ENGW 3302
Fall 2018
Unit 3: Writing for a Public Audience Word Count: 1130

Context:

This article explains the possibility of Iron Man's nanotechnology as demonstrated in the new Marvel blockbuster, Avengers 3: Infinity War. The tone and vocabulary are such that anyone can read it, but because of the content, the audience that will get the most from reading this Explainer are those that are Iron Man fans with science fiction interests. The only people that should not read it are those that have not seen the movie yet, because there may be spoilers ahead! No scientific background is necessary, just a curious mind interested in superheroes.

So how close am I to becoming Iron Man? The feasibility of Iron Man's new Infinity War armor.

Introduction:

The Marvel Cinematic Universe has always brought to screen fantasies of science fiction ideas that people have always dreamed about. From the very beginning of the franchise, Tony Stark is known to be a billionaire tech genius whose prowess in engineering enables him to become not only the richest human on earth but a real-life superhero as well. Movie after movie, audiences have seen new iterations of the technology grow and expand to new heights.

The new Avengers Infinity War movie had avid science-fiction fans wondering, "What will Tony Stark unveil next?" The answer is the much-anticipated nanotech armor, a mix between the comic's "Bleeding Edge" and "Model Prime" suit. From the movie, we see that the suit is capable of being

housed within Tony's new chest piece and as shown in the photo, the suit can also assemble itself around Tony's body. This is much different from traditional perceptions of Iron Man, where each piece of the suit is specifically fitted to a body part, placed onto his body with an almost equally complicated robotic system. Not only is the new suit 100% portable, it can also form and re-form into seemingly infinite combinations of tools for whatever Tony needs. The suit is shown to be able to provide additional rocket thrusters, shields, more powerful repulsor cannons, and can even heal injuries.

None of these capabilities are out of reach for this powerful exoskeleton which begs the question: is this technology even possible or is Marvel overstepping its expectations with how much the audience should suspend their disbelief? After all, part of the Iron Man appeal is that the movies are grounded in engineering and science.

What are we even talking about?

In order to talk about nanotechnology, we first must visualize exactly what working in this field means. Engineering on the nanoscale means working within the 1 to 100 nanometers range. To put this into perspective, a sheet of paper is about 100,000 nanometers thick. Basically, these are ridiculously tiny machines, an idea born from K. Eric Drexler's 1986 book, Engines of Creation: The Coming Era of Nanotechnology. In this, he proposed the idea of self-replicating nanomachines, machines that build other machines on the atomic scale. Because of this, these bots should be able to pull apart any kind of material, atom by atom, and construct anything. This explains how Iron

Figure 1: Screenshot taken from movie

Man is able to manipulate his suit in different combinations, but there are three aspects of the suit that need to be addressed:

1. Signal Processor

2. Operating System

3. The actual nano-machines

Signal Processor:

From the movie, we know that the suit can form different tools at will. In the example shown, Tony assembled more powerful blasting cannons to battle Thanos with seemingly neither tangible nor audio signal. This means that the suit must have some way to be able to get the signals coming directly from the brain to formulate whatever Tony needs, essentially reading his mind.

Operating System:

Figure 2: Screenshot taken from movie

Not only does the suit need to get the signals, but it must also analyze them and then execute whatever the command is. This is done by Tony's artificial intelligence system, "FRIDAY". Each bot would have to be driven by FRIDAY because just one nanobot is insignificant, you wouldn't even be able to see it with the naked eye. Thus, the trillions of bots have to be able to communicate with the central control and with each other to participate collectively to be effective. In order to do this, FRIDAY would have to be an extremely powerful artificially intelligent system to drive this functionality, and also fit on a computer small enough to fit within the suit.

The Actual Nano-Machines

Even if the operating system can utilize the central radio control and communicate with trillions of nanobots, there is still the issue of making the nanobots. The same aspect of this technology that makes it so interesting also makes it hard: its ridiculously small size. Picture constructing a desk you just ordered from IKEA. How would you go about doing this? Simple enough, just grab the necessary pieces and fit them together according to the directions. However, putting together furniture can already be extremely frustrating - building a night stand shouldn't require an advanced degree in

engineering but sometimes it feels that way. But what if you couldn't touch the pieces with your hands or any other tool? What if the desk was so small you could neither feel nor see it? How would the desk be built then? This analogy can be directly related to constructing nanobots. Doing so involves all of the complexity of building a desk but has another layer of difficulty with not being able to touch any of the pieces. According to pioneering researchers in the field, the current technology is such that we do not have the tools to create a nanobot in the same regard we create other pieces of machinery. Despite this, researchers in the nanotech field have

---

been able to create less powerful nanobots; they're semi-mobile devices that are not autonomous, are extremely fragile, and cannot self-replicate because of their limited power capacity. But they're pretty small!

The Road to Travel..

Niklas Rohleder, a physics researcher at the Technical University of Dortmund summarizes these difficulties best in just a few bullet points when he says that in order to create Iron Man's nanotech suit, we need a couple of breakthroughs in nanotechnology, a couple of breakthroughs in our methods of power generation, and the capability of programming a highly sophisticated AI.

Just a handful of groundbreaking scientific breakthroughs and we're basically there! However, I wouldn't give up hope. As a species, we achieved short-distance sustained flight and less than seven decades later, landed on the moon. The point here is that technological innovations can take extreme leaps and bounds in just a single lifespan. Overall, the short answer to the feasibility of Iron Man's suit is unfortunately no – with the way the current technology exists, Iron Man's nanotech suit is impossible to create, but maybe in just seven short decades, we'll have Iron Man flying overhead battling an army of aliens.

References:

. [1] “Benefits and Applications.” What Is Nanotechnology? | Nano, www.nano.gov/you/nanotechnology-benefits.

. [2] Diamandis, Peter H. “Nanorobots: Where We Are Today and Why Their Future Has
Amazing Potential.” Singularity Hub, Singularity Hub, 20 Mar. 2018, singularityhub.com/2016/05/16/nanorobots-where-we-are-today-and-why-their-future- has-amazing-potential/#sm.00009zxkyxyx9egrs9v28pws9druo.

. [3] Drum, Nicole. “'Avengers: Infinity War' Reveals How Iron Man's New Suit Works.” WWG, ComicBook.com, 29 Apr. 2018, comicbook.com/marvel/2018/04/29/avengers-infinity-war-how-iron-man-new-suit-works/.