Coast Beast

By Stephen Battersby

The beach is where Theo Jansen's wild things are.

On a windy stretch of beach on the coast of Holland, a skeletal creature crawls across the sand. It stands as high as a person and seems to have as many legs as a centipede. A close-up look reveals primitive senses and the beginnings of a brain. The creature stops, then starts again, relying on the inconstant wind for its mobility.

What is this thing? It's a *strandbeest,* a creation of Dutch inventor Theo Jansen. It exists between the dunes and the sea in a twilight zone linking art and science. "I am trying to remake nature," says Jansen.

Loek van der Klis/www.kliski.com
The plastic mechanical skeletons pictured on these pages are just a few of the many strandbeests that kinetic sculptor Theo Jansen has built in the Netherlands since 1990.

Plastic Bones

Jansen graduated from college with a degree in physics in the 1970s. He then turned to painting and other art projects. Jansen never abandoned his scientific inclinations, though. In 1990, he conceived the idea of leggy, wind-

driven machines that could walk along the beach, helping build dunes that would defend the Netherlands against any rise in the North Sea.

For his raw material, Jansen chose a type of stiff, yellow plastic tubing that is easily cut and fitted together. When heated with a hot-air gun, two tubes can be joined and bent to form a simple joint that's a little like a human knee.

Loek van der Klis/www.kliski.com
The bones of every strandbeest are made from stiff plastic tubing that's easily fitted together.

The central spine of a strandbeest is a plastic *crankshaft* (rotating rod) that's linked to all its many legs. Each leg has 11 plastic "bones" that form a *mechanical linkage*—an assembly of rigid rods and joints that transmits mechanical forces and movement from one place to another. As the crankshaft rotates, it moves a leg joint, which transmits motion via the other joints to the foot.

A leg's motion depends on the lengths of all 11 bones. To develop a leg with a smooth step, Jansen used a *genetic algorithm,* a computer program that mimics *natural selection.* Natural selection is a process that drives evolution, favoring the fittest forms of living things. From an initial population of legs, each one of which flailed clumsily, a more elegant leg evolved. Its foot lifts and moves forward swiftly, then sets down and pushes backward, horizontally and steadily.

Loek van der Klis/www.kliski.com

With the computer-generated leg as a blueprint, Jansen painstakingly pieced together his first strandbeest, which means “beach animal” in Dutch. He named it *Animaris Currens Vulgaris,* took it to a beach, and set it free. It collapsed.

Back in his studio, Jansen slowly learned how to design a more robust structure. He also added simple sails so that it could be pushed forward by the wind.

Energy Conversion

Over the years, Jansen has experimented with different strandbeests. Some move forward, and some move sideways. Some can even store energy using simple air pumps. Each pump is a narrow tube that slides up and down like a piston inside a larger tube. Sails drive the pumps, and with every up-and-down movement, each pump squirts air into a plastic bottle. As the air is compressed in the bottle, it gains *potential energy* (stored energy). When enough air is stored, valves open, releasing the air into a second set of pumps, forcing the pistons in them to move. Those pumps act like muscles, moving the beasts’ legs. The compressed air’s potential energy is turned into *kinetic energy,* the energy of movement.

Loek van der Klis/www.kliski.com
Sails mounted on a strandbeest pump pistons that enable it to move and sense things it should avoid, such as water and sand dunes.

Even after 21 years of tinkering, the strandbeests remain delicate. They can blow over in storms and get stuck if they wander into the sea. “I have to nurse these animals,” says Jansen. “Every few minutes, I have to save them from dying.”

Jansen is now trying to make the beasts more independent by giving them senses. He has added another system of air pumps that suck on a long plastic tube hanging from one side of the beast. If the strandbeest veers into the sea, the tube starts to inhale water. The weight of that water changes the air pressure, prompting the beast to change direction.

Jansen has even tried giving one of his beasts a brain—as any mad scientist should. A piston with a hole in one side can switch a flow of air on and off, imitating the on and off positions of a computer’s electric switches. “With this basic device, you can make networks comparable to electronics,” says Jansen. He has built a network of hissing valves and pistons that can count a strandbeest’s steps so, in theory, the beast knows how far it has walked.

3-D Printing

Jansen claims to be creating new forms of life. He originally hoped that the beasts would be able to reproduce, perhaps by feeding on plastic and making offspring inside themselves. That idea proved to be too ambitious. "Then I found that behind my back, these animals were using people to multiply," he says. Enthusiasts in Japan and the United States are making their own beach creatures, some using the modern technology of three-dimensional printing. "A year ago, two students put a small beast on a table. It comes in one piece out of a printer and walks away," says Jansen. "It's a real miracle."

Strandbeest by Theo Jansen, powered by Shapeways

Name: _____ Date: _____

1. Why does Theo Jansen say that every few minutes he has to save his strandbeests from dying?

A They can be attacked by dogs.
B They can be destroyed by frightened people.
C They can blow over in storms.
D They can swim away from shore.

2. Which of the following best *describes* a strandbeest?

A an artistic animal
B a kinetic sculpture
C a technical blueprint
D a basic device

3. In paragraph 13, Jansen calls a small strandbeest that two students made as "a miracle." What word could be used to describe his reaction?

A proud
B jealous
C indifferent
D scared

4. Read the following sentences and answer the question below: "Back in his studio, Jansen slowly learned how to design a more robust structure. He also added simple sails so that it could be pushed forward by the wind."

In this context, what does the word **robust** mean?

A fragile
B delicate
C active
D strong

5. The primary purpose of this passage is to describe

A how strandbeests will guard the shores of countries
B how Theo Jansen created strandbeests
C how people perceive strandbeests on the beach
D how Japanese and U.S. students are stealing strandbeest designs

6. What job were the strandbeests designed to do?

_____

_____

_____

7. How can a computer program that mimics "natural selection" help Jansen complete his strandbeest?

_____

_____

_____

8. The question below is an incomplete sentence. Choose the word that best completes the sentence.

Jansen hoped that his strandbeests would be able to reproduce _____ that idea proved to be too ambitious.

A until
B so
C because
D but

9. Answer the questions based on the sentence below.

Theo Jansen is trying to make the strandbeests more independent by giving them senses.

Who? Theo Jansen

(is) What? _____

How? _____

10. Read the vocabulary word and definition below and completes questions 10a, 10b, and 11.

Vocabulary Word: conceived (con· ceived): to think of something.

10a. Read the five sentences below and underline the word **conceived** in each sentence.

1. The writer was very creative and conceived of an entire imaginary world for her book.

2. Any type of candy that the kids could have conceived of was there in Willy Wonka's Chocolate Factory.

3. The inventor conceived of a machine that would allow people to travel anywhere in the blink of an eye.

4. The speaker asked the audience to conceive of a nation where all people respected each other, no matter what they looked like or where they came from.

5. The artist conceived her painting while she was dreaming, which may be why there was a pig dressed up next to a lady at the dinner table!

10b. Which image is something many young children conceive as being in their closets?

11. What is the wildest story that you've ever conceived?

_____

_____

_____

_____