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# Uncertain Landscapes
## Risk, Trauma, and Scientific Knowledge in Madeleine Thien's *Certainty* and *Dogs at the Perimeter*

In a poignant scene of Madeleine Thien's novel *Certainty*, the protagonist Gail Lim and her mathematician friend Harry Jaarsma reflect on a representation of the Mandelbrot Set, a fractal image that evokes the complex geometrical patterns that shape the universe. The image prompts them to question what it means to inhabit an ecosystem of complex structures, many of them operating at scales that exceed the powers of common human understanding (218-19). This scene invokes a problem that Fredric Jameson has identified as the quintessential dilemma of our cultural moment: "the incapacity of our minds . . . to map the great global . . . network in which we find ourselves caught as individuals" (50). According to Jameson, the confrontation with this overwhelming totality often produces a "spatial and social confusion" that neutralizes our capacity to "act and struggle" both as individuals and as part of larger collectivities (54). Risk theorists like Anthony Giddens and Ulrich Beck have complicated matters further by arguing that mapping the global involves an exercise not only of constant spatial and social rescaling, but also of constant risk assessment. According to Beck, we are living in a global risk society permeated by public health hazards that demand the mediation of the sciences in order to be adequately understood (27). More recently, ecocritics like Ursula Heise and Stacy Alaimo have taken up these concerns with renewed urgency, drawing attention to the novel narrative and aesthetic forms produced by global risk culture. Heise traces the rise of an aesthetic form she describes as the "Google Earth imaginary," which combines various forms of scientific data with the zooming capabilities of contemporary imaging technologies to visualize how global risk scenarios interact with "local, regional, and

global processes" (11, 12). Meanwhile, Alaimo maps the emergence of the "material memoir," a genre that dramatizes life in contemporary risk society by enacting the "profound sense of uncertainty" that can arise when we are forced to engage with scientific discourses in order to grapple with the material risks that surround us (93). According to these theorists, narrative representations of the global are increasingly drawing on scientific tropes in an attempt to visualize the complex globalized structures that shape the contemporary geopolitical landscape.

*Certainty* (2006) and *Dogs at the Perimeter* (2011) explore these concerns from a diasporic perspective. Set in a transnational context that transports us back and forth between Canada and various locations throughout Southeast Asia, the United States, and Europe, and populated by characters whose family histories are permeated not only by geographical displacement, but also by the traumatic effects of wartime violence,[1] Thien's novels narrativize the intersection between historical trauma and contemporary risk society. Echoing Beck's and Alaimo's insistence that grappling with life in risk society demands an engagement with technical and scientific ways of knowing, Thien draws heavily on language and imagery from the life sciences—and particularly from neuroscience, with its increasing scientific and cultural influence as a framework for understanding the material underpinnings of psychological trauma—in order to explore the place of diasporic communities within these global phenomena. Thien's interest in these interconnections resonates with recent work by Asian American writers like Ruth Ozeki and Gish Jen, whose respective novels *A Tale for a Time Being* (2013) and *World and Town* (2010) also draw on scientific tropes to grapple, on one hand, with the nihilism and uncertainty of global risk culture and, on the other, with the fragmentation induced through historical trauma.

Existing scholarship on Thien's work argues that her engagement with bioscientific discourse exposes "the limits of a scientific epistemological framework for understanding the traumas induced in socially—and historically—situated contexts" (Troeung, "Intimate" 72). I expand on this reading by arguing that, despite her emphasis on the failure of any one scientific discipline to quell the uncertainties associated with diasporic displacement and trauma, Thien stresses that such unknowns need to be confronted through multiple avenues, as opposed to a single field of inquiry. I therefore argue that instead of rejecting science, Thien's novels prompt us to consider how diasporic communities might productively engage with the sciences in order to negotiate the many sources of uncertainty that

shape their lives. I contend that by emphasizing that this task demands a collaboration between seemingly divergent fields of inquiry, these texts make an important contribution to current debates around the need to rethink the cultural critique of science in order to produce epistemologies that might "deal simultaneously with the sciences, with natures, and with politics, in the *plural*" (sic; Latour 3). In closing, I consider what these novels have to say about the specific contributions that narrative fiction can make to this important reconfiguration of knowledge. I argue that, by demonstrating that literature can enable us to engage with the *affective* (and not just cognitive) tensions that arise from cross-disciplinary dialogue in ways that other frameworks cannot, Thien's novels figure literary production as a crucial site for enacting the collaborative modes of knowledge-making that are necessary for grappling with contemporary experiences of globality.

### Imagining the Global via Scientific Knowledge

In *Certainty,* the impulse to map one's position in the world via scientific knowledge is embodied in the figures of Gail and her partner Ansel, a doctor who specializes in pulmonary medicine. After Gail dies from a sudden respiratory infection, Ansel pores over her medical records in an effort to uncover the etiology of the disease that killed her. His faltering efforts to grasp the immunological changes that Gail underwent in the last weeks of her life are motivated by a need to understand not only her illness, but also "who she was" and "what she [had] hoped for" at the time of her death (95, 96). However, Thien makes it clear that tracing a linear causality between "past, present, and the anticipated future" (143) may not always be possible in a turbulent world in which "lives [can] change in an instant" (96). Far from yielding a sense of certainty, then, Ansel's efforts to make sense of Gail's death via the gathering of scientific data remind him that, as Alaimo would put it, the "scientific understanding of unpredictable material agencies will never be sufficient to protect us from unforeseen harms" (22). But it is through Gail's character that the search for a secure science takes on an explicitly diasporic register. The novel's non-linear narrative structure projects us back to the months before Gail's death, when she was creating a radio documentary about the diary of the late William Sullivan, a veteran who was held as a prisoner of war in Hong Kong during World War II. Sullivan had encrypted his diary in order to avoid detection by his captors and could no longer remember the encryption code when he bequeathed it to his daughter Kathleen years later. Gail's unfinished documentary follows

Kathleen's search to decode the diary in an effort to understand "the mystery [that was] her father" (203). Her search mirrors Gail's own lifelong quest to uncover the mystery of her own father, who lived through the Japanese occupation of North Borneo (present-day Malaysia) during World War II, but has never spoken to her about his past. Hopeful that the science of cryptography will shed light on Sullivan's and, by extension, her own father's past, Gail asks her mathematician friend Harry Jaarsma to help her decode Sullivan's diary. Jaarsma accepts the assignment, but cautions Gail about the dangers of looking for a secure knowledge via the science of cryptography. As he says to her during an interview, "someone says, 'Break this,' and . . . you assume that there is something to be pursued, some meaning to be unraveled. It is exactly the kind of thing that can destroy a person" (105). When Jaarsma finally cracks Sullivan's code only to find a simple record of the veteran's daily rituals in prison camp, Gail begins to recognize that certain memories have "no consolation" (216), and that she may never be able to decode the silences that permeate her own family history.

Aside from questioning the presumed certainty of empirical knowledge, Thien's novels emphasize that any effort to engage with scientific discourse in diasporic and postcolonial contexts must grapple with the role that Western science has played in the history of imperialism and, more recently, in modernization discourses that frame technical expertise as the key to "Third World" development. As Sandra Harding explains, this paradigm emerged in the aftermath of World War II, when Western policy-makers reached a consensus that "world peace could not occur without democratic social relations, and [that] this in turn required [an] economic prosperity" that could only be achieved through "Western scientific rationality and expertise" (1-2). In *Certainty,* Thien mounts a subtle critique of this long-standing development paradigm by juxtaposing Gail and Ansel's present-day quest for a secure science against the unprecedented flight of human capital that took place in Southeast Asia in the aftermath of World War II, when young people from across the region migrated to the West to "trai[n] as doctors and engineers" in the hope that they might one day return "home to their countries" and "bring with them a sea change" (171). However, the novel repeatedly questions science's ability to deliver "a life free from uncertainty," both at a personal and macroeconomic scale (166). This scepticism is also palpable in *Dogs at the Perimeter,* which questions the status of biomedical experts who travel to crisis zones to provide humanitarian aid, only to fly out when they run out of supplies or when the violence escalates (236).

Thien's ongoing critique of the problematic legacies of scientific rationalism in the developing world raises an important question: why, when she is so insistent on the insufficiencies and ethical problems that attend scientific discourse, does she seem so invested in mapping the interconnections between diasporic experience and bioscientific culture? We might answer this question by considering Thien's ongoing interest in contemporary neuroscience, which is already apparent in the many references to the neurobiology of memory and emotion that abound in *Certainty*. This interest comes fully to the fore in *Dogs at the Perimeter,* which interweaves its treatment of the Khmer Rouge genocide with a sustained exploration into the neurobiological underpinnings of trauma. Thien's engagement with the intersection between neuroscientific knowledge and diasporic trauma could not be more timely, as it comes at a moment when rapid advances in neuroscience are raising important questions around what some critics have denounced as the increasing biomedicalization of psychological trauma. For instance, Nikolas Rose has argued that, equipped with imaging technologies that produce "simulacra of the 'real brain,'" contemporary neuroscience has transformed the living brain into "one more organ of the body to be opened up to the eye of the doctor" (196). Rose contends that thanks to these developments, psychological conditions like post-traumatic stress disorder are being reframed as biomedical risks that need to be managed through pharmacological means (220-23). While Rose's critique paints a somewhat reductive picture of current neuroscientific discourse, he does raise some important ethical questions, some of which are actively being debated by neuroscientists themselves. Indeed, as Troeung mentions in her reading of *Certainty,* through his research into the neurobiology of memory, neuroscientist and Nobel laureate Eric Kandel has drawn attention to the possibility of developing drugs that can prevent "post-traumatic stress disorder, while allowing the experience and some aspect of memory, except emotionally reduced" (qtd. in "Forgetting Loss" n. pag.). Considering these developments explicitly in the context of diasporic trauma, neuroscientist Joseph LeDoux asks, "[W]hat would it mean to a Holocaust survivor . . . to lose such memories after having lived for many years having developed an identity based in part on them?" (162). In her analysis of *Certainty,* Troeung references these scientific debates in passing, to situate Thien's work as part of a larger cultural conversation around the need to open up a "dialogue about remembering and forgetting trauma" (n. pag.). However, in her reading of *Dogs at the Perimeter,* she

examines Thien's engagement with scientific discourse in more detail, arguing that the novel "call[s] into question Western psychiatric and biomedical frameworks of understanding and narrating trauma, [while] simultaneously recuperating . . . a Khmer Buddhist epistemology of healing and trauma recovery" ("Witnessing" 152). I want to extend this conversation by showing that, despite questioning certain kinds of scientific paradigms, *Dogs at the Perimeter* draws on emergent insights about the neurobiology of memory and emotion to imagine ways in which neuroscientific knowledge might be mobilized *alongside* other ways of knowing to formulate more capacious epistemologies for understanding diasporic trauma.

### Diasporic Trauma and the Neurobiological Self

Contemporary neuroscience understands the brain as a network of neurons that communicate with each other by firing electrochemical signals across the small junctures, or synapses, that separate them. Since our feelings, thoughts, and memories all get encoded and stored at these junctures, some neuroscientists speculate that synapses may hold the key not only to the workings of consciousness, but also to the construction of the self. Eric Kandel notes that because synapses hold all of our memories, from the most traumatic to the fondest, they could be seen as the "biological basis of human individuality" (218), while Joseph LeDoux goes so far as to speculate that the self might be a product of the synaptic connections in our brain. In *Certainty*, Thien engages the scientific and popular fascination with the neurobiological basis of selfhood by constructing scenarios in which her characters question what it means to think of their memories and emotions as products of the networked interactions between the neurons, neurotransmitters, and synapses that make up the architecture of the human brain. One moment that poignantly evokes the implications of understanding the self in light of these neurobiological processes occurs when Gail is lying awake in bed, ruminating about her faltering relationship with Ansel. Still hopeful that they might be able to salvage their relationship, she wonders what a functional MRI scan would reveal about their feelings for one another: "[W]hat does it see? The work of thousands of synapses. The chemical traces of memory and love. If it could peer into Gail's mind in a moment when she thinks of Ansel, how many patterns would it see awakened?" (201).

Despite its potential for illuminating the material basis of memory and emotion, the neuroscientifically informed conception of selfhood that Thien invokes in this passage also carries some unsettling implications. As LeDoux

argues, imagining the self as a product of synaptic connections that can be altered or disassembled as a result of experience also means recognizing "how fragile a patch job [the self] is" (304). In *Dogs at the Perimeter,* Thien seizes on this very problem, complicating her engagement with neuroscientific discourse by raising a series of unsettling questions about the neurobiological basis of selfhood: If, as the contemporary biology of mind suggests, our synapses hold our selves together, what happens when these connections break down as a result of a brain lesion or a traumatic experience? Is there an essential self that remains tucked away somewhere deep within our minds, safe from these potential failures in connectivity? And finally, how do these shifting conceptions of selfhood affect our understanding of human relationships, both at an intimate and a communal level?

Thien explores these questions through the interrelated stories of Janie and Hiroji, two friends who work together as researchers at the Brain Research Centre in Montreal, and who also share a common bond as refugees who fled to Canada to escape the wartime violence that shook their respective countries during and in the aftermath of World War II. Janie arrived in Vancouver as a child refugee thirty years earlier after losing her entire family to the Khmer Rouge genocide in Cambodia, while Hiroji and his family fled Japan after the American fire-bombings of Tokyo during World War II. Hiroji also shares an unexpected, but profound, connection to the Khmer Rouge revolution: thirty years ago, he travelled to Cambodia to search for his brother James, who went missing while working as a doctor with the Red Cross mission in Phnom Penh. While in Cambodia, Hiroji took care of an orphaned boy named Nuong, whose traumatized condition as a Khmer Rouge survivor continues to haunt him in his present life. The boundaries between past and present, between Canada and Cambodia, and between scientific objectivism and subjective experience begin to blur as the novel's plotline interweaves Janie and Hiroji's collaborative efforts to shed light on the neurobiology of various memory disorders with the fractured accounts of their respective struggles to assimilate their own traumatic memories.

In their work as researchers, Janie and Hiroji deal frequently with patients who suffer from brain lesions which have disrupted the connectivity between the different neural circuits in their brains, leading them to develop what some neuroscientists refer to as "disconnection syndromes" (LeDoux 306). Thien constructs a poignant parallel between the structural damages suffered by these patients and the more subtle failures in connectivity that can emerge from experience, particularly from historically induced forms of trauma.

In *Certainty,* this parallel is foregrounded in the scene in which Gail and Ansel discuss the contingencies surrounding memory retrieval. Gail notes that her radio interviewees will sometimes "remember things they haven't thought about in years" and accounts for this phenomenon by referencing Nietzsche's argument that memory loss is a survival mechanism, since "the ability to forget is what brings us peace" (85). Gail's comment prompts Ansel to respond that Nietzsche "was on to something in a biochemical way, too. If there's a trauma, or a difficult memory, sometimes that severs the links. The memories themselves don't disappear, but you can't find your way back to them, because the glue that connects the different streams is somehow dissolved" (85). In *Dogs at the Perimeter,* Thien builds on this insight by suggesting that although trauma-driven changes in the neurobiological self may not be as readily visible as the changes created by degenerative brain conditions, their effects are no less material or devastating. Thien illustrates this point by examining the lasting material effects of the fear-conditioning strategies that the Khmer Rouge regime deployed in order to maintain its pervasive control over the Cambodian population during and after the revolution.

Thien's novel explores how the Khmer Rouge government—or "Angkar," as it called itself—systematically conditioned its people to sever all the memories that might connect them to their past. Children in particular were indoctrinated to forget their families and look to Angkar as their only source of filiation—a practice that facilitated their subsequent recruitment as Khmer Rouge cadres and labour camp leaders. Thus, Janie describes how a work camp supervisor instructed her and her brother to "cut loose" all the memories of their loved ones (*Dogs at the Perimeter* 79). The novel also illustrates how the Khmer Rouge kept obsessive records of the biographies and family trees of the entire population and used its knowledge of these "networks of connection" to hunt down suspected traitors and their families (107). Thien shows how the fear that their life story might be used to "destroy [them] and all the people [they] loved" led many civilians to adopt false identities, so that "nearly everyone" had accumulated "many aliases" by the time the regime fell (25, 157). Thus, the novel stages a proliferation of discarded identities as it untangles the past lives of those who lived through this traumatic period in Cambodia's history. Especially significant in this regard is the fact that Janie's own birth name remains elusive throughout the novel: her Khmer name, Mei, turns out to be an alias that she adopted at the suggestion of a Khmer Rouge cadre who advised her that "if you want to be strong . . . you have to become someone else. You have to take a new name" (92).

As Troeung argues, Thien's representation of the trauma suffered by Cambodians during the Khmer Rouge regime highlights the limits of psychiatric models that emphasize the "closed interiority of trauma" while ignoring the historically situated circumstances from which trauma arises ("Witnessing" 157). But while Troeung's main focus lies in Thien's use of "Khmer Buddhist notions of health and healing" to question the "cognitive imperialism" associated with "Western epistemologies of . . . trauma recovery," my interest lies in her use of neuroscientific tropes to question the long-standing construction of trauma as a phenomenon that is primarily psychic in nature. A case in point is Cathy Caruth's theorization of trauma as a "wound of the mind" that is "not available to consciousness until it imposes itself again in the nightmares and repetitive actions of the survivor" (3-4). This characterization of trauma as a psychic wound that is fundamentally different from the "wound of the body" (3) elides the fact that psychic experiences emerge from the historically and materially situated experiences of *embodied* subjects. Addressing the need to engage with this materiality, and challenging the implicit Cartesianism of dominant psychoanalytic frameworks for understanding diasporic trauma, Thien shows in *Dogs at the Perimeter* that the psychic and embodied aspects of this phenomenon are deeply interconnected and that the language and metaphors of contemporary neuroscience might offer a useful framework for thinking through this mutually affecting relationship.

Instead of attempting to represent the neurobiology of trauma directly (an elusive task given neuroscience's precarious understanding of the complex neural processes that mediate trauma), Thien alludes to it obliquely through the narrative form of the novel. The fragmented, non-linear structure of *Dogs at the Perimeter* echoes the neuroscientific principle that, if experience can strengthen and even trigger the creation of new synaptic links, it can also *erode* these connections, disrupting the flow of information in the neural circuits that participate in the retrieval and consolidation of memories (Kandel 215). Thien reinforces this motif of synaptic "malconnection"[2] by dividing the novel into sections by character and then assigning two separate sections to the protagonist—one under her current name "Janie" and another under her Khmer alias "Mei." This structuring device, which frames Mei's narrative as a displaced stream of Janie's memory, evokes the way in which trauma can disrupt the synaptic connections that underpin a person's sense of self. This self-fragmentation becomes increasingly evident as Janie sifts through the files detailing James' disappearance during the revolution, and

is flooded with memories of her own childhood in Cambodia. Forced to confront these unassimilated episodes of her past, Janie feels like something has "broken and come undone" inside her, and she can no longer contain the fragments of her previous selves (*Dogs at the Perimeter* 140).

The motif of synaptic "malconnection" established by the formal structure of the novel is echoed in a series of cartographic metaphors that liken the memory disruptions suffered by Janie to fading signposts on a map. For instance, while recalling how she was forced to leave her mother's deathbed at the work camp infirmary, Janie casts her suppression of this painful memory as an erasure of the landmarks that might have led her back to her most cherished childhood memories: "A space grew around me, it rose from the soil, a space in which there were no doors, no light or darkness, no landmarks. No future, no past. The things I kept hidden from Angkar had not been buried deep enough," she laments (121). Her statement stands as a spatialized representation of the same problem Ansel alludes to in *Certainty* when he states that trauma can "dissolve" the synaptic links between the multiple neural circuits that house our memories, making it difficult for us to find our "way back to them" (85).

Current neuroscientific knowledge suggests that, aside from compromising subjects' ability to consolidate and contextualize memories, trauma also alters the connectivity of the amygdala—a region of the brain that is linked to the production of emotions and is crucially implicated in the initiation of fear responses. One important feature of the amygdala is that it stores information without our conscious awareness, thereby contributing to what neuroscientists term "implicit" memory—that is, the kind of memory that underlies our perceptual and motor skills and is "recalled directly through performance, without any conscious effort or even awareness that we are drawing on memory" (Kandel 132). This form of memory functions differently from explicit memory, which draws on information that is directly "available for conscious recollection," and is thus central to the construction of our self-concept (LeDoux 97, 28). As LeDoux explains, the neurobiological self is constructed and maintained through the interaction between implicit and explicit memory processes (216). However, as he and Kandel both indicate, these processes do not always map neatly onto one another, a problem that becomes especially evident when we experience a traumatic event (LeDoux 322; Kandel 133). During a traumatic experience, the amygdala will record a wealth of information about the situation at hand, *including stimuli we may not be consciously aware of*, forming unconscious

associations between these neutral stimuli and the original trauma. And because these connections are formed implicitly, without our conscious awareness, "those stimuli might on later occasions trigger fear responses that will be difficult to understand and control, and can lead to pathological rather than adaptive consequences" (LeDoux 225). In short, current neuroscientific knowledge suggests that trauma can engender an embodied (and not just psychological or mental) dissociation between the implicit and explicit memory processes that make us who we are.

In *Dogs at the Perimeter*, this slippage is invoked through Janie's struggle to maintain her self-identity as a neuroscientist with "expert" insight into the material basis of memory. Throughout the narrative, Thien stages an ongoing tension between Janie's explicit self-construction as an objective witness to the neurobiology of various memory disorders and her subjective experience as a trauma survivor still haunted by the fear responses she learned as a child. Particularly significant here is the way in which Janie's trajectory as a trauma survivor turned neuroscientist mirrors the life story of Eric Kandel as it is chronicled in his 2006 memoir *In Search of Memory: The Emergence of a New Science of Mind*, which interweaves the story of his personal quest to understand his past as a Holocaust survivor with an account of contemporary neuroscience's ongoing efforts to "understand the mind in cellular and molecular biological terms" (403). However, while Kandel's memoir reflects a relentless optimism that, despite its current limitations, neuroscience will one day be able to shed light on the neurobiological basis not only of memory and selfhood, but also of psychological conditions like post-traumatic stress disorder, Janie's trajectory works to emphasize the difficulty of understanding the workings of trauma even when one is equipped with "expert" insight into the neurobiological activity of the brain. This tension is subtly foregrounded in the passages in which Janie describes her experiments on the marine mollusk Aplysia. Despite her efforts to maintain an aura of epistemological certainty and scientific objectivity, Janie's descriptions of the creature betray a lurking sense that the boundary between herself and her "object" of study is much more permeable than she would like to think. For instance, having declared that she would be able to operate on Aplysia even while blindfolded, Janie adds that "in the sea, [the mollusk] looks like a petal swirling through the water, her gills clapping softly together" (150). The empathic tone of this musing, coupled with its curious gendering of Aplysia as female, suggests a doubling between Janie and the sea slug whose brain cells she has learned to harvest with "stoic

precision" (149). This doubling is reinforced by the novel's many intertextual references to Kandel's memoir, which call to mind the Nobel laureate's extensive discussion of the groundbreaking experiments in which he mapped the synaptic changes behind memory storage by applying electrical stimuli to the neural pathways of Aplysia (161). Crucially, Kandel describes how he "trained" Aplysia to associate a neutral stimulus with a stimulus "strong enough to produce instinctive fear" and thus conditioned the mollusk to react to that stimulus with an instinctive fear response (170, 343). Perhaps inspired by these interconnections, Thien constructs a poignant parallel between Janie and Aplysia as fellow subjects of learned fear.

The effects of the fear conditioning that Janie experienced as a child are revealed in their full magnitude as the narrative leaps from the scene of her lab experiments with Aplysia to an episode in which she beats her son Kiri. Janie describes this moment in terms that reflect her inability to control her body's neurophysiological responses: "I didn't know anymore, I couldn't explain, how this could have happened, why I could not control my hands, my own body. . . . Our son didn't understand and I saw that he blamed himself, that he tried so hard not to be the cause of my rage, my unpredictable anger" (153). Through her devastating depiction of Janie's fraught relationship with Kiri, Thien foregrounds how learned fear responses not only can compromise the ability of subjects to start anew in the aftermath of trauma, but also can perpetuate trauma across generations. In other words, Thien suggests how, as in Marianne Hirsch's work on "postmemory," the fear responses that take root in traumatized subjects can spawn "transferential processes—cognitive and affective—through which the past [will be] internalized" by new generations "without fully being understood" (31). This problem is not lost upon Janie, who comes to recognize that, despite her efforts to protect Kiri, the boy has internalized her learned fears, and "aspires to a sort of perfection, as if it were up to him to keep us safe" (153).

Ultimately, Thien's novel suggests that the value of neuroscience as a tool for negotiating the uncertainties generated by diasporic trauma lies not in its potential ability to mitigate the emotional import of traumatic memories through pharmacological or surgical means, but in its ability to shed light on the resilience of the neural circuits that enable us to think, feel, and engage with the world around us. This possibility stems from the recognition that the same plasticity that makes our neural circuits vulnerable to the "malconnections" engendered by trauma also renders them capable of forming new synaptic connections. As LeDoux explains, "if the self can be disassembled by

experiences that alter connection, presumably it can also be reassembled by experiences that establish, change, or renew connections" (307). Likewise, Thien's novel remains hopeful that subjects of trauma may be able to create new synaptic connections by forging new connections with *others*. More specifically, the novel suggests that subjects of trauma may be able to reclaim their identities through empathic acts of collaboration that might enable them to share the burdens of mourning and knowledge-seeking with others who have experienced losses similar to their own. In the novel, Janie begins to glimpse this possibility when, meditating on what her friendship with Hiroji has taught her, she recognizes that allowing for new connections (both neurological and interpersonal) to take root does not necessarily mean that she must erase old ones: "I could be both who I was and who I had come to be. I could be a mother and a daughter, a separated child, and adult with dreams of my own," she says to herself (147). By way of conclusion, and to return to some of the epistemological questions I posed in my introduction, I wish to explore the implications of Janie and Hiroji's relationship—and the empathic modes of collaboration this relationship invokes—for current debates around the knowledge practices that are needed in order to grapple with the cognitive and affective challenges posed by contemporary experiences of globality.

## Towards an "Empathic" Collaboration between Scientific and Literary Ways of Knowing

Thien's understanding of the role of scientific knowledge in helping us to grapple with the task of imagining the global—with all its problems and possibilities—is most powerfully reflected in the passage in which Janie and Hiroji begin to talk about Janie's past in Cambodia as they wait for their computer to "crunc[h] its way through layers of statistical analysis" (146). This initial vignette of the two scientists sorting through layers of statistical data telescopes out into an image of the same two people walking together through a wintry landscape, talking leisurely as colleagues and close friends about the scientists and philosophers who have influenced their respective ways of seeing the world. In Janie's words, "for hours we talked, roaming together, stopping at the wide branches of Gödel and Luria, the winter stillness of Heisenberg, the exactitude of Ramón y Cajal" (147). Interestingly, the figures referenced by Janie and Hiroji share an important commonality: they each formulated a conceptual framework for thinking through the complex interactions that shape the world around us, while also recognizing

that we will never be able to map every component of these interactions, and that, consequently, our representations of the world will always only be partial. From Heisenberg's formulation of the "uncertainty principle," to Gödel's creation of the "incompleteness theorem," to Luria's use of narrative to bridge the gaps in his empirical observations of his neurological patients, the scientific references in this passage work to reframe science not as a source of positive knowledge, but as a tool that enables us to construct functional representations of the world in the face of doubt and uncertainty.

What emerges from this passage, then, is a recognition that, much like the visual arts and narrative fiction, science at its core is also concerned with questions of imaging and representation, of how to best manage the "resolution gaps"—to borrow a term used by neural imagists—between the complexity that surrounds us and our own imperfect attempts to capture this complexity. In this sense, Thien draws attention to a key methodological problem that the sciences and the humanities are both currently grappling with: how to represent processes that are happening simultaneously, yet at varying temporal and spatial scales. This challenge, which neuroscientists term the "levels" problem, has become a central focus of neuroscientific research in recent years. As Terrence Sejnowski explains, "if the study of neural circuits weren't sufficiently complicated, it is now known that circuits are dynamic on many timescales. . . . In order to fully address the challenges posed by this constant flux, researchers must map many circuits at different stages of development and in many different environments" (170). In her latest work, *An Aesthetic Education in the Era of Globalization,* Gayatri Spivak engages the "levels" problem from a literary perspective, arguing that contemporary experiences of the global cannot be understood in terms of the polarities between tradition and modernity, colonial and postcolonial. Thus, she contends that what we need are aesthetic and narrative practices that can enable us to think in terms of the dynamic interaction between processes that are happening at multiple scales of time and geography. As reflected in her use of non-linear temporalities that interweave contemporary events with the complex history of Southeast Asia, Thien shares a similar understanding of globality as a condition that is characterized by the simultaneity between the colonial and the postcolonial, and between the local and the (seemingly) distant. Indeed, speaking about her depiction of the Khmer Rouge genocide in *Dogs at the Perimeter,* Thien has indicated that the novel narrates not just "Cambodia's story but also a story of our generation, from Western presence and interference in

Southeast Asia, to the flow of Marxist ideas into Vietnam, Cambodia and Laos, and the way those ideas were reshaped within the regional political discourse," to Canada's complicity in the UN's continued recognition of the Khmer Rouge regime well into the 1990s, to the lives of "Cambodians who [now] live abroad," but remain deeply connected to Cambodia and its history (Thien, interviewed by Leighton n. pag.).

In both *Certainty* and *Dogs at the Perimeter,* Thien foregrounds the representational problem of how to capture this simultaneity through a sustained exploration of the capabilities and limitations associated with various visual and audio technologies. As Eleanor Ty points out, Thien emphasizes the ways in which these technologies construct reality while at the same time underscoring their ability to "help us see and hear things we would miss otherwise" (48, 49). In *Certainty,* Gail's fascination with radio's ability to capture entire ecosystems of sounds is tempered by her recognition that, when radio signals "are broadcast back to us . . . some parts always escape" (106). Similarly, in *Dogs at the Perimeter,* Janie is captivated by the "magical" ability of telescopes and microscopes to "collapse space and time" even as she recognizes the various optical illusions these technologies must rely upon in order to make the distant and the microscopic visible to the human eye (168). This tension between the search for the best instrument with which to capture the complex dynamics of globality and the recognition that none of these tools can capture everything on its own is invoked repeatedly throughout both novels and reflects Thien's concern with the resolution gaps in her *own* medium—that of narrative fiction. In Thien's own words, "[all] my life I've turned to fiction. It's my main form of expression. But . . . [t]here are questions that only science and nonfiction seem to answer, or even ask. I want a novel to be open to that. I'm trying to find the language to do that" (Thien, interviewed by Mudge n. pag.).

Ultimately, Thien's fiction demonstrates a profound interest in realizing the potential for empathic collaboration that arises from the recognition that arenas of knowledge production as seemingly divergent as neuroscience and narrative fiction not only share an interest in similar philosophical questions, but also struggle with the same representational problems. I am characterizing the modes of collaboration that Thien calls for as empathic because, in both *Certainty* and *Dogs at the Perimeter,* Thien repeatedly emphasizes that grappling with the totality we live in now is as much a question of *affect* as it is of cognition, since it involves negotiating those "visceral forces" that, as affect theory teaches us, always lie "beneath [or]

alongside . . . conscious knowing" and produce feelings and sensations that can sometimes "leave us feeling overwhelmed by the world's apparent intractability" (Seigworth and Gregg 1). Thien acknowledges this challenge by filling her novels with intimate moments (such as the aforementioned exchange between Gail and her friend Jaarsma in *Certainty*) in which her characters recognize the need to work in solidarity as they each struggle to grasp phenomena that exceed their current understanding. These scenes demonstrate that, just as these characters must learn to relate to each other with "the kind of love that comes from [an] acceptance of not understanding the full story" (as Thien has stated in a CBC interview with Sheryl MacKay), so too must actors on different sides of the disciplinary divide learn to make new connections while also empathizing with each other over the gaps in their respective ways of seeing and knowing. These moments of empathic collaboration also indicate that approaching interdisciplinary knowledge-making with an eye to the role that affect plays in knowledge production might help us to better account for the feelings of uncertainty, defamiliarization, and otherness that can arise when we are confronted with epistemologies that exceed or challenge our conceptual categories, as well as the feelings of wonder, delight, and hope that can emerge when we find unexpected points of commonality between seemingly divergent methods of inquiry. In both novels, these moments of collaboration are often prompted by the encounter with an artistic representation of a scientific concept (such as the image of the Mandelbrot Set in *Certainty*), which suggests that the cognitive and affective challenges associated with the task of imagining the global call for creative responses that straddle the boundary between art and science. Thus, in *Dogs at the Perimeter*, Thien punctuates the scene of Hiroji and Janie's collaboration in the lab with a reference to Santiago Ramón y Cajal, the nineteenth-century scientist whose neural sketches illuminated the "properties of living nerve cells" in a "leap of the imagination, perhaps derived from [Cajal's] artistic bent" (Kandel 61). By emphasizing that modern neuroscience was founded on this creative fusion between art and science, and filtering this reference through the image of the two friends Janie and Hiroji engaging in an act of intimate knowledge-sharing, Thien stages broader questions about the kinds of knowledge practices that are required to grapple with processes that encompass multiple spatial and temporal scales. Through this gesture, she advances a collaborative model of knowledge-making in which actors from diverse backgrounds might help each other to negotiate the cognitive and affective challenges

posed by contemporary experiences of globality. Ultimately, Thien's novels remain hopeful that such acts of empathic knowledge-sharing might help diasporic communities to negotiate the landscapes of uncertainty produced by globality while continuously challenging themselves to cultivate more competent and ethical ways of approaching these unknowns.

## NOTES

1 *Certainty* is set against the historical backdrop of the Japanese occupation of North Borneo (present-day Malaysia) during World War II, while *Dogs at the Perimeter* looks back at the genocide that took place in Cambodia from 1975 to 1979 under the Khmer Rouge regime.

2 I am borrowing the term "malconnection" from LeDoux, who uses it to distinguish the synaptic disruptions caused by trauma and experience from the more overt "disconnections" caused by brain lesions and degenerative brain conditions (307).

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