

Dinner for Two by John Woodruff

Dad,

I know it's been a while since you've heard from me, and I'm sorry I haven't written to you more recently. I've been busy troubleshooting some of our dietary programs — The Factory is absolutely set on getting them to market as soon as possible. Not that I'm complaining though. Since I'm one of the developers, I get to take advantage of the nutritionist algorithm we're troubleshooting. So far, it's been fed about 40 years of medical data, and the results are promising. Given a rudimentary amount of physiological information about a person, it can create a meal plan tailored to anybody's needs. We still have to cook the meals ourselves, of course. Our machine learning may be advanced, but we're hardly to the point where we have robot servants to do household tasks for us like in some 1970s pulp novel. (Would that that were the case though; I'm still a terrible cook.)

Today for dinner the algorithm prescribed me a pasta dish with carrots and plant-based beef substitute in a thick red sauce. I think some kind of ragù? I'm a little fuzzy on the finer points of the culinary arts, though you might know better than me. Nutritional assignment amounts to the delivery of the ingredients and a few different possible recipes to incorporate them into, but there's not a whole lot of cultural context for it. Still, this one was more exciting than usual; it's been ages since I'd eaten meat, even the soy derivatives. That's where it all comes from these days — it's been about ten years since the deterioration of the Amazon rainforest made wide scale cattle farming impossible, and thankfully about twenty since we started developing alternatives. Personally, I don't think it's a bad thing; it may not be exactly like real meat, but it still tastes pretty much the same. With proper monitoring and care for the soybeans, it's vastly more efficient too. Synthetic protein does a great job of reducing trophic losses through organic processing. Without the nutrient waste of allowing the food to move through multiple phases of biological processes, with energy loss at every level, we really just get more output for our input. An added bonus that I think you'll appreciate — animal cruelty protests are a thing of the distant past now. After all, how can you argue that harvesting plants is an ethical violation? The industrial switch may have been made for environmental problems, but it solves a century old moral dilemma too.

As for the carrots, they were still grown naturally. Well, maybe not naturally, but of all the growing techniques we use, theirs is one of the closest to traditional agriculture. They weren't grown hydroponically, like lots of our fruit and produce is, but they still aren't exactly hand planted. Unmanned ground vehicles are typically used for large-scale planting and harvesting operations in the Factory farms. Guided by satellite positioning feedback, they perform tasks in hours that, even a century ago, could take days. Of course, there are still fail-safes in place so that they can be driven by humans if the satellite system fails, but they've been on autopilot so long people don't even think about it anymore. Watering is more or less automatic too. All our fields are fed from the sizeable aquifer on which the Factory was built. Irrigation requirements are carefully deducted from estimated stores by our computers using decades of

evapotranspiration data. Irrigation inlets are equipped with fertigation systems, meaning that nutrients can be inserted as much or as little as needed. Of course, this need is also detected visually. Back in university, I studied different signs of nutrient deficiencies in plants – purple or blue leaf edges for phosphorous deficiencies, interveinal chlorosis for magnesium – but now, decades of plant health datasets have trained our computers to detect problems before even the human eye could. While it will take decades more to perfect the process, I'm proud to say our data suggests that even this early technique has shown great promise.

And finally, what I consider the crowning achievement of the process is the fields themselves. Each separate growing zone is inside of a self-contained, climate controlled biodome. A century ago, when the first geodesic biodome was built in St. Louis (a fact I'm sure you'll be happy to learn if you didn't know already, given your prodigious civic pride) it was considered an architectural oddity and interesting science experiment. Can you imagine, back in the days when you and Mom would walk past it almost every day, knowing that it was the prototype for the future of agriculture? But the technology kept growing, and the concept was built upon and refined to what it has become today. While they aren't true sealed biospheres, the extremely controllable nature of our domes has allowed us to make great strides in yield advancement. Not only are the crops protected from the elements, rendering them immune to weather events from heat waves to droughts to cold snaps, we can grow crops all year round, meaning that the unrelenting pattern of growing seasons that's controlled agriculture since its inception has finally been broken.

Of course, just knowing the mechanical processes doesn't even begin to describe the whole picture. From the window of my apartment, high up in the administrative building at the center of the Factory, I can see miles of our domes and hydroponics towers, stretching nearly to the horizon in every direction, like checkers between the intersecting lines of our autonomous rail transports. I wish you could see the way the sunset glitters off the glass right now; it's like a sea of fire. It makes me think, too. Sometimes I wonder what it would look like to a farmer from the distant past. If you took someone from fifteen thousand years ago and dropped them in my place, I have no doubt they wouldn't even recognize it as agriculture. Of course, in those days, agriculture basically amounted to a few trenches dug from a river to a field. But then, what would even that look like to some hunter-gatherer of the past? I'm no anthropologist, but I'm confident that even the concept of living in one place for more than a few years would be foreign to them, let alone dwelling in a place long enough to learn to shape the land for their own benefit. Hell, sometimes I wonder what you would have thought if teenage you were plucked straight out of Illinois farm country and dropped here. I guess you'd know a lot better than me, but I can't help but think you'd be amazed at how far we've come.

Ha, I got so wrapped up in my own thoughts for a minute I forgot what I was talking about. Well, now that you've heard all about our relatively simple root vegetable operations, I think I'm going to move on to the tomatoes that made up the sauce of my little pasta dinner. Granted, tomato sauce is hardly the most interesting part of any given pasta, but I'd like to think that where these tomatoes came from is a different story—one that begins amidst the endless ocean of domes and transport lines. Every quarter mile or so, you can see the hydroponics towers rising into the sky between their smaller cousins. They're not all the same height, but assuming they haven't built any more since I was reassigned to administration, the tallest one

measures just under three hundred feet of glass and plain steel. They're not just impressive from the outside either. Looking up from the bottom, you can see hundreds of rows of hydroponic racks making rings around the inside of the tower. Each hydroponic rack contains dozens of trays, with carefully monitored nutrient and water intake. In the center of the tower is a cylindrical column stretching from the bottom to the top, equipped with vertical tracks on four sides. On these tracks, we've mounted sophisticated camera systems, capable of detecting significant changes in plant health and growth stage and immediately matching this data to the corresponding tray. These sensor apparatuses move constantly, making so many circuits per day and collecting so much data that it would be impossible for the human mind to parse it unaided.

Unfortunately, this is where our current problems with our hydroponics systems begin. While the vertical method is easily the most space and resource intensive way to grow these crops, we've had a great deal of difficulty attempting to automate the harvest. The creation of autonomous harvesting regimens, like we have with normal fields, would simply require infrastructure we did not build into the hydroponics facilities while the designs were being developed. Unfortunately, this means that even though we have the technology to harvest crops mostly autonomously now, we're limited to using human laborers to harvest our hydroponic crops. All things considered, I personally find this to be a reasonable tradeoff for the amount of conventional labor our systems have managed to replace. A week or two of hard work doesn't even compare to the amount of time and effort that once went into food cultivation. Months and even years of time that were once lost to repetitive manual labor can now go towards so many other things, such as simple leisure, art, and even more research to vault further hurdles. Side note: even though it's impossible to prove in even a remotely scientific way, I swear that handpicked tomatoes always taste better.

That last thought, I suppose, does remind me of another possible problem with the automation of our food. I'm forced to ask, what do we lose when we take the minutiae of farming out of our own hands? For so long, agriculture has been the main link between increasingly urban societies and the natural world that we depend on for survival. I must ask myself, is the convenience worth the increasing disconnection from the world around us? But I suppose if the question is rooted in history, the answer might be too. I'm sure that when you read this, you'll immediately be able to cite some obscure historical context to disprove me, but I can't help thinking back to the Green Revolution. The invention of chemical fertilizers was a huge blow to the dependency of humanity on the whims of nature. They allowed us to control soil conditions more carefully, support crop growth more effectively, and address problems that were previously out of our control. But, to dramatize things a bit, this power went to our collective head. Decades of over-fertilization and poor stewardship of the land wrecked almost all of our arable soil, making the extreme measures of agricultural facilities like mine necessary in the first place. Still though, even with all the damage it did, I find it hard to blame the technology. It was perfectly within our capabilities to use it responsibly and avoid these problems, but we chose not to and faced the consequences of our own actions, nearly exterminating ourselves in the process. I think we can learn from our mistakes and use our new, more effective technologies to build a better world instead of ruining the one we already have.

After all that's said and done, there's still one thing in the back of my mind. Thinking back to the first time I ever worked in a field; ironically, doing research for crop imaging. The feeling of absolute peace, standing alone in a quiet field, with nobody around for miles in any direction. I know we've discussed it before, but I think it's worth mentioning at least one more time. No matter how much better our yields can get, no matter how much more efficient our nutrition is, to me, nothing in this new world can compare to the feeling of the wind in my hair on a cool summer morning.

Yours Always,

John