time.

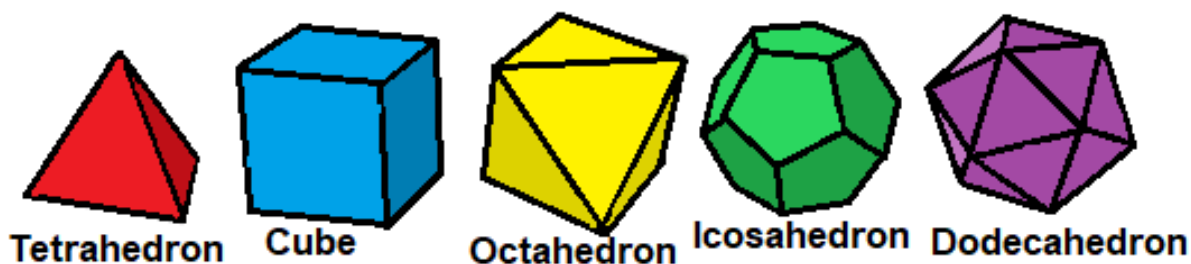
Here are some guiding questions to use if you would like:

- Who invented the object? Where was the object invented?
- What was the public’s reaction to the new invention? Was there any doubt or concern?
- How has the object changed since its first version?

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1. This activity can be done before or after reading “-And He Built a Crooked House”

Platonic Solids Pictured below are five very important 3-dimensional shapes called the **Platonic Solids**. Ancient greek philosopher’s believed that there existed five elements which made up everything (kind of like the 118 elements we have on the periodic table today). They believed that the atoms of each element **Earth, Water, Fire, Air, and The Universe** could be made up of one of the five solids. If you were tasked with matching the solid to the element, how would you go about it? Remember your answer does not have to match how the ancient greeks did it. The important part is providing your reasoning in the “why” column. Think creatively!

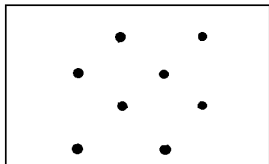


Solid	Element	Why?
Tetrahedron		.
Octahedron		
Cube		
Icosahedron		
Dodecahedron		

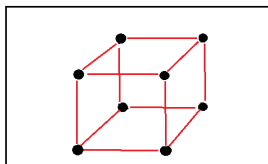
Pick one of the platonic solids and do some research about it. Share 3-5 interesting facts about your solid of choice. They could be mathematical facts, historical facts, whatever interests you. Find a classmate that chose a different solid than you. Take turns teaching each other about your solid.

Here are some definitions to keep in mind, as they will most likely come up during your research:

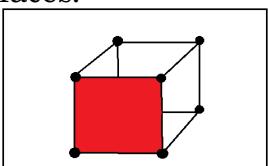
Vertices: The corners of the solids are often represented as dots called vertices.



Edges The line segments used to connect the vertices are called edges.



Faces The 2-dimensional shapes that make up the sides of the solids are called faces.



Exponents Here we look at some shapes in different dimensions. Take a minute and notice how each shape helps build the next one. Do you notice any patterns?

0 dimensions Vertex	1 dimension Line Segment	2 dimensions Square	3 dimensions Cube

(figure 1)

Let's do some calculations:

Imagine we have a line segment of length 2 this time:

0 dimensions Vertex	1 dimension Line Segment	2 dimensions Square	3 dimensions Cube

Notice:



To make a line segment of length 2, we needed $2^1 = 2$ line segments.

To make a square of height and width of length 2, we needed $2^2 = 4$ squares.

To make a cube of height, width, and depth of length 2, we needed $2^3 = 8$ cubes.

Take a minute to think about the pattern (We just need to take our desired length and use the dimension as the exponent).

Do the pictures and calculations for a line segment of length 3: (Hint: your cube should look like a rubik's cube)

			
0 dimensions Vertex	1 dimension Line Segment	2 dimensions Square	3 dimensions Cube

$3^1 =$ line segments.
 $3^2 =$ squares.
 $3^3 =$ cubes.

Now do the calculations for length 4. There is no need to draw pictures unless you would like to.

More Dimensions When doing mathematics, we are allowed to use numbers greater than 3 as exponents. Calculate these:

$2^4 = 2 \times 2 \times 2 \times 2 =$
 $2^5 =$
 $3^4 =$
 $3^5 =$
 $3^6 =$

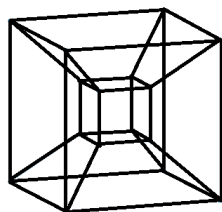
We can calculate this information using our knowledge of exponents, but why does everything start to break down when we try to draw in more than 3 dimensions?

2. If you haven't already, make sure you have at least read to the break on page 4 of "And He Built a Crooked House"

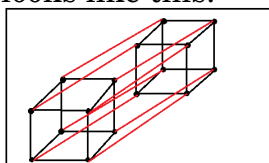
Define a House The story begins by Teal asking Bailey "What is a house?" Teal is not satisfied by Bailey's response "speaking in broad terms, I've always regarded a house as a gadget to keep off the rain." How would you have answered Teal's question?

The Tesseract You may have decided that the reason our drawings begin to break down after 3-dimensions is because we do not have a 4-dimensional shape to use, like how we had the line segment, square, and cube -There must be something more, right!
Stop and think about if this could be true.

There actually is a 4-dimensional equivalent. It is called **the tesseract**:



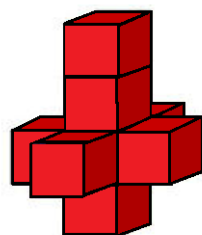
The picture above is the second shape that Teal makes for Bailey. The first one looks like this:



How does this picture continue the pattern you noticed from the images in figure 1?

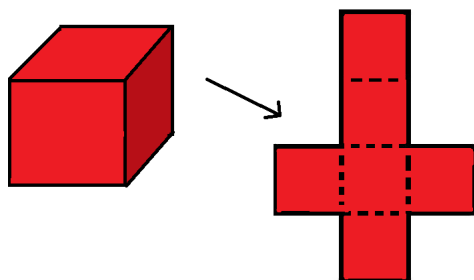
Examine these two pictures of tesseracts. How are they both the same shape?

The third shape that teal makes, which becomes the final design plan for Bailey's house is this:



How is this third shape related to our tesseract?

Hint: Below is an image of an unfolded cube. You may notice a pattern or relationship:



3. Read the full story, if you haven't already, before doing the next parts

Nothing "To speak of a thing, one has to speak of a thing that exists" - Parmenides (5th century BC)

Reread this part of the story below:

“Teal lifted the blind a few inches. He saw nothing, and raised it a little more—still nothing. Slowly he raised it until the window was fully exposed. They gazed out at—nothing.

nothing, nothing at all. What color is nothing? Don’t be silly! What shape is it? Shape is an attribute of something. It had neither depth nor form. It had not even blackness. It was nothing.”

How does this passage from our 1941 story relate to the quote above from ancient Greece? Do you think Teal had a hard time describing “nothing”?

It took a long time for the number zero to be accepted as a part of our number system -since it is a “thing” representing “nothing”. In fact, ancient mathematicians would often leave a blank space in their work rather than write a zero!

Watch the video below. Click: [HERE](#)

Or copy and paste into your browser:

<https://www.youtube.com/watch?v=9Y7gAzTMdMA&t=11s>

Why do you think it took so long for zero to be accepted? Why do you think it is a useful number for us to have?

4. **Homework** Teal is more than just your typical architect. He wants to design a house which has never been designed before: He is an innovator. Think about something important in your life or our world. It could be an object, a law, a system, a common idea. Think about how you would change or improve upon it to make it better. Write a short paragraph about what it is you would change and, most importantly, how/why you would change it.

—And He Built a Crooked House

by Robert A. Heinlein

Americans are considered crazy anywhere in the world.

They will usually concede a basis for the accusation but point to California as the focus of the infection. Californians stoutly maintain that their bad reputation is derived solely from the acts of the inhabitants of Los Angeles County. Angelenos will, when pressed, admit the charge but explain hastily, "It's Hollywood. It's not our fault—we didn't ask for it; Hollywood just grew."

The people in Hollywood don't care; they glory in it. If you are interested, they will drive you up Laurel Canyon "—where we keep the violent cases." The Canyonites—the brown-legged women, the trunks-clad men constantly busy building and rebuilding their slap-happy unfinished houses—regard with faint contempt the dull creatures who live down in the flats, and treasure in their hearts the secret knowledge that they, and only they, know how to live.

Lookout Mountain Avenue is the name of a side canyon which twists up from Laurel Canyon. The other Canyonites don't like to have it mentioned; after all, one must draw the line somewhere!

High up on Lookout Mountain at number 8775, across the street from the Hermit—the original Hermit of Hollywood—lived Quintus Teal, graduate architect.

Even the architecture of southern California is different. Hot dogs are sold from a structure built like and designated "The Pup." Ice cream cones come from a giant stucco ice cream cone, and neon proclaims "Get the Chili Bowl Habit!" from the roofs of buildings which are indisputably chili bowls. Gasoline, oil, and free road maps are dispensed beneath the wings of tri-motored transport planes, while the certified rest rooms, inspected hourly for your comfort, are located in the cabin of the plane itself. These things may surprise, or amuse, the tourist, but the local residents, who walk bareheaded in the famous California noonday sun, take them as a matter of course.

Quintus Teal regarded the efforts of his colleagues in architecture as faint-hearted, fumbling, and timid.

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"What is a house?" Teal demanded of his friend, Homer Bailey.

"Well—" Bailey admitted cautiously, "speaking in broad terms, I've always regarded a house as a gadget to keep off the rain."

"Nuts! You're as bad as the rest of them."

"I didn't say the definition was complete—"

"Complete! It isn't even in the right direction. From that point of view we might just as well be squatting in caves. But I don't blame you," Teal went on magnanimously, "you're no worse than the lugs you find practicing architecture. Even the Moderns—all they've done is to abandon the Wedding Cake School in favor of the Service Station School, chucked away the gingerbread and slapped on some chromium, but at heart they are as conservative and traditional as a county courthouse. Neutra! Schindler! What have those bums got? What's Frank Lloyd Wright got that I haven't got?"

"Commissions," his friend answered succinctly.

"Huh? Wha' d'ju say?" Teal stumbled slightly in his flow of words, did a slight double take, and recovered himself. "Commissions. Correct. And why? Because I don't think of a house as an upholstered cave; I think of it as a machine for living, a vital process, a live dynamic thing, changing with the mood of the dweller—not a dead, static, oversized coffin. Why should we be held down by the frozen concepts of our ancestors? Any fool with a little smattering of descriptive geometry can design a house in the ordinary way. Is the static geometry of Euclid the only mathematics? Are we to completely disregard the Picard-Vessiot theory? How about modular system?—to say nothing of the

rich suggestions of stereochemistry. Isn't there a place in architecture for transformation, for homomorphology, for actional structures?"

"Blessed if I know," answered Bailey. "You might just as well be talking about the fourth dimension for all it means to me."

"And why not? Why should we limit ourselves to the—Say!" He interrupted himself and stared into distances. "Homer, I think you've really got something. After all, why not? Think of the infinite richness of articulation and relationship in four dimensions. What a house, what a house—" He stood quite still, his pale bulging eyes blinking thoughtfully.

Bailey reached up and shook his arm. "Snap out of it. What the hell are you talking about, four dimensions? Time is the fourth dimension; you can't drive nails into that."

Teal shrugged him off. "Sure. Sure. Time is a fourth dimension, but I'm thinking about a fourth spatial dimension, like length, breadth, and thickness. For economy of materials and convenience of arrangement you couldn't beat it. To say nothing of the saving of ground space—you could put an eight-room house on the land now occupied by a one-room house. Like a tesseract—"

"What's a tesseract?"

"Didn't you go to school? A tesseract is a hypercube, a square figure with four dimensions to it, like a cube has three, and a square has two. Here, I'll show you." Teal dashed out into the kitchen of his apartment and returned with a box of toothpicks which he spilled on the table between them, brushing glasses and a nearly empty Holland gin bottle carelessly aside. "I'll need some plasticine. I had some around here last week." He burrowed into a drawer of the littered desk which crowded one corner of his dining room and emerged with a lump of oily sculptor's clay. "Here's some."

"What are you going to do?"

"I'll show you." Teal rapidly pinched off small masses of the clay and rolled them into pea-sized balls. He stuck toothpicks into four of these and hooked them together into a square. "There! That's a square."

"Obviously."

"Another one like it, four more toothpicks, and we make a cube." The toothpicks were now arranged in the framework of a square box, a cube, with the pellets of clay holding the corners together. "Now we make another cube just like the first one, and the two of them will be two sides of the tesseract."

Bailey started to help him roll the little balls of clay for the second cube, but became diverted by the sensuous feel of the docile clay and started working and shaping it with his fingers.

"Look," he said, holding up his effort, a tiny figurine, "Gypsy Rose Lee."

"Looks more like Gargantua; she ought to sue you. Now pay attention. You open up one corner of the first cube, interlock the second cube at the corner, and then close the corner. Then take eight more toothpicks and join the bottom of the first cube to the bottom of the second, on a slant, and the top of the first to the top of the second, the same way." This he did rapidly, while he talked.

"What's that supposed to be?" Bailey demanded suspiciously.

"That's a tesseract, eight cubes forming the sides of a hypercube in four dimensions."

"It looks more like a cat's cradle to me. You've only got two cubes there anyhow. Where are the other six?"

"Use your imagination, man. Consider the top of the first cube in relation to the top of the second; that's cube number three. Then the two bottom squares, then the front faces of each cube, the back faces, the right hand, the left hand—eight cubes." He pointed them out.

"Yeah, I see 'em. But they still aren't cubes; they're whatchamacallems—prisms. They are not square, they slant."

"That's just the way you look at it, in perspective. If you drew a picture of a cube on a piece of paper, the side squares would be slantwise, wouldn't they? That's perspective. When you look at a four-dimensional figure in three dimensions, naturally it looks crooked. But those are all cubes just

the same."

"Maybe they are to you, brother, but they still look crooked to me."

Teal ignored the objections and went on. "Now consider this as the framework of an eight-room house; there's one room on the ground floor—that's for service, utilities, and garage. There are six rooms opening off it on the next floor, living room, dining room, bath, bedrooms, and so forth. And up at the top, completely enclosed and with windows on four sides, is your study. There! How do you like it?"

"Seems to me you have the bathtub hanging out of the living room ceiling. Those rooms are interlaced like an octopus."

"Only in perspective, only in perspective. Here, I'll do it another way so you can see it." This time Teal made a cube of toothpicks, then made a second of halves of toothpicks, and set it exactly in the center of the first by attaching the corners of the small cube to the large cube by short lengths of toothpick.

"Now—the big cube is your ground floor, the little cube inside is your study on the top floor. The six cubes joining them are the living rooms. See?"

Bailey studied the figure, then shook his head. "I still don't see but two cubes, a big one and a little one. Those other six things, they look like pyramids this time instead of prisms, but they still aren't cubes."

"Certainly, certainly, you are seeing them in different perspective. Can't you see that?"

"Well, maybe. But that room on the inside, there. It's completely surrounded by the thingamujigs. I thought you said it had windows on four sides."

"It has—it just looks like it was surrounded. That's the grand feature about a tesseract house, complete outside exposure for every room, yet every wall serves two rooms and an eight-room house requires only a one-room foundation. It's revolutionary."

"That's putting it mildly. You're crazy, bud; you can't build a house like that. That inside room is on the inside, and there she stays."

Teal looked at his friend in controlled exasperation. "It's guys like you that keep architecture in its infancy. How many square sides has a cube?"

"Six."

"How many of them are inside?"

"Why, none of 'em. They're all on the outside."

"All right. Now listen—a tesseract has eight cubical sides, all on the outside. Now watch me. I'm going to open up this tesseract like you can open up a cubical pasteboard box, until it's flat. That way you'll be able to see all eight of the cubes." Working very rapidly he constructed four cubes, piling one on top of the other in an unsteady tower. He then built out four more cubes from the four exposed faces of the second cube in the pile. The structure swayed a little under the loose coupling of the clay pellets, but it stood, eight cubes in an inverted cross, a double cross, as the four additional cubes stuck out in four directions. "Do you see it now? It rests on the ground floor room, the next six cubes are the living rooms, and there is your study, up at the top."

Bailey regarded it with more approval than he had the other figures. "At least I can understand it. You say that is a tesseract, too?"

"That is a tesseract unfolded in three dimensions. To put it back together you tuck the top cube onto the bottom cube, fold those side cubes in till they meet the top cube and there you are. You do all this folding through a fourth dimension of course; you don't distort any of the cubes, or fold them into each other."

Bailey studied the wobbly framework further. "Look here," he said at last, "why don't you forget about folding this thing up through a fourth dimension—you can't anyway—and build a house like this?"

"What do you mean, I can't? It's a simple mathematical problem—"

"Take is easy, son. It may be simple in mathematics, but you could never get your plans approved for construction. There isn't any fourth dimension; forget it. But this kind of a house—it might have some advantages."

Checked, Teal studied the model. "Hm-m-m—Maybe you got something. We could have the same number of rooms, and we'd save the same amount of ground space. Yes, and we would set that middle cross-shaped floor northeast, southwest, and so forth, so that every room would get sunlight all day long. That central axis lends itself nicely to central heating. We'll put the dining room on the northeast and the kitchen on the southeast, with big view windows in every room. Okay, Homer, I'll do it! Where do you want it built?"

"Wait a minute! Wait a minute! I didn't say you were going to build it for me—"

"Of course I am. Who else? Your wife wants a new house; this it it."

"But Mrs. Bailey wants a Georgian house—"

"Just an idea she has. Women don't know what they want—"

"Mrs. Bailey does."

"Just some idea an out-of-date architect has put in her head. She drives a new car, doesn't she? She wears the very latest styles—why should she live in an eighteenth century house? This house will be even later than this year's model; it's years in the future. She'll be the talk of the town."

"Well—I'll have to talk to her."

"Nothing of the sort. We'll surprise her with it. Have another drink."

"Anyhow, we can't do anything about it now. Mrs. Bailey and I are driving up to Bakersfield tomorrow. The company's bringing in a couple of wells tomorrow."

"Nonsense. That's just the opportunity we want. It will be a surprise for her when you get back. You can just write me a check right now, and your worries are over."

"I oughtn't to do anything like this without consulting her. She won't like it."

"Say, who wears the pants in your family anyhow?"

The check was signed about halfway down the second bottle.

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Things are done fast in southern California. Ordinary houses there are usually built in a month's time. Under Teal's impassioned heckling the tesseract house climbed dizzily skyward in days rather than weeks, and its cross-shaped second story came jutting out at the four corners of the world. He had some trouble at first with the inspectors over these four projecting rooms but by using strong girders and folding money he had been able to convince them of the soundness of this engineering.

By arrangement, Teal drove up in front of the Bailey residence the morning after their return to town. He improvised on his two-tone horn. Bailey stuck his head out the front door. "Why don't you use the bell?"

"Too slow," answered Teal cheerfully. "I'm a man of action. Is Mrs. Bailey ready? Ah, there you are, Mrs. Bailey! Welcome home, welcome home. Jump in, we've got a surprise for you!"

"You know Teal, my dear," Bailey put in uncomfortably.

Mrs. Bailey sniffed. "I know him. We'll go in our own car, Homer."

"Certainly, my dear."

"Good idea," Teal agreed; "I've got more power than mine; we'll get there faster. I'll drive, I know the way." He took the keys from Bailey, slid into the driver's seat, and had the engine started before Mrs. Bailey could rally her forces.

"Never have to worry about my driving," he assured Mrs. Bailey, turning his head as he did so, while he shot the powerful car down the avenue and swung onto Sunset Boulevard, "it's a matter of power and control, a dynamic process, just my meat—I've never had a serious accident."

"You won't have but one," she said bitingly. "Will you please keep your eyes on the traffic?"

He attempted to explain to her that a traffic situation was a matter, not of eyesight, but intuitive integration of courses, speeds, and probabilities, but Bailey cut him short. "Where is the house, Quintus?"

"House?" asked Mrs. Bailey suspiciously. "What's this about a house, Homer? Have you been up to something without telling me?"

Teal cut in with his best diplomatic manner. "It certainly is a house, Mrs. Bailey. And what a house! It's a surprise for you from a devoted husband. Just wait till you see it—"

"I shall," she agreed grimly. "What style is it?"

"This house sets a new style. It's later than television, newer than next week. It must be seen to be appreciated. By the way," he went on rapidly, heading off any retort, "did you folks feel the earthquake last night?"

"Earthquake? What earthquake? Homer, was there an earthquake?"

"Just a little one," Teal continued, "about two A.M. If I hadn't been awake, I wouldn't have noticed it."

Mrs. Bailey shuddered. "Oh, this awful country! Do you hear that, Homer? We might have been killed in our beds and never have known it. Why did I ever let you persuade me to leave Iowa?"

"But my dear," he protested hopelessly, "you wanted to come out to California; you didn't like Des Moines."

"We needn't go into that," she said firmly. "You are a man; you should anticipate such things. Earthquakes!"

"That's one thing you needn't fear in your new home, Mrs. Bailey," Teal told her. "It's absolutely earthquake-proof; every part is in perfect dynamic balance with every other part."

"Well, I hope so. Where is this house?"

"Just around this bend. There's the sign now." A large arrow sign, of the sort favored by real estate promoters, proclaimed in letters that were large and bright even for southern California:

THE HOUSE OF THE FUTURE!!!
COLOSSAL—AMAZING—REVOLUTIONARY
SEE HOW YOUR GRANDCHILDREN WILL LIVE!
Q. TEAL, ARCHITECT

"Of course that will be taken down," he added hastily, noting her expression, "as soon as you take possession." He slued around the corner and brought the car to a squealing halt in front of the House of the Future. "Voilà!" He watched their faces for response.

Bailey stared unbelievably, Mrs. Bailey in open dislike. They saw a simple cubical mass, possessing doors and windows, but no other architectural features, save that it was decorated in intricate mathematical designs. "Teal," Bailey asked slowly, "what have you been up to?"

Teal turned from their faces to the house. Gone was the crazy tower with its jutting second-story rooms. No trace remained of the seven rooms above ground floor level. Nothing remained but the single room that rested on the foundations. "Great jumping cats!" he yelled, "I've been robbed!"

He broke into a run.

But it did him no good. Front or back, the story was the same: the other seven rooms had disappeared, vanished completely. Bailey caught up with him, and took his arm. "Explain yourself. What is this about being robbed? How come you built anything like this—it's not according to agreement."

"But I didn't. I built just what we had planned to build, an eight-room house in the form of a developed tesseract. I've been sabotaged; that's what it is! Jealousy! The other architects in town didn't dare let me finish this job; they knew they'd be washed up if I did."

"When were you last here?"

"Yesterday afternoon."

"Everything all right then?"

"Yes. The gardeners were just finishing up."

Bailey glanced around at the faultlessly manicured landscaping. "I don't see how seven rooms could have been dismantled and carted away from here in a single night without wrecking this garden."

Teal looked around, too. "It doesn't look it. I don't understand it."

Mrs. Bailey joined them. "Well? Well? Am I to be left to amuse myself? We might as well look it over as long as we are here, though I'm warning you, Homer, I'm not going to like it."

"We might as well," agreed Teal, and drew a key from his pocket with which he let them in the front door. "We may pick up some clues."

The entrance hall was in perfect order, the sliding screens that separated it from the garage space were back, permitting them to see the entire compartment. "This looks all right," observed Bailey. "Let's go up on the roof and try to figure out what happened. Where's the staircase? Have they stolen that, too?"

"Oh, no," Teal denied, "look—" He pressed a button below the light switch; a panel in the ceiling fell away and a light, graceful flight of stairs swung noiselessly down. Its strength members were the frosty silver of duralumin, its tread and risers transparent plastic. Teal wriggled like a boy who has successfully performed a card trick, while Mrs. Bailey thawed perceptibly.

It was beautiful.

"Pretty slick," Bailey admitted. "Howsomever it doesn't seem to go any place—"

"Oh, that—" Teal followed his gaze. "The cover lifts up as you approach the top. Open stair wells are anachronisms. Come on." As predicted, the lid of the staircase got out of their way as they climbed the flight and permitted them to debouch at the top, but not, as they had expected, on the roof of the single room. They found themselves standing in the middle one of the five rooms which constituted the second floor of the original structure.

For the first time on record Teal had nothing to say. Bailey echoed him, chewing on his cigar. Everything was in perfect order. Before them, through an open doorway and translucent partition lay the kitchen, a chef's dream of up-to-the-minute domestic engineering, monel metal, continuous counter space, concealed lighting, functional arrangement. On the left the formal, yet gracious and hospitable dining room awaited guests, its furniture in parade-ground alignment.

Teal knew before he turned his head that the drawing room and lounge would be found in equally substantial and impossible existence.

"Well, I must admit this is charming," Mrs. Bailey approved, "and the kitchen is just too quaint for words—though I would never have guessed from the exterior that this house had so much room upstairs. Of course some changes will have to be made. That secretary now—if we moved it over here and put the settle over there—"

"Stow it, Matilda," Bailey cut in brusquely. "Wha'd'yuh make of it, Teal?"

"Why, Homer Bailey! The very id—"

"Stow it, I said. Well, Teal?"

The architect shuffled his rambling body. "I'm afraid to say. Let's go on up."

"How?"

"Like this." He touched another button; a mate, in deeper colors, to the fairy bridge that had let them up from below offered them access to the next floor. They climbed it, Mrs. Bailey expostulating in the rear, and found themselves in the master bedroom. Its shades were drawn, as had been those on the level below, but the mellow lighting came on automatically. Teal at once activated the switch which controlled still another flight of stairs, and they hurried up into the top floor study.

"Look, Teal," suggested Bailey when he had caught his breath, "can we get to the roof above this room? Then we could look around."

"Sure, it's an observatory platform." They climbed a fourth flight of stairs, but when the cover at the top lifted to let them reach the level above, they found themselves, not on the roof, but standing in the ground floor room where they had entered the house.

Mr. Bailey turned a sickly gray. "Angels in heaven," he cried, "this place is haunted. We're getting out of here." Grabbing his wife he threw open the front door and plunged out.

Teal was too much preoccupied to bother with their departure. There was an answer to all this, an answer that he did not believe. But he was forced to break off considering it because of hoarse shouts from somewhere above him. He lowered the staircase and rushed upstairs. Bailey was in the central room leaning over Mrs. Bailey, who had fainted. Teal took in the situation, went to the bar built into the lounge, and poured three fingers of brandy, which he returned with and handed to Bailey. "Here—this'll fix her up."

Bailey drank it.

"That was for Mrs. Bailey," said Teal.

"Don't quibble," snapped Bailey. "Get her another." Teal took the precaution of taking one himself before returning with a dose earmarked for his client's wife. He found her just opening her eyes.

"Here, Mrs. Bailey," he soothed, "this will make you feel better."

"I never touch spirits," she protested, and gulped it.

"Now tell me what happened," suggested Teal. "I thought you two had left."

"But we did—we walked out the front door and found ourselves up here, in the lounge."

"The hell you say! Hm-m-m—wait a minute." Teal went into the lounge. There he found that the big view window at the end of the room was open. He peered cautiously through it. He stared, not out at the California countryside, but into the ground floor room—or a reasonable facsimile thereof. He said nothing, but went back to the stair well which he had left open and looked down it. The ground floor room was still in place. Somehow, it managed to be in two different places at once, on different levels.

He came back into the central room and seated himself opposite Bailey in a deep, low chair, and sighted him past his upthrust bony knees. "Homer," he said impressively, "do you know what has happened?"

"No, I don't—but if I don't find out pretty soon, something is going to happen and pretty drastic, too!"

"Homer, this is a vindication of my theories. This house is a real tesseract."

"What's he talking about, Homer?"

"Wait, Matilda—now Teal, that's ridiculous. You've pulled some hanky-panky here and I won't have it—scaring Mrs. Bailey half to death, and making me nervous. All I want is to get out of here, with no more of your trapdoors and silly practical jokes."

"Speak for yourself, Homer," Mrs. Bailey interrupted, "I was not frightened; I was just took all over queer for a moment. It's my heart; all of my people are delicate and high-strung. Now about this tessy thing—explain yourself, Mr. Teal. Speak up."

He told her as well as he could in the face of numerous interruptions the theory back of the house. "Now as I see it, Mrs. Bailey," he concluded, "this house, while perfectly stable in three dimensions, was not stable in four dimensions. I had built a house in the shape of an unfolded tesseract; something happened to it, some jar or side thrust, and it collapsed into its normal shape—it folded up." He snapped his fingers suddenly. "I've got it! The earthquake!"

"Earthquake?"

"Yes, yes, the little shake we had last night. From a four-dimensional standpoint this house was like a plane balanced on edge. One little push and it fell over, collapsed along its natural joints into a stable four-dimensional figure."

"I thought you boasted about how safe this house was."

"It is safe—three-dimensionally."

"I don't call a house safe," commented Bailey edgily, "that collapses on the first little temblor."

"But look around you, man!" Teal protested. "Nothing has been disturbed, not a piece of glassware cracked. Rotations through a fourth dimension can't affect a three-dimensional figure any more than you can shake letters off a printed page. If you had been sleeping in here last night, you would never have awakened."

"That's just what I'm afraid of. Incidentally, has your great genius figured out any way for us to get out of this booby trap?"

"Huh? Oh, yes, you and Mrs. Bailey started to leave and landed back up here, didn't you? But I'm sure there is no real difficulty—we came in, we can go out. I'll try it." He was up and hurrying downstairs before he had finished talking. He flung open the front door, stepped through, and found himself staring at his companions, down the length of the second floor lounge. "Well, there does seem to be some slight problem," he admitted blandly. "A mere technicality, though—we can always go out a window." He jerked aside the long drapes that covered the deep French windows set in one side wall of the lounge. He stopped suddenly.

"Hm-m-m," he said, "this is very interesting—very."

"What is it?" asked Bailey, joining him.

"This." The window stared directly into the dining room, instead of looking outdoors. Bailey stepped back to the corner where the lounge and the dining room joined the central room at ninety degrees.

"But that can't be," he protested, "that window is maybe fifteen, twenty feet from the dining room."

"Not in a tesseract," corrected Teal. "Watch." He opened the window and stepped through, talking back over his shoulder as he did so.

From the point of view of the Baileys he simply disappeared.

But not from his own viewpoint. It took him some seconds to catch his breath. Then he cautiously disentangled himself from the rosebush to which he had become almost irrevocably wedded, making a mental note the while never again to order landscaping which involved plants with thorns, and looked around him.

He was outside the house. The massive bulk of the ground floor room thrust up beside him. Apparently he had fallen off the roof.

He dashed around the corner of the house, flung open the front door and hurried up the stairs. "Homer!" he called out, "Mrs. Bailey! I've found a way out!"

Bailey looked annoyed rather than pleased to see him. "What happened to you?"

"I fell out. I've been outside the house. You can do it just as easily—just step through those French windows. Mind the rosebush, though—we may have to build another stairway."

"How did you get back in?"

"Through the front door."

"Then we shall leave the same way. Come, my dear." Bailey set his hat firmly on his head and marched down the stairs, his wife on his arm.

Teal met them in the lounge. "I could have told you that wouldn't work," he announced. "Now here's what we have to do: As I see it, in a four-dimensional figure a three-dimensional man has two choices every time he crosses a line of juncture, like a wall or a threshold. Ordinarily he will make a ninety-degree turn through the fourth dimension, only he doesn't feel it with his three dimensions. Look." He stepped through the very window that he had fallen out of a moment before. Stepped through and arrived in the dining room, where he stood, still talking.

"I watched where I was going and arrived where I intended to." He stepped back into the lounge. "The time before I didn't watch and I moved on through normal space and fell out of the house. It must be a matter of subconscious orientation."

"I'd hate to depend on subconscious orientation when I step out for the morning paper."

"You won't have to; it'll become automatic. Now to get out of the house this time—Mrs. Bailey, if you will stand here with your back to the window, and jump backward, I'm pretty sure you will land in the garden."

Mrs. Bailey's face expressed her opinion of Teal and his ideas. "Homer Bailey," she said shrilly, "are you going to stand there and let him suggest such—"

"But Mrs. Bailey," Teal attempted to explain, "we can tie a rope on you and lower you down eas—"

"Forget it, Teal," Bailey cut him off brusquely. "We'll have to find a better way than that. Neither Mrs. Bailey nor I are fitted for jumping."

Teal was temporarily nonplussed; there ensued a short silence. Bailey broke it with, "Did you hear that, Teal?"

"Hear what?"

"Someone talking off in the distance. D'you s'pose there could be someone else in the house, playing tricks on us, maybe?"

"Oh, not a chance. I've got the only key."

"But I'm sure of it," Mrs. Bailey confirmed. "I've heard them ever since we came in. Voices. Homer, I can't stand much more of this. Do something."

"Now, now, Mrs. Bailey," Teal soothed, "don't get upset. There can't be anyone else in the house, but I'll explore and make sure. Homer, you stay here with Mrs. Bailey and keep an eye on the rooms on this floor." He passed from the lounge into the ground floor room and from there to the kitchen and on into the bedroom. This led him back to the lounge by a straight-line route, that is to say, by going straight ahead on the entire trip he returned to the place from which he started.

"Nobody around," he reported. "I opened all of the doors and windows as I went—all except this one." He stepped to the window opposite the one through which he had recently fallen and thrust back the drapes.

He saw a man with his back toward him, four rooms away. Teal snatched open the French window and dived through it, shouting, "There he goes now! Stop thief!"

The figure evidently heard him; it fled precipitately. Teal pursued, his gangling limbs stirred to unanimous activity, through drawing room, kitchen, dining room, lounge—room after room, yet in spite of Teal's best efforts he could not seem to cut down the four-room lead that the interloper had started with.

He saw the pursued jump awkwardly but actively over the low sill of a French window and in so doing knock off the hat. When he came up to the point where his quarry had lost his headgear, he stopped and picked it up, glad of an excuse to stop and catch his breath. He was back in the lounge.

"I guess he got away from me," he admitted. "Anyhow, here's his hat. Maybe we can identify him."

Bailey took the hat, looked at it, then snorted, and slapped it on Teal's head. It fitted perfectly. Teal look puzzled, took the hat off, and examined it. On the sweat band were the initials "Q.T." It was his own.

Slowly comprehension filtered through Teal's features. He went back to the French window and gazed down the series of rooms through which he had pursued the mysterious stranger. They saw him wave his arms semaphore fashion. "What are you doing?" asked Bailey.

"Come see." The two joined him and followed his stare with their own. Four rooms away they saw the backs of three figures, two male and one female. The taller, thinner of the men was waving his arms in a silly fashion.

Mrs. Bailey screamed and fainted again.

Some minutes later, when Mrs. Bailey had been resuscitated and somewhat composed, Bailey and Teal took stock. "Teal," said Bailey, "I won't waste any time blaming you; recriminations are useless

and I'm sure you didn't plan for this to happen, but I suppose you realize we are in a pretty serious predicament. How are we going to get out of here? It looks now as if we would stay until we starve; every room leads into another room."

"Oh, it's not that bad. I got out once, you know."

"Yes, but you can't repeat it—you tried."

"Anyhow we haven't tried all the rooms. There's still the study."

"Oh, yes, the study. We went through there when we first came in, and didn't stop. Is it your idea that we might get out through its windows?"

"Don't get your hopes up. Mathematically, it ought to look into the four side rooms on this floor. Still we never opened the blinds; maybe we ought to look."

"I won't do any harm anyhow. Dear, I think you had best just stay here and rest—"

"Be left alone in this horrible place? I should say not!" Mrs. Bailey was up off the couch where she had been recuperating even as she spoke.

They went upstairs. "This is the inside room, isn't it, Teal?" Bailey inquired as they passed through the master bedroom and climbed on up toward the study. "I mean it was the little cube in your diagram that was in the middle of the big cube, and completely surrounded."

"That's right," agreed Teal. "Well, let's have a look. I figure this window ought to give into the kitchen." He grasped the cords of Venetian blinds and pulled them.

It did not. Waves of vertigo shook them. Involuntarily they fell to the floor and grasped helplessly at the pattern on the rug to keep from falling. "Close it! Close it!" moaned Bailey.

Mastering in part a primitive atavistic fear, Teal worked his way back to the window and managed to release the screen. The window had looked down instead of out, down from a terrifying height.

Mrs. Bailey had fainted again.

Teal went back after more brandy while Bailey chafed her wrists. When she had recovered, Teal went cautiously to the window and raised the screen a crack. Bracing his knees, he studied the scene. He turned to Bailey. "Come look at this, Homer. See if you recognize it."

"You stay away from there, Homer Bailey!"

"Now, Matilda, I'll be careful." Bailey joined him and peered out.

"See up there? That's the Chrysler Building, sure as shooting. And there's the East River, and Brooklyn." They gazed straight down the sheer face of an enormously tall building. More than a thousand feet away a toy city, very much alive, was spread out before them. "As near as I can figure it out, we are looking down the side of the Empire State Building from a point just above its tower."

"I don't think so—it's too perfect. I think space is folded over through the fourth dimension here and we are looking past the fold."

"You mean we aren't really seeing it?"

"No, we're seeing it all right. I don't know what would happen if we climbed out this window, but I for one don't want to try. But what a view! Oh, boy, what a view! Let's try the other windows."

They approached the next window more cautiously, and it was well that they did, for it was even more disconcerting, more reason-shaking, than the one looking down the gasping height of the skyscraper. It was a simple seascape, open ocean and blue sky—but the ocean was where the sky should have been, and contrariwise. This time they were somewhat braced for it, but they both felt seasickness about to overcome them at the sight of waves rolling overhead; they lowered the blind quickly without giving Mrs. Bailey a chance to be disturbed by it.

Teal looked at the third window. "Game to try it, Homer?"

"Hrrumph—well, we won't be satisfied if we don't. Take it easy." Teal lifted the blind a few inches. He saw nothing, and raised it a little more—still nothing. Slowly he raised it until the window was fully exposed. They gazed out at—nothing.

Nothing, nothing at all. What color is nothing? Don't be silly! What shape is it? Shape is an

attribute of something. It had neither depth nor form. It had not even blackness. It was nothing.

Bailey chewed at his cigar. "Teal, what do you make of that?"

Teal's insouciance was shaken for the first time. "I don't know, Homer, I don't rightly know—but I think that window ought to be walled up." He stared at the lowered blind for a moment. "I think maybe we looked at a place where space isn't. We looked around a fourth-dimensional corner and there wasn't anything there." He rubbed his eyes. "I've got a headache."

They waited for a while before tackling the fourth window. Like an unopened letter, it might not contain bad news. The doubt left hope. Finally the suspense stretched too thin and Bailey pulled the cord himself, in the face of his wife's protests.

It was not so bad. A landscape stretched away from them, right side up, and on such a level that the study appeared to be a ground floor room. But it was distinctly unfriendly.

A hot, hot sun beat down from lemon-colored sky. The flat ground seemed burned a sterile, bleached brown and incapable of supporting life. Life there was, strange stunted trees that lifted knotted, twisted arms to the sky. Little clumps of spiky leaves grew on the outer extremities of these misshapen growths.

"Heavenly day," breathed Bailey. "Where is that?"

Teal shook his head, his eyes troubled. "It beats me."

"It doesn't look like anything on Earth. It looks more like another planet—Mars, maybe."

"I wouldn't know. But, do you know, Homer, it might be worse than that, worse than another planet, I mean."

"Huh? What's that you say?"

"It might be clear out of space entirely. I'm not sure that that is our sun at all. It seems too bright."

Mrs. Bailey had somewhat timidly joined them and now gazed out at the outré scene. "Homer," she said in a subdued voice, "those hideous trees—they frighten me."

He patted her hand.

Teal fumbled with the window catch.

"What are you doing?" Bailey demanded.

"I thought if I stuck my head out the window I might be able to look around and tell a bit more."

"Well—all right," Bailey grudged, "but be careful."

"I will." He opened the window a crack and sniffed. "The air is all right, at least." He threw it open wide.

His attention was diverted before he could carry out his plan. An uneasy tremor, like the first intimation of nausea, shivered the entire building for a long second, and was gone.

"Earthquake!" They all said at once. Mrs. Bailey flung her arms around her husband's neck.

Teal gulped and recovered himself, saying: "It's all right, Mrs. Bailey. This house is perfectly safe. You know you can expect settling tremors after a shock like last night." He had just settled his features into an expression of reassurance when the second shock came. This one was no mild shimmy but the real seasick roll.

In every Californian, native born or grafted, there is a deep-rooted primitive reflex. An earthquake fills him with soul-shaking claustrophobia which impels him blindly to get outdoors! Model Boy Scouts will push aged grandmothers aside to obey it. It is a matter of record that Teal and Bailey landed on top of Mrs. Bailey. Therefore, she must have jumped through the window first. The order of precedence cannot be attributed to chivalry; it must be assumed that she was in readier position to spring.

They pulled themselves together, collected their wits a little, and rubbed sand from their eyes. Their first sensations were relief at feeling the solid sand of the desert land under them. Then Bailey noticed something that brought them to their feet and checked Mrs. Bailey from bursting into the speech that she had ready.

"Where's the house?"

It was gone. There was no sign of it at all. They stood in the center of flat desolation, the landscape they had seen from the window. But, aside from the tortured, twisted trees there was nothing to be seen but the yellow sky and the luminary overhead, whose furnacelike glare was already almost insufferable.

Bailey looked slowly around, then turned to the architect.

"Well, Teal?" His voice was ominous.

Teal shrugged helplessly. "I wish I knew. I wish I could even be sure that we were on Earth."

"Well, we can't stand here. It's sure death if we do. Which direction?"

"Any, I guess. Let's keep a bearing on the sun."

.

They had trudged on for an undetermined distance when Mrs. Bailey demanded a rest. They stopped.

Teal said in an aside to Bailey, "Any ideas?"

"No ... no, none. Say, do you hear anything?"

Teal listened. "Maybe—unless it's my imagination."

"Sounds like an automobile. Say, it is an automobile!"

They came to the highway in less than another hundred yards. The automobile, when it arrived, proved to be an elderly, puffing light truck, driven by a rancher. He crunched to a stop at their hail.

"We're stranded. Can you help us out?"

"Sure. Pile in."

"Where are you headed?"

"Los Angeles."

"Los Angeles? Say, where is this place?"

"Well, you're right in the middle of the Joshua Tree National Forest."

.

The return was as dispiriting as the Retreat from Moscow. Mr. and Mrs. Bailey sat up in front with the driver while Teal bumped along in the body of the truck, and tried to protect his head from the sun. Bailey subsidized the friendly rancher to detour to the tesseract house, not because they wanted to see it again, but in order to pick up their car.

At last the rancher turned the corner that brought them back to where they had started. But the house was no longer there.

There was not even the ground floor room. It had vanished. The Baileys, interested in spite of themselves, poked around the foundations with Teal.

"Got any answers for this one, Teal?" asked Bailey.

"It must be that on that last shock it simply fell through into another section of space. I can see now that I should have anchored it at the foundations."

"That's not all you should have done."

"Well, I don't see that there is anything to get down-hearted about. The house was insured, and we've learned an amazing lot. There are possibilities, man, possibilities! Why, right now I've got a great new revolutionary idea for a house—"

Teal ducked in time. He was always a man of action.