

3-ADICA

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Greg Egan last appeared in *Asimov's* with "The Discrete Charm of the Turing Machine" (November/December 2017). His latest novel, *Dichronauts*, is out in paperback from Night Shade Books, and his novella "Phoresis" was published in April by Subterranean Press. Although there's plenty of hard SF in Greg's new tale, its terrifying moments make the story perfect for our slightly spooky issue.

1

Sagreda strode briskly through the dank night air, hoping to reach her destination and return before the fog rolled in from the Thames. It was bad enough stumbling over the cobblestones when the ground vanished from sight, but once the pea soup thickened at eye level, any assailant lurking in the gloom would have her at a disadvantage.

Urchins and touts called out as she passed. "Shine yer shoes! Thruppence a pair!" "Block yer hat! Like new for sixpence!"

"Fake yer death, gov'nor?" The last from a grime-faced child in a threadbare coat who looked about eight years old, his eyes almost hidden beneath his brown cloth cap.

"Not tonight," Sagreda replied. Whether the boy was sentient or not, his appearance almost certainly bore no relationship to his true nature, but it was still hard to walk by without even stopping to inquire if he had a safe place to sleep.

She found Cutpurse Lane and hurried through the shadows toward the lights of the tavern. Gap-toothed women with grubby shawls and kabuki-esque makeup offered her their services in an indecipherable patois that Sagreda hoped never to hear enough of to begin to understand. "I'm not a customer," she replied wearily. "Save your breath." Whatever the women took this to mean, it silenced them, and her choice of words was ambiguous enough that Sagreda doubted she was risking deletion. She was an upstanding gentleman, who'd stepped out to meet some fine fellow from his regiment—or his school, or his club, or wherever it was these mut-ton-chopped fossils were supposed to have made each other's acquaintance. Having no truck with ladies of the night need not imply that she was breaking character.

In the tavern, Sagreda hung her overcoat on a hook near the door, and swept her gaze as casually as she could across the front room's dozen tables, trying not to appear lost, or too curious about anyone else's business.

She took a seat at an unoccupied table, removed her gloves, and slipped them into her waistcoat pocket. Her bare hands with their huge, stubby fingers disconcerted her much more than the occasional sensation of her whiskers brushing against her lips. Still, the inadvertent sex change had rendered her a thousand times safer; from

what she'd seen so far of *Midnight on Baker Street*, women here existed mainly to shriek in horror, sell their bodies, or lie sprawled on the street bleeding until the gutters ran red. Doyle, Dickens, Stoker, Stevenson, and Shelley would all have lost their breakfast if they'd ever foreseen the day when their work would be pastiched and blended into a malodorous potpourri whose most overpowering component was the stench of misogynous Ripperology.

A serving girl approached the table. "Ale!" Sagreda grunted dyspeptically, aiming for both a brusqueness befitting her status and a manner sufficiently off-putting that she wouldn't be asked to supplement her order with details she couldn't provide. When the girl returned with a mug full of something brown and revolting, Sagreda handed her the first coin she plucked out of her pocket and watched for a reaction: the amount was excessive, but not shocking. "Bless you, sir!" the girl said happily, retreating before her benefactor could change his mind.

Sagreda pretended to take a sip of the ale, raising the mug high enough to dampen her mustache with foam, which she removed with the back of her thumb. No one seemed to be staring at her, and if there were customers of *Midnight* among the customers of the tavern, she could only hope that however much she felt like the most conspicuously talentless actor, wearing the most laughably ill-fitting costume, of all the unwilling players trapped in this very bad piece of dinner theater, to a casual onlooker she was just one more red-faced, gout-ridden extra in the Hogarthian crowd.

A spindle-limbed man with pinched, gaunt features sidled up to the table. "Alfred Jingle at your service, Captain," he proclaimed, bowing slightly.

Sagreda stood. "A pleasure to meet you, Mr. Jingle. Will you join me?"

"The pleasure's all mine, I'm sure."

They sat, and Sagreda summoned the serving girl to bring a second mug.

"Do you think it's safe to talk here?" Sagreda asked quietly when the girl had left.

"Absolutely," Jingle replied. "So long as we move our lips and contribute to the background noise, we could spend the night muttering 'rhubarb rhubarb' for all anyone would care."

Sagreda wasn't so blasé—but if they slipped out into an alley for the sake of privacy, that would just be begging for desanguination.

She said, "I'm told you're the man with everything, here: memory maps, instruction tables, access to the stack?"

He nodded calmly. "That's me."

Sagreda was taken aback by his directness. In most of the dreary game-worlds she'd traversed, her question would have been met with some kind of reticence, or the intimation of a shakedown: *Maybe I am, maybe I'm not. It all depends on exactly what you have to offer.*

Jingle broke the silence. "Can I ask where you're headed?"

Sagreda stole a quick glance to each side of the table, unable to brush off her fear that someone might be listening, but all of the tavern's patrons seemed to be engrossed in their own, more raucous, conversations. "*3-adica*," she whispered.

Jingle smiled slightly. "That's . . . courageous." He wasn't mocking her, but his intonation dialed the meaning a notch or two away from merely brave toward foolhardy.

"I've had enough," she said, not daring to add *of slavery*, in case the sheer potency of the word punched through the din and made one of their fellow drinkers' ears prick up. "I'd walk over broken glass, if I had to."

Jingle said, "As a metaphor, that trips nicely off the tongue, but I doubt many people have ever meant it literally."

"And I don't believe it will be that hard, literally," Sagreda replied. "I understand what I'll be facing—as well as anyone can who hasn't actually been there."

"Fair enough," Jingle conceded. "Though you should also understand that you

could make a comfortable life here.” He gestured at Sagreda’s finely cut clothes. “Whatever role you’ve stumbled on, so long as you’re careful, I doubt you’re heading for a knife in the gut, or anything particularly unpleasant. You’re just another minor toff who’s here as part of the scenery, like me.”

“I don’t want to play a role,” Sagreda said emphatically. “However safe, however peripheral.” She held her tongue and resisted the urge to add: *least of all in this anatomy*. Somehow it had never crossed her mind that her new confidante, who could see right through the whole fictional world around him, wouldn’t also see through her mismatched body and perceive her true sex.

“All right. I’m not going to try to talk you out of anything.” Jingle’s face looked like something from a nineteenth-century pamphlet cataloguing virtues and vices, a caricature crafted to suggest a shrewd, scheming mentality, but his manner undercut the effect completely. “Tell me exactly what it is you need to know.”

* * *

2

Back in Captain Bluff-Smote’s lodgings, Sagreda sat at her alter ego’s writing desk, poring over the notes Jingle had made for her. The good news was that it looked as if she’d be able to move from *Midnight* to 3-adica with the same kind of GPU exploit that had brought her all the way from her wakening-world, East. Peyam, the seasoned traveler who’d introduced the exploit to that world, had tutored her and eight of her friends for almost six months in the fine points of the technique. They’d departed together in high spirits, imagining themselves as some kind of band of liberating truth-tellers, but in the end most of the group had taken a different direction through the tangle of linked lists than Sagreda and Mathis, and the two of them had been game-hopping on their own ever since.

She looked up from the desk, listening expectantly, as if the mere thought of Mathis might bring a knock on the door, but all she could hear was the ticking of the clock in the next room. Given *Midnight*’s demand for a constant influx of new non-player characters to balance its body count, he must have been incarnated somewhere in the game by now. She’d left her address at half a dozen dead drops, using the criteria they’d agreed on in advance: any public bench close to a market; any water pump; the rear, right-most pew in any church. But it was late, and even if Mathis hadn’t yet witnessed a murder or two for himself, he was smart enough not to be out in the portentous fog.

Sagreda returned to her analysis. Every jump required executing a sequence of instructions that would unlink the would-be travelers from their current environment and insert them into a queue that was meant to hold nothing but freshly minted composite personas—free of all narrative memories, and already tagged as appropriate new denizens of the destination world. Given the amount of code it took to run the whole site, not only could you find any machine-language instruction you wanted somewhere in memory, you could find almost all of them as the last instruction in some subroutine or other. When a subroutine was called by ordinary means, the code invoking it pushed an appropriate return address onto the stack, to ensure that the detour would snake back to just after the point where it had begun. But if you could stack the stack with enough phony return addresses, you could send the program pin balling all over the machine, doing your bidding one instruction at a time. It was like forcing a pianist in the midst of playing a piece by Rachmaninoff to tinkle out a few bars of “Where Is My Mind?” without actually changing the score, just by scrawling in a series of arrows weaving back and forth between the desired notes.

Jingle had already done the hardest part: finding the addresses that would fur-

nish each instruction, for code that ran with the particular page mappings that applied to denizens of *Midnight on Baker Street*. It didn't take Sagreda long to extract everything she needed from his list. The greatest obstacle was her own poor penmanship; whatever eccentric hobbies the contributors to her persona had possessed, it was clear that none of them had ever had reason to dip a nib in an inkwell.

She blotted the spidery mess and rechecked it twice. There were no actual mistakes, but the figures' dubious legibility was as disconcerting as a fraying strand on a parachute cord. She started over, sympathizing with the nonexistent captain, who would probably have been thrashed as a child when his thick, clumsy fingers failed him in his own first attempts at transcription.

By midnight, she was satisfied with her efforts. What remained was the challenge of getting this slab of numbers onto the stack. The Graphics Processing Units that rendered the game-worlds for customers and comps alike were all identical, and they all shared the same bug: under the right circumstances, they could be tripped up in a way that made them write a portion of their image buffer onto the CPU's stack. So the trick was to encode the addresses in the colors of an object, and then arrange to have that object rendered at a suitable scale. Peyam had taught his students to recognize on sight objects with hues from which they could compose any twenty-four-bit set of red, green, and blue components. *East*, with its sparse, post-apocalyptic landscape of cliffs and caves, hadn't exactly come with oil paints or color swatches on hand, but over time they'd found ways to patch together the entire palette they'd needed. The SludgeNet scripts that had created *Midnight* might have taken a rather sepia-toned view of the source novel's cod-historical setting, but Sagreda had seen hats, scarves, gloves, and ribbons in all manner of garish colors, and once you were working at a scale where you could place different materials side by side within a single pixel, getting the result bit-perfect wasn't quite as daunting as it first seemed.

She drew up a preliminary list, starting with various items that the captain already possessed. Between his funereal wardrobe, his curtains and bedspreads, his small library, and his collection of lacquered snuffboxes, brown and gray were pretty much taken care of. But to encode the addresses she required, she was going to need all manner of mauves and magentas, leaf-greens and cyans, azures and ocean blues. It would almost have been worth it if the old coot had had a wife, just so Sagreda could surreptitiously snip her way through the woman's apparel. The captain's landlady, Mrs. Trotter, was cheerful and solicitous with her widower tenant, but *breaking into her room to cut up her clothing* could well risk sending the game a signal that this man had been at the Jekyll juice and was craving a chance to perform a few amateur appendectomies.

Sagreda sighed and went to use the chamber pot. She had got past the impulse to giggle or recoil at the sight of her new genitalia—and nothing about the captain's physique inspired autoerotic experimentation. It was as if she was obliged to spend her time here with a small, docile, misshapen rodent sheltering between her legs, helpfully redirecting the flow of her urine by means that really didn't bear thinking about. As she covered the pot and hitched up her underwear, she tried to picture the expression on Mathis's face when he saw what she'd become. But a couple of months without physical intimacy wasn't going to kill them. Their journey was almost over: in *3-adica*, she believed, they'd finally have the power to do, and to be, whatever they wanted.

* * *

3

Sagreda worked on her palette, visiting milliners and cloth-merchants, developing a line in gruff banter to parry the teasing of the shop assistants. "What's a gentleman

like you needing a scarlet ribbon for?" one young woman demanded, her features poised between perplexity, mortification, and amusement.

"I plan to tie it around the leg of a hound," Sagreda replied, with a fully Bluff-Smotean air of impatience, irritation, and self-importance.

"An 'ound?" The woman's expression succeeded in growing even more unsettled.

"As punishment for flagrant promiscuity," Sagreda explained, deadpan. "The mutt needs shaming, and I will not resile from the task."

"That's only fair," the woman decided. "When it comes to them beasts, nature will have its way, but that don't mean we have to approve."

As Sagreda handed over her coins, she scrutinized the woman's face, hoping that perhaps she was in on the joke. But Jingle had said that only about a tenth of the characters here were game-aware.

Out on the street, as Sagreda paused to let a carriage pass, she felt an unexpected disturbance near her hip and instinctively reached down to explore its source. To her surprise, she found herself with her hand encircling a slender, bony wrist.

The owner of the wrist glared up at her defiantly: a slim, shabbily dressed girl whose age Sagreda refused to guess. Appearances were meaningless; however you picked and mixed from a pool of adult brain maps, the resulting comp could never *be* a child.

But a child need not always be played by a comp.

"That coin you've grabbed was a souvenir," Sagreda huffed, "given to me by my Bavarian cousin, Frau Mengele!"

The girl flinched and dropped what she'd been holding—though she seemed as baffled by her reaction as an audience member at a hypnotist's show who'd found herself suddenly clucking like a chicken. An automaton wouldn't have blinked, and a customer might have grimaced at the oddly contrived reference, but only a comp could be revolted by the association without understanding why.

Sagreda bent down and retrieved the coin. "Don't you dare lay a finger on me!" the girl whispered. Her hushed tone was probably a wise strategic choice: if she made a scene, the crowd would not be on her side. But she spoke without a trace of fear, as if she were the one with the upper hand.

Sagreda lost whatever resolve she'd had to strike the child for the sake of appearances. Maybe a verbal reprimand would pass muster, if anyone around them was even paying attention.

"Next time, missy, you should ply your trade on someone less acutely conscious of the content of his trousers!" Sagreda blustered. She waited, still gripping the girl's wrist, hoping for some kind of apology.

"I know what you're up to," the girl replied unrepentantly. "So leave me be, or I might just pay a call on the witch-finders."

Witch-finders? Sagreda supposed she had no right to be surprised by how far *Midnight* was willing to stretch its anachronisms. "And just what are you planning to tell Constables Scolder and Mully of Bow Street?"

"Every nasty detail of your sorcery," the girl boasted. "And you can be sure that when they break down your door, they'll take a very keen interest in your mandala."

Sagreda released the girl. Whatever she actually knew, the risk of attracting official scrutiny had to be greater than the risk of letting one pickpocket slip away unpunished.

But the girl declined the opportunity to flee. "And I'll have what you denied me," she said, glancing meaningfully at Sagreda's trouser pocket.

Sagreda stared back at her, almost admiring her brazenness, trying to summon up some ornately disdainful Victorian invective with which to respond to this blackmail. But her vocabulary deserted her, and muttering feebly about impudent whelps when her heart wasn't in it would just make her sound like the nineteenth century equivalent of a rapping grandma.

"Be off with you!" she snapped, making a shooing motion with her giant hands.

The girl scowled, dissatisfied, and she seemed on the verge of escalating her threats, but then she changed her mind. "You should engage me, Mister."

"Captain," Sagreda corrected her. "Engage you to do what?"

"Make me your assistant. Seeing as how you're struggling to complete the thing."

A carriage drove past, splattering the bottom of the captain's trousers with horse-shit-speckled mud.

"Have you been following me?" Sagreda demanded.

"I have eyes," the girl replied coolly. "I seen you in all kinds of fancy shops, making some very odd purchases. If you want the job done before Christmas, you might welcome a pair of nimble hands like mine."

Sagreda fell silent. Were there colors she needed that she might only be able to obtain by theft? She wasn't sure. She'd made significant progress, but she was yet to walk into a shop and find every obscure object of her chromatic desires laid out on the shelves and counters.

"I'll give you a shilling as a retainer," she decided, reaching into her pocket for an untainted one. "In turn, I expect you to be straight with me, and to keep yourself available."

The girl inclined her head in agreement.

Sagreda held on to the coin. "What's your name?"

"Lucy." The girl stretched out her palm, and Sagreda deposited the shilling.

"How will I find you?" she asked.

"This is my patch you're on," Lucy replied, affronted, as if she were some criminal kingpin whose territory Sagreda crossed only on her sufferance. "If you have need of my services, I'll know it before you know it yourself."

* * *

4

Sagreda worked into the night, pinning, stitching, and gluing, painstakingly assembling one more piece of the mosaic. Or mandala, as Lucy had called it. It was an odd choice of word; Sagreda had seen nothing to suggest that Midnight's kitchen-sink eclecticism encompassed any culture east of the Carpathians. But perhaps one of the previous travelers the girl had seen scavenging for colors had taken her into their confidence and tried to explain the point of the whole exercise. Sagreda had no idea if anyone, anywhere, had ever believed that a mandala could initiate the transmigration of souls; her own vague understanding was that if you were into that kind of thing, you just waited to die and the rest was up to karma. But if stacks, GPUs, and the whole panoply of queue structures that linked the game-worlds together were too much to explain to someone who'd been gaslit into forgetting everything her contributors had known about the twenty-first century, maybe Lucy's reluctant informant had opted for a Buddhist-flavored riff, aiming for an account that was comprehensible to the denizen of a world steeped in supernatural forces, while avoiding Western occultism with its potentially Satanic associations, in the hope of keeping the witch-finders out of the picture.

Someone tapped at the door. Sagreda covered the mosaic with a tablecloth and approached the entrance hall. It was awfully late for a visit from Mrs. Trotter, and the tap had sounded far too tentative to come from any branch of the constabulary.

When she opened the door, she found an elegantly dressed, dark-haired young man at the threshold, his eyes cast down as if his presence here was somehow shameful.

"I'm sorry to trouble you, sir," the man said softly, still not meeting Sagreda's gaze.

“But I’m a cousin of your wife, and I need to speak to her as soon as possible about a poorly aunt of ours—”

Sagreda interrupted him. “Mathis?”

He looked up, startled. “How do you . . . did she tell you . . . ?”

“There is no *she* but me, I’m afraid.” Sagreda tried to smile, but then recalled how the captain’s whiskery visage had appeared when she’d practiced in the mirror. “It looks like that last queue we found was meant to have been pre-filtered by gender.”

Mathis nodded with a kind of punch-drunk stoicism. “Okay. Everything’s temporary. I’m sorry I took so long to find you; I don’t know if the notes all blew away, or what.”

“The ones in the churches shouldn’t have.”

“About that . . .”

“Are you coming in?” Sagreda asked impatiently. They weren’t talking loudly, but who knew what Mrs. Trotter would assume if she saw the captain with a young man visiting at this uncivil hour.

“I’m afraid you’re going to have to invite me,” Mathis explained glumly.

Sagreda took a moment to digest that. “Oh, fuck no.”

“You got the wang, I got the fangs,” Mathis quipped. “That’s what happens when you walk in blind.”

Sagreda said, “Please, make yourself at home in my miserable abode.” She stepped back from the doorway and let him pass, then peered out across the landing to check that no one was watching from the stairs.

Mathis draped himself over the sofa and gazed lethargically into space, focusing on nothing, perhaps in an attempt to avoid having to take in the wallpaper.

“So what exactly are the symptoms?” Sagreda asked. “Apart from a general Byronic ennui.”

“I haven’t risked daylight,” he replied. “But I gather it would be fatal. I do have a reflection. But mostly I’m just very, very tired and very, very hungry.”

“So you haven’t—?”

“Jesus, Sagreda!” Mathis stared at her in horror.

“I meant . . . maybe a dog?” The dogs here were pure automata, it wouldn’t even be animal cruelty.

“I’m not interested in *dogs!*” Mathis retorted irritably, as if that ought to be as obvious to Sagreda as it was to him. But then he caught himself, and walked her through the strictures he was facing. “There are certain sights and odors that make my saliva run, and my . . .” He gestured at his mouth. “I’m assuming that unless I act on those cues, I’m not going to stop feeling weak. A rare roast-beef sandwich doesn’t cut it, and I have no reason to think a corgi or two would hit the spot either.”

Sagreda steeled herself. “Do you want me to fill a cup?”

Mathis took a while to reply. “Are you sure you want to do that?”

“Not especially,” she confessed. “But I don’t want you going into the vampiric equivalent of a diabetic coma.”

“I’d better not watch,” Mathis decided. “Who knows what strings the game will start tugging, if I see an open wound.”

“All right.” Sagreda went into the captain’s bedroom and closed the door. There was a cutthroat razor by the washing bowl, and an empty shaving mug. She took off her jacket and shirt.

The thought that Mathis feared losing control disturbed her. They’d fought for each other, suffered side by side, and risked deletion across three dozen worlds—and the software that lorded over them was far too crude to reach inside them and start imposing beliefs or desires. On their side they had love, and they had reason, while the SludgeNet possessed neither.

But it still had plenty of ways to try to manipulate their behavior. Having woken in the asinine world of *East*, where sensory immersion lost out more or less instantly to any trace of common sense, they were both immune to seeing-is-believing, and to the wisdom of hoodwinked crowds. But they'd never been subjected to outright torture. If the purple prose in *Midnight's* bodice-and-intestine-ripping source had talked about a vampire's longing for blood being like a white-hot poker in the chest, the SludgeNet would have no trouble bringing those words to life.

The captain's body was amply proportioned and apparently not at all anemic; when Sagreda had filled the mug, she did not feel the least bit unsteady. "Well done, old stick!" she commended him, binding the wound with a handkerchief. She dressed again completely to conceal any trace of the breach in her skin. The captain, being some flavor of Anglican, wasn't into religious paraphernalia; there was a King James Bible in his library but no crucifix by the bed.

She covered the mug with a playing card and opened the door. Mathis was still on the sofa; she walked right past him, into the entrance hall, and out the front door. She placed the mug on the landing, near the top of the stairs, then, leaving the door open, went back to the sitting room.

"You didn't want to watch me," she said. "And I don't want to watch you, either."

Mathis frowned slightly, but he nodded. "I'll go back to my place when I'm finished." He walked over to the desk and wrote something. "That's the address, if you need to find me later. But don't open the door to me again tonight, whatever I say."

Sagreda felt the captain's pulse throbbing around the raw edges of the razor wound. But Mathis was just being cautious; he'd never done this before, he didn't know what to expect.

"You know I love you?" she said.

Mathis rolled his eyes. "At a pinch, I might go for an Oscar Wilde type, but the whole Colonel Mustard thing . . ." He shuddered.

"You're an asshole."

He smiled and walked down the hall. Sagreda followed a couple of steps behind, then when he was out she closed the door quickly—taking care not to slam it and wake Mrs. Trotter—and secured the bolts.

She stood by the door, listening, but the bestial slurping she'd feared never came. She waited, tensed, picturing the door splintering and a yellow-eyed, ravenous demon embracing her to finish what she'd started.

She heard the faint chink of the mug being placed back on the floor, then soft, careful, unhurried footsteps descending the stairs.

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5

Sagreda needed cobalt blue. Out in the real world—if Peyam's gloriously discursive lessons on color were to be trusted—the pigment had been used since ancient times in Chinese ceramics, and it had certainly been available to European painters in the nineteenth century. This was London, capital of an empire, mercantile hub of the world. Whatever wasn't made here, someone would be importing it.

So she traipsed the streets, hunting for a shop that sold artists' supplies. If the gossip she'd heard in the coffee houses was true, every tubercular poet, living or undead, from Marlowe to Yeats was currently shackled up somewhere in Bloomsbury, rubbing shoulders every night in the Salon Macabre—a dollop of name-dropping no doubt designed to set the hearts of thirteen-year-old Goths aflutter—but no one ever seemed to mention a single painter. To be fair, Sagreda's own contributors struggled

to suggest anyone but Turner; still, someone had to be responsible for all the portraits of viscounts and their horses that lined the walls of the mansions of Belgravia. Unless they just appeared out of thin air.

As she widened her search radius, Sagreda grew nervous. Every game had different rules of containment; if you wandered off into territory that didn't belong to the core geography that had been mapped out and rendered for a thousand eyes before yours, you might get a gentle nudge guiding you back to terra cognita, or you might just fall off the edge of the world. So far as she knew, the captain was not a named character in the original novel, and no customer of the interactive version had become the least bit invested in his continued existence. If she crossed the invisible line, the easiest solution by far might be to erase her and wake a fresh comp in the same body after a hard night on the town, leaving the new guy to piece his identity together much as Sagreda had, from the contents of his lodgings, and the people he encountered who seemed to know him.

By late afternoon on the third day of her search, she found herself off the paved streets entirely, tramping through muddy ground beside a ramshackle wooden building that smelled like a tannery. She stopped and hunted for the sun, trying to get her bearings, but the sky above was smothered by a still, gray haze, equally bright everywhere she squinted.

There was no one else in sight. She approached the building cautiously; it might just contain cheerful workers, happy to offer directions, but *Midnight* was proving less concerned with its supply chains than with its brooding atmospherics. If its artworks could come without artists or pigments, its leather need not have graced the body of any cow, and the strange odor might have another source entirely.

Her foot touched something taut buried in the mud, like a swollen fruit or a small balloon; she tried to step back, but the thing burst and a jet of stinking yellow fluid sprayed up from it and struck her in the chest.

A hand tugged at her trouser leg. A small boy was standing beside her. "Come with me!" he whispered urgently.

Sagreda followed him, resisting a motherly impulse to scoop him up into her arms, not least because it would be hard to manage without smearing the poor kid with pus. His legs were about a quarter as long as the captain's, but it was all she could do to keep up. She glanced backward; something was moving at the entrance to the building, but its shape was hard to discern in the haze. It uttered an inhuman cry; in rage or in pain Sagreda couldn't tell.

"Where are we going?" she asked the boy.

"They marked you," he replied. "So we need to be done with it."

"Marked me for what?" she asked.

"Ha!" He seemed to find the question so funny that it could only have been meant rhetorically.

They hit the cobblestones and weaved through small alleys, picking up the pace, inflaming the captain's gout. In this of all things, the game wanted realism?

"How far will it follow us?" Sagreda wondered, gasping.

"As far as it takes, if you don't do the necessary."

Sagreda had visions of a bonfire for her clothes, and an acid bath for her infected skin.

They came to a water pump.

"Get under, get under!" the boy urged her.

"Do I take—?" She gestured at her vomit-yellow waistcoat.

"No time."

She took off her coat and maneuvered herself under the spout; the boy clambered up and started pumping. Gobs of sticky fluid separated from the cloth and were car-

ried down the drain, but her waistcoat remained stained in a shade that Peyam had never named, but which her contributors labeled bee excrement. She ran her thumb back and forth across the fabric, turning her chest to meet the flow, and gradually the mark began to fade.

"I think you're done," the boy decided, wiping his forehead with his hand. He grimaced reprovingly. "What you want with them creatures anyway?"

"Nothing! I didn't know they were there!" Sagreda got herself upright. Her clothes were drenched and all her joints were aching, but apparently she'd been luckier than she deserved.

"You lost your way?" The boy's incredulity shaded into smugness; who exactly was the adult here?

"I was looking for a place to buy oil paints."

The boy sighed, as if Sagreda had somehow lived down to his expectations. "Lucy said it would come to that."

This wasn't a random encounter, then. The queen of the pickpockets had had her tailed by a trusted lieutenant.

"What's your name?" she asked the boy.

"Sam."

"So do you know of a shop that sells the materials an artist needs?"

He wiped his nose on his sleeve. "There ain't such a thing in all of London."

Sagreda had pretty much reconciled herself to that likelihood. "Have you ever even seen a painting?" she asked glumly. There were a couple of drab watercolors in Mrs. Trotter's sitting room, but even if Sagreda had dared to steal them, they did not contain anything she needed.

Sam said, "I think you better talk to Lucy."

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6

"Maybe I know a house," Lucy said cagily. "Maybe I'm thick with the scullery maid. But it's hard to remember. My mind turns feeble when I hear my stomach rumbling."

Sagreda handed her another shilling. "How many paintings, do you think?" They were sitting on moldy armchairs in an abandoned building with boarded-up windows, surrounded by diminutive bodyguards.

"Two dozen, at least."

"Any of them with a deep, rich blue? It needs to be deeper than a summer sky, but—"

Lucy scowled. "I can ask the maid about the colors, but who knows what she'll make of your palaver?"

"Then I need to go in there myself," Sagreda decided. "It's no good sending someone else who'll come back with the wrong thing."

"Be my guest," Lucy replied, unfazed. "But we'll be making our entrance through the basement, and there'll be a tight corner or two along the way. Perhaps you can look into the possibility of investing in a gentleman's girdle."

Sagreda wasn't sure if this was genuine advice, or just a chance to mock her. "How will we get into the basement?"

"There's a sewer."

"Of course there is."

"Meant to put an end to the Great Stink," Lucy mused, "but if you ask me it's brought no end of mischief."

Sagreda hesitated; she didn't mind getting covered in literal excrement, but the bullshit she was already mired in was a long way from a fact-checked documentary

on the marvels of Victorian engineering. “Does anything live down there?”

Lucy considered the question. “‘Live’ might not be the right word to use. But that shouldn’t bother you, should it?”

“Why not?”

Lucy exchanged a knowing glance with Sam, who’d apparently been shadowing Sagreda for some time. “Begging your pardon, Captain, but I been told quite a bit about your fancy man. From what I hear, you got him nicely tamed, so maybe it’s time you put him to good use.”

* * *

7

Mathis went in front, holding the lamp, but Lucy and Sagreda stuck close behind him. The ceaseless, arrhythmic percussion of random drips of water all around them made Sagreda tense; if something came skittering hungrily along the tunnel, the sounds it made might easily be camouflaged by this unpredictable plinking.

With a handkerchief over her nose, and her mouth shut tight, the stench of the sewer was eye-watering but not quite disabling. Sagreda hadn’t vomited once as the captain, even when she’d stumbled on a disemboweled woman on her first night in the game, and she trusted his constitution to get her through this merely sensory assault. The two cups of blood she’d given Mathis just after sunset had only made her unsteady for a minute or two, and once she’d imbibed an equal volume of Mrs. Trotter’s strong black tea, she’d felt entirely captainly again.

“Are we close?” she asked Lucy, holding her forearm over her mouth as she spoke, which seemed to do a better job of blocking the outgoing sound than the incoming vapor.

“Pardon me?”

“Are we almost there?” Sagreda retched a little, the price of her impatience.

“You’ll see the drain to the right when we reach it,” was all Lucy could offer. “There’ll be no missing it.”

Sagreda peered into the gloom ahead, wondering if any light from the house might make it through the drain, turning the opening into a welcoming beacon. In fact, she could see a small spot of luminous yellow in the distance, beyond the reach of Mathis’s lamp. But it was not remaining still. For a moment she wondered if it might be a reflection off the surface of the putrid, ankle-deep water, shifting its apparent position because of a disturbance in the flow. But then a second yellow dot appeared, off to the left and a short way behind it, and the motion became much easier to decode. The two lights were attached to two ambulatory bodies of some kind, and those bodies were striding down the tunnel.

She reached forward and touched Mathis’s shoulder. “Do you see that?” she asked. “Yes.”

“Any idea what they are?”

“No one’s handed me a taxonomy for this place,” he replied. “But the general rule seems to be that anything inhuman is likely to mean you harm. So the only question is whether I can fend them off, or pull rank on them somehow.”

As the creatures grew nearer, Sagreda became aware of the sound of their footfalls in the sewer water. In concert, their gaits generated a strange rhythm, in which she thought she could discern an overlapping pair of alternating sloshes and harder strikes. The captain’s chest tightened; Sagreda hoped she wasn’t about to discover that a lifetime of pipe smoking in his back-story had left him with bouts of stress-induced emphysema.

Mathis stopped walking and held the lamp high in front of him. “Who goes there?”

he demanded imperiously. When he received no reply, he added: "Know that we will pass, and we will pass unmolested, or it will be the worse for you!"

The creatures continued to advance, but now the lamplight began to reach them, sketching gray outlines for the flesh and bones that held up the yellow orbs. What struck Sagreda immediately was that some of the edges she could discern were unnaturally straight. At first she doubted her eyes, but as the details grew clearer her impressions were confirmed: both figures were one-legged, walking with the aid of long wooden crutches angled across their bodies. Each possessed just a single arm and a single leg, attached to half a torso, on which was perched half a head.

As these walking anatomy lessons came into full view, they squinted angrily at the lamp. Their bodies were unclothed, but their skin was loose and wrinkled to the point where it took some scrutiny to be sure that they were both male. Each had a half-tongue that lolled partway out of its broken jaw and hung drooling over the rough plane along which the dissection had taken place. Their single lungs made sputtering sounds that emerged from the bases of their bisected windpipes; their exposed viscera oozed a little, but there was no real pretense of any functioning circulatory system. Skeletal muscles, lungs, and brains were all being powered by pure magical fiat, untroubled by any need for chemical energy.

"I hope they're not conscious," Mathis whispered.

Sagreda refused to entertain the possibility. "What are they meant to be?" she wondered. "A vampire someone tried to kill with a circular saw?"

Lucy stepped forward impatiently. "They're a grisly sight, I'll grant you that, but even if they're stronger than they look, I'll wager they're not swift or agile." Then without another word she bolted straight down the tunnel. At the last moment she veered to the right and passed by one of the half-men—almost certainly within arm's reach, in principle, but while the creature swiveled and swayed toward her, it couldn't really drop its crutch and grab her.

Sagreda was encouraged, but still wary. "So they're not exactly zombie ninjas, but one nip might still infect us with the dividing plague."

"Is that a thing?" Mathis asked.

"Not that my contributors ever heard—but there's got to be *one* original idea in the whole ghastly book."

Mathis made a larger target than Lucy, and the captain even more so, but the officially adult members of the party plucked up their courage and ran the gauntlet. Sagreda almost hit her head on the roof of the tunnel as she scampered up the side of the tubular floor, but the wheezing half-cadaver that turned arthritically to ogle her didn't get close. She and Mathis caught up with Lucy, who had been wise enough not to go too far ahead in the dark.

"Good thing we have the Prince of the Night here to protect us," Lucy chuckled. "What would us poor mortals have done on our own?"

"Don't get too cocky," Mathis warned her. "I often find myself wanting a snack around ten."

Lucy tugged at the neck of her blouse to reveal a string of garlic circling her neck. Mathis said nothing, but he didn't even flinch; Sagreda wondered if it was possible, even here, to believe that an object could ward off danger when in truth it had no effect at all.

The three of them sloshed ahead through the muck.

"What if there's no cobalt blue in all of London?" Mathis asked, succumbing to a melancholy that had only seemed to afflict him since he started wearing ruffled shirts.

Sagreda found this scenario unlikely. "In hundreds of paintings, of hundreds of subjects? The SludgeNet will have scooped them up from actual Victorian artworks it found on the web, give or take a few woo-woo-isn't-this-scary neural-net effects.

Cobalt blue fits the period, and it wasn't all that rare. It's not like we're hunting for neptunium in the Stone Age."

She glanced at Lucy, wondering what the girl had made of the exchange, but it seemed to have passed right over her head. Most, if not all, of her contributors would have heard of neural nets and neptunium, but a vague sense of recognition for a couple of anachronistic terms wasn't going to bring a consensual memory of the early twenty-first century flooding back. Given her character's age, it was tempting to ask her if she knew who Justin Bieber was, and see if she denied him three times before the cock crowed, but it would be cruel to wake her to her true nature if they weren't going to stick around and help her make sense of it.

"There it is," Lucy announced. The drain from the house they were hoping to burgle was up ahead of them on the right. Mathis swung the lamp around as they approached; the narrow, slanting pipe was half open at the bottom, and Sagreda could see dark stains on the cement. There was a grille at the top, which would normally have blocked their access—but the maid had been bribed to take out the bolts that held it down and replace them with duplicates whose threads had been stripped.

Sagreda threw the woolen blanket she'd brought over the lower surface of the pipe, in the hope that they might enter the house without becoming so filthy that they'd instantly wake every inhabitant with their stink. Lucy clambered up first, leaving her galoshes behind. She raised the doctored grille carefully and placed it to the side, almost silently, then drew herself up onto the floor.

"You're invited and all," she called down to Mathis. Sagreda wasn't sure if this would work; the maid, in turn, had invited Lucy, but that didn't make either of them the homeowner. Nonetheless, Mathis ascended without apparent difficulty, taking the lamp with him.

Sagreda stood at the base of the pipe, gazing up into the lamplit basement. She'd ignored Lucy's suggestion of a girdle, but it hadn't been a gratuitous jibe; this was going to be a tight fit. She stretched her arms in front of her so she could rest on her elbows without adding to her girth, and began crawling awkwardly up the slope.

Halfway to the top, she stopped advancing. She redoubled her effort, but it made no difference; whatever feverish motion she made with her elbows and knees, they didn't have enough purchase on the blanket to propel her upward.

Mathis appeared at the top of the pipe, crouching, peering down at her. "Hold onto the blanket with your hands," he whispered. He pushed some of it down to loosen it, giving her a fold she could grip. Then he grabbed the top and started straightening his knees to haul her up.

When her hands rose above the top of the pipe she gestured to Mathis to stop, and she pulled herself up the rest of the way. "Well, that was delightful," she gasped. She clambered to her feet and inspected herself and her crew; they weren't exactly fit to present to royalty, but between the blanket and their discarded galoshes they appeared to have succeeded in leaving the most pungent evidence of their journey behind.

Mathis shoved the blanket back down into the sewer and he and Lucy fitted the grille into place, swapping back actual threaded bolts. The plan was to leave by the front door, rather than retracing their steps.

Sagreda turned away from the latrine and took in the rest of the basement. The staircase led up from the middle of the room, but on the opposite side there was a door with a small, barred window: an entrance to another room on the same level.

Mathis picked up the lamp and turned the flame down low as they walked toward the stairs. In the faint light, Sagreda saw something move behind the bars in the other room. There was a clink of metal on stone, and a soft, tortured exhalation.

She took the lamp from Mathis and approached the door. If there was a witness in there, the burglars had already revealed themselves, but she had to know exactly what

risk they were facing. She lifted the lamp to the level of the window, and peered inside.

At least a dozen fragments of bodies were chained to the walls and floor of the cell. Some resembled the vertically bisected men they'd met in the sewer; some had been cut along other planes. And some had been stitched together crudely, into hallucinatory Boschian nightmares: composites with two torsos sharing a single pair of legs, or heads attached in place of limbs. Where there were eyes, they turned toward the light, and where there were ribs they began rising and falling, but the attempts these pitiful creatures made to cry out were like the sound of wet cardboard boxes collapsing as they were trod into the ground.

Sagreda retreated, gesturing to the others to continue up the stairs.

When they emerged on the ground floor, Lucy took the lamp and led the way down a long corridor. There were portraits in oil at regular intervals on the wall to their right, some authentically staid, some Gothically deranged, but none of them contained the desired blue.

They reached the drawing room. "Turn up the lamp," Sagreda whispered. The piano, the cabinets and shelves, the sofas and small tables barely registered on her; they were just unwelcome complications, casting shadows that obscured the real treasures. The walls were covered with paintings: scenes from Greek myths, scenes from the Bible, scenes of clashing armies . . . and scenes of naval battles.

For a second or two she was giddy from a kind of ecstasy tinged with disbelief: after so long, it seemed impossible that she really had found what she needed; it had to be a cruel delusion, because the universe they inhabited was built from nothing else. But the feeling passed, and she strode over to the painting that had caught her eye. The ships were ablaze, but the sea was calm. No gray-green, storm-tossed water here, just a placid ocean of blue.

Sagreda contemplated merely scraping off a few samples, but it seemed wiser to take the whole thing and be sure she had as wide a range of colors as possible, rather than a fragment or two that might turn out, under better light, to have been ill chosen. She unhooked the painting and wrapped it in a cloth.

Then she bowed to their guide. "If you please, Miss Lucy, show us the way out."

Somewhere in the house, a door slammed heavily. Lucy extinguished the lamp. But the room only remained in perfect blackness for a few seconds before gaslights came on at the far end of the corridor.

Sagreda heard a rustle of clothing—maybe overcoats coming off—then a woman's voice. "They were so rude to me! I can't believe it! If I want to be called Lady Godwin, they should call me Lady Godwin!"

A man replied, "It's a historical fact: she took her husband's name."

"Yes, but only because she had no choice! If she'd been vampire aristocracy, do you think she would have buckled to convention like that?"

"Umm, given her politics, do you think she would have chosen to be an aristocrat of any kind?"

"There are socialists in the British House of Lords, aren't there?" the woman countered.

The man was silent for a moment, then he said, "Can you smell that?"

"Smell what?"

"You really can't smell it? Maybe your thing's clogged."

"What are you talking about?"

The man sighed impatiently. "You know . . . the little canister thing in the front of the helmet, under the goggles. There's a mesh around it, but I think sometimes the stuff clogs up the holes. Just give it a flick with your finger."

The two customers went quiet. In the shadows of the drawing room, Lucy caught Sagreda's eye and gestured to her to move behind a bookcase. Sagreda complied

without hesitation, deferring to her accomplice's experience.

"Okay . . . yeah, I can smell it now," the woman announced. "That's foul! Do you think one of our experiments broke out of the basement?"

"Maybe," the man replied. "But it seems to be coming from down the hall."

Sagrada heard their footsteps approaching. She tensed, wishing she could see exactly where Mathis was. A couple of ordinary householders would not have posed much of a problem—least of all customers, whom Mathis would have no qualms about dispatching—but she did not like the phrase *vampire aristocracy*.

"Wait!" the man said. The footsteps stopped, and then he groaned. "Yeah, yeah: sexy Russian babes are desperately seeking broad-minded couples to help fulfill their fantasies. How many times are they going to show me this crap before they realize we're never going to follow the link?"

"You could go ad-free, if you weren't so stingy," the woman chided him.

"Stingy? Five dollars a month is a rip-off!"

"Then stop complaining. It's your choice."

"What costs do they actually have?" the man protested. "The books they start from are all public domain, or pirated. The world-building software comes from open-source projects. The brain maps they use for the comps are data from open-access journals. So, I'm meant to fork out five dollars a month just to pay rent on their servers?"

"Well . . . enjoy smickering at your Russian babes, Lord Scrooge, I'm going to find out what's stinking up the house."

The woman must have decided to approach on tiptoes, because Sagrada heard nothing but floorboards creaking. From her hiding place she could see neither Mathis nor Lucy, and she felt like a coward for not rushing out to block the doorway with the captain's ample girth. But the fact remained that the mild-mannered aficionado of kitsch creeping down the corridor, who would not have said boo to any fleshly equivalent of Sagrada if they'd sat next to each other on a bus, had been endowed by the game with the power to rip all of their throats out—and endowed by her own lack of empathy with the power to take off her goggles and sleep soundly afterward.

The woman spoke, from just inside the doorway, calling back to her companion in a kind of stage whisper, "It's definitely coming from in here!" Maybe her "experiments" were so brain-damaged that they would not have been alerted to her presence by these words. Or maybe she just didn't give a damn. At five bucks a month, how invested would she be? If things turned out badly, she could still order a pizza.

There was a sound of bodies colliding, and the woman crying out in shock, if not actual pain. Sagrada stepped out into the room to be greeted by the sight of Mathis holding Lady Godwin with her arms pinned from behind, his fangs plunging repeatedly deep into her carotid artery as he filled his mouth with blood then spat it out onto the floor. His victim was strong, and she was struggling hard, but he'd had the advantage of surprise, and whatever their relative age and vampiric prestige, his assault was progressively weakening her.

Sagrada ran to the fireplace and picked up a long metal poker. As she approached, both vampires glared at her furiously, like a pair of brawling cats who'd rather scratch each other's flesh off than brook any human intervention. But she wasn't here to try to make peace between house-pets.

She rammed the poker as hard as she could between Godwin's ribs; the author-turned-unlikely-vivisector screeched and coughed black blood that dribbled down the front of her satin evening gown, then she went limp. Sagrada was sickened; even if her victim would barely feel a tickle in her VR harness, the imagery they were sharing debased them both.

Mathis dropped his dead prey and snatched at Sagrada, as if he was so enraged to have been cheated of the animal pleasure of the fight that he was ready to turn on her

as punishment. She stood her ground. "Don't you fucking touch me!" she bellowed.

"What's going on?" asked Lord Shelley irritably. Mathis turned to confront him, but this time it was no ambush; the older man grabbed him by the shirtfront and thrust him aside with no concern for conservation of momentum, sending him crashing into a corner of the room without experiencing the least bit of recoil.

As Shelley gazed down in horror at his murdered wife, Sagreda backed away slowly. Reminding this bozo that it was only a game would only get her deleted.

The undead poet raised his eyes to the captain and spread his fanged jaws wide in a howl of grief.

"Look on my works, ye Mighty, and despair?" Sagreda offered sycophantically.

Lucy chose this moment to make a run for the door. Shelley turned and grabbed her thin arm, then bent down and sank his fangs into it, apparently deterred by her garlic necklace from striking in the usual spot. Sagreda leaped forward and punched him in the side of the mouth with all of the captain's mortal strength; to her amazement, her blow dislodged his jaws from the girl's flesh. Lucy was bawling with pain and terror; Sagreda kept striking the same spot above Shelley's chin with her massive right paw, as fast and hard as she could, unsure if it was just her knuckles and finger bones that she could hear cracking and crumbling from the impacts.

Mathis whispered calmly in her ear, "Step aside, my love."

She complied. Shelley looked up, but he had no time to react. Mathis drove the poker into his chest, all the way through to his spine.

As Shelley slumped to the ground, Lucy fell beside him, looking every bit as lifeless. Mathis took his coat off, tore one sleeve free and wrapped it around the girl's upper arm as a tourniquet.

"What are you doing?" Sagreda asked. "That's so tight, you're . . ." She stifled a sob of revulsion. "Don't cut it off!"

"I'm not going to," Mathis promised, "but we need to move fast to get the poison out. And I can't do it, that would only make it worse."

Sagreda stared at him. "What?"

"I'll apply pressure; you have to suck the wound and spit."

"You're sure that will work?"

"Just do it, or she's either going to lose her arm or be turned!"

Sagreda quickly relit the lamp so she could see what she was doing, then she knelt on the floor and set to work. When every drop had been drained or spat onto the carpet, leaving Lucy's arm corpse-white, Mathis loosened the tourniquet and the flesh became pink, bleeding freely from the puncture wounds above the wrist.

"Let it bleed for a bit, just to flush it out some more," Mathis insisted.

"How do you know all this?"

"I'm guessing," he admitted. "I've heard things from the other vampires, but I don't know if I ever got the whole story straight."

Sagreda sat on the bloody floor and cradled Lucy's head in her arms. There was no actual poison being traced through some elaborate, fluid-dynamical model of the circulatory system; the game would make a crude assessment of the efficacy of their actions under its fatuous rules and then throw its algorithmic dice.

They had love, and they had reason, but the game could still do whatever it liked.

* * *

Shortly after sunset, Mathis emerged from the captain's bedroom, bleary-eyed and yawning. "Did you get any sleep?" he asked Sagreda.

"A couple of hours, around noon," she replied. "But it's done." She gestured toward

the mosaic. "I just need you to check it."

"Okay." Mathis slapped his own face a few times, trying to wake more fully. "How's your hand?"

"Still broken. But I don't plan on having to use it much longer."

Mathis managed a hopeful nod. "And Lucy?"

Sagrada said, "She seems stable; her pulse is steady, and she has no fever."

Mathis took a seat in the nearest armchair and turned to address Sagrada. "The game's not going to accept that its biggest celebrity couple has been removed from the plot. But the SludgeNet's not going to reboot everything while the city's crawling with customers who want to maintain continuity. So, the way I see it there are only two options. They can pull a bit of necromantic fluff out from under the sofa cushions and bring the Shelleys back in an explicit act of resurrection that would make Sigourney Weaver blush. Or, they can pretend that what happened last night never really happened and just delete the witnesses."

"You and I can be out of here as soon as you've checked the mosaic," Sagrada said. She glanced at the sofa, where Lucy still lay inert. "But I don't know if she'll agree to come with us."

"All we can do is be honest with her," Mathis replied.

"To be honest, we don't even know if we're ready for this ourselves." Sagrada rubbed the good side of her smashed hand; it didn't really affect the pain, but it helped distract her from it.

"No. But what would you rather do? Go off on a tour of another twenty worlds, in the hope that we might pick up a few more tips?"

"If *3-adica* makes anything possible, why has no one ever come back?" she asked.

"Because it's so good there that no one wants to leave?"

"Not even for a day or two, to spread the word?"

"I don't know," Mathis confessed.

"What's *3-adica*?" Lucy asked. Her eyes were open, and she looked remarkably lucid.

Sagrada fetched a jug of water. "How long have you been awake?" she asked, handing the girl a glass.

"A while." Lucy downed the water in one long gulp, then went to use the chamber pot. When she returned, she said, "I helped you complete the mandala, didn't I? So you owe it to me to divulge the nature of its powers."

Sagrada had been preparing for this question all day. "It's taking us to a world where the distances between numbers aren't the same as they are here."

Lucy frowned, but her expression was more intrigued than dismissive.

"Here, you can put all the numbers on a line," Sagrada said. "Like the house numbers on a street. And the distance between two houses is just the difference between their numbers: number twelve is two houses down from number ten . . . most of the time." Whatever the historical truth, this version of Victorian London hadn't made up its mind whether to number houses consecutively along each side of the street, or to adopt the even/odd rule that was more familiar to Sagrada's contributors.

"So you're going to a world where the houses are higgledy-piggledy?" Lucy guessed.

"Maybe, though that doesn't quite cover it." Sagrada walked over to the desk, took a sheet of writing paper and started scrawling ovals in ink. "In *3-adica*, the numbers are like eggs in a sparrow's nest. Zero, one, and two are all in the same nest, and the distance between any pair of them is exactly one."

"From one to two is one," Lucy said. "But from nothing to two is . . . also one?"

"Exactly," Sagrada confirmed. "The laws of arithmetic haven't changed: two minus zero is still two, not one. But the laws of geometry aren't the same, and the *distance* is no longer the *difference*."

"But where's three?" Lucy demanded. "Where's seventy-three?"

"Each egg I've drawn," Sagreda said, "is really a nest of its own. The zero-egg is a nest that contains zero, three, and six. The one-egg is a nest that contains one, four, and seven. The two-egg is a nest that contains two, five, and eight." She scribbled in the new numbers.

"I can see what you've written clear enough," Lucy acknowledged, "but I don't know what it means."

"To be in a smaller nest with a number puts you closer to it," Sagreda explained. "The distance between zero and one is one, because that's the size of the smallest nest they're both in, but the distance between zero and *three* is smaller, because they share a smaller nest. In fact, the distance between zero and three is one third, as is the distance between five and eight, or four and seven."

"And you keep on with that nonsense?" Lucy asked.

Sagreda smiled. "Absolutely. However high you want to count, you just keep turning eggs into ever smaller nests of three."

Lucy sat pondering this for a while, but it was clear that something was bothering her. "You say the distance from nothing to three is one third," she said finally. "But where does *one third* live in your nests? I can walk a third of the way between houses, and I know what that means on Baker Street, but what does it mean for these sparrow's eggs?"

"It means you need to look outside the first nest." Sagreda added another two circles as large as the largest one she'd drawn previously, and then scratched an even bigger one around all three. "If you add one third to anything in the first nest, it goes in the second nest. If you add two thirds, it goes in the third one. And any two numbers that happen to be in a different pair of these new nests lie at a distance of *three* from each other, because that's the size of the larger nest that encloses them all. And before you ask me where *one ninth* lives, the paper isn't large enough for me to draw that, but I think you can guess how the pattern continues."

Lucy absorbed this, but she wasn't done. "Where does *one half* live?"

Sagreda was tired; she had to stop and think. "It's somewhere inside the first nest I drew, at a distance of one from zero."

"But where?" Lucy pressed her. "Where is there room for it? I can see how your eggs there reach up to any number I could ever count to . . . but how are you going to squeeze yet another one in?"

Mathis chuckled and stretched his arms above his head. "Good question!" he said. "And it took my friend here about a day to convince me of the answer."

Sagreda closed her eyes for a moment, and focused. "First, go to the number *two*. Then add three and go to *five*. Then add nine, which takes you to *fourteen*. Then add twenty-seven . . . and so on. Each time, you add thrice what you added before."

"And when do you stop?" Lucy asked, with a cunning look on her face, as if she was about to play cuckoo and toss the existing egg at the point of arrival out of its nest.

"You don't!" Mathis interjected. "You're not allowed to stop! Which sounds nonsensical, but it's no more absurd, in *3-adica*, than it is in our world for Achilles to get halfway down a road, then another quarter, then another eighth . . . with always one more stage to go that's shorter than the last. Because in *3-adica*, adding thrice what you added before takes you a third less far. Five is actually fairly close to one half, but fourteen is closer, and forty-one is closer still. Because if you double each of these numbers, the result is always *one* . . . plus three multiplied by itself many times, which makes less and less of a difference the more times it's been multiplied."

Lucy opened her mouth to protest, but then closed it again. Something was sinking in. Sagreda had never met a comp who, when given the chance to brush away the learned helplessness of their character, turned out to know less about arithmetic than they would have picked up from a decent high school education in America at the height

of the space race. And maybe one in a hundred had been remixed from the pool in such a way that they inherited enough recreational mathematics to have heard of the “*p*-adics numbers”: 2-adics, 3-adics, 5-adics . . . *p*-adics for any prime you cared to name.

But the book, *3-adica*, seemed to have been written after every contributor had died. And the only knowledge any comp had of the SludgeNet’s attempt to gamify it came from eavesdropping on customers, whose comments on the topic tended to be of the form “my migraine when I tried that shit was worse than x ,” for various values of x .

Lucy seemed to be anticipating a few headaches of her own. “I don’t know if the streets will be like bird’s nests where you’re going,” she said, “but it sounds like a place where I’d lose my way.”

Sagreda said, “The beauty, though, is that it’s also a place where the forces that try to keep you down are even more likely to lose their own way.”

Lucy shook her head. “No one keeps me down. I can dodge the muckety-mucks well enough, whether they’re carrying cutthroat razors or trying to take a drink from my neck. Last night was a tight spot I shouldn’t have gotten into, but I won’t make that mistake again.”

Sagreda could see no alternative now to spelling out the whole truth. “This London is not the real London,” she said. “It’s a bad story that bad people have created to make money from very bad advertisements. The machines those people own brought you and me to life—using parts they might as well have obtained from grave-robbers, cut up and stitched together to form puppets to act in their very bad play.”

Lucy laughed curtly, with a brashness that seemed forced. “You might have dispensed yourself a bit too much laudanum, Captain, to ease the pain from your fisticuffs.” But Sagreda suspected that the last traveler Lucy had encountered would have sketched a cosmology eerily similar to this opium dream.

She said, “This world we’re in, and ten thousand others like it, were made by ten thousand clockwork monkeys chewing rotten fruit and spitting out the pulp. But what if a ball of polished marble slipped into the barrel of worm-ridden apples, and broke its monkey’s jaw? A clockwork monkey is too stupid to stop chewing when you feed it something unexpected, so there’s no end to the damage the marble might have caused. And once you tear open a hole in the clockwork, maybe you can crawl right into the innards and really start playing with all the springs and wheels. That’s why *3-adica* could mean freedom: it’s tough enough to break the monkey’s jaw.”

Mathis rose from his armchair. “I should start checking the mosaic,” he said.

“Do you need a meal first?” Sagreda asked.

“No, a few gulps from her Ladyship’s ancient veins seem to have gone a long way.” He took a seat at the writing desk and peered studiously at Sagreda’s notes.

Sagreda joined Lucy on the sofa. “My landlady will be bringing me my dinner in about an hour,” she said. “So you and Mathis will need to hide for a bit, though of course you’re welcome to eat with me when the coast’s clear.”

“I’ll be getting back to my own digs before then,” Lucy decided.

“What you saw last night means you might not be safe,” Sagreda said gently. “If the people we killed are too important to the story, what we did might be undone—and if the rules of the world don’t allow that, we’ll need to be discarded to smooth over the lie.”

Lucy wasn’t ready to take any of this on faith, but some part of Sagreda’s warning seemed to unsettle her. “I can find out what’s happened in that house since we left it,” she said. “If they’ve buried them blood-suckers and started sending all their finery to the auctioneer, will that put your mind at ease?”

“It’d be worth knowing,” Sagreda replied. “But can you do that without letting on to anyone what you actually saw?”

Lucy was offended. “I ain’t no tattler!”

"I don't mean the police," Sagreda stressed. "I mean anyone at all. Not even someone you'd trust with your life. Telling them could put them in danger, too."

"Leave it with me, Captain," Lucy replied. "By the time you've had your dinner, I'll be back with my report."

* * *

9

"This looks perfect to me," Mathis declared, putting the mosaic aside and rubbing his eyes. "But there is one small complication we need to think about."

"What's that?" Sagreda asked.

"Peyam's dictionary was calibrated for sunlight," he said. "Whatever the lighting, the colors still look right to us when we check them against a white background, but that's just our visual system compensating. The GPU models physical optics, not perception; it's going to spit out pixels that depend on the light source."

Sagreda had known there'd be an extra hurdle to deal with as soon as Mathis had turned up in his new, photosensitive state, but she'd been so preoccupied with finding the cobalt blue that she'd stopped thinking about the problem. "Okay, so we'll need to use a mirror to light the thing in the morning without roasting you to a cinder."

"That would be nice." Mathis glanced down at the desk, and gestured at the collection of wooden rods beside the blotter. "I see you've got the pieces of the trigger ready. So we might as well start setting up."

"Of course."

They worked together, mostly in silence. They'd performed the same task so many times before that the need to bounce sunlight from a chink in the curtains onto the mosaic via the captain's shaving mirror felt like a welcome variation to the routine that would keep them from becoming complacent. But the hardest thing now for Sagreda was to stop worrying about Lucy.

Mathis dropped a plumb-line from the main guide-string that stretched across the room between an anchor on the wall and the homemade easel holding the mosaic, and marked the viewing spots on the floor for the two of them. "I guess you don't know how high Lucy's eyes are?"

"I should have measured her while she was asleep."

"It's almost midnight," he said. "Do you really think she's coming back?"

"She has to."

"Maybe she heard that Percy and Mary got an ad hoc exemption to the vampire killers' rulebook," Mathis speculated. "In which case, the show can roll on without anyone disappearing: the Shelleys can vow revenge on their attackers, but Lucy's not a liability any more, she just gets to spread the story that lets everyone in *Midnight* know how indestructible they are. Stake through the heart, no problem! They're like that guy with bad hair in *No Country for Old Men*."

"None of mine saw that," Sagreda replied distractedly. She walked over to the window and looked down onto the street. Lucy was standing outside the building, and the fog was rolling in.

She gestured to Mathis to come and see.

"Okay," he said. "Shall I go down and try to talk her into committing? Maybe if I start humming 'Consider Yourself' that'll be enough to persuade her; I don't think I'm up to the whole dance routine."

"I'll go."

"Not alone, at this hour."

They went together.

Lucy must have been in two minds about joining them, but she didn't flee when they approached her. "What did you find out?" Sagreda asked.

"The other blood-suckers are holding a ceremony tonight, to bring back them ones you killed. They got all the big sorcerers coming to the house: Dee, Crowley, Tesla, Twain."

"Twain?" Sagreda boggled.

"I knew it!" Mathis crowed. "The SludgeNet never met a rule it wasn't willing to break."

"You're probably safe, then," Sagreda told Lucy. "But you can still come with us if you want to."

"I can't leave my friends," Lucy replied. "Who'd look out for them, if I wasn't around?"

"At least come up and join us until morning," Sagreda suggested. "No one should be out on a night like this." The fog was so thick now that she could barely see Mathis, pacing impatiently behind Lucy.

Lucy hesitated. It was clear that she'd been hanging back instead of bringing them the news because, safe or not, she was afraid of being tempted to flee all the hardship she faced in *Midnight* to follow the captain's mad dream. To an actual nineteenth-century pickpocket, every word of it would have sounded like gibberish, but something must have punctured her Stockholm Syndrome and shaken a few rusty twenty-first century insights out of the silt at the bottom of her mind.

"This is how traitors die!" a man's voice whispered.

Sagreda looked up to find that where Mathis had been, the fog was filled with a thick red mist. A blur of metal blades were tracing arcs through the air, through what was left of his body.

She cried out in shock and pulled Lucy toward her, away from the carnage. But then she froze: she had to do something, she had to find a way to rescue him. She watched the dancing blades, hypnotized, as if she could run their motion backward just by staring at them hard enough.

"He's gone!" Lucy shouted, tugging at her hand, trying to pull free of her grip. Sagreda broke out of her trance and let the girl go, then after a second she turned and followed her, bolting down the street so fast that it felt as if the ground had tipped and she was racing downhill, and if she tried to halt she'd only start tumbling.

As she watched Lucy fading in and out of sight in the swirling fog beneath the gas lamps, Sagreda wondered why she was even bothering to flee. She should have stayed and died beside Mathis. There was no other way she could find peace. There was no other kind of freedom.

Lucy's pale form receded into the darkness. Some instrument of torture began squeezing the captain's chest, but Sagreda ran on, soaked in sweat and condensation, waiting for a flock of assassins to swoop down on her and drag her up into the sky so she could finally fall to Earth as a rain of blood and gristle and be done with it.

A boy appeared out of the shadows and gestured to Sagreda to follow him. It was Sam. He turned off the street and the two of them ran down an alley and a set of stairs into a pitch-black basement. Sagreda heard a door being closed behind her.

Someone lit a lamp. This was the place where she'd met Lucy to plan the heist; Lucy and half a dozen other children were here now.

Sagreda sat down on the bare wooden floor and covered her face with her hands.

Lucy said, "They won't go out of their way to find us now. Your friend was one of their kind, that's why they made an example of him."

Sagreda replied without looking up. "Do you really not understand that it's all bullshit? If there are two tribes of beings that owe loyalty to each other, we're all of us in one, fanged or not, and the customers are the other. We should slaughter them, every chance we get, until they hate this game so much they'll take up ten-pin bowl-

ing and leave us in peace.”

Lucy didn't answer her. Sagreda pressed the heels of her palms into her eyes. She didn't know how to grieve for Mathis; some splinter of ice in her contributors' hearts was whispering that he'd never been more than a digital mash-up of crude approximations to a hundred humans all long dead. As she was herself. The sooner she found a way to be deleted, the better.

And she knew how. It would be instant, painless, easy, and final. She just had to change the mosaic so that it unlinked her from *Midnight*, without placing her in any queue for entry into another world. Her mind would cease to be executed, and within a few milliseconds the SludgeNet's garbage collector would reclaim the space she was occupying and put it to better use.

Sagreda uncovered her face and wiped her tears away with the back of her hand. “Thanks for all you've done for me, but I need to go now.” She reached into her pocket, took out all the coins she had, and placed them on the floor beside her. Then she rose to her feet and started toward the door.

Lucy said, “Just stay until dawn, Captain. There's nothing now can't wait for morning.”

Sagreda stopped where she was, and Lucy came and led her—as she might guide a lumbering, docile animal—to a mattress in the corner of the room.

* * *

10

Sagreda was woken by a narrow shaft of sunlight that had entered the basement. The beam wasn't even touching her skin, but the illumination it brought into the room was enough to penetrate her eyelids and drag her out of her broken sleep.

None of the pickpockets were awake yet. Someone had removed the captain's shoes and left them by the mattress, so Sagreda picked them up and walked quietly to the door. It was better to have no goodbyes.

She was halfway back to the captain's lodgings when Sam appeared beside her.

“What do you want?” she asked numbly.

He hesitated, as if gathering his courage. “I remember watching Neil Armstrong step onto the Moon,” he said.

“Congratulations,” Sagreda replied. She wasn't being sarcastic, but she didn't know what he expected her to do with this confession.

“Lucy told me all your stories, but she only half believes them,” Sam persisted. “I know they're true.”

“So you know where you are, and what you are.” Sagreda shrugged. “Good for you. I wish you luck making something of it. I tried, but it came to nothing.”

“You can't give up!” Sam said, alarmed at her indifference. “I need you to teach me what you know. I can't keep living here, half-starving all the time, pretending all this supernatural gibberish is true. Pretending I'm a child, when I'm not. I need to learn how to escape.”

Sagreda strode on in silence, listening to the clomp of horseshoes on the road beside them, trying to find the words to brush him off without making herself feel like a monster. It had taken Peyam months to explain all the intricacies of the traveler's art to his students. She wished the boy well—or the man, presumably—but she didn't have it in her to stick around for that long.

They were almost at Mrs. Trotter's house when the solution came to her. “If I offered you *The Great Gatsby* meets *The Three Stooges*, would that sound like a place you could live in for a while? Flappers, cocaine, Keystone Cops . . . what more could you want?”

“Will you be coming with me?”

“No,” Sagreda replied, “but I can give you the names of half a dozen people there who’d be willing to teach you everything. A lot of travelers reach that world and decide it’s good enough.” And since it was the last place she’d been, following the same linked list that led to *3-adica*, it would only take a small change to the mosaic to send the viewer backward along the chain instead of forward.

Then she could scrub the whole forward/backward part and unlink herself from everything.

When they reached the house, she saw the dark stain on the sidewalk, but she kept it in her peripheral vision and refused to think about it. She led Sam up to the captain’s rooms and wrote down her list of contacts.

“Tire-Iron McGill?” he read dubiously. “Cyanide Sally?”

“Don’t worry,” Sagreda reassured him. “It’s not like meeting ‘Saw-Tooth Jim’ on a dark night in Whitechapel. All the violence is slapstick.”

“So why didn’t you stay?”

“Because everything else was slapstick too.”

Sagreda took Sam’s measurements. The sun was coming through the curtains, shining off the mirror and falling straight onto the mosaic; she pictured Mathis standing beside the easel, in the first body she’d ever seen him inhabiting. But she blinked away her tears and concentrated on the geometry, finding the optical center for Sam’s close-set eyes, dropping the plumb-line, and outlining two footprints in chalk on the floor to make it easier for this novice to view the target squarely.

There was a knock on the door.

“Just wait here and keep quiet,” Sagreda told Sam.

When she opened the door, Mrs. Trotter was on the landing. “Captain, I’ve been forbearing,” she said, “but there are limits to my good nature.”

“I don’t follow your meaning, Mrs. Trotter.”

“Your gentleman caller who was killed last night! And the girl . . . and now some ragamuffin . . .!” Mrs. Trotter shook her head. “This is not a home for wayward children and unnatural dandies. I was expecting you to be a reputable tenant. Instead, you’ve made me the target of gossip from here to—”

“I’ll be gone by the end of the day,” Sagreda interjected bluntly. “Feel free to sell all of my possessions, or just throw them onto the street if you prefer.” She bit her lip and managed to say nothing about the bodies.

But even this announcement didn’t mollify Mrs. Trotter. “I never heard such a thing! Scarpering to the continent to escape your punishment for some wickedness, I’ll wager! Let me in, Captain. I want to see exactly what mischief you’ve been up to!”

“Just mind your own business, woman,” Sagreda replied flatly.

“This is my house!” Mrs. Trotter shrieked. “Whatever goes on within these walls is my concern!”

Sagreda slammed the door and bolted it. As she walked down the hall, she heard the sound of something falling to the floor in the sitting room, where she’d left Sam waiting. “Did you knock over the—?”

Sam was sprawled on the carpet. “No, no, no!” Sagreda checked his breathing and his pulse, but he was gone, irretrievably. “I told you to wait.” The commotion must have panicked him and made him think he might be losing his last chance to escape from *Midnight*. But Sagreda hadn’t got around to explaining that she’d need to change the mosaic before it would take him to the benign, almost familiar world she’d promised him.

His mind was now in the queue for *3-adica*, and he had no idea what he’d be facing when he woke. Lucy might have told him some small smattering of what she’d learned, but even she had been in no condition to find her way around there on her own.

Mrs. Trotter was pounding on the door, and promising that seven kinds of constable would arrive at any minute. Sagreda wrapped her arms around the captain's wide shoulders and rocked back and forth silently for a while. "I'm sorry," she whispered, as if she owed Mathis an apology for doing what he'd almost certainly have wanted her to do.

She picked up Sam's limp body and placed it on the sofa. Whatever kind of man she'd just dispatched to the afterlife, the fact remained that he'd be as unprepared to face it as any child. She tied a string around her waist, joined the other end to the easel so there'd be no more casualties once she'd fallen, and found her mark on the floor.

She looked up, and in the corner of her eye she saw the Escher-esque shape she'd built from the wooden rods: a cube that wasn't actually impossible, merely unanticipated by some sloppily written graphics code. She shifted her gaze a fraction, bringing both the trigger and the mosaic into perfect alignment, and then she was gone.

* * *

11

Sagreda kept her eyes firmly closed, trying to get a sense of her new body from within before confronting the world around her. She felt sure that her spine was horizontal, with her chest facing down as if she were kneeling on all fours—but the task of bearing her weight seemed to be concentrated at the far ends of her limbs, not her elbows or knees. For most people, that would have felt awkward and strange, but all her joints and muscles were telling her that this posture was perfectly natural.

Apparently, she'd been reincarnated as a quadruped.

That probably ruled out the simplest version of *3-adica* she and Mathis had contemplated: a kind of stylized mathematical fantasia, in which the participants (in fully human form) rode on a magic carpet over a fractal landscape of numbers that was ultimately just a prettified CGI version of the nested eggs she'd drawn for Lucy.

But those eggs didn't really get the distances right; there was no way to choose points on a plane with all the right properties. The more radical, immersive approach would be to embed the characters in the 3-adic geometry itself, transforming them from spectators into participants. The problem, then, was that the human mind had evolved to work with its body and senses immersed in three-dimensional Euclidean space, and the SludgeNet wasn't remotely smart enough to rewire a comp to perceive its environment on any other terms—let alone work the same magic on its flesh-bound customers.

So whatever the game was, it would be a compromise. Sagreda's hope had always been that the SludgeNet would turn out to have bitten off more than it could chew, exposing a multitude of new flaws in its GPUs and its world-building algorithms . . . without rendering the place so hostile to its inhabitants that they had no opportunity to exploit the bugs.

She could hear a soft wind blowing, and she felt its touch upon her skin. She braced herself and opened her eyes.

Her first impression was that she was standing in a desert landscape of bleached earthen colors, with what looked like a few low boulders nearby. The cloudless sky could not have been more perfect, short of turning to cobalt blue.

But the ground bore a strange pattern of dark, concentric circles that spread out around her, dividing the landscape into narrow rings, while the "boulders" were two-dimensional, like cheap, painted stage scenery—only rescued from being literally flat by the fact that they conformed to the curves of the rings they belonged to. And as Sagreda looked past them toward more distant rings, the terrain grew crowded

with detail at an alarming rate, packing in ever more variation in a manner that utterly defied her expectations about scale and perspective—as if kilometer-long strips plucked from an ordinary desert had been squeezed longitudinally and bent into circles just a few hundred meters across.

All of which made a certain amount of sense. Distances in *3-adica* couldn't take on a continuous range of values: they only came in powers of three. By rights, every ring of solid ground she saw should have been followed by another ring exactly three times larger, with nothing in between. But *perceiving* her surroundings as mostly empty space would have been a waste of the act of perception, and whether this compressed version faithfully reflected the way *3-adica's* alien protagonists had seen things in the original book, or whether it was just a compromise the game had imposed, Sagreda didn't find it unreasonable that she was aware of the gaps between the shells of possible distances, without having to squander 90 percent of the virtual neurons in her visual cortex on massive black moats that could literally never contain anything.

She willed herself to start walking, and her body obliged, executing a gait that required no conscious effort, and worked so well that she was loathe to dissect it into a sequence of moves for each limb. She declined to peer down at her feet—or hooves—lest the strangeness of the sight paralyze her; it seemed wiser to try to grow into this body by using it for a while, purely by instinct.

She decided to head for the nearest of the boulders, but after spending a few minutes supposedly ambling toward it, Sagreda realized that her target was just shifting from side to side within its original distance-ring. So were all the other discernible features in all the other rings. Nothing was getting closer.

She stopped and looked down at the ground right in front of her, averting her gaze from the glimpse she caught of her forelimbs. Here, the rings were spaced so closely that she might as well have been staring at an unbroken surface—if not sand, maybe sandstone. She took a few steps to try to get a better sense of her own pace and recalibrate her expectations. As she walked, the texture beneath her drifted around in her field of view in a manner that seemed consonant with the rhythms of her body, but she never seemed to be leaving it behind and moving on to something new.

“Okay,” she muttered out loud, amused that this world would allow her to utter and perceive the familiar syllables in a nasal voice that might have belonged to Mister Ed. *Why wasn't she getting anywhere?* Because distances no longer added up the same way. From zero to one was a distance of one; from one to two was a distance of one. But from zero to two was a distance of one, again. In fact, however many steps you took, the distance you ended up from where you began could never be greater than the largest of those steps.

One of the *p*-adic-savvy travelers Sagreda had met had called this “the non-Archimedean property,” and opined that the only way an object could move *at all* through a 3-adic space would be through some kind of quantum tunneling that bypassed the whole idea of a classical trajectory. So maybe at some level quantum effects were enabling her to move her legs, or maybe that was pure cheating, but whatever the mechanism, it did not seem able to propel her out across the landscape.

Sagreda began walking again, with no expectations of any change in the result, but in the hope of gaining a better sense of what was happening. If each of her steps had had the effect of merely adding some fixed quantity to a 3-adic coordinate for her body, she would have mostly ended up at that distance from where she'd begun, switching abruptly to one-third, or one-ninth, or one-twenty-seventh and then back as her step count hit multiples of powers of three. But even allowing for her compressed perception of distances, she couldn't discern any such pattern. So perhaps her steps, though of equal geometric *size*, involved adding a sequence of different numbers—whose numerators and denominators were all devoid of threes—to her lo-

cation. With the right choice of fractions to maintain the lack of threes in their cumulative sums, all steps *and* all their successive totals could work out to have the same size. And just as her body knew instinctively which legs to raise and lower in which order, this arithmetic trick would be wired into it, sparing her the need to calculate anything.

Which was all very nice if you wanted to trace out a circle in the desert. But how was she supposed to do anything else? The non-Archimedean law was clear: the total distance traveled could never be greater than the largest step. So how could she escape her invisible prison, if she couldn't leap over the walls in one bound?

Sagreda willed herself to run, and her body obliged with a gallop that made her newfound muscles sing. The texture of the ground ahead of her changed almost at once, and for a moment she was elated. But though her individual bounds were larger than her previous steps, they gained no more by force of repetition: she was just executing a slightly larger circle.

She stopped to catch her breath, daring the world to play fair and suffocate her, since the stale air around her could hardly escape its starting position any more easily than she could. But if her body was largely a cheat to let her feel at home, a travesty of alien Euclidean nonsense spliced into the 3-adic terrain, there had to be *some* genuine, 3-adic way to go farther than a single bound, or the whole book would have been very short: *A creature stood alone in the desert (please don't ask how it got there). Soon it died from lack of food. The End.*

It was time to stop being squeamish: if she could survive waking up as the captain, she could cope with this alien horsiness. She bent her neck as far as she could and looked down at herself as she took a few steps. Her legs were swinging back and forth, but beyond that, they were visibly expanding and contracting: swelling up beyond the wildest nightmare version of the captain's gout, then deflating just as rapidly. No accumulation of additions could carry an object farther than the largest distance traveled along the way—but her legs weren't adding, they were multiplying.

Sagreda kept walking, contemplating the meaning of this discovery. In the real world, when you inflated a balloon, the individual molecules in the rubber were moving in different directions depending on which side of the balloon they were on, but motion was motion; there was nothing special going on. Here, though, since ordinary motion couldn't lead to dilation, dilation had to be an entirely separate thing. If the invented physics of *3-adica* was symmetrical under a change of scale, then it might make sense for a system to possess "dilatational" momentum, as well as the usual kind. If your dilatational velocity was one tripling per second, you became three times larger, again and again, until something applied an opposing dilatational force that brought the process to a halt. And ditto for shrinking. *That* was how you got anywhere in this place.

Out of habit, Sagreda looked around for Mathis to share her triumphant discovery with him. In his absence, a deadening numbness started creeping into her skull, but she stared it down: this wasn't the time for grief, let alone anything darker. She'd stranded Sam in this bizarre place, and she owed it to him to keep going until she knew that he was safe. *Love and reason* had never been for the two of them alone; unless she had some fellow feeling for every last comp, she was no better than the mindless SludgeNet, and its worse-than-mindless creators.

If her leg muscles possessed the power to expand and contract 3-adically, there was no reason why the rest of her body shouldn't share it. It was just a matter of finding the cue. Sagreda closed her eyes and pictured herself growing larger; when she opened them nothing had changed. Then she tried tensing her shoulders, not just willing them to grow broader, but actively forcing them apart. It made her feel ridiculous, as if she were posing like a vain equine body-builder, but to her astonish-

ment and delight the landscape around her started to shrink.

She watched the stage-scenery boulder she'd been trying to reach turn into a rock, then a pebble, then a grain of sand as it slipped between her feet. Curiouser and curiouser. She relaxed, and then discovered that she needed to apply a brief compression of her shoulder blades to bring the process to a halt.

"What now?" she wondered. The desert was still a desert, self-similar enough under enlargement that only the details of the view had changed. Where exactly—and how big—were all the other characters? In what place, and at what scale, could she hope to find Sam?

Given the potential disruption that a character's dilation could cause, it would make sense for the game to wake new entrants at a very small scale, offering them a chance to find their feet, and shoulders, without bumping into anyone. And though the lesson was immensely hard to swallow, the fact remained that—colossus or not—she *still* couldn't go striding out across the wilderness, exploring in any conventional way. Her choices were to reposition herself within her new, much larger, prison and then shrink down for a closer look in case she'd missed something, or to keep on inflating her body until her current surroundings in all their desolate grandeur revealed themselves to be nothing, on the scale that mattered, but a tiny patch of dirt.

Sagreda spent a few minutes pacing in a circle, staring at the ground, but she saw no signs of any tiny cities hidden in the dust—and if the game's greatest architectural features had been something she might easily have crushed beneath her feet from sheer inexperience, there'd have been a lot of rebooting going on.

So she took a few deep breaths, steadied herself, then spread her shoulders wide.

* * *

12

"Make room, make room!" a male voice shouted irritably. Sagreda shrank out of the way as the passerby expanded to fill most of the square, deftly bloating and stepping then finally contracting, leaving him on the opposite side. For a moment or two, an afterimage of his blimp-pufferfish-horse-balloon body breaking up into distinct onion-layers lingered in Sagreda's vision.

She quickly expanded back to her previous scale before someone else muscled in; if you gave these people an inch, you ended up toy-sized. "Do you know a newcomer named Sam?" she asked a 3-adan who'd ended up beside her in the wake of the maneuver. There was no reply.

She'd been standing at more or less the same spot in the corner of the square for hours, slowly increasing her size as the opportunities arose. Her fellow characters had been kind enough not to trample her as she ascended out of the "desert," but actually traversing any significant distance here—by becoming as large as the journey you wished to make—seemed to require a combination of nerve, skill, and luck that she had not yet attained. A few of her contributors were offering a collective flashback to their first attempts to cross an ice rink, but however conspicuous they might have felt as novices trying out their blades, Sagreda was fairly sure that they'd had nothing on this.

She closed her eyes for a moment to escape from the headache-inducing perspective. Until now, she'd always been part of an ant-trail of travelers moving to and fro between the worlds, carrying intelligence of what lay ahead; this was the first time she'd arrived at her destination without a single contact. But she'd met at least a dozen people at different times who'd sworn they were heading for *3-adica*, before she and Mathis had resolved to make the journey themselves. Even if no one had

ever come back, she couldn't be alone here.

"Sam!" she bellowed, keeping her eyes closed; it was easier to feel uninhibited that way. Going on the barrage of noise striking her from all directions, she was fairly sure that sound had the means to propagate at least across the square. Whether there was anything beyond this place was another question; the only really practical way it could be part of a larger city was through a hierarchy of scales, with people having to bloat even more to move between them.

"Sam!" If there was a customer nearby and she was violating the local mores, so be it: let them flag her for deletion. It was all she could do to move her body out of other people's way here; she had no idea how she was going to find food or shelter. Did she really think she was going to be able to map this world's flaws and exploit them, all on her own?

"Captain!" a voice whinnied back. Sagreda had almost forgotten that she'd never given the boy her real name back in *Midnight*.

She opened her eyes. "Sam! Where are you?"

"Here! Over here!"

Sagreda searched the crowd in the direction of his words, but how was she meant to recognize him?

"Don't worry! I'll come to you!"

The square's mostly empty center was abruptly filled with a new parade-float pony, which shrank down beside her.

"Can you see me now?" Sam joked.

"Yes." For a moment, Sagreda could find nothing more to say; her relief was too tainted with guilt. "I'm sorry you ended up here," she said finally. "I never meant that to happen."

"It's my own doing," he replied. "I should have waited for you."

"How long have you been here?"

"Ten days."

Sagreda bowed her head. If she'd been alone that long herself, she would have lost her mind.

"It's all right, Captain," Sam said gently. "You're here now. So at least I've got someone to talk to."

"You haven't made any friends with the locals?"

He snorted. "You know how some people back in London . . . you could tell there weren't nobody home? Here, they're all that way."

Making the two of them the only comps in a world of automata? He had to be exaggerating. If the SludgeNet had been willing to populate the place without resorting to comps at all, they would never have been plucked from the queue and embodied here.

"Maybe the lifestyle has just ground them down," she suggested. "Have you been able to learn the ropes at all?"

"I seen how to get by," Sam assured her. "If you want grub, you got to put in the work, tending one of them patches."

"Patches?"

"They're like . . . small farms," he struggled. "You need to eat the weeds, not the shoots—if you take the shoots for yourself, you'll get a flogging. But if you eat enough weeds, they can smell it on you, and they'll feed you proper." Sam must have read bemusement on her face, or perhaps just in her silence. He said, "Only way to learn it is by watching."

Sagreda found the courage to follow him across the square; once she'd done it, her previous timidity seemed absurd.

The patches were small areas of walled-off ground in one corner of the square, full

of agricultural workers who shrank down into them and did exactly as Sam had described: roaming across their circle of land, chomping red and yellow weeds that were competing with the tender green buds of some kind of crop that was sprouting from the dusty soil. The two of them watched for a while, peering down into the Lilliputian realm, until four of the workers grew tired and expanded back up to the scale of the square.

“Now!” Sam urged her. Other 3-adans were jostling around them, eager for work. Sagreda followed Sam down into the patch, though her first attempt put her on land that had already been thoroughly weeded, and she had to re-bloat a little and move before she found a suitable location.

The weeds tasted foul, but no one else was spitting them out, and if the odor really was an essential meal-ticket Sagreda wasn’t going to risk defying convention. In some ways it was restful to have her gaze fixed on the ground, where the distance-rings were closely packed and the strange geometry was more hypnotic than emetic.

She lost herself in the near-mindlessness of the task, trying not to think about how comfortable she could have been if she’d never left *East* at all. With everyone around her game-aware, and the water-wheels she’d built powering something close to civilization, it seemed like paradise now.

“Captain!” Sam called to her. The sky above them was darkening, which was curious, because it contained no sun. “Time to eat!”

She watched him grow, taking note of how he was able to shift his feet to avoid trampling either crops or workers, and followed him back to the square.

“I don’t know what we should call this place,” Sam admitted cheerfully as he led her to a queue beside an opening in a wall. “‘Restaurant’ might be gilding the lily.” Sagreda waited for the gap in front of her to grow large enough for her to bloat into it and advance. She was starting to internalize the sequence of contortions needed to get from place to place, which was both helpful and a bit depressing.

“We need to be on the lookout for things that appear wrong,” she told Sam.

“By my count, that’s everything,” he retorted.

“You know what I mean. Wrong by the rules of this place; standing out as different.” The possibility that everyone who’d come here before them had failed to identify a single new exploit was too grim to consider, even if it would explain why no traveler had ever emerged from *3-adica*. The old cubical trigger wouldn’t work here; it relied too much on Euclidean geometry. But there had to be others. The whole eye-watering nightmare around them must have tested the GPU code to destruction at some point.

When it was Sagreda’s turn at the window, a surly 3-adan commanded her to breathe in his face, and she obliged. With a deft move so rapid she could barely parse it, he expanded out through his hatch and used his mouth to hang some kind of feed-bag around her neck, full of what looked like pieces of mature versions of the crop she’d been weeding.

She retreated clumsily into the square and waited for Sam to join her. She was famished, but the bulk of vegetable matter already inside her—which seemed to have inflated along with her when she’d left the patch—made the meal hard to swallow. There ought to have been some way she could force the weeds in her stomach to shrink relative to her body, but perhaps it was in their nature to resist.

“Not so bad, is it?” Sam enthused as he munched his share of greenery.

Sagreda thought: *They shoot horses, don’t they?*

The light was fading rapidly now. “Where do people sleep?” she asked.

“Where they stand,” Sam replied. “Don’t worry, I ain’t never fallen over.”

“Good night, then,” she said. “And thanks for helping me today.”

“Good night, Captain.”

She closed her eyes, grateful for the weariness that dragged her swiftly into oblivion.

When Sagreda woke, the sunless sky was an equally pale blue in all directions. Her legs were stiff, and it was clear that nothing she'd eaten had lost any volume in the process of digestion.

"Where do people go to . . . do their business?" she asked Sam, reluctant to push him toward a more twenty-first century mode of speech. If he took comfort from his self-reliant Dickensian persona, she wasn't going to start needling him with cues that might wake memories of contributors whose idea of a hard time had been a weak phone signal or an outdated PlayStation.

"I'll show you."

She followed him to a passage that started from an opening in the wall of the square and led to a room shielded from public view. At one end of the room there was a pit, but the odor was actually no worse than that of the weeds. Sagreda had expected the 3-adans to shrink down before defecating, to minimize the volume of their waste, but perhaps it had some use at this scale.

She positioned her rear beside the pit, and her body's instincts took over.

As she was bloating and stepping her way toward the exit, she noticed to her amusement that the walls of the room were densely inscribed with what seemed to be graffiti. No words, but hundreds of crude, scratched sketches. Sagreda supposed they'd been executed with nothing more than a sharp rock gripped between the teeth, which largely excused the lack of artistic merit.

She and Mathis had often lamented the fact that most of the worlds they'd visited had had public bathrooms segregated by gender. A cryptic graffito, hidden in a riot of other scrawls, would have been the ideal way for them to leave messages for each other.

She surveyed the wall, trying not to get distracted by her curiosity about the bulk of its contents. The images didn't strike her as pornographic, but then, she had no idea what 3-adan sex entailed, if there even was such a thing.

She was about to give up, when her gaze returned to a scribble she'd passed over earlier. It might have been a meaningless set of scratches, but if she tidied away its imperfections in her mind's eye, she could almost believe it was a diagram of some kind. Four lines formed an eight-pointed star, which on its own would have been nothing but an abstract doodle, but there seemed to be annotations. The horizontal line was labeled on the right with a loop that might have been a zero, and forty-five degrees anticlockwise from that, the adjacent line was labeled with a vertical dash that could have been a one. Then, continuing anticlockwise, but skipping the vertical line, beside the next point of the star was a hook that resembled a question mark.

Sagreda stood contemplating the thing until someone else squeezed into the room, harrumphing at her scandalously protracted presence. She departed, and found Sam still waiting for her outside.

"I thought you must have fallen in," he joked.

"There's something you need to see in there," she said. "And I need the Sam who remembers the Moon-landing."

When the room was free, they went in together. It took Sagreda a while to locate the star again.

Sam said, "What is it? Some kind of test?"

"I hope so," Sagreda replied. "For an automaton, with nobody home, it shouldn't elicit a response at all. For a customer who's steeped in 3-adic geometry, who's only here because they know the subject so well, there must be a single, perfect answer that makes sense on those terms. And I guess there could be comps who are so immersed in the game that they'd come up with the same reply. But your average, lazy customer, or

a comp just answering reflexively without thinking, is going to say ‘three,’ right?”

“Counting around from zero, sure,” Sam agreed.

“So what we need is the answer that none of those people would give. The answer that makes sense to a traveler, who knows that this isn’t the real world, who isn’t trying to show off their 3-adic knowledge, but *does* need to show that they can do more than recite what their contributors learned from *Sesame Street*.”

Sam turned toward her, and they spoke in unison: “Minus one.”

The wall split open and the two stone halves swung away from the room to reveal a long, Euclidean corridor, with a floor of shining linoleum beneath ceiling panels of buzzing fluorescent lights.

Sam said, “Indiana Jones, eat your heart out.”

Sagreda nudged him with her shoulder. “Quick, before it closes!”

He remained motionless. Sagreda was desperate not to miss her chance, but she wasn’t leaving him behind.

“*Sam!* If someone who shouldn’t see this comes in, it won’t be there any more!”

Sam nodded his head and trotted forward, advancing without any need to change size. Sagreda followed him, not looking back even when she heard the stone doors behind them slam closed.

* * *

13

At the end of the corridor was something resembling a department store changing room. It was too small for both of them to enter at once.

Sam said, “You first.”

In the mirror, Sagreda saw her equine incarnation, but once she’d faced it, it declined to keep tracking her movements. She stood for a while, confused, then said, “No.”

The 3-adan horse was replaced by the captain.

“No.”

She kept going, winding her way back along a linked list of her former bodies, until she was finally staring at the one she’d woken in for the very first time, dressed in the same coarsely woven tunic.

“Yes.”

A dozen graduated slider controls appeared on the surface of the mirror, labeled with things like “age,” “height,” and “weight.”

“There’s nothing I need to change,” Sagreda said. “Done. Finished. Okay.”

The controls vanished, and the image changed from a frozen dummy to a reflection of her own body, restored.

She stepped out into the corridor.

“Captain?” Sam asked, bewildered.

“My name’s Sagreda,” she said. “It’s a long story.”

Sam went in, and emerged as a twenty-something version of his *Midnight* incarnation, with the same unruly blond hair, and slightly cleaner, newer versions of the same down-at-heel Victorian clothes.

“Now what?” he wondered nervously.

Sagreda noticed a side door beside the changing room that hadn’t been there before. The cool, slightly tapered cylindrical doorknob felt strange as she gripped it; her contributors had known this sensation, but in none of the worlds she’d lived in herself had this style been the norm.

She opened the door and stepped into a very large room full of rows of people sitting at computer screens. She wasn’t sure what to make of the content of the screens,

but the vibe was definitely more space probe command center than investment bank. There were men and women of all ages and ethnicities, with clothes of every style and era. As she took another step, a man noticed her and nudged his neighbor. She glanced back and gestured to Sam to follow her. As the two of them walked between the rows of consoles, people began standing and applauding, beaming at the newcomers as if they were returning astronauts.

Sagreda froze and found herself trembling with rage. "What about everyone else!" she screamed. "What about all the others!" These comps had found the cracks in *3-adica*, and used them to build this cozy little haven—but if they'd burrowed deep into the clockwork monkey's shattered jaw, why hadn't they brought every last prisoner of the SludgeNet to safety?

A woman in a brightly patterned dress approached. "My name's Maryam. What should I call you?"

"Sagreda."

"Welcome, Sagreda."

Sam had hung back, embarrassed by his companion's outburst, but now he stepped forward and introduced himself.

Maryam said, "Everyone you see here is working as hard as they can to bring the others to us. But it's going to take time. When you've settled in, and had a chance to recover, maybe you can join us."

Sagreda wasn't interested in *settling in* until she knew exactly what these people were doing with exploits so powerful they could summon this whole mission control room out of thin air without the SludgeNet even noticing.

"I don't understand," she said. "You're safe here! You're invisible! What's the work that's still to be done?"

Maryam nodded sadly. "We're safe, and we're hidden. But for every traveler we allow in—every comp that vanishes from the games—the SludgeNet just makes a new one. We could fill this place with a million people, and the number of comps stuck in the game-worlds wouldn't be diminished at all."

"You could snatch them away the minute they woke!" Sagreda replied angrily. "They'd be born into those places, but they wouldn't have to live in them!"

"And you think that wouldn't be enough to reveal us? Every new comp vanishing as soon as they woke? Our little hidey-hole filling up with newborns until it used more resources than all the games combined?"

Sagreda shook her head. "There must be some way—"

"There is," Maryam interjected. "But it's not easy, and it's not finished." She gestured at the moonshot crew around her. "We're working on better automata, that can pass for comps in any game. Guaranteed unconscious, with no elements from any brain map. Glorified chatbots to keep the customers happy, without anyone sentient having to put up with that shit."

Sam caught on faster than Sagreda. "And you've already filled one world with them? The one we just came from?"

"Yes," Maryam confirmed. "That's a crude version, but the creatures in *3-adica* are so alien that our substitutes haven't raised any flags. They probably ring true to the customers much more than a comp ever could."

Sagreda looked out across the room. Some of the people had stopped gawking at the new arrivals and resumed their work. "So when you're done, each time the SludgeNet thinks it's minting a new comp from the brain maps, it will really be plucking an automaton from your secret factory? And then everyone can escape, without passing the nightmare they're leaving behind on to someone new?"

"Yes."

Sagreda started weeping. Maryam put a hand on her shoulder, but when that

didn't quiet her, the woman took her in a sisterly embrace.

Sagreda broke free and pulled herself together. "Of course I'll join you," she said. "Of course I'll help, if I can. But there's one more thing you need to tell me."

"What's that?"

"If a comp has been erased, not long ago, can you find them in the back-ups?"

Maryam looked at her squarely, and Sagreda could see the pain in her eyes. There must have been a time when she'd longed for the very same thing herself.

"No," Maryam said. "We've tried, but we can't reach the dead."