

The Bouligand Structure, by Chidume Nwambu

Plot Summary: *After a series of injuries at a company, the engineering team tests a potentially much more damage-resistant helmet based on a revolutionary new structure.*

Characters:

ENGINEER (-), 40s or 50s, a senior engineer

ANDREW (m), late 20s or early 30s, an engineer

EMEKA (f), late 20s or early 30s, an engineer

DR JACK (m), 30s, an engineer

SCENE ONE: Quality Assurance Unit (Chief Engineer and other support staff which are Andrew and Emeka)

ENGINEER: Welcome Emeka and Andrew. Thanks for coming. For the past four months, we have recorded many head injuries in this company. What is the cause?

ANDREW: Ma'am, the workers, don't wear protective equipment as they're supposed to, especially helmets.

EMEKA: Andrew, I don't think so; they wear the helmets always, and properly.

ENGINEER: Hmm! Emeka, what is the cause then?

EMEKA: These helmets don't withstand high impact damage. Look here...

EMEKA picks one of the helmets, strikes it on the wall and the helmet shatters on the floor.

ANDREW: What have you done, Emeka?

EMEKA: You can see! The helmets don't hold up. We need new helmets with more damage tolerant structures.

ENGINEER/ANDREW: No! There is no reason for that.

EMEKA: Ok! I know you guys are concerned about the financial implications, but what if there were new helmets with a high damage tolerance, at the same cost as the old helmets?

ANDREW: This is obviously uncalled for.

EMEKA: I know of an engineer, Dr. Jack, who has been developing a new structure.

ENGINEER: All right! Invite Dr Jack to our next meeting Emeka.

A transition to the next meeting.

SCENE TWO:

EMEKA: Hello, everyone! Here is Dr Jack with the new helmet manufactured from his structure.

ENGINEER: Great! Welcome, Dr Jack.

ANDREW: We have heard a lot about this new helmet. What can you tell us about it?

DR JACK (*nervous, but getting carried away*): Ok, I got inspiration from naturally designed materials- the mantis shrimp. They are found along shorelines, usually living in an abandoned burrow to move in and out to capture prey. They are armed with two hammer-like raptorial appendages called *dactyl clubs*, that they use to bludgeon and smash their prey. These fists, able to accelerate from the body at over 50 mph, deliver powerful blows yet appear undamaged afterwards because of their unique helicoidal architectures that resemble... plywood...

EMEKA: So, how do you relate this to the design of engineering structures?

DR JACK: I mimicked the dactyl club's helicoidal architectures with carbon fibre reinforced polymer composite. However, this research has taken over six years, and my life savings to arrive at this stage.

ANDREW: This is a moonlight story. Engineering materials are not produced this way.

ENGINEER: I'm sceptical about this your approach.

DR JACK: Let me put it to the test!

ANDREW: We don't need to waste our precious time on this. There is no relationship between biological materials and engineering mechanisms.

EMEKA: We can subject the new helmet and the old helmet to an impact test to verify their damage tolerance for the benefit of the doubt.

ENGINEER: All right! We will conduct the test.

An aside -

ENGINEER: Andrew! Why do you disagree entirely with the new helmet made from Dr Jack's structure?

ANDREW: Dr Jack is on a wild-goose chase. His concept is not backed by any known engineering processes. However, we can go ahead with the impact test.

Transition to the testing lab. Through the following, sounds of the testing machine being prepared for the drop dart impact test.***

ANDREW: I still wonder why you guys are bent on wasting our time on this. The old helmets were produced according to engineering principles and have been in use for a decade with proven impact strength.

DR JACK: I have observed all the necessary precautions. The old helmets have failed on several occasions. Therefore, it should be an ethical imperative for engineers to search for a solution, which led me to this research to reduce or stop the failure, save lives and properties.

ENGINEER: The concept seems involuted. How could a solution to engineering structural failures have emanated from the dactyl clubs of Mantis Shrimp?

ANDREW: A trial-and-error strategy should not be allowed in issues of life and death.

EMEKA: Well! I admit it sounds weird. Notwithstanding, only the test result can unravel the mystery.

ENGINEER: All right, if everyone has their eye goggles on? The technician can drop the dart ...
Okay, let's go.

Boooooooooooooom!... The dart speedily strikes the helmets. The old helmet was shattered, it broke into pieces while the new helmet was not shattered or broken; instead, it had an insignificant scratch on the top.

EMEKA: Oh, my gosh!

ANDREW: I don't believe it!

EMEKA: Can you see the helmet made with Dr Jack's structure compared to the old helmet?

ANDREW: Hmm, a closer analysis of the test result will tell us what happened.

ENGINEER: According to the results, the new helmet is still sound for use after the drop test, it has minimal scratches, compared to the old helmet that shattered beyond use. Thus, it shows that the new helmet produced from Dr Jack's structure can withstand a high impact damage event significantly better than the old ones.

EMEKA: I'm not surprised. The test supports my view that these old helmets brought about the recent report of head injuries within the company. ***(Momentarily distracted by:)*** Dr Jack?

DR JACK *(Laughing)*: Wow! I'm excited because my six years and my life's savings were not a waste!

ANDREW: Congratulations Dr Jack. I can't believe it withstood such level of impact.

EMEKA: Me too! It is amazing. Dr Jack, were you convinced before the test that your new product would be this outstanding?

DR JACK: Yes, I was 100% sure I always believed in my newly developed helicoidal structure! And what is more, it can even be used to manufacture other engineering products such as parts for the aircraft, automobile, and marine industries.

DR JACK is smiling and dancing while receiving handshakes from people within the laboratory.

ENGINEER: Congratulations, Dr Jack, your innovative structure has high impact damage tolerance.

END

***** Writer's note re testing procedure:**

The objective of this test is to determine the impact strength or toughness of helmets by understanding the material's impact resistance. This test is carried out by a free-falling dart method, The set-up of the test involves a single dart configuration and a specified drop height whilst the dart's weight will vary. The selected dart is secured by a bracket and adjusted to the specified height. The dart drops onto the centre of the specimen (helmets) when it is released. At the end of the drop dart test, the result will be recorded along with the drop weight.