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## Meme and Variations

By Liane Gabora

Turning the glass doorknob, Stella almost dropped the tray of food. She paused to steady herself. The sky was strewn with cauliflower clouds, which looked faintly magical through the uneven panes of the Century-old window.

“Hey Bruno,” she called out, taking in the musty smell as she carefully descended the worn stairwell. She hit her elbow on the lampshade of a broken lamp, and the glass of lemonade wobbled perilously. The lamp was perched on a pile of books on a threadbare brocade sofa that looked as if it had spent decades disintegrating in an opium den. At the far end of the basement, a shaft of light from the small window cut through the dinginess, framing Bruno, sitting on the futon, grinning.

“Brought you a bite to eat,” she said, handing him the tray.

“Thank you!” Bruno said, accepting it eagerly. “You didn’t have to. But I *am* famished.” His bulging, Neanderthal-sized nostrils expanded, and his pale green eyes in their huge, Neanderthal-like sockets closed slightly as he breathed in the aroma. His forehead was decidedly not Neanderthal-like: straight and high, framed with orange curls. He gave her a broad smile.

Stella glanced around. There was nothing else nearby to sit on, so she sat on the futon too. Although Bruno was a frequent visitor to the house where she lived with three other graduate students, she had never been alone with him before. A strand of sleek, dark hair fell in front of her face, and she brushed it back slowly.

“Mac ’n cheese,” he said. “Yum! What’s the green stuff?”

“Basil and chives,” Stella said. “Alyzia’s growing them on the kitchen window ledge.”

“Your plants are doing better than mine,” Bruno said.

“Alyzia says they’ve been growing faster since she started talking to them.”

“They understand English, do they? I suppose that question can be resolved with an experiment. I’ll always say ‘nice plant’ to the basil, and ‘stupid plant’ to the chives, and we’ll see if there’s a difference in how fast they grow.”

They laughed.

“Hey, how long am I welcome to stay here for?” Bruno said between bites. “I guess I kinda showed up on your doorstep unexpectedly yesterday.”

“It *was* a surprise for you to appear in the middle of a storm in the middle of a pandemic!”

“Like I said, a tree literally fell right in front of me, knocking over a power line. I didn’t know if I’d make it all the way back to my place alive. Montreal is a disaster zone right now.” He stabbed a large wad of macaroni. “And it isn’t fun being alone for weeks on end.”

“I’m, um, fine with you staying here for a bit myself.” Stella felt her face flush. It was strangely exhilarating to think of Bruno holing up in the basement. Though it was against the provincial lockdown guidelines.

“Of course, I wouldn’t want to outstay my welcome.”

“I’d have to make sure everyone’s okay with it,” Stella said hesitantly.

“Any roommate drama? Are Raj and Alyzia getting it on? Seung Gong feeding you chicken feet for dinner?”

“No,” Stella said, half smiling, nose wrinkled.

“Every student household has drama,” Bruno insisted. “No temper tantrums? No secret hookups?”

Stella shook her head. “Not that I’m aware of.”

Something metallic darted out from behind a paper mâché mummy and scampered under the futon.

Stella’s heart fluttered. “Did I just see what I thought I saw?” she asked.

“That’s Meme-bot. He’s harmless.”

“Meme-bot?”

“My meme-spreading robot. I brought him along.”

Stella stood up and bent down.

“Don’t look under the futon,” Bruno said. “He’s shy.”

“Surely, you don’t think he’s conscious?”

“I think of him as conscious. He’s my bud. Right Meme-bo?” He turned to Stella.

“Sometimes I call him Meme-bo for short.”

Stella smiled uncertainly. A deep longing to hug him surged through her. It left her feeling incomplete, tingling all over. But hugging seemed impossible, not least of all because it was forbidden during the pandemic.

She felt a quiver of fear.

“You’re *totally* sure you haven’t seen anyone since the pandemic started?” she asked.

“You must at least have gone out for groceries.”

“Peanut butter lasts forever,” Bruno said. “It’s basically what I live on. This wriggle-oni and tomato slop with herbs is the most gourmet thing I’ve had in ages.”

Stella fidgeted with the bedspread. She noticed the overlapping multicolored rounded rectangles on Bruno’s retro linen shirt. It was the first time she’d ever seen him in anything other than a T-shirt.

“Hey, I just noticed, your shirt has dog hair on it,” she said. “You’ve never mentioned you have a dog. Do you?”

“Nope,” Bruno said. “Just me and my lonesome.”

Stella took a deep breath, and gave him a radiant smile. She was so achingly aware of his earthy presence, she felt giddy. “Well, I’m glad you’re here with us now.” She watched him scrape the last bit of sauce from the bowl.

“Delicious,” Bruno said, gulping down the last of the lemonade, and putting the tray on the floor. He stared at her as if waiting for something to happen.

Stella noticed a deep green fleck of basil stuck between his teeth. It was weirdly thrilling that less than an hour ago she had held that piece of basil. She had touched something that was touching him, that would become part of him.

It would be so easy for them to lean in a little closer and snuggle up. Even in a pandemic, people had to go on living their lives. But that could wait until the time was right.

“I’ll let you settle in,” she said. She got up so quickly that her head swam and she accidentally kicked the tray. She gave him a self-conscious smile, and picked it up.

“Pay my respects to the plants,” Bruno called out, bending his wrist as if to tip an imaginary hat. “Oops!” he said, sniffing, as pasta sauce spilled from his fork. “Ah well, no problem. This shirt’s so colorful it camouflages spilled food.” He smiled.

When Stella emerged from the basement, the brightness of the kitchen surprised her. The clouds still looked like cauliflower, but they now had a radiant glow, as if sizzling in the sunshine of a celestial wok.

She heard a strange mechanical sound, and peered down the stairwell. Through an elaborate contortion, Meme-bot had managed to hoist himself up the bottom-most stair.

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“Wow,” Bruno exclaimed. “Breakfast in bed! I could get used to this.”

“Just a bagel with cream cheese,” Stella said. She gave him the tray, and sat next to him on the futon. “Hey, guess what: everyone is fine with you staying here for a bit.”

“Yay! And yum! You even brought coffee. With cream, just how I like it.”

A flash of doubt jolted through Stella’s body. “What have you been using instead of cream?” she asked timidly.

“Huh?”

Stella stared at the little orange hairs on Bruno’s muscular arm. “I just mean, well, you said you hadn’t left your apartment at all during the pandemic. So, for over a month. So, I guess you’ve had to drink your coffee black?”

Bruno frowned. “Am I being interrogated?”

“Not at all,” Stella said quickly. “I didn’t mean it that way.” She stared at the meandering cracks in the cement floor. A miniature robot, silver with gun metal accents, shot out from under the futon. It spun around twice, faced them, and blinked its big round eyes, before flashing across the room and hiding behind the dryer.

“What on earth?! Alyzia exclaimed from the stairwell.

Bruno gave Alyzia a wide smile. “That was Meme-bot. I made him myself.”

Meme-bot peeked out from behind the dryer.

“No kidding,” Alyzia said, approaching Meme-bot cautiously. “Impressive! I like the rows of square holes and blinking, multicolored lights around his chest. And the cadmium yellow antennae are a nice touch.” She twirled a strand of ash-blond hair. “He looks worried though.”

Stella stifled an eye roll. “Just because it *looks* worried doesn’t mean it *feels* worried. Although, I think it might have been smiling last time I saw it.”

“He’s quite expressive, actually,” Bruno said with a snuffle. “Not quite sure why.”

“You could take him apart and look inside and see why his facial expression changes,” Alyzia suggested.

“I’m no shrink.”

“You built him, Alyzia said. “So, you’re his psychologist.”

“Psychologists don’t look inside,” Bruno said. “Not even figuratively. I dated one. They just make the outside completely convoluted and then look at the inner folds of the outside.”

“I thought you study culture,” Alyzia said, joining them on the futon. “Isn’t that related to psychology?”

“I study it computationally,” Bruno said. “That’s different.”

“Your psychologist friend, does she have a dog?” Stella asked.

Bruno raised an eyebrow.

“So, Al, Stella says you’re all really still just roomies?” Bruno said. “No secret hookups? Not even between you two?”

“No,” Stella and Alyzia said at the same time, smiling.

“Really?” Bruno said incredulously. “No-one’s falling head over hooters?” He turned to Stella. “Though, that’s not much of a tumble for you, is it my little A Cups?”

Stella’s eyes widened in surprise. They laughed.

“A Cups, E Cups... it’s all good. What are all these tittering ladies doing down here anyhow? You’d think I was giving away free pantyhose.” He reached out and started tickling them both.

They sat back, startled, and then fell over each other, giggling.

“Foo off, you mongrel!” Stella said playfully. She reached out as if she were about to lightly slap him.

Bruno coughed, and cleared his throat. Stella’s hand hovered in midair for a second, and then she withdrew it. She looked at them both. She got up, brought two fold-up chairs from the other side of the basement, and placed them two meters from the futon. She sat in one, and nodded in Alyzia’s direction as invitation to sit in the other.

“Let’s be socially distanced, just to be on the safe side,” Stella said.

Alyzia stayed where she was. “Why does he look so unhappy?” she said.

“He’s lonely because I left the rest of them in the lab.”

“Why do you have so many?” Alyzia asked.

“I study cultural evolution with them.”

“How did a respectable hard scientist like you wind up studying soft, mushy crap like culture?” Alyzia asked.

Bruno leaned back against the wall behind the futon. Alyzia followed suit.

“Around the time I arrived in ‘la belle province,’ It occurred to me that *biological evolution* accounts for a relatively small proportion of the change we see on Earth. *Cultural evolution* now plays a larger role.”

“That’s probably true,” Stella said. “Mines, factories, galleries, guns, handiwork of, not Mother Nature, but Mother Culture.”

“Please confirm,” Meme-bot said in a silvery voice, “Activate protocol for PsyOp Mother Culture.”

“Whoa, Meme-bo, no!” Bruno said. “Override. Bad robot.”

Meme-bot scampered under the futon. Bruno eyed Stella suspiciously.

“He *talks*?” Alyzia said.

“He does lots of things,” Bruno said.

Bruno shifted his position such that his leg was almost touching Alyzia’s. Alyzia didn’t pull away. Stella was suddenly aware how close they were to each other, and how far away she was from them. There was no one in the world Stella felt closer to than Alyzia, but right now she wished Alyzia wasn’t there.

“What just happened?” Stella asked.

“No biggie,” Bruno said, wiping his nose. “You just happened to use a phrase that Meme-bot knows. Where was I? Oh yeah. I started comparing these two forms of evolution. Eventually I reached the conclusion that even though ideas and genomes both *evolve*, they evolve differently. In cultural evolution, new variants are generated strategically, because brains connect memes up with knowledge and experience, which they use to cook up *new* memes.”

Alyzia was looking at Bruno with a rapt expression. “Remind me what a meme is, exactly,” she said.

“Meme-bo! Come out, come out wherever you are.”

Meme-bot emerged and stood before them. Bruno seemed newly energized.

“How did it know where we are, and what direction we’re facing? Stella asked. “Can Meme-bot see?”

“Sure, he can do lots of things. Meme-bo, tell them what a meme is.”

“So glad you asked!” Meme-bot said in a tinkling metallic voice. “A meme is an idea, a unit of culture. Like a song, or turn of phrase, or a new toy design. Memes are one of my specialties.”

“Thank you kindly, Meme-bot,” Bruno said. “So, for example, the idea of talking to your plants is a meme. Except, I don’t actually *believe in* memes.”

“Huh?” Stella said. Her stomach was cramping up.

“Well, for technical reasons, the theory of memes—memetics—doesn’t make scientific sense. But the word meme itself is still a useful way of referring to a unit of culture. So, the novelty-generating components of culture—the mental equivalents of biological mutation and recombination—operate with *smarts*. A dab of hindsight, a dash of foresight, a sprinkling of ‘je ne sais quoi’, you might say,” Bruno said, with a provocative twirl of his index finger.

“What are mutation and recombination?” Alyzia asked. Her head drifted toward Bruno, almost as if she were about to lean it on his shoulder, thought she didn’t.

“They’re Mother Nature’s bag of tricks for varying a pattern of information. Meme-bot, give us a meme. Any old saying you’ve picked up recently.”

“Just me and my lonesome,” Meme-bot twinkled.

Inkling, a black cat, jumped onto the futon and nestled herself with her head on Alyzia’s lap and her tail splayed over Bruno’s.

“That’ll do, Meme-bo. Thank you. Now mutate it.”

“Just me and my threesome.”

“Great job!” Bruno said with a jubilant smile. “Couldn’t have done better myself. So, a mutation is a little tweak. Recombination means combining two patterns. Meme-bot, give us another meme.”

“A sprinkling of *je ne sais quoi*.”

“Good. Now recombine them.”

“A sprinkling of my threesome.”

Stella and Alyzia smiled begrudgingly. Stella thought back to the pure and uncomplicated attraction she’d felt the day before watching Bruno eat macaroni.

“How much intelligence does Meme-bot have?” Alyzia asked. “I’m not sure how random his answers were.”

“Yeah, Stella said. “Didn’t you just say Mother Culture generates novelty strategically?”

“Please confirm, activate protocol...” Meme-bot said.

“No, Meme-bot!” Bruno said. “Override.”

“What would have happened if you didn’t say ‘override’?” Stella asked.

Bruno raised his eyebrows. “Meme-bot would probably tie me to that decaying chesterfield and get his yayas out watching you two have your way with me.”

Stella rolled her eyes. An image of the three of them piled on the tiny chesterfield drifted through her mind. Obviously, it couldn’t hold three people.

“You’re right,” Bruno said, “In culture, new stuff isn’t generated randomly. For example, say you’re tired of having to get out of your car into the fucking cold to open the garage door. You don’t randomly tweak and combine every concept in your brain, from ‘spaghetti’ to ‘existentialism’, to ‘sexting’, in hopes of solving the problem. You consider stuff that’s potentially relevant. You might tweak and combine ideas about electricity with ideas about other kinds of openers, can-openers maybe, with insights into human laziness, and voilà: the electric garage door opener!” Bruno sniffled and wiped his nose. “That’s one way cultural evolution differs from biological evolution: people get hunches about how to tweak and blend memes to generate new ones. We can take existing memes and put our own spin on them.”

“Like, ‘spin the truth’?” Stella asked.

“As in, fake news?” Alyzia said. “Or, alternative facts?”

“Yeah,” Stella said. “Can this theory explain how someone takes a kernel of truth and gives it a twist? Like, say, theoretically, if someone who had *mostly* been alone during the

pandemic were to say they haven't seen anyone at all, even though, when it comes down to it, that person hadn't been *completely* alone."

Bruno cleared his throat. "What are you trying to say, Stella?" he asked.

Stella gulped. She suddenly understood what had made Paul McCartney write the song, 'Yesterday.'

"Hey Bruno," Alyzia said, "If Meme-bot can see, is it possible for you to somehow see what it's seeing?"

Bruno furrowed his brow. "Yes. And then he sees what *I'm* seeing, and then I see what *he's* seeing, and so on and so forth, til our circuits overload and we both blow up."

They laughed, but Stella's stomach was in knots. The lights on Meme-bot's midriff were blinking chaotically.

That night, Stella made certain to close her bedroom door.

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"Let's sit on the porch, Stella said.

"Good idea," Seung Gong said, nodding. "Socially distanced." He was lean, with an infectious smile.

They filed out, followed by Meme-bot. Large branches were strewn across their tree-lined street in the student ghetto near McGill University. The absence of backpack-laden students on bikes and skateboards was unsettling, but the sun was shining, and there was a gentle breeze.

"I'm so grateful to you guys for letting me stay with you," Bruno said. "Just let me know how I can contribute. If anything needs fixing, I'm your man." He plopped down on the outdoor sofa and took a deep breath. "Meme-bot's helpful too," he added.

"You're the court jester," Raj said, eyes glinting like drops of maple syrup. He hoisted himself gracefully onto the porch railing.

"Not to mention, our own knowledge channel," Alyzia said.

When Alyzia took the seat beside Bruno, Stella felt a twinge of regret; she could so easily have ensured that it was *her* sitting next to Bruno. Though, on second thought, it was probably wise to sit as far away from him as possible. She joined Raj on the porch railing. Seung Gong took the swing. The forsythia was a spritz of buttered popcorn, and the scent of magnolia blossoms filled the air.

"Don't they smell amazing?" Stella said.

Bruno sniffed, and shrugged his shoulders.

"I have a question about memes," Alyzia said, "To evolve, don't you have to be able to bear offspring? And memes don't bear offspring, so how could they evolve?"

Bruno spat loudly into the forsythia. "Meme-bot, tell Al how memes evolve."

"In biological evolution, organisms that survive long enough to produce offspring are doing something right," Meme-bot said brightly. "Natural selection weeds out the ones that don't produce offspring. In cultural evolution, replication occurs when we imitate one another, share ideas, teach each other things." He blinked.

"Why, thank you Meme-bot!" Alyzia said.

“So, we didn’t have to invent handwashing and social distancing from scratch,” Stella said. “We learnt them from other people.”

Bruno narrowed his eyes slightly. “Correct. We learn them and adapt them. You take the idea of social distancing and adapt it to the constraints of your own business, and that might look different for, say, a pork processing plant than a hot yoga studio.”

Bruno casually put his arm around Alyzia. Stella’s heart skipped a beat. She took a deep breath, not sure whether she was jealous of Alyzia, or concerned for her.

Meme-bot clasped its little metallic hands together. “Allow me to tell you about another difference between biological and cultural evolution. Biological entities contain the instructions for their own replication, whereas cultural entities don’t. That is, genomes contain two kinds of instructions. The first kind they use to build bodies that house and protect them, and the second kind tells them how to assemble whole new genomes. When they reproduce, they just follow the instructions. Ideas, on the other hand, lack this second kind of instruction; they kowtow to *us* to replicate them. We implement ideas that help us satisfy our needs and aesthetic sensibilities, so our needs and aesthetic sensibilities guide their evolution.”

Inkling appeared on the porch rail, next to Raj. He eyed Meme-bot suspiciously.

“Sort of like how viruses get us to replicate them,” Raj commented, fingering the tiny gold stud in his left ear.

“Sort of.” Bruno sneezed. “Damn,” he said. “I’ve had a cold every day of my life since I was five.”

Stella frowned. She opened her mouth to speak, but at that moment, Meme-bot shot up several metres into the air, leaving a trail of glittering dark smoke. He hovered above them lights blinking ferociously, bristling with the sound of electric currents, for about ten seconds, before plunging and landing in the centre of the porch.

“Whoa, little guy!” Bruno said, giving Meme-bot a gentle pat.

Inkling hissed loudly. His back was arched and his tiny fangs gleamed.

“What the heck—so, Meme-bot’s a drone?” Stella said. She made a mental note not to leave her bedroom window open that night.

“Allow me to continue,” Meme-bot said with a blink and a smile. “That leads to an interesting *similarity* between cultural evolution and biological evolution. One ecological niche spawns another. The evolution of cars created niches for gas stations and seat belts and garage door openers, just like the evolution of cats created niches for species that eat cats and species that live in their guts as parasites.”

Stella gave Bruno an impish look. “I’m going to grab Meme-bot and see what happens when I whisper in its antennae: Mother Culture,” she said, mouthing the last two words.

Bruno gave Stella a sly look. “The password’s been changed.”

There was a tiny clinking sound as Meme-bot turned his head and faced Stella squarely.

“Culture is a fractal process, in the sense that every time you examine one need, you realize that it can be decomposed into a set of *sub*-needs, which themselves are decomposable into *sub*-sub-needs.”



What Stella needed was to get away from this place. She couldn't cross the Provincial boundary due to the lockdown, and she didn't even own a car, but maybe she could load up her bike with supplies and find a little spot by a river somewhere.

"As the number of need-fulfilling objects increases," Meme-bot continued. "The utility of any one of them appears to decrease," "This is called invariance with respect to scale."

"Right-oh, Meme-bo," Bruno said. "Until it reaches the state of absurdity it's reached in our society, where we make stuff like the strip of paper they put over toilets in hotels to make it look like you're the first person who ever took a dump in them."

"So, you see," Meme-bot said, "The flurry of new gadgets on the market these days is analogous to the flurry of new species during the Cambrian explosion."

"Exactly," Bruno said. He started gently massaging Alyzia's shoulder with the hand that was not patting Meme-Bot.

Raj crooked his eyebrow. "That's why we're all generally pretty nice to one another even though we're not genetically related," he said eagerly. "We're *memetically* related. You get memetic altruism between people who share ideas."

"Right," Bruno said. "And wars between people who don't. If you want to contribute to the evolution of ideas, you first internalize any relevant *precursor ideas*. So, the person who invented the car first had to learn everything there was to know about axles and engines. The person who opened up the first adult toy shop had to do some objective research on porn and vibrators. This creates a viable 'niche' for the innovation to be born into."

Raj gave Meme-bot a penetrating look. "What idea-niche was Meme-bot born into?" he asked.

Meme-bot blinked. "Allow me to proceed toward the climax of my information," he said. "There is another way ideas con us, their hosts, into evolving them, besides by being useful. It is by making us *identify* with them, making us think we possess them, think they are inherently part of us. The best way to make someone like an idea enough to pass it on is to make them think it's theirs."

"That's my 'lil Meme-bo," Bruno said.

"I have more," Meme-bot said. "Humans participate in two evolutionary processes, biological, and cultural. They don't deserve *credit* for their ideas any more than they deserve credit for the microorganisms evolving in their guts."

"Or our lungs," Stella said. Bruno was staring at her hands, and became aware that she had been clenching and unclenching them.

"Wherever," Bruno said. "In both cases, all we do is provide a fertile ground for them to be fruitful and multiply. When the Wright Brothers collaboratively invented the airplane, memetically speaking, they were screwing."

"That might be taking it too far," Alyzia said with a snuffle.

Bruno spat on the forsythia again. The impact of the spittle caused a tiny yellow flower to wobble and glisten.

“That may be another similarity between the cultural scenario and the biological scenario,” Bruno said. “Before someone gets the virus, they feel one way about it. But if they start to wonder...” He gulped.

“Bruno, do you think you might have COVID?” Raj said.

“Absolutely not,” Bruno said defiantly. “I’ve hung out with you guys enough that you know I *always* have a cold. I meant *theoretically*.”

Stella and Raj exchanged glances, and then stared at Bruno. Bruno looked around, bushy orange eyebrows raised.

That night, Stella again envisioned herself packing up her tent and wandering off and hunkering down somewhere by a river for a while. Then it dawned on her: why should *she* leave? Bruno was obviously the one who should go.

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Raj set an iron skillet full of scrambled eggs on the table of the spacious kitchen where Stella, Alyzia, and Seung Gong were seated. Sunlight poured in, and Stella noticed a glittering crack in the stained-glass window.

“It’s probably time to start hinting to Bruno about going back to his apartment,” she said, trying to sound casual.

Alyzia looked startled. “There’s no reason to do that,” she said. “It’s great having him around. Last night he fixed the leaking tap in the bathroom.”

“I can fix things too,” Stella said. “And I don’t...”

Seung Gong held a finger in front of his lips. Stella heard Bruno’s lumbering footsteps on the basement staircase.

“Top o’ the mornin’ to yuh!” said a disheveled Bruno, grinning.

“You up already?” Raj said. “It’s only noon.”

“I was lying in bed thinking about my Meme and Variations program. Hi nice plant. Hi stupid plant.”

“You’re out of breath,” Stella commented.

“The pandemic has interfered with my exercise routine. Shall we start the day with an orgy, just for the exercise?”

They laughed.

“What’s Meme and Variations?” Alyzia asked.

“My computer model of cultural evolution. The title is a pun on the classical music form, ‘theme and variations.’ Just like you can start with a melody and generate variations of that melody, you can start with a meme—an idea or belief—and then generate variations of it.”

“Like,” Stella said hesitantly, “as a hypothetical example, you might start with the meme that a particular person was completely isolated during the pandemic. A minor variation on that meme might be, say, that the person went to the grocery store once with their mask too loose.”

“Give it a break!” Alyzia said. “He told us he’s been alone since the pandemic started. And it almost never affects people in their twenties anyway.”

“Montreal is a hot spot,” Seung Gong said.

“We’re doing all we can,” Bruno said. “Staying home. Eating healthy. And like I said: an orgy a day keeps the flab at bay.”

They laughed.

“Show us Meme and Variations,” Alyzia said.

“It’s actually the next best thing: a *memetic* orgy,” Bruno said.

Stella put on a mask. Seung Gong followed suite.

“Here, use my laptop,” Alyzia said.

“That’ll work,” Bruno said. “Now... I wonder, what would Alyzia have as a password?” he added thoughtfully. “Let’s try P-E-N-I-S.” He froze, mouth agape.

“Hah!” Raj said. “It says: ‘Password Invalid: Too short’.”

They burst out laughing.

Bruno grinned sheepishly. “The computer didn’t know whose penis it was. I bet if I try ‘BRUNO-PENIS’ it will say, ‘Very long’.”

Alyzia bent over Bruno to type in her password. The close way she leaned into him made Stella nervous.

“Al, your computer takes forever to start up. Sure you don’t have a virus? Ah, here we are.”

Bruno’s fingers scuttled over the keyboard like water spiders, and windows filled with code, graphs, statistical data appeared on the monitor. At the top it read ‘Meme and Variations’. Bruno scanned his phone around the room, snapping pics of each person present.

“Check it out,” Bruno said, pointing above them. Dozens of holographic avatars popped into existence above and around them.

“Oh my gosh!” Stella exclaimed. “That one suddenly changed from looking bland and generic to looking just like me, even the mask. It just winked at me! And there’s one of Seung Gong, and Bruno, and all of us.”

“I populated the avatars with the scanned pics of you guys.”

“Mine is wearing different shoes from the ones I’m wearing now, but they’re the exact same shoes as I was just looking at online,” Alyzia said.

“They look great on you!” the other avatars chimed in unison.

Stella’s avatar approached Alyzia’s avatar, holding a similar pair of shoes. “Wearers of *these* shoes are slightly less accident-prone. If you buy them instead, you could say five dollars per year on car insurance!”

Stella raised her eyebrows. “Hey, where does the funding for this project come from?” she asked.

Bruno turned away from Stella.

“I’m not sure the avatars are anatomically correct,” Raj said. He pushed his sleeves up to his elbows. “Bruno, rescan my biceps.”

Bruno rolled his eyes.

“Some of them look like people who aren’t present,” Alyzia commented.

“They’re people who’ve seen the program before. Grad students, mostly.”

“Does your psychologist friend have an avatar?” Seung Gong asked.

“Who told you about her?” Bruno said.

Seung Gong blinked and looked from side to side.

“Bruno, you might want to do some memetic contact tracing,” Raj said with a wry smile.

Bruno pursed his lips.

“What about Meme-bot?” Alyzia said. “Does he have an avatar. Oh yes, there he is.

Wow, Meme-bot’s avatar looks incredibly real.”

“Meme-bot *doesn’t* have an avatar,” Bruno said, his face brightening. “Holy crap, Meme-bot finally reproduced! I’ve been working on that forever!”

“Hello, Meme-bot2!” Alyzia said. “You’re even more adorable than the original Meme-bot. Although, you sure spin around a lot.”

Bruno picked up Meme-bot2 and examined him.

“Let’s get on with it, Bruno,” Raj said.

“Absolutely,” Bruno said, cradling Meme-bot2 with parental love. “The avatars invent and imitate memes for actions and gestures. What kind of memes would you like them to invent and imitate? If I turn on the ‘procure food and shelter’ goal they evolve tools. If the ‘attract a mate’ goal is on they evolve dance steps...”

“Dance steps!” Alyzia said.

“I’m surprised Bruno didn’t choose verbal memes,” Stella said. “His avatars could have invented puns, or mixed metaphors.”

“I hate it when someone talks about you behind your back right under your nose,” Bruno said.

They chuckled. “Nice one,” Stella said.

“Well,” Bruno said, “for one thing, that would be complicated; I’d have to write a parser and an interpreter, and get ensnagled in all kinds of natural language crap. The idea of Meme and Variations was to build a *minimal model* of cultural evolution, one that captures the skeletal essence of the process. And second, there’s scientific evidence that mimetic display was the earliest form of cultural exchange. And third, it makes for nice visuals. Speaking of visuals, what would you like the setting to be? A garden?”

The avatars were suddenly adrift in a bright, floating garden with moss-covered stone bridges, twittering robins, and floral scents.

“Burning Man?”

The scene changed to a pandemonium of multi-colored lights on a sand-swept desert, with an ornate temple burning against a coppery rhubarb sunset.

“Another planet?”

“Another planet!” Stella said eagerly.

The avatars were enveloped in purple-ish mist. Faint rainbows shimmered in the light of a distant crimson sun, and hazy grey shapes, unrecognizable, hovered behind them.

Bruno made an obnoxious churning sound not unlike a motor trying to start.

“Living alone one forgets politeness,” Seung Gong commented, with an understanding smile.

“Where were we?” Bruno asked. “Oh yeah. The avatars have three parts. They have a deep neural network: a brain-like device that learns and encodes memes, a *meme-ory* if you will. They also have an *embodiment*: a set of body parts that implement memes. Finally, they have a *memetic learning algorithm* of sorts, a set of instructions for how to alter existing memes to make new ones, capitalizing on knowledge they’ve built up throughout a run.

“Every iteration, three events take place. First, each avatar has the opportunity to learn a new meme, either by imitating a neighbor or inventing one of its own. Second, each avatar gets to decide whether it wants to actually *implement* the new meme. Third, if it has gained any insight into what constitutes a good meme, it updates its memetic algorithm. A run of the program consists of these three events iterated over and over. Because they’re occurring in parallel across the society of avatars, interesting patterns pop out.”

“Let’s see it in action,” Raj said.

“Here goes,” Bruno said. He sneezed, and wiped his nose on his sleeve.

“Nothing’s happening,” Alyzia said, wiping the back of her hand across her forehead.

“Sure, it is,” Bruno said. “They’re implementing the ‘do nothing’ meme. Not a particularly impressive meme, I admit. But soon one of them will alter it. By golly, there she goes!”

Bruno’s avatar began swaying its hips. It smiled broadly, then turned to Alyzia and winked, as its T-shirt turned blue.

Alyzia looked at it quizzically.

“Their T-shirts change color depending on what meme they’re implementing,” Bruno said. “Watch what happens to its neighbors. Since this meme, and in fact, just about *any* meme, is better than the ‘do nothing’ meme, its neighbors will imitate it.”

One of the neighboring avatars started swaying its hips, and its T-shirt turned blue.

“The colors could stand for different mutant forms of a virus,” Raj observed. “Instead of spreading some kind of ‘virus of the mind’ they would be spreading literal viruses.”

“The Stella one is shaking not its hips but its head,” Seung Gong said.

“Yeah, it invented a new meme,” Bruno said. “Look at the two by the window nodding their heads at each other. And Al’s avatar has combined the hip-swaying meme with the hand-waving meme!”

“Look at me,” Alyzia’s avatar called out. “My favourite shoes—now in hot pink!”

Alyzia’s jaw dropped. “So, *they* can talk too?” she asked. “I thought they just did actions.”

“They aren’t yet *culturally evolving* their speech,” Bruno said. “Though they’ve been known to surprise their maker.”

“Look at *me*,” Seung Gong’s avatar said cheerfully. “In Canadian-style tuque!” A red and white tuque appeared on the avatar’s head.

Raj raised his eyebrows. “There’s new memes popping up everywhere,” he said. “The one that looks like Seung Gong is jiggling its foot.”

“Or maybe it isn’t an *idea* for how to jiggle its foot,” Stella said. “Maybe it caught a wacked-out mutant version of some virus that causes it to jiggle its foot.”

“The head-nodding red T-shirt ones are all in the corner,” Seung Gong said. “And all the blue T-shirt ones in the middle are swaying their hips. They seem to be clumping into a subculture.”

“Look at me!” the avatars cried out in a tumultuous chorus, like popcorn, above and around them.

“My avatar is moving its arms, swaying its hips, *and* jiggling its feet,” said Raj. “If that doesn’t attract mates, nothing will!”

Bruno fluttered his eyelashes seductively in Raj’s direction.

Alyzia gazed up at the holograph, transfixed. “This really does resemble how ideas spread in a society. But all they do is invent and imitate.”

Bruno grinned proudly.

“Of course, if they were different mutant virus infections instead of different memetic subcultures, Raj said, “you’d want to figure out if getting infected by one kind of mutant makes you resistant to another.”

“Hey guys, look at me,” Raj’s avatar said. “You like my sexy new swim trunks?”

“Don’t look at *him*,” Bruno’s avatar said gaily. “Look at *me*.”

Stella noticed, in a corner of the kitchen ceiling, a second sun, dimmer and darker than the main one. “This is getting kind of creepy,” she said. “Will these courtship displays be followed by, um, consummation? Cause if so...,”

“Look at *me!*” Stella’s avatar said.

“They’re getting louder,” Seung Gong observed.

“We are louder!” Seung Gong’s avatar called out gleefully.

“They understand?” Alyzia asked.

“I didn’t explicitly program that in,” Bruno said. “But they know how to evolve actions. Maybe they’re doing a bit of cross-domain knowledge transfer.”

“We understand!” Alyzia’s avatar said, loudly and definitively, eyes shining.

“We understand!” other avatars echoed.

“*I* understand!” Seung Gong’s avatar shrieked. “Me, *I* understand!”

“We stand under!” Stella’s avatar said.

“*They* stand under *us!*” Bruno’s avatar cried out.

The avatars were all shrieking now, in a wild cacophony. Beneath them Meme-bot zigzagged erratically, while Meme-bot2 spun in circles and called out in a painfully tinkling voice, “A sprinkling of Inkling!” Inkling himself gazed down in horror from high atop a kitchen cabinet.

Stella and Seung Gong exchanged wide-eyed glances. Alyzia came over to Stella and put her arm around her waist. Stella froze.

“*We stand over them!*” Raj’s avatar cried out jubilantly.

“Turn off the sound,” Raj shouted.

Bruno frowned, and clicked a button on the computer. Silence filled the room.

Stella looked at Alyzia apologetically, and pulled away from her. She took a deep breath, and peered into the misty violet landscape above them where legions of avatars were dancing in synchrony, silently, though their lips still moved. Her own world had become almost as alien as that one.

“A sprri...” Meme-bot2 said. Inkling made a wide arc through the air and pounced on Meme-bot2, knocking him against Meme-bot. Meme-bot toppled over. Meme-bot2 fell silent.

A gust of wind rattled through the kitchen window, which wasn’t quite shut. A small chunk of window adjacent to the crack fell to the floor.

“That was something, Bruno,” Raj said.

“I don’t see any new memes popping up,” Seung Gong observed.

“That’s because I only gave them one goal: to come up with mate-attracting dance steps,” Bruno said, stopping the program. He coughed. “Once they found an attention-grabbing dance step, they stuck with it. Things are more complicated when they have two goals.”

“I found it sad that in the end they converged on just two different memes,” Raj said.

“That’s because I gave them a low creation to imitation ratio. They spent most of their iterations copying one another. When I don’t allow them to imitate at all, they end up doing their own thing; you don’t see any spatial patterns in their T-shirt colors. But they evolve more slowly, because imitation can be an effective shortcut. On the other hand, if *all* they can do is imitate, nothing happens; there’s nothing to imitate! The optimal creation to imitation ratio is about 2:1. Well, that’s when their *average* performance is optimal. The performance of the *best* avatar is optimal when there’s no imitation.”

“Makes sense,” Raj said. “If you’re the best, imitating others is a waste of time. I can relate to that,” he added, with an impish smile.

“So, is the moral of the story that if you’re smart, live in an individualist society and do your own thing, and if you’re not, live in a conformist society, and copy everyone else?” Alyzia asked.

Stella noticed that the inner corner of Alyzia’s left eye was inflamed.

“Not quite,” Bruno said. “That too was an artifact of them having just one goal. In a complex society with a division of labour, *everyone’s* the best at *something*.”

“It would be good if they could adjust how creative they are according to the success of their ideas,” Raj said. “You might end up with some avatars that are ignored, while others are imitated by everyone. A sort of primitive social hierarchy.”

“Self-tuning,” Bruno said. There were beads of sweat on his brow. “Yeah, I’ve done that. I have a paper on it if you’re interested.”

“Not *that* interested,” Raj said. “But thanks. It’s cute, but it misses the boat.”

“What do you mean?”

“I think I know what he means,” Alyzia said slowly. “Even for a minimal model, it does leave out some vital stuff.” She suddenly clutched her chest with her hand, then sat back and took a deep breath.

Bruno’s eyes widened. He looked at Alyzia intently. After a minute he said, “Like what?”

“Well, creativity isn’t just a mechanical process of mixing and matching. It involves intuitions. Passions. Daydreams.”

“Daydreams are just mental states conducive to the mixing and matching of memes.”

“And the spinning of them?” Stella said.

Bruno tried to stifle a cough, which seemed to make his need to cough greater. He bent over, coughing profusely, until he ejected a large wad of translucent goop. It landed on the floor with an audible splatter. He rubbed his eyes. “Jesus, I feel like my eyes are gonna pop out of their sockets.”

“Does anyone remember exactly the list of symptoms of COVID19?” Seung Gong asked.

“Bruno,” Stella said, “We need a straight answer from you. Have you been *completely* isolated during the pandemic?”

Bruno slumped his shoulders and looked down. “Most of the time,” he said softly. He coughed, then coughed again, then followed that up with an excruciating onslaught of raspy coughs. His neck lurched forward as if he were about to throw up. He put his hand to his mouth, ran to the bathroom.

They looked around at each other, wide-eyed.

“May I?” Stella said to Alyzia, pointing at her computer.

Alyzia nodded, and put her head between her hands. She groaned softly. Inkling jumped onto her lap. Stella pulled a chair into the far corner of the kitchen and sat down with the computer. Disconcerting noises emanated from the bathroom.

“Very interesting,” Stella said slowly, rolling the ‘r’s. “Meme and Variations is funded by a number of social media companies. And Meme-bot is funded by Department of National Defense.”

“It often rattles me to learn where my tax dollars go,” Raj commented.

Stella noticed that Raj and Seung Gong were bent over Meme-bot, tools in hand. Seung Gong detached Meme-bot’s head and examined it quizzically. Raj peered into Meme-bot’s belly with a flashlight.

“Here’s a layperson summary,” Stella said. “Meme and Variations aims to study how social groups evolve distinctive subcultures that impact their interpersonal dynamics and effectiveness, and investigate the role robots can play in social responses to disaster. It accomplishes this using cross-correlational analysis of language, voice, prosody, and—hm, didn’t see this coming—pheromone release.”

“So *that’s* what this is!” Raj said. His arm was deep in Meme-bot’s innards. “It’s for analyzing the pheromones floating in through that ring of little holes that spans its circumference.”

“How ya doin, Al?” Stella said.



“Been better. Sad more than anything.”

Raj’s eyes lit up. “When he comes out of the bathroom, let’s pretend we’re all deathly sick,” he whispered.

Seung Gong grinned. “And we hate each other,” he whispered. “A true social disaster.”

A bedraggled Bruno returned from the bathroom. There was fear in his bloodshot eyes. He blinked in surprise when he saw the disassembled Meme-bot.

“Don’t throw up on me, Raj,” Alyzia said, pulling her chair away, as Raj careened against the kitchen table with an agonizing moan.

“Shit, you guys,” Bruno said, eyes glistening unnaturally. “I’m horribly sorry. I swear I didn’t feel anything ’til after I got here.”

“What—the hell do you mean—we have no aspirin—Seung Gong?” Stella said, gasping for air as she spoke. “I distinctly—remember buying aspirin. You bastard, did you take them all?” She slumped down onto the floor, wheezing heavily.

“My head!” Seung Gong cried out, eyes closed shut, squishing his head with his hands.

“My pheromones are acting up again!” Raj wailed.

Alyzia widened her eyes and pinched her nose.

Bruno’s eyes darted around nervously. “Hopefully it’s just a cold,” he said. “I’m gonna grab my wallet downstairs and then go get tested.” He started coughing and spitting up phlegm. His elbow reached his mouth just in time to catch it. “You guys wanna come with me?”

“No, go ahead,” Alyzia said, shaking her head.

“Hurry and get better,” Stella said. “We can’t wait to see how your robot experiments turn out.”

END

#### FURTHER READING

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